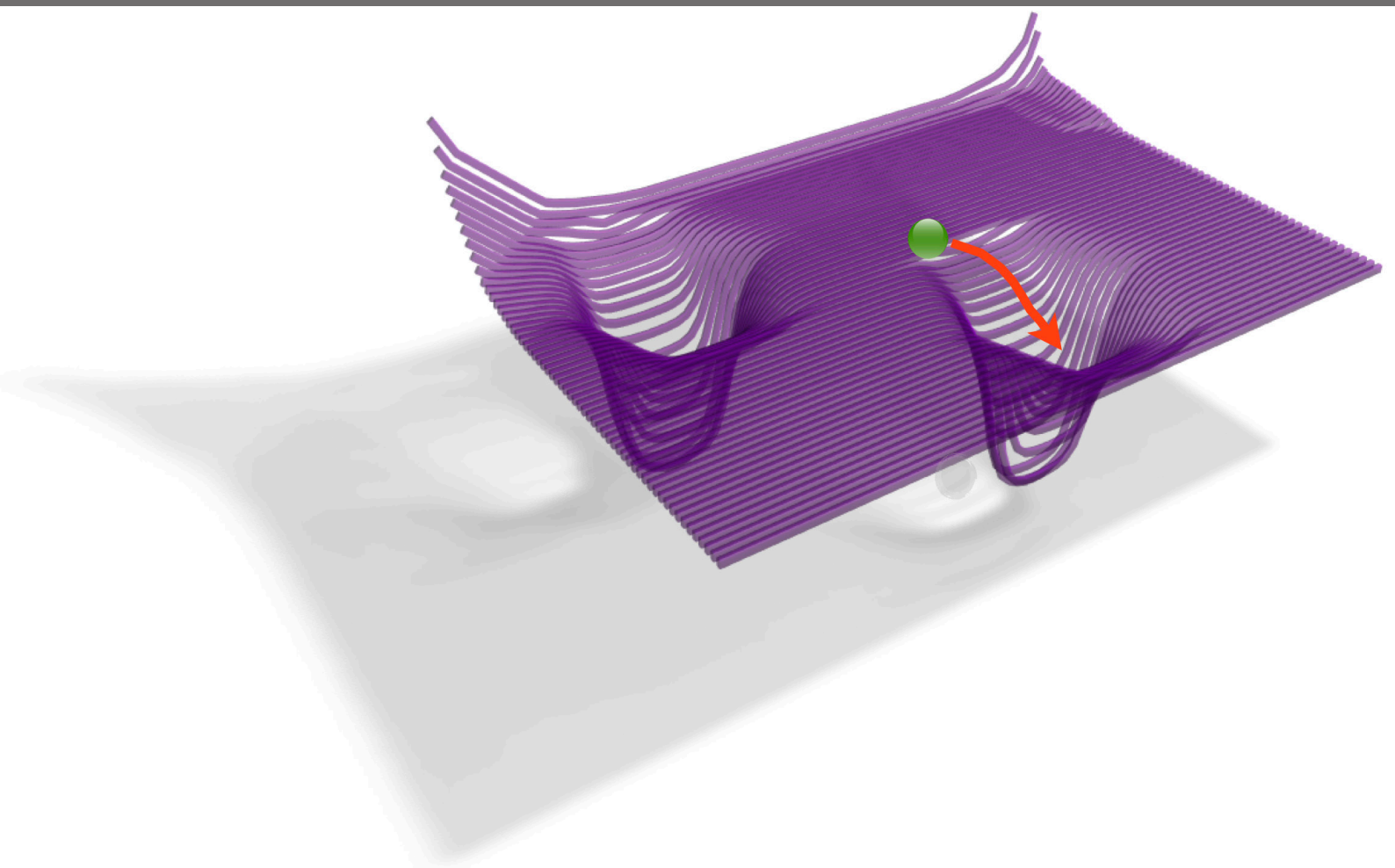
DYNAMIC SYSTEMS THEORY AND EMBODIMENT IN PSYCHOTHERAPY RESEARCH. A NEW LOOK AT PROCESS AND OUTCOME

EDITED BY: Sergio Salvatore, Wolfgang Tschacher, Omar Carlo Gioacchino Gelo and Sabine C. Koch

PUBLISHED IN: Frontiers in Psychology



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ISSN 1664-8714
ISBN 978-2-88919-780-4
DOI 10.3389/978-2-88919-780-4

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DYNAMIC SYSTEMS THEORY AND EMBODIMENT IN PSYCHOTHERAPY RESEARCH. A NEW LOOK AT PROCESS AND OUTCOME

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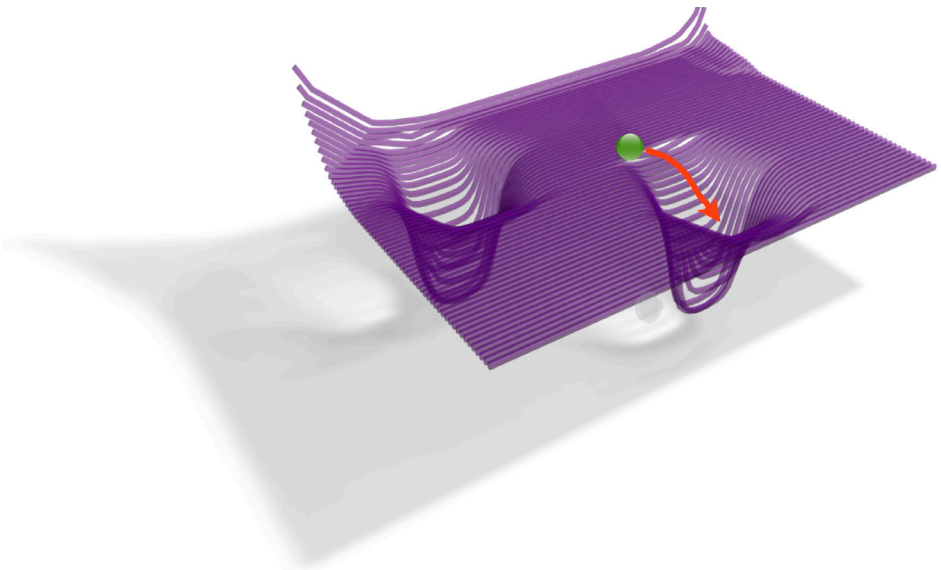

A phase space of a system, with potential wells indicating attractors. Taken from: Kyselo M and Tschacher W (2014) An enactive and dynamical systems theory account of dyadic relationships. Front. Psychol. 5:452. doi: 10.3389/fpsyg.2014.00452

In an attempt to cease from reducing the world and its phenomena to linear modeling and analytic dissection, Dynamic Systems Theories (DST) and Embodiment theories and methods aim to account for the complex, dynamic, and non-linear phenomena that we constantly deal with in psychology. For instance, a DST and Embodiment perspective can enrich psychology's understanding of communicative processes both in clinical and non-clinical settings.

In psychotherapy, research has shown that there are a number of common factors contributing to psychotherapy outcome, of which the therapeutic relationship is the most important one. These findings give communication a central role in the psychotherapy process. In the traditional view, the underlying model of understanding psychotherapy processes is that of a number of components summatively coming together enabling us to make a linear causal prediction. Yet,

communication is inherently dynamic. A shift to viewing the communication process in psychotherapy as a field dynamic phenomenon helps us to take into account nonlinear phenomena, such as feedback processes within and between persons. We thus propose an *embodied enactive dynamic systems view* as a new theoretical and methodological perspective that can more realistically capture what happens among and between two persons in psychotherapy. This view is broader than that of most current models in psychotherapy research.

DST and Embodied Enactive Approaches can offer solutions to the prevailing neglect of non-linear phenomena in Western science, to better account for the complex dynamics of reality, and to move to a more holistic level of analysis. DST and Embodied Enactive Approaches have developed not in a single discipline but in a joined movement based on various fields such as physics, biology, robotics, anthropology, philosophy, linguistics, neuroscience, and psychology, and have only recently entered clinical theorizing. The two new paradigms are presently triggering a rethinking of the therapeutic process by recognizing the embodied nature of psychological and communicative phenomena. Their integration opens up a promising scenario in the field of psychotherapy research, developing new, profoundly transdisciplinary, theoretical concepts, methodologies, and standards of knowledge. The notion of field dynamics enables us to account for the role of the communicational context in the regulation of intra-psychological processes, while at the same time avoiding the pitfalls of an ontologization of the hierarchy of systemic organization. Moreover, the new approach implements methodological strategies that can transcend the conventional opposition between idiographic and nomothetic sciences.

Citation: Salvatore, S., Tschacher, W., Gelo, O. C. G., Koch, S. C., eds. (2016). Dynamic Systems Theory and Embodiment in Psychotherapy Research. A New Look at Process and Outcome. Lausanne: Frontiers Media. doi: 10.3389/978-2-88919-780-4

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frontiers in Psychology

EDITORIAL
published: 01 July 2015
doi: 10.3389/fpsyg.2015.00914

Editorial: Dynamic systems theory and embodiment in psychotherapy research. A new look at process and outcome

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Keywords: dynamic systems theory, embodiment, psychotherapy process, psychotherapy outcome, self-organization, emergence, enactivism, temporality

OPEN ACCESS

Edited by:
Gianluca Castelnuovo, Università Cattolica del Sacro Cuore, Italy

Reviewed by:
Osmano Oasi, Università Cattolica del Sacro Cuore, Italy

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Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *16 April 2015*
Accepted: *18 June 2015*
Published: *01 July 2015*

Citation:
Salvatore S, Tschacher W, Gelo OCG and Koch SC (2015) Editorial: Dynamic systems theory and embodiment in psychotherapy research. A new look at process and outcome. Front. Psychol. 6:914. doi: 10.3389/fpsyg.2015.00914

This research topic encompasses a collection of articles from a dynamic systems and embodiment perspective on psychotherapy research. The collection follows the general tenet that communicative processes in psychotherapy are a field-dynamic phenomenon with temporal extension occurring in a context.

The context of psychotherapy, at any point in time, is given by multiple elements that belong to different phenomenological domains (e.g., sensation, behavior, affectivity, thought, language) and interact with each other and the environment over time (Salvatore and Tschacher, 2012). What works is the interaction between elements—namely, their being part of a whole—rather than the elements themselves. Consequently, no element is considered to possess invariant clinical meaning; rather, its impact on the entire therapeutic system is mediated by the field, understood as the set of ever-changing, co-occurring elements regulating (e.g., "enslaving") the system's behavior. In addition, psychotherapy unfolds irreversibly through time. Everything happening within the communication between client and therapist (and within their minds) occurs in a time-frame, i.e., owed to what happened before, and paving the way for what will follow. In this sense, psychotherapy—just as any form of interaction—is inherently dynamic, and as such time-dependent.

Although these observations are familiar to clinicians, they have been widely neglected by researchers who have continued to endorse reductionist approaches (e.g., Elliott and Anderson, 1994). This is partly so because alternative approaches entail epistemological and methodological difficulties. Viewing psychotherapy in terms of field dynamics raises the epistemological issue of downward causality, i.e., the problem of modeling the *pars-toto* relation among levels of explanation. Moreover, the time dependency of psychotherapy processes renders most traditional strategies of data analysis unsuitable because these strategies commonly assume independent observations.

Dynamic Systems Theory (DST) (Thelen and Smith, 1994; Kelso, 1995; Haken, 2010) can offer a solution to this impasse. DST has developed in various fields (e.g., physics, biology, as well as cognitive sciences), adopting a holistic and time-dependent approach. However, it is not widely applied in psychotherapy research. The reason may be sought in the fact that DST represents a challenge for the traditional, evidence-based approach to the empirical study of psychotherapy. Psychotherapy research adopts mainly an inductive, data-driven logic of investigation. Accordingly, research is assumed to deal with facts, with interpretation following after. DST challenges such a view. It proposes a new way of looking at the relation between theory and data: Data are not self-contained facts ready to be retrieved and evident in and of themselves. Rather, they are the

product of the theory-driven modeling of phenomena. The very notion of time dependency shows the inherent nexus between theory and data characterizing the DST perspective. Indeed time dependency is not an empirical fact, but a theoretical tenet that is used to interpret phenomena; accordingly, what is relevant is not the event that occurs, but the co-occurrence of the event with what occurs *before, together with,* and *after* it. Thus, it is a theoretical tenet that defines what empirical content to focus on: the co-occurrence of events. In the final analysis, the empirical datum of co-occurrence emerges only through and within the theoretical framework of the time-dependency tenet.

The theory-driven logic contained in DST provides a two-fold opportunity. On the one hand, it demands *methodological* innovation in the field of psychotherapy research. Data can be collected by making use of traditional instruments (e.g., session reports, category systems, video analysis, repeated ambulatory assessments, etc.) with a data analysis focus on measures of variability (e.g., standard deviation, entropy), since this is considered informative of the behavior of a dynamic system. Moreover, research designs should necessarily be longitudinal, aiming at assessing many time-points as possible over sessions and/or treatments. Finally, data-analysis should make use of longitudinal modeling in order to model the time-dependent system's behavior; moreover, idiographic approaches should be adopted, with the aim of being able to create general, nomothetic models without disregarding the individual, idiographic nature of each system's dynamics (e.g., Tschacher and Ramseyer, 2009).

On the other hand, it pushes researchers to develop *theoretical* frameworks capable of grounding the empirical investigation of clinical phenomena. The need for theoretical development is particularly evident in process research. Indeed, basic questions of outcome research (e.g., Does the psychotherapy work? For whom? Under which conditions?) may be addressed in terms of the evidence-based paradigm, this does not hold once the focus moves to the issue of *why* and *how* psychotherapy works. Answers to such questions require developing a model of psychotherapy process—an enterprise that cannot be carried out purely empirical, i.e., as a mere accumulation of evidence. Theory-free research has provided an increasing collection of factors that play a role (moderating, mediating) in clinical exchange and its efficacy; and this has been enlarging the knowledge of what is relevant in psychotherapy process. However, this process in itself—the inherent dynamics of how it works—has remained a black box. The more data one collects, the more one is able to detect what happens outside the box—the input, the output, and their linkage—but one cannot look inside. The key to open the black box is theory, not data.

In this situation, some clinical researchers have started to introduce ideas of *embodiment and enaction* into psychotherapy research (e.g., Fuchs and Schlimme, 2009; Koch, 2011; Michalak et al., 2014). Embodiment and enaction theories bring in an organismic perspective on human interaction and outcomes—taking into account body-environment coupling, dynamic movement, emergent phenomena, and the circularity of interaction processes as opposed to the cognitivistic computer metaphor that tries to predict interaction processes and outcomes from a linear causality perspective. This innovative view triggers a rethinking of the clinical interaction by recognizing the embodied nature of psychological and communicative phenomena. The embodied enactive perspective has extended the cognitive paradigm in psychology to include the body, that is, the "lived body" as conceptualized by phenomenology (e.g., Merleau-Ponty, 1962), as an organismic, self-organizing entity (Varela et al., 1992), forming multiple feedback cycles with its environment (Gibson, 1966). Empathy, bonding and rapport are formed on a body basis (Ramseyer and Tschacher, 2011).

The tenet of embodiment contributes to the theoretical framework psychotherapy research has been looking for. The integration of this tenet with DST opens up a promising scenario in the field of psychotherapy research, developing new transdisciplinary theoretical concepts, methodologies, and standards of knowledge. The notion of field dynamics enables us to account for the role played by the communication context in the regulation of intra-psychological processes. Moreover, the new embodied-systemic approach provides a way of seeing psychological phenomena in terms of dynamic Gestalts, thereby enabling researchers to go beyond hampering dichotomies (e.g., mind-body; structure-function) as well as beyond reductive, molecular approaches. The embodied-systemic approach is prone to develop methodological strategies transcending the conventional opposition between idiographic and nomothetic sciences, by accounting for the temporal dynamics of data.

This research topic aims to outline and develop this promising scenario. We have collected theoretical, methodological, and empirical papers that highlight the heuristic power of approaches endorsing the embodied and field-dynamic nature of clinical phenomena. In sum, these contributions demonstrate the need for (a) more theory development in the field of psychotherapy research, (b) more development of methods that appropriately reflect the complexity of natural interaction between two or more agents, and (c) more translational research based upon clinical questions and implicit knowledge of clinical practitioners. We hope that this special issue is a beginning of clinicians and researchers being bolder in terms of acknowledging complexity, emergence and uncertainty, developing theories, methods and practice that account for them. The collected contributions pave the way for more appropriate and heuristically more powerful empirical investigations of complex phenomena such as the psychotherapy process.

References

Elliott, R., and Anderson, C. (1994). "Simplicity and complexity in psychotherapy research," in *Reassessing Psychotherapy Research*, ed R. L. Russell (New York, NY: Guilford Press), 65–113.

Fuchs, T., and Schlimme, J. (2009). Embodiment and psychopathology: a phenomenological perspective. Curr. *Opin. Psychiatry* 22, 570–575. doi: 10.1097/YCO.0b013e3283318e5c

Gibson, J. J. (1966). *The Senses Considered as Perceptual Systems*. Boston, MA: Houghton Mifflin.

Haken, H. (2010). *Information and Self-organization: A Macroscopic Approach to Complex Systems*, *3rd Edn*. Berlin: Springer.

Kelso, J. A. S. (1995). *Dynamic Patterns: The Self-organization of Brain and Behaviour*. Cambridge, MA: MIT Press.

Koch, S. C. (2011). "Basic body rhythms and embodied intercorporality: from individual to interpersonal movement feedback," in *The Implications of Embodiment: Cognition and Communication*, eds W. Tschacher and C. Bergomi (Exeter: Imprint Academic), 151–171.

Merleau-Ponty, M. (1962). *Phenomenology of Perception*. London: Routledge.

Michalak, J., Mischnat, J., and Teismann, T. (2014). Sitting posture makes a difference—embodiment effects on depressive memory bias. *Clin. Psychol. Psychother.* 21, 519–524. doi: 10.1002/cpp.1890

Ramseyer, F., and Tschacher, W. (2011). Nonverbal synchrony in psychotherapy: coordinated body-movement reflects relationship quality and outcome. *J. Consult. Clin. Psychol.* 79, 284–295. doi: 10.1037/a0023419

Salvatore, S., and Tschacher, W. (2012). Time dependency of psychotherapeutic exchanges: the contribution of the theory of dynamic systems in analyzing process. *Front. Psychol.* 3:253. doi: 10.3389/fpsyg.2012.00253

Thelen, E., and Smith, L. B. (1994). *A Dynamic Systems Approach to the Development of Cognition and Action*. Cambridge, MA: MIT Press.

Tschacher, W., and Ramseyer, F. (2009). Modeling psychotherapy process by time-series panel analysis (TSPA). *Psychother. Res.* 19, 469–481. doi: 10.1080/10503300802654496

Varela, F., Thompson, E., and Rosch, E., (1992). *The Embodied Mind*. Cambridge, MA: MIT Press.

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in
PSYCHOLOGY

ORIGINAL RESEARCH ARTICLE
published: 23 February 2015
doi: 10.3389/fpsyg.2015.00107

Pattern destabilization and emotional processing in cognitive therapy for personality disorders

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Clinical trials of treatments for personality disorders can provide a medium for studying the process of therapeutic change with particularly entrenched and self-perpetuating systems and might reveal important principles of system transition. We examined the extent to which maladaptive personality patterns were destabilized in a trial of cognitive therapy personality disorders (CT-PD) and how destabilization was associated with emotional processing and treatment outcomes. Dynamic systems theory was used as a theoretical framework for studying change.

Method: Participants were 27 patients diagnosed with Avoidant or Obsessive Compulsive Personality Disorder (AVPD or OCPD), who completed an open trial of CT-PD. Raters coded treatment sessions using a coding system that operationalizes emotional processing, as well as cognitive, affective, behavioral, and somatic components of pathological (negative) and more adaptive (positive) patterns of functioning. Pattern destabilization (dispersion) scores during the early phase of treatment (phase 1: session 1–10) and the schema-focused phase (phase 2: session 11–34) were calculated using a program called GridWare.

Results: More pattern destabilization and emotional processing in the schema-focused phase of CT-PD predicted more improvement in personality disorder symptoms and positive pattern strength at the end of treatment, whereas these variables in phase 1 did not predict outcome.

Conclusion: In addition to illustrating a quantitative method for studying destabilization and change of patterns of psychopathology, we present findings that are consistent with recent updates of emotional processing theory and with principles from dynamic systems theory.

Keywords: personality disorders, dynamic systems, associative networks, cognitive therapy, psychotherapy research

INTRODUCTION

For researchers interested in the science of change, psychotherapy for entrenched patterns of psychopathology can provide a context for revealing some basic principles of human change. Effective psychotherapy can be viewed as a way to perturb self-perpetuating and disabling patterns to facilitate new learning and more adaptive functioning. Personality disorders, by definition, are longstanding maladaptive patterns with interacting cognitive, affective, behavioral, and somatic components that are highly interconnected and resistant to change (American Psychiatric Association [APA], 2013). Avoidant and obsessive–compulsive personality disorders (AVPD and OCPD) epitomize two emotion regulation strategies that are associated with a number of forms of psychopathology – avoidance and repetitive, unproductive analysis and processing, such as worry and rumination (Hayes et al., 1996; Watkins, 2008; Kashdan and Rottenberg, 2010). Cognitive therapy for personality disorders (CT-PD; Beck et al., 2004) and related schema-based therapies (e.g., Young et al., 2003; Arntz, 2012) are designed to reduce regulation strategies that inhibit change and to dislodge pathological patterns that maintain personality disorders. Thus, clinical trials of treatments for personality disorders can provide a medium for studying the therapeutic change process with particularly entrenched and self-perpetuating problems. We examined the extent to which maladaptive personality patterns were destabilized in a trial of CT-PD (Beck et al., 2004), and whether destabilization was associated with treatment outcomes and with emotional processing, a key hypothesized mechanism of therapeutic change. We apply some basic principles from dynamic systems theory as a theoretical framework for the study of change.

BASIC PRINCIPLES OF DYNAMIC SYSTEMS THEORY RELEVANT TO PSYCHOTHERAPY

A dynamic systems perspective, which has been applied across sciences such as physics, biology, ecology, chemistry, and political science involves the study of relatively stable patterns, called attractors, as well as system destabilization and the process by which new attractors develop and stabilize (Thelen, 1995). The principles and general approach of dynamic systems theory can inform the study of how effective therapy moves individuals from disabling and rigid patterns to more flexible and adaptive ones (Hayes et al., 2007c; Schiepek and Perlitz, 2009; Salvatore and Tschacher,

2012). We illustrate a relatively simple approach for studying concepts from dynamic systems theory and apply it to the study of change in CT-PD (Beck et al., 2004). It is important to note that we distill some basic principles from the science of dynamic systems that can inform psychotherapy research (for more comprehensive presentations, see Lewis, 2005; van Geert and Steenbeek, 2005; Granic and Hollenstein, 2006; Salvatore and Tschacher, 2012), but these are theoretical constructs and not the same as a true application of dynamic systems analysis and modeling. Nonetheless, the framework and methods that we describe can place the study of therapeutic change in the context of a broader science of change. This approach can also apply to the investigation of other types of treatment and patterns of psychopathology.

A dynamic system consists of components that constantly interact with each other and with internal and external processes to form patterns that change and evolve over time (Thelen, 1995). An adaptive system maintains a dynamic tension between stability and variability. Stabilizing forces maintain the coherence or integrity of a system, whereas variability provides the flexibility necessary for adaptation, growth, and change (Hollenstein et al., 2013). When a dynamic system self-organizes, the components settle into preferred and relatively stable patterns, called *attractor states*. The system tends to return to these patterns when perturbed. Attractors that are activated repeatedly over time and contexts are particularly stable. When attractors are entrenched, a significant amount of energy and perturbation is required to move a system from these preferred states. Attractors that are less developed or have been destabilized are more sensitive to perturbation and thus are more easily changed.

Dynamically stable systems undergo constant perturbation related to internal dynamics and interactions with the environment. Stabilizing or inhibitory forces maintain system coherence and integrity by absorbing or assimilating perturbations, keeping the system organized around the same attractor state(s). When challenges are too great to assimilate, change is often not gradual and linear, but rather is characterized by disturbance and increased variability in system behavior, which can facilitate changes in system organization called *phase* or *order transitions* (Kelso et al., 1993; van Geert and van Dijk, 2002; Salvatore and Tschacher, 2012).

Perturbation studies in dynamic systems research have documented two early indicators of system transition: (1) a period of increased variability in system behavior called *critical instability* (van der Maas and Molenaar, 1992; Kelso, 1997; Vallacher et al., 2002; Schiepek et al., 2003; Schiepek and Strunk, 2010), and (2) a period of *critical slowing*, which is an increase in the time to recover from perturbation that reflects attractor stability and resilience (Scheffer et al., 2012). These indicators of impending transition are reliably quantified by the extent of variance in system behavior and temporal (lag-1) autocorrelation (extent to which the system becomes more and more like its past state; Dakos et al., 2012a,b). The study of system behavior in the vicinity of these early indicators can reveal: (1) the nature of the interactions among system elements, (2) system response to perturbation and challenge, (3) the emergence and break down of attractors, (4) the relative flexibility and rigidity of the system, and (5) the probability of change (Hollenstein et al., 2013). System dynamics can be understood on multiple, interacting levels and time scales, from moment-to-moment fluctuations in human behaviors to constellations of personality traits that occur over long periods of time across a variety of contexts (Hollenstein et al., 2013).

During periods of fluctuation, the system is destabilized and therefore more flexible and open to new information and exploration of potentially more adaptive configurations. System flexibility is conceptualized as curvilinear in that too much or too little flexibility is associated with worse functioning, whereas moderate levels are likely to reflect the balance of system integrity and openness to change (Lunkenheimer et al., 2011; Hollenstein et al., 2013). A system that is too rigid is characterized by patterns that perseverate and repeat over time and are insensitive to shifts in contextual demands, all of which inhibit adaptation.

A period of "flickering" (Dakos et al., 2013) or oscillating between alternative attractors (e.g., old and new patterns) can precede or accompany transition, until the system settles into a new dynamically stable state, marked by decreased variability in system behavior and increased temporal autocorrelation (Thelen and Smith, 1994; Kelso, 1997; van Geert and van Dijk, 2002; Scheffer et al., 2012). A new attractor can be strengthened and generalized by repeated activation across multiple contexts. If more adaptive, this new attractor can then inhibit or compete with the old attractor state(s) to prevent a return to less adaptive functioning.

DYNAMIC SYSTEMS CONCEPTS AND COGNITIVE-BEHAVIORAL THERAPY

Although not framed in the language of dynamic systems theory, key theories of change in cognitive-behavioral therapies (CBT) refer to constructs that can be understood from this perspective. For example, pathological associative networks, such as fear networks (Lang, 1977; Foa and Kozak, 1986), depressive networks or interlocks (Teasdale, 1999; Dozois and Beck, 2008), and the cognitive-affective-behavioral nodes and patterns of personality disorders (Young and Lindemann, 2002; Beck et al., 2004) can be conceptualized as attractors that are central targets of change in CBT.

Successful therapy is thought to involve the activation of these pathological patterns, together with exposure to corrective information and new experiences that induce dissonance. Consistent with dynamic systems principles, this disturbance challenges patients to develop new cognitive-affective-behavioral-somatic patterns rather than assimilate new information into old patterns. Destabilization of pathological patterns can facilitate new learning, a shift in meaning and affective response, and an integration of cognitive and affective experiences, often called *emotional processing* (Greenberg, 2002; Foa et al., 2006). This therapeutic processing involves approaching previously avoided or difficult experiences without becoming immersed in rumination, worry, venting, and other repetitive and unproductive forms of processing (Watkins, 2008). Emotional processing (also called cognitive-emotional processing) has been proposed by researchers across theoretical orientations to be a common mechanism of change, with applications across a range of treatments and clinical disorders (Foa and Kozak, 1986; Greenberg, 2002; Whelton, 2004; Foa et al., 2006; Carey, 2011; McCarthy et al., 2013; Hayes et al., 2014).

Emotional processing is likely to be apparent at points of destabilization and system transition, as we have found in the treatment of depression with an exposure-based cognitive therapy (Hayes et al., 2007a; Holtforth et al., 2012).

Recent developments in human and animal learning theory also highlight the importance of developing and strengthening new associative networks and patterns, which can function like new attractors and compete with pathological patterns to reduce the risk of relapse (Bouton, 2002; Foa et al., 2006; Craske et al., 2008; Schiller et al., 2008; Schiepek et al., 2015). Depression researchers similarly have begun to emphasize not only destabilizing depressive patterns, but also generating and consolidating new, more positive and adaptive patterns (Dunn, 2012; Carl et al., 2013). For instance, Dozois et al. (2009) highlight that patients treated with cognitive therapy (combined with pharmacotherapy) showed both a decrease in the interconnectivity of negative interpersonal schemata and an increase in interconnectivity of positive interpersonal schemata. In contrast, those who received pharmacotherapy alone did not show such changes in connectivity. These authors suggest that the development of what can be conceptualized as a new attractor might account in part for the prophylactic effects of cognitive therapy. In a small sample patients who received exposure therapy for obsessive-compulsive disorder, Schiepek et al. (2013) also demonstrated that new patterns and qualitative shifts in functioning occurred during periods of increased disturbance, and further that these new patterns were associated with therapeutic changes in patterns of neuronal activation. In short, therapeutic change is likely to involve disrupting old, well-worn patterns and developing new, more adaptive configurations of cognition, emotions, behaviors, and somatic functioning that, with repetition across contexts, evolve into new attractors.

RIGIDITY, FLEXIBILITY, AND CHANGE IN PERSONALITY DISORDERS

A dynamic systems framework may be particularly relevant when conceptualizing personality disorders and their treatment. Modern theorists propose that personality is a complex dynamic system, rather than a static grouping of traits or tendencies (Cloninger et al., 1997; Cervone, 2004). Extending his earlier cognitive-affective personality systems theory (CAPS; Mischel and Shoda, 1995, 1998) to treatment, Mischel (2004) contends that personality is more than the associations between single situations and responses and is better understood as relatively stable and predictable patterns that emerge over time. The challenge of therapy from this perspective is to identify the situations that trigger the patterns, change the relationships among the elements and the "processing dynamics," decrease automaticity, and increase openness to modification (p. 194). Cervone's (2004) knowledge-and-appraisal personality architecture (KAPA) and Read et al.'s (2010) "neural network model" of personality also suggest that personality is best understood by the dynamic interaction among its internal elements (e.g., cognitive, affective, behavioral) and between these elements and the external environment. Borsboom and Cramer's (2013) network approach similarly conceptualizes psychopathology as a causal system of functionally interrelated symptoms that have settled into a pathological equilibrium (see also Schmittmann et al., 2013).

Personality disorders are characterized by dysfunctional personality traits or dimensions that are relatively stable across time and situations (American Psychiatric Association [APA], 2013). These disorders require therapists to treat problems at the level of patterns or networks, given the pervasiveness of the problems and the high rates of comorbidity with other disorders that further solidify the patterns (Clark, 2009). Young and Lindemann (2002) propose that "early maladaptive schemas" (EMSs), or deeply entrenched patterns of cognition, affect, and behavior, underlie the rigidity of personality disorders. EMSs are thought to stem from adverse early life experiences and to be maintained by perceptual biases and maladaptive behavioral tendencies that feed back into and strengthen these schemas. Beck et al. (2004) emphasize the importance of fully activating the cognitive-affective-motivational programs that form maladaptive personality patterns, exploring their historical antecedents, and introducing corrective information to destabilize old patterns and facilitate cognitive restructuring and emotional processing. Thus, schema-focused treatments are multimodal in their focus and target broad, maladaptive patterns of functioning. Recent evidence suggests that schema-focused approaches are associated with significant improvement in personality disorders (Leichsenring and Leibing, 2003; Arntz, 2012). In addition, change in schemas and symptomatology can mutually reinforce each other and contribute to the development of more adaptive patterns of functioning (Lobbestael et al., 2007; van Vreeswijk et al., 2014).

The task of therapy for Cluster C (anxious, fearful) personality disorders is to destabilize the maladaptive patterns that maintain the disorders and increase flexibility, which has been proposed to be a fundamental aspect of mental health (Kashdan and Rottenberg, 2010). For instance, in a time series of an individual patient with avoidant personality disorder (AVPD) and comorbid depression, Maurer et al. (2011) illustrated how more instability of problematic patterns was associated with transition points in the course of therapy and better outcome. The treatment of personality disorders might involve inducing two types of variability: (1) *opening and loosening* pathological patterns early in treatment by providing a strong treatment rationale, case conceptualization, and a supportive treatment context, as well as building resources and instilling hope and motivation; and (2) *destabilizing* pathological patterns by exposing the person to corrective information and experiences and facilitating emotional processing. Both should be marked by an increase in the variability of patterns of cognitive, affective, behavioral, and somatic functioning, but the variability early in treatment might set the conditions for change, whereas the destabilization in the schema-focused phase might predict more substantial shifts in personality symptoms and facilitate the development of more adaptive patterns (Hayes et al., 2007a, 2014).

In previous research examining data from this trial of CT-PD (Beck et al., 2004), some forms of disruption and variability predicted later improvement in personality symptoms. Strauss et al. (2006) found that "rupture-repair" episodes (disruptions in the therapeutic relationship that can provide corrective information and facilitate change) were associated with more improvement in personality disorder and depressive symptomatology at the end

of treatment. Variability in self-esteem within the first 10 sessions of treatment was also associated with better treatment outcomes (Cummings et al., 2012). These findings suggest that increased variability in intra- and interpersonal functioning may be an important marker of change in CT-PD. Although promising, these studies examined disruption of single variables (self-esteem, the therapeutic alliance) rather than pathological and more adaptive patterns of functioning, the focus of the current study.

THE CURRENT STUDY

We examined change in cognitive-affective-behavioral-somatic patterns of patients with AVPD and OCPD, who received CT-PD (Beck et al., 2004). This therapy can be conceptualized as a perturbation in that it is designed to activate, challenge, and loosen multimodal patterns of personality functioning, which can be conceptualized as attractors. We describe a coding system that can be used to create pathological and more adaptive pattern variables with four components: cognitive, affective, behavioral, and somatic functioning. We illustrate how a freely available computer resource, GridWare (Lamey et al., 2004; Hollenstein, 2007), can be used to capture qualitatively and quantitatively the dynamics of pattern activation across the course of therapy.

We predicted that more destabilization of the pattern of pathological personality functioning, particularly in the schema-focused phase of CT-PD, would be associated with more symptom change and also with the emergence of a more positive, adaptive pattern at the end of treatment. More emotional processing during this period of destabilization was also expected to predict better outcomes. We explored whether the disturbance of old patterns and emotional processing were both important in the change process, or whether one or the other was primary.

MATERIALS AND METHODS

DATA SOURCE

Outcome data for this study were drawn from an archived open trial of CT-PD for AVPD and/or OCPD. The details of the trial have been described in an earlier publication (Strauss et al., 2006); we present below the design and outcome variables relevant to the present study. Audiotaped therapy sessions from the trial were coded to create the negative (personality disorder-related) and positive (more adaptive) patterns, as well as the emotional processing variable.

PARTICIPANTS

Potential participants were administered the Structured Clinical Interview for the DSM-III-R (SCID; Spitzer et al., 1990a) and the Structured Clinical Interview for the DSM- III-R Personality Disorders (SCID-II; Spitzer et al., 1990b) at intake. As noted in the Strauss et al. (2006) description of the trial, a review of the original assessments revealed that all patients also met criteria for SCID-II for DSM-IV (First et al., 1997). Exclusion criteria were active suicidality, substance dependence within the past year, psychosis, bipolar disorder, schizotypal or borderline personality disorder, or organic dysfunction. Thirty patients in that trial met diagnostic criteria for a primary diagnosis of AVPD ($n = 22$) or OCPD ($n = 8$) and completed the session 34 symptom assessment. In addition, 75% met criteria for comorbid major depressive disorder, 56% for a comorbid anxiety disorder, and 28% of those with a primary diagnosis of AVPD or OCPD also met criteria for the other personality disorder. Patients were allowed up to 52 sessions that occurred across 12–16 months. On average, participants attended 29.74 sessions (SD = 18.85).

Twenty-seven of the 30 patients had symptom data at pretreatment and week 34 (which was used as the posttreatment score) and had audible session tapes during that period. The mean age of participants was 34 years old (SD = 9.30). The majority of patients were female (15 female, 12 male), single or divorced (63% single/divorced, 33% married), and 8% were ethnic minorities. All but one participant had some college education.

PERSONALITY DISORDER SYMPTOMS

Personality disorder symptoms were assessed by the SCID-II (Spitzer et al., 1990b). Interviewers were postdoctoral psychologists with extensive training in structured interviewing and blind to patients' diagnosis and progress in therapy. Interviewers probed and rated the presence of each personality disorder symptom on a 3-point scale (0 = *absent*, 1 = *subthreshold*, 2 = *present*). Unweighted kappa coefficients for inter-rater agreement for AVPD and OCPD diagnoses were 0.94 and 0.69, respectively, which fall in the good to excellent range of agreement (Landis and Koch, 1977). Personality disorder severity ratings were obtained by totaling the individual symptom scores for each disorder to yield dimensional scores that corresponded to patients' primary diagnosis (AVPD or OCPD). The SCID-II was administered at intake, session 17, session 34, and at the last treatment session.

THERAPISTS AND TREATMENT OUTCOME

Fourteen therapists (2 predoctoral, 12 doctoral-level), who were previously trained in cognitive therapy at the Center for Cognitive Therapy at the University of Pennsylvania, received additional training in CT-PD (Beck et al., 1990). CT-PD is similar to Beck's cognitive therapy for depression (Beck et al., 1979) in its focus on dysfunctional schemata, cognitive-affective-behavioral connections, and teaching skills to modify schematic vulnerabilities. In addition, CT-PD places more emphasis on examining the historical roots of problems, interpersonal patterns, the therapeutic alliance, and eliciting in-session affect. The early phase of treatment focuses on symptom reduction (roughly the first 10 sessions), especially related to mood and anxiety disorders, and then the focus moves to schema level change (after session 10). We therefore examined process variables in the symptom reduction phase (phase 1) and in the schema-focused phase (phase 2: sessions 11–34).

Therapists received one hour of individual supervision for every two hours of therapy and attended weekly group supervision meetings and monthly case conferences. In addition, the Revised Cognitive Therapy Rating Scale (Blackburn et al., 2001) was used by raters blind to type of Cluster C diagnosis and treatment outcome. One session was sampled and rated from phase 1 and one session from phase 2 for each patient. The mean therapist competence ratings were above the established threshold for competence (for details see Strauss et al., 2006).

Outcome analyses for all patients who completed any personality and depression symptom assessments after initial intake were

reported in Strauss et al. (2006). *T*-tests of pre to posttreatment differences revealed that CT-PD was associated with significant improvement in personality and depression symptoms with large effect sizes [SCID-II: mean difference = 6.59, SD = 3.31, 95% CI = 5.27–7.91, $t(29) = 10.16$, $p < 0.001$; Cohen's $d = 1.98$; Beck Depression Inventory (BDI; Beck et al., 1961): mean difference = 8.60, SD = 8.45, 95% CI = 5.89–11.30; $t(29) = 6.43$, $p < 0.001$; effect size $d = 1.02$]. Only 6% met diagnostic criteria for AVPD or OCPD at posttreatment, and although 75% met criteria for a comorbid mood disorders at intake, only 37% met criteria at posttreatment.

CODING OF CT-PD SESSIONS

Coders were three doctoral-level clinical psychology graduate students and one bachelor-level research assistant. All were blind to patient diagnosis, session number, and treatment outcome. Coders were trained to criterion with practice coding for approximately 10 h. After reaching criterion agreement (intraclass correlation coefficient; ICC = 0.80), two coders rated each session. Coders were paired with each other an equal number of times. Weekly to biweekly meetings were held to review discrepancies and prevent rater drift.

The *CHANGE coding system* (Hayes et al., 2006) was used to code the content of therapy sessions in this trial of CT-PD. The coding system includes a range of variables thought to be important in the therapeutic change process. The variables relevant to the current study assess cognitive, affective, behavioral, and somatic aspects of functioning, as well emotional processing. Each variable is coded on a scale from 0 to 3 (0 = *not present or very low*, 1 = *low*, 2 = *medium*, 3 = *high*). Variables are not mutually exclusive and can co-occur.

All sessions were audiotaped, and each session was coded independently by two of the four raters. Sessions were 50 min in duration. Because each patient had up to 52 session tapes and coding is labor-intensive, we coded every other session from the early phase of CT-PD (sessions 1–10) and every fourth session from the second phase of treatment (11–34). In addition to coding session one for baseline and session 34 for posttreatment, an average of 4.07 (SD = 0.68) of 5 (81%) possible session tapes from phase 1 were coded, and an average of 4.96 (SD = 1.04) of 6 (82.6%) possible sessions from the schema-focused phase were coded. Pattern strength and dispersion scores (described below) take into account the number of sessions available for a given patient. Interrater agreement on all coding categories was good to excellent (ICC = 0.70–0.87). Because agreement was good, the ratings for the two coders on each item of the CHANGE for a given session were averaged. Averaged ratings were used in all analyses.

CHANGE VARIABLES: EMOTIONAL PROCESSING AND COGNITIVE-AFFECTIVE-BEHAVIORAL-SOMATIC PATTERN VARIABLES

Emotional Processing is defined as exploring and questioning issues and emotions related to one's maladaptive functioning, with some shift in meaning, perspective, and affective response and at higher levels, with an integration of cognitive and affective experiences. Affective arousal without some insight or perspective shift is not considered processing. Rumination, worry, and other perseverative thoughts are also not coded as emotional processing.

Two cognitive-affective-behavioral-somatic pattern variables were created. One assessed patterns related to one's personality disorder or other maladaptive functioning (labeled *Negative Pattern*), and one assessed more adaptive functioning (labeled *Positive Pattern*). Each pattern included four components or nodes: cognition, emotion, behavior, and somatic functioning. Six CHANGE variables were used to capture the four pattern nodes. Each CHANGE variable is coded for valence (positive, negative) and level (0 = *not present or very low* to 3 = *high*).

A cognitive node variable was created by averaging the scores of three cognitive variables: *View of Self, Hope,* and *Relationships*. This combination captures the cognitive triad: views of self, future, and others (Beck et al., 1979). *View of Self* captures a person's self-concept and sense of worth. *Hope* captures the person's expectations for the future and commitment to change. *View of Relationships* is the perceived quality of the person's interactions with others or one's view of people in general. The *Emotion* node captures the emotion words expressed in the session, as well as the affective tone and level of arousal. The *Behavior* node describes the number and intensity of adaptive and maladaptive actions the person engaged in since the last session. The *Somatic Functioning* node captures mention of the impact of one's actions, thinking, or emotions on physiological functioning (e.g., Negative: reporting muscle tension, trouble sleeping, gastrointestinal distress; Positive: reporting feeling calm, relaxed, more peaceful). This category is not coded for physiological responses associated with sickness, surgery, jet lag, and other circumstances not clearly related to one's psychological functioning.

Negative and positive pattern strength scores were computed for the first session and the session closest to session 34 for each patient. These variables yielded measures of overall pattern strength at baseline and posttreatment and provided another indicator of functioning in addition to the SCID-II personality disorder symptom scores. Negative pattern scores were computed by summing the CHANGE scores on the four node ratings [CHANGE ratings for cognition, emotion, behavior, somatic functioning nodes rated 0–3 (0 = *not present to very low*, 3 = *high*)] for a given session. Similarly, positive pattern scores were computed by summing the positive cognitive, emotion, behavior, and somatic functioning nodes. For example, negative pattern strength would be high when a patient describes and elaborates strong views of the self as incompetent, defective, and socially awkward (cognitions, rating = 3), and reports feeling anxiety, loneliness, and sadness (emotions, rating = 3), multiple instances of avoidant coping and social withdrawal (behaviors, rating = 3), and occasional trembling in social situations (somatic, rating = 1). The negative pattern strength in this example is 10.

MEASUREMENT OF PATTERN ACTIVATION AND DESTABILIZATION: STATE SPACE GRIDS AND GridWare

State-space grid

GridWare (Lamey et al., 2004; Hollenstein, 2007) was used to create state space grids for each patient over the course of CT-PD. The two variables used for each axis were: *negative pattern activation* and *positive pattern activation*. These variables were created to

operationalize the extent to which the cognitive, affective, behavioral, and somatic nodes of the negative or positive pattern were activated during a given session. These activation scores are different from the baseline and posttreatment pattern scores, which provide a sum of the CHANGE ratings for each of the four nodes (cognitive, affective, behavioral, and somatic), or the overall *pattern strength*. Pattern strength does not provide information on how multimodal the activation is.

The activation scores capture the number of the four nodes activated at a moderate to high level (rating of 2 or 3) on the CHANGE ratings. This sets a clear threshold for defining activation or engagement of each area of functioning (cognitive, affective, behavioral, and somatic). The number of nodes activated (breadth) was of interest because of the therapeutic importance of activating the full network or pattern of pathology to facilitate change (Foa and Kozak, 1986; Teasdale, 1999; Young and Lindemann, 2002; Beck et al., 2004). For instance, multimodal activation and challenges of the beliefs, emotions, behaviors, and somatic responses that maintain a patient's personality disorder are likely to be more potent than a focus on only one node, such as cognitions. Similarly, developing and exercising multiple nodes of a more adaptive positive pattern can help strengthen and solidify the new learning (e.g., Bouton, 2002; Foa et al., 2006; Craske et al., 2008; Schiepek et al., 2015).

To create final positive and negative activation scores, the number of activated positive or negative nodes in each session's narrative were summed. Each participant had a total score for positive and negative pattern activation per session in a given phase of treatment. These scores could range from 0 (*no nodes activated at a moderate to high level*) to 4 (*all nodes activated above threshold*). GridWare thus assesses pattern *breadth* (number of nodes activated, 0–4), considering also the *strength* of activation (0 = *none to very low*, 1 = *low*, 2 = *moderate*, 3 = *high* on the CHANGE rating scale) of each node in the negative and positive pattern. In the example of high negative pattern strength above, three (cognition, emotion, behavior) of the four nodes were activated at a moderate to high level; thus, the negative activation score would be 3. **Figure 1** illustrates how CHANGE codings are used to create the negative and positive pattern activation scores.

Dispersion

Activation scores for each session for each patient were entered into GridWare, with positive pattern activation on the x-axis and negative pattern activation on the y-axis. This provides a visual map of the behavior of the patterns for that person over the course of CT-PD (phase 1, phase 2). To aid analysis, we separated the behavior of the patterns into two phases of CT-PD: symptom reduction (phase 1: sessions 1–10) and schema focus (phase 2: session 11–34). The distribution of the activation scores can be used to calculate the extent of pattern rigidity or variability.

Dispersion operationalizes the variance or "spread" of the positive and negative activation scores across the grid for a particular patient in phase 1 or 2 of therapy. More stability is characterized by less movement across the cells of the grid, whereas more variance is characterized by a wider range of movement or distribution across the cells. Dispersion is computed by taking the sum of the squared proportional durations across all cells in the grid, corrected for the total number of cells and inverted so that values range from 0 (*no dispersion* – all behavior in one cell) to 1.00 (*maximum dispersion*- all behavior distributed across different cells). Dispersion is computed by the equation: $1 - [(n \sum(di/D)^2) - 1]/(n - 1)$. *D* is the total duration (in this case the total number of sessions in that phase), d*i* is the number of sessions spent in a given cell, and *n* is the total number of cells or states in the grid. The right panel of **Figure 1** shows an example of a patient with high dispersion across the sessions in phase 2 of treatment.

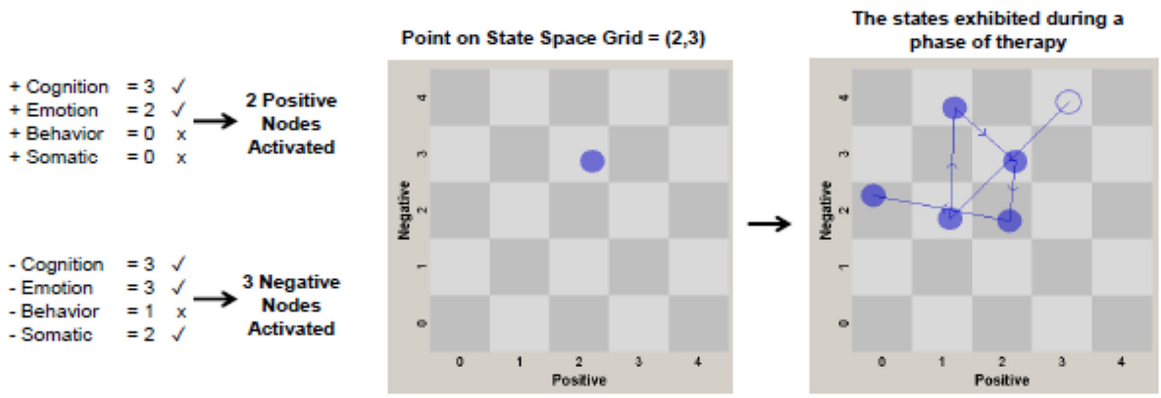

FIGURE 1 | Chart depicting how CHANGE coding variables (positive and negative cognition, emotion, behavior, and somatic functioning) are converted from raw values for an individual patient to points on the state space grid. Each CHANGE variable with a check mark (rather than an *x*) was coded at a moderate or high level (score of 2 or 3) and therefore is considered "activated." The number of CHANGE variables (or nodes of each pattern) activated are then used to plot a point on the state space grid. The number of positive pattern nodes activated corresponds to a value on the *x*-axis, and the number of negative pattern nodes activated corresponds to a point on the *y*-axis. Two treatment phase grids [phase 1 (sessions 1–10), phase 2 (sessions 11–34)] are plotted for each patient. The grids are used to generate dispersion scores for each patient in each phase of treatment. The panel on the right illustrates a patient with a high dispersion score of 0.868 in the schema-focused phase of CT-PD. Low dispersion scores occur when few cells on the grid are visited, as might occur in the earliest sessions of treatment.

RESULTS

PRELIMINARY ANALYSES

Neither AVPD nor OCPD diagnostic status predicted posttreatment outcome on the SCID-II or the positive and negative pattern scores, after controlling for respective pretreatment scores. In addition, there were no significant differences between AVPD and OCPD patients on the extent of dispersion or processing in either phase 1 or 2 of CT-PD. Thus, the two Cluster C groups, AVPD and OCPD, were aggregated to increase statistical power.

The first session maladaptive (negative) and positive pattern strength scores were used for baseline and the scores closest to session 34 were used for posttreatment for each patient. Dispersion was calculated for the sessions coded in the early phase of treatment (phase 1: sessions 1–10, excluding baseline) and then in the schema phase (phase 2: sessions 11–34, excluding posttreatment). The highest (peak) level of processing was identified from the first 10 sessions and then from the schema phase of treatment. Because emotional processing often occurs and then decreases, the highest level achieved (peak) more accurately detects shifts in meaning, perspective, and affective responses than mean values, as we have found in previous research (e.g., Hayes et al., 2007a). The modal session number of peak processing was 15 (56% of the sample), and the mean peak processing session number was 18.40 (SD = 4.26). In all cases, the peak processing score preceded the measure of posttreatment outcome.

Descriptive and correlational statistics for all predictor and outcome variables are presented in **Table 1**. Pretreatment personality symptom severity was not associated with any of the predictors, but higher baseline positive pattern scores were associated with more early dispersion. Dispersion in phases 1 and 2 were significantly correlated, as were processing scores in phases 1 and 2. Dispersion in phase 2 was marginally but not significantly correlated with processing in that same phase. It is interesting to note that the negative and positive pattern strength scores were not significantly correlated at baseline or posttreatment, suggesting that the positive pattern strength scores might be more than simply a decrease in the negative scores.

As reported in a previous publication on this sample (Strauss et al., 2006), both personality disorder and depression symptoms decreased significantly with large effects sizes. Paired sample *t*-tests in the current study also revealed that CT-PD was associated with significant pre to posttreatment reductions in maladaptive patterns (negative pattern: mean diff = 1.06, SD = 1.87, *CI* = 0.32, 1.79, $t(26) = 2.94$, $p < 0.01$, Cohen's $d = 0.57$) and increases in adaptive functioning (positive pattern: mean diff = −0.72, SD = 1.83, *CI* = −1.45−0.0005; $t(26) = -2.06$, $p < 0.05$, $d = 0.40$). Processing scores were higher in phase 2 than in phase 1 (Mean diff = −0.46, SD = 0.65, *CI* = −0.72, −0.20, $t(26) = -3.64$, $p = 0.001$; $d = 0.71$), but dispersion scores did not differ significantly between phases (Mean diff = 0.08, SD = 0.27, *CI* = −0.03, 0.20, $t(26) = 1.53$, $p = 0.138$; $d = 0.29$).

PREDICTORS OF TREATMENT OUTCOME

Hierarchical multiple regression analyses were conducted to examine dispersion and emotional processing as predictors of posttreatment outcomes. Personality symptoms and negative and positive pattern strength scores at session 34 were examined as outcomes in separate models. In all models, pretreatment scores for a given outcome variable were entered in Step 1. In Step 2, dispersion and processing in phase 1 were entered in the first set of equations, and those same variables in phase 2 were entered in a second set of equations.

Neither dispersion nor processing in the early phase of CT-PD predicted any of the treatment outcomes (see **Table 2**). However, higher scores on dispersion and processing in phase 2 uniquely predicted improvement; together these variables accounted for 49% of the variance in personality symptoms and 64% of the variance in positive pattern strength. Neither dispersion nor processing predicted change in the negative pattern strength (see **Table 3**).

Table 1 | Summary of intercorrelations, means, and SD for predictor and outcome variables.

Variable	1	2	3	4	5	6	7	8	9	10
1. Dispersion 1		–								
2. Dispersion 2	0.57**	–								
3. Processing 1	0.06	0.05	–							
4. Processing 2	0.31	0.32	0.45*	–						
5. SCID-II pre	−0.18	−0.13	0.04	0.03	–					
6. SCID-II post	−0.39*	−0.53**	−0.14	−0.55**	−0.33	–				
7. Negative pre	0.17	−0.02	0.04	0.08	0.22	−0.41*	–			
8. Negative post	−0.01	−0.30	−0.01	−0.17	−0.14	0.04	0.11	–		
9. Positive pre	0.51**	0.34	0.01	0.23	−0.08	−0.45*	0.18	−0.19	–	
10. Positive post	0.39*	0.62**	0.22	0.64***	−0.09	−0.73***	0.30	−0.29	0.50**	–
Mean	0.62	0.54	1.65	2.12	10.82	4.93	4.68	3.63	1.55	2.28
SD	*0.24*	*0.33*	*0.53*	*0.62*	*2.18*	*3.35*	*1.24*	*1.53*	*1.28*	*2.09*

*1 = Phase 1; 2 = Phase 2; SCID-II = Structured Clinical Interview for DSM-IV; Negative = Personality Disorder Pattern; Positive = Positive Pattern; Pre = Baseline; Post = Posttreatment. *p < 0.05, **p < 0.01, ***p < 0.001.*

Table 2 | Hierarchical multiple regression analyses: dispersion and processing in phase 1 predicting therapy outcome variables.

	B	SE	β	*t*	*p*	R^2	ΔR^2	ΔF	$p\ \Delta F$
SCID-II									
Step 1						0.11	0.11	3.15	0.088
SCID-II pre	0.51	0.29	0.33	1.74	0.088				
Step 2						0.24	0.13	1.93	0.168
SCID-II pre	0.43	0.28	0.28	1.52	0.142				
Dispersion 1	−4.75	2.66	−0.33	−1.79	0.087				
Processing 1	−0.81	1.15	−0.13	−0.70	0.490				
Negative Pattern									
Step 1						0.01	0.01	0.28	0.599
Negative pre	0.13	0.24	0.11	0.53	0.599				
Step 2						0.01	0.001	0.01	0.987
Negative pre	0.14	0.26	0.11	0.53	0.601				
Dispersion 1	−0.19	1.38	−0.03	−0.41	0.889				
Processing 1	−0.05	0.60	−0.02	−0.08	0.940				
Positive Pattern									
Step 1						0.25	0.25	8.36**	0.008
Positive pre	0.82	0.28	0.50	2.89**	0.008				
Step 2						0.32	0.07	1.13	0.341
Positive pre	0.68	0.33	0.41	2.07	0.050				
Dispersion 1	1.51	1.79	0.17	0.84	0.408				
Processing 1	0.81	0.68	0.21	1.19	0.246				

*SCID-II = Structured Clinical Interview for DSM-IV; 1 = phase 1 (sessions 1–10); Negative = Personality Disorder Pattern; Positive = Positive Pattern; Pre = Baseline; Post = Posttreatment. **p < 0.01.*

DISCUSSION

We illustrate how GridWare (Lamey et al., 2004; Hollenstein, 2007), a computer program designed by developmental researchers to study transitions from a dynamic systems perspective, can be used to investigate variables central to psychotherapy research. The state space grid generated by GridWare can depict pattern activity for a given person in a specific phase of treatment or across an entire course of treatment. In our study, the program was used to capture pattern activation and destabilization (measured as dispersion). Patient sessions were coded with the CHANGE coding system (Hayes et al., 2006), which assesses components of pathological and more positive patterns of functioning, as well as emotional processing. Researchers also can choose other combinations of variables relevant to their specific research questions. The stability and variability of the patterns can be depicted and quantified using the measure of dispersion generated by GridWare. These within-individual variation data, which are gathered across a specified time window (e.g., a phase of treatment), can then be used at the group level of analysis to examine questions such as whether and where maladaptive patterns destabilize, what correlates with this increase in variance, and whether variability predicts better treatment outcomes. In this study, the phase 1 and phase 2 pattern dispersion scores for each individual, together with peak processing scores for each phase, were examined in regression equations as predictors of posttreatment outcomes. This illustrates how individual- and group-level data can be combined in simple ways to capture some of the dynamics of therapeutic change and also how coding systems, such as the CHANGE (Hayes et al., 2006) can be used to create therapy process studies from ongoing, or archived clinical trials.

In addition, the findings from this study can contribute to current theories of therapeutic change and fit within a broader framework of general system change. As hypothesized, pattern destabilization and emotional processing during the schema phase of therapy were both significant predictors of improvement in personality disorder symptoms and positive pattern strength at the end of treatment. There was some specificity, as only these variables during the schema phase of CT-PD predicted outcome.

PATTERN VARIABILITY (DISPERSION)

Avoidant personality disorder and obsessive–compulsive personality disorder are characterized by rigid restriction of affect, avoidance, and perseverative thinking and behaving. As in the treatment of anxiety disorders (Foa et al., 2006), the current study suggests that in the right context and at the right time, activation, and destabilization of the personality disorder-related patterns might be beneficial. Maurer et al. (2011) also illustrated

Table 3 | Hierarchical multiple regression analyses: dispersion and processing in phase 2 predicting therapy outcome variables.

	B	SE	β	*t*	*p*	R^2	ΔR^2	ΔF	$p\ \Delta F$
SCID-II									
Step 1						0.07	0.07	1.77	0.196
SCID-II pre	0.42	0.32	0.27	1.33	0.196				
Step 2						0.49	0.42	8.77**	0.002
SCID-II pre	0.37	0.25	0.24	1.50	0.149				
Dispersion 2	−3.59	1.69	−0.35	−2.13*	0.046				
Processing 2	−1.92	0.71	−0.45	−2.72*	0.013				
Negative Pattern									
Step 1						0.03	0.03	0.62	0.438
Negative pre	0.19	0.24	0.16	0.79	0.438				
Step 2						0.12	0.10	1.16	0.333
Negative pre	0.19	0.24	0.16	0.81	0.429				
Dispersion 2	−1.12	0.99	−0.27	−1.23	0.231				
Processing 2	−0.19	0.42	−0.10	−0.45	0.658				
Positive Pattern									
Step 1						0.24	0.24	7.05*	0.014
Positive pre	0.78	0.30	0.48	2.66*	0.014				
Step 2						0.65	0.42	12.72***	0.000
Positive pre	0.40	0.22	0.25	1.81	0.085				
Dispersion 2	2.51	0.92	0.39	2.73*	0.013				
Processing 2	1.27	0.38	0.46	3.73**	0.003				

*SCID-II = Structured Clinical Interview for DSM-IV; 2 = phase 2 (sessions 11–34); Negative = Personality Disorder Pattern; Positive = Positive Pattern; Pre = Baseline; Post = Posttreatment. *p < 0.05, ** p <0.01, ***p < 0.001.*

that periods of critical instability can reveal therapeutic transition points in the treatment of AVPD.

Early dispersion was only marginally associated with improvement in posttreatment personality disorder symptoms, whereas dispersion in the schema-focused phase not only predicted more symptom reduction, but also predicted an increase in the strength of the positive, more adaptive pattern. It may be that more variability in a person's thoughts, behaviors, emotions, and somatic functioning in the beginning of treatment reflects an opening or loosening of the rigid patterns of personality disorders and can set the conditions for further change. Indeed, more destabilization early in treatment was strongly correlated with destabilization in the subsequent schema-focused phase.

It is also possible that more early variability simply reflects less severe personality disorder pathology and rigidity at baseline. However, early dispersion scores were not significantly associated with more symptom severity at baseline, but instead were associated with more positive pattern strength at baseline. Baseline levels of positive resources and those developed over the first 10 sessions of CT-PD (e.g., changes in hope, motivation, self-esteem, and coping) might spark "upward spirals" that can counter or loosen the personality disorder-related patterns (Garland et al., 2010). For instance, in a study of this same trial of CT-PD, Cummings et al. (2012) found that early variability in one's self-esteem predicted more improvement in personality disorder symptoms and depression. In short, early dispersion might reflect a loosening of the rigid patterns of pathology that can allow for further change.

Dispersion in the subsequent schema-focused phase might capture the turbulence associated with more difficult schema-level change and with the emergence of more positive patterns of functioning. This might be akin to the concept of flickering (Dakos et al., 2013), which involves briefly visiting another attractor or pattern (in this case a new more adaptive pattern of functioning activated and developed in treatment), before the system shifts and stabilizes into the new pattern. Further research is needed to explore whether variability early and later in treatment might capture different facilitative conditions in the therapeutic change process.

EMOTIONAL PROCESSING

Emotional processing is hypothesized to be a key mechanism of therapeutic change across a range of treatments and clinical disorders (Foa and Kozak, 1986; Greenberg, 2002; Whelton, 2004; Foa et al., 2006; Carey, 2011; McCarthy et al., 2013; Hayes et al., 2014). We further hypothesized that more emotional processing would be apparent at points of destabilization and would predict improvement in personality disorder symptoms, as reported

in exposure-based cognitive therapy (Hayes et al., 2007a; Holtforth et al., 2012) and emotion-focused therapy (Pos et al., 2003; Pascual-Leone and Greenberg, 2007) for depression. Indeed, in the current study of patients with AVPD and OCPD (75% of whom had comorbid depression), more pattern destabilization (dispersion) and processing during the schema-focused phase of CT-PD predicted more improvement in personality disorder symptoms and adaptive functioning (positive network). Tschacher et al. (2012) reported similar findings on the importance of emotional activation and clarification, as well as insight, in a group schema-focused therapy for personality disorders.

As proposed in dynamic systems theory (Salvatore and Tschacher, 2012; Schiepek et al., 2015), increased variability and pattern destabilization might index points of transition in psychotherapy that can reveal important predictors of treatment outcome, such as emotional processing (Hayes et al., 2007a; Holtforth et al., 2012). Our findings also contribute to a growing body of literature suggesting that emotional processing, which is thought to play a central role in the treatment of anxiety disorders (Foa et al., 2006), might be also be important in the treatment of other disorders, such as personality disorders (Tschacher et al., 2012; McCarthy et al., 2013) and depression (Pos et al., 2003; Hayes et al., 2007a; Pascual-Leone and Greenberg, 2007; Holtforth et al., 2012)

POSITIVE GROWTH

Although the schema-focused phase of CT-PD can be destabilizing, both dispersion and processing during this phase predicted improvement in personality disorder symptoms and also in more positive patterns of functioning. This is consistent with research on schema-focused therapy for personality disorders (Young et al., 2003), which suggests that change in schemas and symptomatology mutually reinforce each other and can contribute to the development of new and more adaptive patterns of functioning (Lobbestael et al., 2007; van Vreeswijk et al., 2014).

The strengthening of positive patterns can be underemphasized in traditional psychotherapy for depression, anxiety, and personality disorders relative to the emphasis placed on reducing psychopathology (Dunn, 2012; Carl et al., 2013). However, research in modern learning theory (Bouton, 2002; Foa et al., 2006; Craske et al., 2008) and dynamic systems theory (Thelen and Smith, 1994; Kelso, 1997; van Geert and van Dijk, 2002; Schiepek et al., 2015) suggests that new learning and the development of new attractor states can help solidify change by competing with and preventing a return to old, less adaptive patterns. Our finding of significant change in the strength of the positive pattern at the end of CT-PD is similar to past research showing that cognitive therapy for depression can change the strength and interconnectedness of both negative and positive cognitive self-schemata (Dozois and Dobson, 2001; Dozois et al., 2009). The strength of the new pattern or potential attractor state is likely to be an important predictor of the long-term maintenance of treatment gains.

LIMITATIONS

A number of limitations should be considered when interpreting the findings from this study. The sample is typical of those reported in clinical trials of long-term treatments for personality disorders, but the sample size is small, and there is a clear need for replication. An important caveat is that some personality disorders, such as borderline personality disorder, are characterized by extreme lability (Zeigler-Hill and Abraham, 2006), and the focus is on stabilization rather than destabilization. Thus, our results might not generalize to treatment for personality disorders other than AVPD and OCPD, which are characterized by particularly rigid patterns of avoidance, worry, rumination, and other types of perseverative processing that inhibit change.

A strength of our approach is that we were able to build a process study into a completed and archived clinical trial, as we have recommended elsewhere (Hayes et al., 2007b). However, we were limited by the design of the original open trial of CT-PD, which did not include a control condition. Therefore, this study is restricted to an examination of within-subject variation, and the findings cannot be attributed specifically to CT-PD. In addition, the assessment of symptoms at baseline, session 17, and session 34 is not ideal for temporal sequencing of pattern destabilization, emotional processing, and change in symptoms and positive functioning. Further, the phase design that we used was imposed on the course of CT-PD based on the focus and content of treatment described in the CT-PD manual (Beck et al., 2004). However, the sessions at which phase 1 and 2 begin and end are approximate. CT-PD focuses on Axis I symptom reduction in roughly the first 10 sessions and then shifts to a focus on schema change. More frequent symptom assessment and more clear phase delineation would have allowed for more precise temporal sequencing of the variables. However, we did attempt to examine negative and positive pattern strength at baseline and session 34 so that they would not be redundant with the measurement of dispersion. We were also careful to identify the phase 2 peak processing levels that occurred before the end of treatment assessment.

The measure of dispersion captures the number of cells visited in the state space grid of GridWare. This variable does not distinguish variability within the personality disorder-related (negative) pattern from movement between that pattern and an alternative more adaptive (positive) one. In other words, the dispersion score could reflect variability within one pattern, across patterns, or within a new pattern. However, the highest dispersion scores are likely to reflect jumps from the personality-related pattern to the positive pattern. GridWare can be used to quantify specific regions of activation and dispersion within and between regions, but that requires more dense sampling of sessions than in the current study.

Another consideration related to session sampling is that because each patient had up to 52 sessions available to code and the CHANGE coding is labor-intensive, not all sessions could be coded. We sampled every other session from the first 10 sessions and then sampled every fourth session thereafter to capture sessions across the most active, schema-focused phase of CT-PD. Although this sampling strategy allows for coverage of the symptom reduction phase (sessions 1–10) and the schema-focused phase (11–34) of CT-PD, it is possible that some important sessions were missed. In addition, the difference in the between-session intervals across the phases might have implications for the extent of dispersion that could be captured by the GridWare program (Lamey et al., 2004). This relatively low density assessment

also did not allow for true time series analyses, which could be used to assess the extent of temporal (lag-1) autocorrelation, another important marker of system transition (Dakos et al., 2012a,b; Scheffer et al., 2012). Nonetheless, we did identify two significant predictors of symptom reduction and positive pattern strength: dispersion and processing in the schema-focused phase of treatment.

Our measure of negative and positive patterns is based on coding the content of audiotapes of therapy sessions from a course of CT-PD. The CHANGE coding system (Hayes et al., 2006) assesses the extent to which patients verbalize negative and positive cognitions, emotions, behaviors, and somatic functioning in the session or related to the week before the session. Thus, the coding is limited to patient verbalizations in a given session, and there was no visual information, as would be available with video recordings of the sessions. Somatic functioning could be mentioned in sessions (e.g., feeling nauseous, tense, unable to sleep, or relaxed and calm), but additional physiological measures or reports of physical functioning could have complemented the CHANGE coding of this component.

The pattern scores that we created and the activation and dispersion scores generated by GridWare can be used as individual-level or group-level data to compare phases of treatment, correlate with process variables, and predict treatment outcomes. What we describe is but one approach to the study of change that is relatively straightforward and can be applied to a variety of questions in psychotherapy research. There are also more sophisticated methods for operationalizing networks, patterns, or attractors and connectedness that could be applied to psychotherapy research when sample sizes are large (e.g., Cramer et al., 2010; Borsboom et al., 2011; Schmittmann et al., 2013). There are a range of analytic strategies that can be used to study: (1) variability in time course data (Nesselroade and Ram, 2004; Ebner-Priemer et al., 2009), including time series panel analysis (TSPA), which quantifies session-by-session change in process and outcome variables (Tschacher and Ramseyer, 2009; Tschacher et al., 2012); (2) flexibility and order of patterns of pathology (Schiepek and Strunk, 2010; Fisher et al., 2011; Newman and Fisher, 2013); and (3) network interconnectivity (Dozois and Dobson, 2001; Borsboom and Cramer, 2013), depending on the research questions of interest and the type of data available. A number of tools are also available at the early warning signs of transition toolbox website: www.early-warning-signals.org that can be used to quantify and analyze critical instabilities and critical slowing (Scheffer et al., 2012). In addition, the Synergetic Navigation System (SNS) is an ambulatory and real-time monitoring system that provides intensive assessment of process and outcome variables and tools for time series analyses (Schiepek et al., 2015).

CONCLUSION

It is important to reiterate that we examined positive and negative patterns, which we conceptualize as attractors, and the role of destabilization in the change process, but using dynamic systems theory as a conceptual framework is not the same as conducting true dynamic systems analyses and modeling. However, the general approach of perturbing an entrenched system and tracking the old and new patterns (or attractors) can provide a useful way of understanding the process of change in cognitive therapy for two entrenched personality disorders, AVPD and OCPD. We illustrated the use of two fairly simple research tools, the CHANGE coding system and GridWare, and how individual and aggregated group-level data can be used to study the process of therapeutic change. We have generated testable hypotheses that can be investigated further in larger samples with more frequent assessments of process and outcome variables, which would allow for more precise temporal sequencing of the variables and a finer degree of resolution.

ACKNOWLEDGMENTS

This research was supported by National Institute of Mental Health (NIMH) grant R21MH062662 awarded to Adele M. Hayes. We thank Dr. Aaron Beck and Dr. Cory Newman for permission to code the sessions from their archived clinical trial of CT-PD.

REFERENCES

American Psychiatric Association [APA]. (2013). *Diagnostic and Statistical Manual of Mental Disorders*, 5th Edn. Washington, DC: American Psychiatric Association. doi: 10.1176/appi.books.9780890425596

Arntz, A. (2012). "Schema therapy for cluster C personality disorders," in *The Wiley-Blackwell Handbook of Schema Therapy: Theory, Research, and Practice*, eds M. F. Van Vreeswijk, J. Broersen, and M. Nadort (Chichester: John Wiley & Sons, Ltd.), 397–414. doi: 10.1002/9781119962830.ch30

Beck, A. T., Freeman, A., and Davis, D. D. (2004). *Cognitive Therapy of Personality Disorders*, 2nd Edn. New York, NY: Guilford Press.

Beck, A. T., Freeman, A., Davis, D., and Associates. (1990). *Cognitive Therapy of Personality Disorders*. New York: Guilford Press.

Beck, A. T., Rush, A. J., Shaw, B. F., and Emery, G. (1979). *Cognitive Therapy of Depression*. New York: Guilford.

Beck, A. T., Ward, C. H., Mendelson, M., Mock, J., and Erbaugh, J. (1961). An inventory for measuring depression. *Arch. Gen. Psychiatry* 4, 561–571. doi: 10.1001/archpsyc.1961.01710120031004

Blackburn, I., James, I. A., Milne, D. L., Baker, C., Standart, S., Garland, A., et al. (2001). The revised cognitive therapy scale (CTS-R): psychometric properties. *Behav. Cogn. Psychother.* 29, 431–446. doi: 10.1017/S1352465801004040

Borsboom, D., and Cramer, A. O. (2013). Network analysis: an integrative approach to the structure of psychopathology. *Annu. Rev. Clin. Psychol.* 9, 91–121. doi: 10.1146/annurev-clinpsy-050212-185608

Borsboom, D., Cramer, A. O. J., Schmittmann, V. D., Epskamp, S., and Waldorp, L. J. (2011). The small world of psychopathology. *PLoS ONE* 6:e27407. doi: 10.1371/journal.pone.0027407

Bouton, M. E. (2002). Context, ambiguity, and unlearning: sources of relapse after behavioral extinction. *Biol. Psychiatry* 52, 976–986. doi: 10.1016/S0006-3223(02)01546-9

Carey, T. A. (2011). Exposure and reorganization: the what and how of effective psychotherapy. *Clin. Psychol. Rev* 31, 236–248. doi: 10.1016/j.cpr.2010.04.004

Carl, J. R., Soskin, D. P., Kerns, C., and Barlow, D. H. (2013). Positive emotion regulation in emotional disorders: a theoretical review. *Clin. Psychol. Rev.* 33, 343–360. doi: 10.1016/j.cpr.2013.01.003

Cervone, D. (2004). The architecture of personality. *Psychol. Rev.* 111, 183–204. doi: 10.1037/0033-295X.111.1.183

Clark, L. (2009). Stability and change in personality disorder. *Curr. Dir. Psychol. Sci.* 18, 27–31. doi: 10.1111/j.1467-8721.2009.01600.x

Cloninger, C. R., Svrakic, N. M., and Svrakic, D. M. (1997). Role of personality self-organization in development of mental order and disorder. *Dev. Psychopathol.* 9, 881–906. doi: 10.1017/S095457949700148X

Cramer, A. O., Waldorp, L. J., van der Maas, H. L., and Borsboom, D. (2010). Comorbidity: a network perspective. *Behav. Brain Sci.* 33, 137–150. doi: 10.1017/S0140525X09991567

Craske, M. G., Kircanski, K., Zelikowsky, M., Mystkowski, J., Chowdhury, N., and Baker, A. (2008). Optimizing inhibitory learning during exposure therapy. *Behav. Res. Ther.* 46, 5–27. doi: 10.1016/j.brat.2007.10.003

Cummings, J. A., Hayes, A. M., Cardaciotto, L., and Newman, C. F. (2012). The dynamics of self-esteem in cognitive therapy for avoidant and obsessive-compulsive personality disorders: an adaptive role of self-esteem variability? *Cognit. Ther. Res.* 36, 272–281. doi: 10.1007/s10608-011-9375-x

Dakos, V., Carpenter, S. R., Brock, W. A., Ellison, A. M., Guttal, V., and Ives, A. R., et al. (2012a). Methods for detecting early warnings of critical transitions in time series illustrated using simulated ecological data. *PLoS ONE* 7:e41010. doi: 10.1371/journal.pone.0041010

Dakos, V., Van Nes, E. H., D'Odorico, P., and Scheffer, M. (2012b). Robustness of variance and autocorrelation as indicators of critical slowing down. *Ecology* 93, 264–271. doi: 10.1890/11-0889.1

Dakos, V., Van Nes, E. H., and Scheffer, M. (2013). Flickering as an early warning signal. *Theor. Ecol.* 6, 309–317 doi: 10.1007/s12080-013-0186-4

Dozois, D. J. A., and Beck, A. T. (2008). "Cognitive schemas, beliefs and assumptions," in *Risk Factors in Depression*, eds K. S. Dobson and D. J. A. Dozois (San Diego, CA: Elsevier Academic Press), 121–143. doi: 10.1016/B978-0-08-045078-0.00006-X

Dozois, D. J. A., Bieling, P. J., Patelis-Siotis, I., Hoar, L., Chudzik, S., McCabe, K., et al. (2009). Changes in self-schema structure in cognitive therapy for major depressive disorder: a randomized clinical trial. *J. Consult. Clin. Psychol.* 77, 1078–1088. doi: 10.1037/a0016886

Dozois, D. J. A., and Dobson, K. S. (2001). A longitudinal investigation of information processing and cognitive organization in clinical depression: stability of schematic interconnectedness. *J. Consult. Clin. Psychol.* 69, 914–925. doi: 10.1037/0022-006X.69.6.914

Dunn, B. D. (2012). Helping depressed clients reconnect to positive emotion experience: current insights and future directions. *Clin. Psychol. Psychother.* 19, 326–340. doi: 10.1002/cpp.1799

Ebner-Priemer, U. W., Eid, M., Stabenow, S., Kleindienst N., and Trull, T. (2009). Analytic strategies for understanding affective (in)stability and other dynamic processes in psychopathology. *J. Abnorm. Psychol.* 118, 195–202. doi: 10.1037/a0014868

First, M. B., Spitzer, R. L., Williams, J. B. W., and Benjamin, L. S. (1997). *Structured Clinical Interview for DSM-IV Axis II Personality Disorders (SCID-II)*. Washington, DC: American Psychiatric Press, Inc.

Fisher, A. J., Newman, M. G., and Molenaar, P. C. M. (2011). A quantitative method for the analysis of nomothetic relationships between idiographic structures: dynamic patterns create attractor states for sustained posttreatment change. *J. Consult. Clin. Psychol.* 79, 552–563. doi: 10.1037/a0024069

Foa, E. B., Huppert, J. D., and Cahill, S. P. (2006). "Emotional processing theory: an update," in *Pathological Anxiety: Emotional Processing in Etiology and Treatment*, ed. B. O. Rothbaum (New York, NY: Guilford Press), 3–24.

Foa, E. B., and Kozak, M. J. (1986). Emotional processing of fear: exposure to corrective information. *Psychol. Bull.* 99, 20–35. doi: 10.1037/0033-2909.99.1.20

Garland, E. L., Fredrickson, B., Kring, A. M., Johnson, D. P., Meyer, P. S., and Penn, D. L. (2010). Upward spirals of positive emotions counter downward spirals of negativity: insights from the broaden-and-build theory and affective neuroscience on the treatment of emotion. *Clin. Psychol. Rev* 30, 849–864. doi: 10.1016/j.cpr.2010.03.002

Granic, I., and Hollenstein, T. (2006). "A survey of dynamic systems methods for developmental psychopathology," in *Developmental Psychopathology*, Vol. 1, *Theory and Method*, 2nd Edn., eds D. Cicchetti and D. J. Cohen (Hoboken, NJ: John Wiley & Sons), 889–930.

Greenberg, L. S. (2002). Integrating an emotion-focused approach to treatment into psychotherapy integration. *J. Psychother. Integr.* 12, 154–189. doi: 10.1037/1053-0479.12.2.154

Hayes, A. M., Feldman, G., Beevers, C., Laurenceau, J. P., Cardaciotto, L., and Lewis-Smith, J. (2007a). Discontinuities and cognitive changes in exposure-based cognitive therapy for depression. *J. Consult. Clin. Psychol.* 75, 409–421. doi: 10.1037/0022-006X.75.3.409

Hayes, A. M., Laurenceau, J. P., and Cardaciotto, L. (2007b). "Methods for capturing the process of change," in *Evidence-Based Outcome Research: A Practical Guide to Conducting Randomized Clinical Trials for Psychosocial Interventions*, eds A. M. Nezu and C. M. Nezu (Oxford: Oxford University Press), 335–358.

Hayes, A. M., Laurenceau, J. P., Feldman, G. C., Strauss, J. L., and Cardaciotto, L. A. (2007c). Change is not always linear: the study of nonlinear and discontinuous patterns of change in psychotherapy. *Clin. Psychol. Rev* 27, 715–724. doi: 10.1016/j.cpr.2007.01.008

Hayes, A. M., Feldman, G. C., and Goldfried, M. R. (2006). "The change and growth experiences scale (CHANGE): a measure of insight and emotional processing," in *Insight in Psychotherapy*, eds L. G. Castonguay and C. Hill (Washington, DC: American Psychological Association), 231–253.

Hayes, A. M., Ready, C. B., and Yasinski, C. (2014). "Exposure to emotion in depression: exposure-based cognitive therapy," in *Engaging Emotion in Cognitive Behavioral Therapy: Experiential Techniques for Promoting Lasting Change*, eds N. Thoma and D. McKay (New York, NY: Guildford Press), 121–145.

Hayes, S. C., Wilson, K. G., Gifford, E. V., Follette, V. M., and Strosahl, K. (1996). Experiential avoidance and behavioral disorders: a functional dimensional approach to diagnosis and treatment. *J. Consult. Clin. Psychol.* 64, 1152–1168. doi: 10.1037/0022-006X.64.6.1152

Hollenstein, T. (2007). State space grids: analyzing dynamics across development. *Int. J. Behav. Dev.* 31, 384–396. doi: 10.1177/0165025407077765

Hollenstein, T., Lichtwarck-Aschoff, A., and Potworowski, G. (2013). A model of socioemotional flexibility at three time scales. *Emot. Rev.* 5, 397–405. doi: 10.1177/1754073913484181

Holtforth, M. G., Hayes, A. M., Sutter, M., Wilm, K., Schmied, E., Laurenceau, J. P., et al. (2012). Fostering cognitive-emotional processing in the treatment of depression: a preliminary investigation in exposure-based cognitive therapy (EBCT). *Psychother. Psychosom.* 89, 259–260. doi: 10.1159/000336813

Kashdan, T. B., and Rottenberg, J. (2010). Psychological flexibility as a fundamental aspect of health. *Clin. Psychol. Rev* 30, 467–480. doi: 10.1016/j.cpr.2010.03.001

Kelso, J. A. S. (1997). Relative timing in brain and behavior: some observations about the generalized motor program and self-organized coordination dynamics. *Hum. Mov. Sci.* 16, 453–460. doi: 10.1016/S0167-9457(96)00044-9

Kelso, J. A. S., Ding, M., and Schöner, G. (1993). *Dynamic Pattern Formation: A Primer*. Cambridge, MA: The MIT Press.

Lamey, A., Hollenstein, T., Lewis, M. D., and Granic, I. (2004). *GridWare (Version 1.1). [Computer software]*. Available at: http://statespacegrids.org

Landis, J. R., and Koch, G. G. (1977). The measurement of observer agreement for categorical data. *Biometrics* 33, 159–174. doi: 10.2307/2529310

Lang, P. J. (1977). Imagery in therapy: an information processing analysis of fear. *Behav. Ther.* 8, 862–886. doi: 10.1016/S0005-7894(77)80157-3

Leichsenring, F., and Leibing, E. (2003). The effectiveness of psychodynamic therapy and cognitive behavior therapy in the treatment of personality disorders: a meta-analysis. *Am. J. Psychiatry* 160, 1223–1232. doi: 10.1176/appi.ajp.160.7.1223

Lewis, M. D. (2005). Bridging emotion theory and neurobiology through dynamic systems modeling. *Behav. Brain Sci.* 28, 169–245. doi: 10.1017/S0140525X0500004X

Lobbestael, J., van Vreeswijk, M. F., and Arntz, A. (2007). Shedding light on schema modes: a clarification of the mode concept and its current research status. *Neth. J. Psychol.* 63, 76–85.

Lunkenheimer, E. S., Olson, S. L., Hollenstein, T., Sameroff, A. J., and Winter, C. (2011). Dyadic flexibility and positive affect in parent–child coregulation and the development of child behavior problems. *Dev. Psychopathol.* 23, 577–591. doi: 10.1017/S095457941100006X

Maurer, G., Aichhorn, W., Leeb, W., Matschi, B., and Schipek, G. (2011). Real-time monitoring in psychotherapy-methodology and casuistics. *Neuropsychiatry* 25, 135–141.

McCarthy, K. L., Mergenthaler, E., and Grenyer, B. F. S. (2013). Early in-session cognitive-emotional problem-solving predicts 12-month outcomes in depression with personality disorder. *Psychother. Res.* 24, 103–115. doi: 10.1080/10503307.2013.826834

Mischel, W. (2004). Toward an integrative model for CBT: encompassing behavior, cognition, affect, and process. *Behav. Ther.* 35, 185–203. doi: 10.1016/S0005-7894(04)80011-X

Mischel, W., and Shoda, Y. (1995). A cognitive-affective system theory of personality: reconceptualizing situations, dispositions, dynamics, and invariance in personality structure. *Psychol. Rev.* 102, 246–268. doi: 10.1037/0033-295X.102.2.246

Mischel, W., and Shoda, Y. (1998). Reconciling processing dynamics and personality dispositions. *Annu. Rev. Psychol.* 49, 229–258. doi: 10.1146/annurev.psych.49.1.229

Nesselroade, J. R., and Ram, N. (2004). Studying intraindividual variability: what we have learned that will help understand lives in context. *Res. Hum. Dev.* 1, 9–29. doi: 10.1080/15427609.2004.9683328

Newman, M. G., and Fisher, A. J. (2013). Mediated moderation in combined cognitive behavioral therapy versus component treatments for generalized anxiety disorder. *J. Consult. Clin. Psychol.* 81, 405–414. doi: 10.1037/ a0031690

Pascual-Leone, A., and Greenberg, L. S. (2007). Emotional processing in experiential therapy: why "the only way out is through". *J. Consult. Clin. Psychol.* 75, 875–887. doi: 10.1037/0022-006X.75.6.875

Pos, A. E., Greenberg, L. S., Goldman, R. N., and Korman, L. M. (2003). Emotional processing during experiential treatment of depression. *J. Consult. Clin. Psychol.* 71, 1007–1016. doi: 10.1037/0022-006X.71.6.1007

Read, S. J., Monroe, B. M., Brownstein, A. L., Yang, Y., Chopra, G., and Miller, L. C. (2010). A neural network model of the structure and dynamics of human personality. *Psychol. Rev.* 117, 61–92. doi: 10.1037/a0018131

Salvatore, S., and Tschacher, W. (2012). Time dependency of psychotherapeutic exchanges: the contribution of the theory of dynamic systems in analyzing process. *Front. Psychol.* 3:253. doi: 10.3389/fpsyg.2012.00253

Scheffer, M., Carpenter, S. R., Lenton, T. M., Bascompte, J., Brock, W., Dakos, V., et al. (2012). Anticipating critical transitions. *Science* 338, 344–348. doi: 10.1126/science.1225244

Schiepek, G., Eckert, H., Aas, B., Wallot, S., and Wallot, A. (2015). *Integrative Psychotherapy: A Feedback-Driven Dynamic Systems Approach.* Göttingen: Hogrefe Publishing.

Schiepek, G., Eckert, H., and Weihrauch, S. (2003). Critical fluctuations and clinical change: data-based assessment in dynamic systems. *Constructivism Hum. Sci.* 8, 57–84.

Schiepek, G., and Perlitz, V. (2009). "Self-organization in clinical psychology," in *Encyclopedia of Complexity and Systems Science*, ed. R. A. Meyers (New York, NY: Springer), 7991–8009. doi: 10.1007/978-0-387-30440-3_472

Schiepek, G., and Strunk, G. (2010). The identification of critical fluctuations and phase transitions in short term and coarse-grained time series – a method for the real-time monitoring of human change processes. *Biol. Cybern.* 102, 197–207. doi: 10.1007/978-0-387-30440-3_472

Schiepek, G., Tominschek, I., Heinzel, S., Aigner, M., Dold, M., Unger, A., et al. (2013). Discontinuous patterns of brain activation in the psychotherapy process of obsessive-compulsive disorder: converging results from repeated fMRI and daily self-reports. *PLoS ONE* 8:e71863. doi: 10.1371/journal.pone.0071863

Schiller, D., Levy, I., Niv, Y., LeDoux, J. E., and Phelps, E. A. (2008). From fear to safety and back: reversal of fear in the human brain. *J. Neurosci.* 28, 11517–11525. doi: 10.1523/JNEUROSCI.2265-08.2008

Schmittmann, V. D., Cramer, A. O. J., Waldorp, L. J., Epskamp, S., Kievit, R. A., and Borsboom, D. (2013). Deconstructing the construct: a network perspective on psychological phenomena. *New Ideas Psychol.* 31, 43–53. doi: 10.1016/j.newideapsych.2011.02.007

Spitzer, R. L., Williams, J. B. W., Gibbon, M., and First, M. B. (1990a). *Structured Clinical Interview for DSM-III-R, Patient Edition/ Non-Patient Edition (SCID-P/SCID-NP)*. Washington, DC: American Psychiatric Press.

Spitzer, R. L., Williams, J. B. W., Gibbon, M., and First, M. B. (1990b). *Structured Clinical Interview for DSM-II-R—Personality Disorders (SCID-II)*. Washington, DC: American Psychiatric Press.

Strauss, J. L., Hayes, A. M., Johnson, S. L., Newman, C. F., Brown, G. K., Barber, J. P., et al. (2006). Early alliance, alliance ruptures, and symptom change in a nonrandomized trial of cognitive therapy for avoidant and obsessive-compulsive personality disorders. *J. Consult. Clin. Psychol.* 74, 337–345. doi: 10.1037/0022-006X.74.2.337

Teasdale, J. D. (1999). Emotional processing, three modes of mind and the prevention of relapse in depression. *Behav. Res. Ther.* 37(Suppl. 1), S53–S77. doi: 10.1016/S0005-7967(99)00050-9

Thelen, E. (1995). Motor development: a new synthesis. *Am. Psychol.* 50, 79–95. doi: 10.1037/0003-066X.50.2.79

Thelen, E., and Smith, L. B. (1994). *A Dynamic Systems Approach to the Development of Cognition and Action.* Cambridge, MA: The MIT Press.

Tschacher, W. W., and Ramseyer, F. F. (2009). Modeling psychotherapy process by time-series panel analysis (TSPA). *Psychother. Res.* 19, 469–481. doi: 10.1080/10503300802654496

Tschacher, W., Zorn, P., and Ramseyer, F. (2012). Change mechanisms of schema-centered group psychotherapy with personality disorder patients. *PLoS ONE* 7:e39687. doi: 10.1371/journal.pone.0039687

Vallacher, R. R., Read, S. J., and Nowak, A. (2002). The dynamical perspective in personality and social psychology. *Pers. Soc. Psychol. Rev.* 6, 264–273. doi: 10.1207/S15327957PSPR0604_01

van der Maas, H., and Molenaar, P. (1992). A catastrophe-theoretical approach to cognitive development. *Psychol. Rev.* 99, 395–417. doi: 10.1037/0033-295X.99.3.395

van Geert, P., and Steenbeek, H. (2005). Explaining after by before: basic aspects of a dynamic systems approach to the study of development. *Dev. Rev.* 25, 408–442. doi: 10.1016/j.dr.2005.10.003

van Geert, P., and van Dijk, M. (2002). Focus on variability: new tools to study intra-individual variability in developmental data. *Infant Behav. Dev.* 25, 340–374. doi: 10.1016/S0163-6383(02)00140-6

van Vreeswijk, M. F., Spinhoven, P., Eurelings-Bontekoe, E. H. M., and Broersen, J. (2014). Changes in symptom severity, schemas and modes in heterogeneous psychiatric patient groups following short-term schema cognitive–behavioural group therapy: a naturalistic pre-treatment and post-treatment design in an outpatient clinic. *Clin. Psychol. Psychother.* 21, 29–38. doi: 10.1002/cpp.1813

Watkins, E. R. (2008). Constructive and unconstructive repetitive thought. *Psychol. Bull.* 134, 163–206. doi: 10.1037/0033-2909.134.2.163

Whelton, W. J. (2004). Emotional processes in psychotherapy: evidence across therapeutic modalities. *Clin. Psychol. Psychother.* 11, 58–71. doi: 10.1002/cpp.392

Young, J. E., Klosko, J., and Weishaar, M. E. (2003). *Schema Therapy: A Practioner's Guide.* New York: Guilford Press.

Young, J. E., and Lindemann, M. (2002). "An integrative schema-focused model for personality disorders," in *Clinical Advances in Cognitive Psychotherapy: Theory and Application*, eds R. L. Leahy and E. T. Dowd (New York, NY: Springer Publishing Co.), 93–109.

Zeigler-Hill, V., and Abraham, J. (2006). Borderline personality features: instability of self-esteem and affect. *J. Soc. Clin. Psychol.* 25, 668–687. doi: 10.1521/jscp.2006.25.6.668

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Received: 24 September 2014; accepted: 21 January 2015; published online: 23 February 2015.

Citation: Hayes AM and Yasinski C (2015) Pattern destabilization and emotional processing in cognitive therapy for personality disorders. Front. Psychol. ***6****:107. doi: 10.3389/fpsyg.2015.00107*

This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology.

frontiers in PSYCHOLOGY

ORIGINAL RESEARCH ARTICLE
published: 02 October 2014
doi: 10.3389/fpsyg.2014.01089

Self-organization in psychotherapy: testing the synergetic model of change processes

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In recent years, models have been developed that conceive psychotherapy as a self-organizing process of bio-psycho-social systems. These models originate from the theory of self-organization (Synergetics), from the theory of deterministic chaos, or from the approach of self-organized criticality. This process-outcome study examines several hypotheses mainly derived from Synergetics, including the assumption of discontinuous changes in psychotherapy (instead of linear incremental gains), the occurrence of critical instabilities in temporal proximity of pattern transitions, the hypothesis of necessary stable boundary conditions during destabilization processes, and of motivation to change playing the role of a control parameter for psychotherapeutic self-organization. Our study was realized at a day treatment center; 23 patients with obsessive compulsive disorder (OCD) were included. Client self-assessment was performed by an Internet-based process monitoring (referred to as the Synergetic Navigation System), whereby daily ratings were recorded through administering the Therapy Process Questionnaire (TPQ). The process measures of the study were extracted from the subscale dynamics (including the dynamic complexity of their time series) of the TPQ. The outcome criterion was measured by the Yale-Brown Obsessive Compulsive Scale (Y-BOCS) which was completed pre-post and on a bi-weekly schedule by all patients. A second outcome criterion was based on the symptom severity subscale of the TPQ. Results supported the hypothesis of discontinuous changes (pattern transitions), the occurrence of critical instabilities preparing pattern transitions, and of stable boundary conditions as prerequisites for such transitions, but not the assumption of motivation to change as a control parameter.

Keywords: process-outcome research, self-organization, critical instability, sudden gains, obsessive compulsive disorder

INTRODUCTION

A large number of findings within psychotherapy research during recent years have revealed phenomena that, in classical medical models, would be considered anomalies. An example of such a phenomenon is the occurence of sudden gains in the course of symptoms, which go along with substantial changes in outcome criteria before the employment of any psychotherapeutic interventions (Ilardy and Craighead, 1999; Stiles et al., 2003; Tang et al., 2005, 2007; Vittengl et al., 2005; Busch et al., 2006; Kelly et al., 2007; Stulz et al., 2007). These findings suggest the psychotherapeutic process to be discontinuous and non-stationary instead of continuous and linear (Schiepek et al., 1992; Hayes and Strauss, 1998; Hayes et al., 2007; Schiepek and Perlitz, 2009; Haken and Schiepek, 2010). Together with findings that ascribe a comparatively small part of outcome variance to interventions and therapeutic techniques (Shapiro et al., 1994; Ahn and Wampold, 2001; Lambert and Ogles, 2004; Wampold, 2010), they give raise to substantial doubts on the classical view of linear proportionality between input (dosage) and output (outcome) in psychotherapy. Whereas input-output-mechanisms or mainstream dose-outcome models suppose some kind of linear or damped proportionalities between interventions and outcome, non-linear dynamic systems do not assume such proportionalities. Here small interventions can result in large effects on further system trajectories, or big interventions can be counterbalanced by the system dynamics—depending on the stability state of the system under consideration. By this, the mentioned results from the common factors research in psychotherapy point toward the non-linearity of therapeutic processes as a complex system, but further straightforward and positive indications of non-linear characteristics of change processes are necessary. Indeed, some studies produced findings of deterministic chaos, pattern formation and pattern transitions, non-linear precursors of critical events, and dynamic synchronization in high-resolution process markers of psychotherapy (e.g., Kowalik et al., 1997; Schiepek et al., 1997, 2009, in press; Tschacher et al., 1998, 2000; Granic et al., 2007; Ramseyer and Tschacher, 2008; Lichtwarck-Aschoff et al., 2012; Heinzel et al., 2014).

In order to grasp these phenomena, one has to entail models that do not ascribe psychotherapeutic effects merely

to disorder-specific interventions and their appropriate dose. Instead, alternative explanations are being offered from the theory spectrum of complex systems, where changes are understood to result from self-organizing processes (e.g., Mahoney, 1991; Guastello, 1995; Hayes and Strauss, 1998; Orsucci, 2006; Pincus, 2009; Haken and Schiepek, 2010). Here, psychotherapy is conceptualized as a process that tries to support the conditions for self-organized change that underlies the enhancement of capacities of clients and client systems. Self-organization theories (Synergetics: Kelso, 1995; Haken, 2004; self-organized criticality: Bak et al., 1989; Bak, 1996; van Orden et al., 2003) make certain assumptions and provide models from which a number of hypotheses can be derived. Over the next few years the aim should be to design such models on how therapy works in a more explicit way (e.g., a mathematical formalism on common factor dynamics), but also to examine and to corroborate or falsify them.

Pattern formation and pattern transitions in dissipative systems are supposed to occur by so-called disequilibrium phase transitions that are neither linear nor incremental, but occur spontaneously and discontinuously (Kelso, 1995; Haken, 2004). In psychotherapy, these patterns refer to cognitive, affective, or interactional dynamics of clients in natural or clinical settings (e.g., client-therapist interaction). They have a certain organized complexity and at least a transient stability, which is to be seen and to be measured by the embedding of the systems trajectories in a state phase. The organized pattern of such trajectories in a phase space (e.g., the dimensions of this phase space are defined by the variables defining the system) is its *attractor*. In the study at hand, the system trajectories (time series representing the course of therapy) are drawn from daily internet-based self-assessments of the clients.

According to these models, change is a spontaneous process from within a non-linear system rather than a mere reaction to certain "interventions" from the outside. Hence, discontinuous order transitions can be expected that do not necessarily occur in reaction to any specific interventions. For an understanding of how psychotherapy works, the identification of cognitive-emotional patterns and pattern transitions will play an important role. Beyond this, we should proceed in explicit modeling of data-based common factors, their non-linear functions to each other, and the parameters mediating the interactions.

Pattern transitions (here we use the physical terms phase transitions or less specifically: order transitions) require a certain activity level of relevant control parameters which in many physical systems are related to an energy-flow through dissipative systems, thus forcing them out of an existing state of equilibrium. In psychotherapy we do not provide energies of any kind nor do we as therapists have any control parameters at our command. However, one could assume that intrinsic motivation for change, or other mental processes such as emotional involvement, activation of resources, or working intensity, contribute to a client's commitment toward change and can be supported by the therapist. These factors might thus be interpreted as the driving parameters of change in therapeutic processes (control parameter equivalents).

Another assumption is that spontaneous order changes are prepared and accompanied by critical fluctuations. Unlike catastrophe theory (Thom, 1976), this is a central prediction in Synergetics (Haken, 2004). In numerous physical experiments as well as in human development, critical fluctuations and processes related to deviation-amplifying feedback, but also processes of stabilizing changed dynamic patterns, require stable boundary conditions. In physical experiments, such conditions are provided through certain features of the experimental design; in humans they result from consistent experiences, in particular stable relationships and attachment to important others (Carter et al., 1997; Buchheim, 2011). This is where the key role of the client-therapist relationship enters the picture. A stable relationship between client and therapist yields the solid boundary conditions, which in turn allow for a destabilization (self-organized criticality) as well as a restabilization of processes.

To sum up, the hypotheses that were examined in the study at hand are the following:

1. For therapy effects to occur, stable boundary conditions are a necessary requirement; clients experience these in form of a positive atmosphere at the treatment facility and in positive therapeutic relationships. This hypothesis corresponds with current knowledge concerning the importance of good therapeutic relationships (Norcross, 2010) and stable emotional ties to attachment figures as prerequisites for learning processes (Carter et al., 1997). We expect a positive correlation between stability conditions like positive ward atmosphere or trustful working alliance at the one hand and therapy outcome at the other.
2. Phases of critical instability will occur in the course of psychotherapeutic processes. Such phases can be operationalized by local peaks (i.e., intensities that exceed the average level) of the dynamic complexity of change processes. Local maxima of dynamic complexity should be positively correlated with the therapy outcome (Schiepek et al., 2003; Haken and Schiepek, 2010; Gumz et al., 2012).
3. There is a necessity for an interaction between local critical instability and the stability of boundary conditions. (The stability of boundary conditions is operationalized by the experienced ward atmosphere and relationship with fellow patients.) Both are important and predictive for therapy results in as far as especially during instable periods of change processes experiences of stability are important (e.g., in the ward atmosphere or in the working alliance). Supposing a dialectic or counterbalancing relationship between both conditions of self-organization, a statistical interaction effect is expected.
4. Intrinsic motivation for change could be an equivalent of control parameters and is expected to positively correlate with therapy effects. In a strict sense, the effect of control parameters can only be tested in an experimental design which allows for a controlled linear increase of the parameter(s) (causally) related to an expected discontinuous phase transition. Since in human systems intra- or inter-individual conditions for change processes (parameters like motivation for change, intensity of emotions, stress level) usually are not available for external (experimental) control, we decide for an explorative and correlative approach.

5. Instationarities or order transitions are not dependent from specific interventions, therefore, we expect these transitions (sudden gains or losses) to occur independent of or already before major interventions are introduced. In the study at hand, the "major intervention" was exposure with response prevention (ERP) as part of a behavior therapy program for patients with obsessive compulsive disorder (OCD).
6. Changes occur in a discontinuous manner (hypothesis of instationarity), where the steepest change gradient is associated with the occurrence of critical instability. This hypothesis is directly based on the theoretical conjecture of Synergetics, that an enlargement of the potential valley of an existing pattern (attractor) implicates critical fluctuations and proceeds to a symmetry state with unavoidable symmetry breaking (transition to a changed pattern).

METHODS

SETTING AND TREATMENT

Twenty-three clients were recruited from a psychosomatic day treatment center in Munich, Germany, specialized in treating OCD. All participants gave informed consent to the inclusion into the study and participated on a deliberate base. The therapy rationale followed cognitive-behavioral therapy including psychoeducation, analysis of obsession- and compulsion-related behavior and cognitions, and exposure exercises (Lakatos and Reinecker, 2007). Therapy was primarily provided in a group setting, with one group session per day (Monday to Friday) accompanied by individual therapy sessions once or twice per week. The cognitive-behavioral therapeutic groups were guided by two experienced female therapists and two experienced female co-therapists (each had at least 10 years of practical experience in clinical settings). Additionally, clients participated in weekly relaxation training (Jacobson, 1990) and mentalization-focused sessions in a group setting.

From 23 clients, 18 participated in a period of massive exposure with response prevention (ERP) during their stay at the outpatient center. Five clients were not willing to participate in the massive ERP exercises and conducted minor exposure exercises and further cognitive therapy sessions instead. ERP exercises were conducted in individual therapy sessions after a period of preparation in the group setting like writing, signing an "ERP contract," practicing coping skills, and performing minor exposure exercises. During the pre-ERP phase, the patients underwent exposure and coping exercises that focused on every-day and interpersonal situations of minor intensity and difficulty.

The outcome measurement by the Yale-Brown Obsessive Compulsive Scale (Y-BOCS) and the daily ratings by the Therapy Process Questionnaire (TPQ, see below) were realized by an Internet-based system (the Synergetic Navigation System, SNS) which was an integrative part of the therapy routine of the outpatient center in Munich. The SNS was used for continuously self-ratings of all patients (including diaries) applying a generic time schedule (here: process measures once per day, outcome measures two times per week). The system allows for graphical presentation and non-linear time series analysis of the process data.

A written informed consent was obtained from all participants after the procedures of the study had been fully explained.

PARTICIPANTS

The sample covered 23 Caucasian clients diagnosed with OCD (for sample characteristics see **Table 1**). Clients were assessed by an experienced psychiatrist and classified in accordance with the International Classification of Diseases (ICD-10) as F42.0 "OCD, primarily obsessions and ruminations" (4 clients), as F42.1 "OCD, primarily compulsions" (4 clients), or as F42.2 "OCD, obsessions and compulsions" (15 clients). All clients completed the Y-BOCS biweekly and the TPQ once per day. The duration of treatment in days corresponds to the number of measurement points in the time series of TPQ ratings (mean: 60.2; $SD = 12.7$). Except where otherwise noted, all analyses were performed with the full sample of 23 clients.

MEASURES AND PROCEDURE

Process measures

Daily ratings were collected by an Internet-based device (Synergetic Navigation System, SNS, Schiepek, 2009). SNS is an ambulatory and real-time monitoring system which provides outcome- and especially process-assessment, with integrated mathematical tools for the analysis of non-linear and non-stationary time series (Schiepek and Perlitz, 2009; Schiepek and Aichhorn, 2013). Here we used a rating frequency of once per day and administered a questionnaire developed specifically for daily self-ratings during psychotherapeutic processes (TPQ) (Schiepek et al., 2003). The TPQ consisted of 47 items grouped into 5 scales. The TPQ allows for a reflection and assessment of emotions (like joy, fear, grief, anger, self-esteem), self-efficacy and therapeutic progress, hopefulness, working alliance, ward atmosphere, symptom severity, and other therapy-related experiences. The factorial structure of the TPQ is reported in **Table 2** (for statistical details of the factor and item analysis see Schiepek et al., 2012).

The "control parameter" of the therapeutic change process was operationalized by the item "Today I was motivated to work on my problems and on their solution" of the TPQ (this item corresponds to the factor I "Therapy progress").

Table 1 | Characteristics of the sample ($N = 23$).

	Mean ($N = 23$)	*SD*
Age	32.5	9.4
Male/Female	10/13	
Y-BOCS score pre	21.8	8.5
Y-BOCS score post	14.7	5.5
TPQ: symptom severity pre	4.5	1.3
TPQ: symptom severity post	3.7	0.9
Duration of treatment (days)	60.2	12.7

The OCD symptom severity was obtained from the Yale-Brown Obsessive Compulsive Scale (Y-BOCS) and the Therapy Process Questionnaire (TPQ, scale II) before (pre) and after (post) therapy. A significant symptom reduction was reported in Y-BOCS scores [$T_{(22)} = 6.26$, $p < 0.001$; $N = 23$] and in TPQ symptom scores [$T_{(22)} = 4.42$, $p < 0.001$; $N = 23$].

Table 2 | Subscales of the Therapy Process Questionnaire (TPQ), modified for the application to outpatient centers.

I Therapy progress (16.9% explained variance).
II Complaints and problem pressure/symptom severity (16.3% explained variance).
III Relationship quality and trust in therapists (16.3% explained variance).
IV Dysphoric affect (13.0% explained variance).
V Ward atmosphere and relationship with fellow patients (12.0% explained variance).

The 47 items of the questionnaire are related to important common factors discussed in the literature (see Nischk et al., 2000 for a pre-study). The factor analysis of the TPQ was based on 149 in-patient therapy processes and resulted in a 5-factor solution, defining the 5 subscales of the questionnaire. Total explained variance is 74.5%. A confirmatory factor analysis performed for testing factor-model quality confirmed the 5-factor solution (for details see Schiepek et al., 2012).

The stable boundary conditions of the therapeutic destabilization process are represented by the experienced stability of the interpersonal environment of the patients. This experienced stability was measured by the overall mean of the factor V "Ward atmosphere and relationship with fellow patients" and factor III "Relationship quality and trust in therapists" of the TPQ. Both aspects of interpersonal stability, the relationship and working alliance with therapists and the relationship to other patients (ward atmosphere) were closely interrelated ($r = 0.71$, $p < 0.001$).

Identification of critical instabilities

The analysis of the time series concentrated on the dynamic complexity, which results from the product of a fluctuation measure F and a distribution measure D. The algorithm was designed to identify non-stationary phenomena and critical instabilities in short and coarse-grained time series. The fluctuation measure F is sensitive to the amplitude and frequency of changes in a time series, and the distribution measure D scans the scattering of values or system states realized within the range of possible values or system states (for technical details see Schiepek and Strunk, 2010; for clinical applications see Schiepek et al., 2003; Gumz et al., 2012; Heinzel et al., 2014). In order to identify non-stationarity, the combined measure is calculated within a data window of 7 measurement points, moving over the time series, resulting in a time series of dynamic complexity (C) for each item. Each value of this time series includes the information of 7 following days in the raw data. The movement of the running window goes from day to day and by this is partially overlapping.

It should be specified that this complexity measure is applicable to interval-scaled and regularly time-sampled real-world data without any further assumptions (e.g., concerning distribution characteristics, scale resolution, or length of time series). In practice, the length of the time series should be at least 20 measurement points, because this length of the time series is required to ensure sufficient validity of the measurement (Schiepek and Strunk, 2010) and because a change of complexity can only be measured within a sufficiently large period of data points. As other complexity measures like scaling exponents (f^x noise, e.g., Pilgram and Kaplan, 1998), wavelet-based Time Frequency Distributions (e.g., Cohen, 1989; Lambertz et al., 2000), grammar complexity (e.g., Rapp et al., 1991), or fractal dimensionality (D2 Grassberger and Procaccia, 1983a,b or PD2 Skinner et al., 1994), dynamic complexity measures complexity from one of many possible points of view.

The self-organization model underlying this study is not focusing on each client's average level of complexity, but on the local peaks of complexity, indicating critical fluctuations and order transitions during the process. By this, not the averaged complexity, but the difference between the average and the maximum complexity of each item seems to be an appropriate indicator. The maxima result from local critical instabilities of the process. A phase of critical instability was defined as a sequence of days that contributes to a significant increase in dynamic complexity across the complete timeframe.

Outcome measures

The therapy outcome was identified by the self-rating form of the Y-BOCS (Goodman et al., 1989), which is world-wide the most commonly used rating scale for the intensity of obsessions and compulsions. It refers to the quality (e.g., concerning the experienced stress) as well as to the quantity (e.g., the duration of washing or checking rituals) of OCD symptoms. For the outcome assessment, we used the total score of the Y-BOCS combining the subscales "obsessions" and "compulsions." The total score was transformed to a relative change score:

$$\text{relative YBOCS change} = \frac{post\ YBOCS - pre\ YBOCS}{pre\ YBOCS} \times 100$$

For the representation of change gradients, the Y-BOCS was completed twice per week. For the sake of a comparison between the change scores of the patients, the Y-BOCS scores were z-transformed.

Another outcome measure was based on the relative change score of the factor II "Complaints and problem pressure" of the TPQ. The mean of the items representing this factor was calculated for the first week of treatment and then compared to the mean of the last week.

$$\text{relative symptom change (TPQ)} = \frac{post\ symptoms - pre\ symptoms}{pre\ symptoms} \times 100$$

The correlation between the relative Y-BOCS change and the TPQ-based relative symptom change was $r = 0.62$ ($p = 0.002$).

Data analysis

In order to test hypothesis 1, 2, and 4, correlations were calculated between factor scales of the TPQ and outcome measures (hypothesis 1 and 4), or between the difference of the mean and the maximum of the dynamic complexity score (maximum-mean complexity) and outcome measures (hypothesis 2). Further on, we tested hypotheses 1, 2, and 4 by hierarchical linear regression models predicting outcome measures from ward atmosphere, motivation to change, and maximum-mean complexity. The interaction hypothesis 3 (with reference to outcome measures) was tested by a 2×2 ANOVA with two factors based on a median split of all subjects with regard to the dimensions "high or low

ward atmosphere" and "high or low maximum-mean complexity." Hypotheses 5 and 6 were tested by *t*-tests of Y-BOCS and complexity mean levels in relation to the onset time of exposure with response prevention (ERP).

RESULTS

STABILITY OF BOUNDARY CONDITIONS (HYPOTHESIS 1)

The level of the TPQ scale V ("Ward atmosphere and relationship with fellow patients") correlated with the relative Y-BOCS change ($r = -0.49$, $p = 0.017$) and with the relative symptom change (TPQ) ($r = -0.54$, $p = 0.008$). The relationship between the TPQ scale III ("Relationship quality and trust in therapists") and the relative Y-BOCS change ($r = -0.25$, $p = 0.251$) did not meet the significance criterion. However, the relative symptom change (TPQ) correlated significantly with the "Relationship quality and trust in therapists" ($r = -0.43$, $p = 0.042$). The more stable the emotional and interpersonal boundary conditions of the therapeutic change processes, i.e., the better the quality of the therapeutic relationship and the ward atmosphere as experienced by the patients, the more the symptom severity (obsessions and compulsions) and problem pressure were reduced (as was expected in hypothesis 1).

INTENSITY OF CRITICAL INSTABILITIES (HYPOTHESIS 2)

The intensity of critical instabilities was represented by the difference between the mean and the maximum of the complexity of each therapy process, as explained above in the section Identification of critical instabilities. This criterion does not represent the overall complexity of the change dynamics (which can be interindividually different), but the local periods of order transition-related critical instabilities. It correlated non-significantly ($r = -0.29$, $p = 0.177$) with the relative Y-BOCS change. The relative symptom change (TPQ) was significantly related to the complexity score ($r = -0.49$; $p = 0.018$). The negative sign of the correlation coefficients means that an enhanced local complexity of the process corresponds to more reduced problem intensity or symptom severity after the psychotherapy. The results support hypothesis 2.

INTERACTIONS BETWEEN CRITICAL INSTABILITY AND STABILITY OF BOUNDARY CONDITIONS (HYPOTHESIS 3)

In order to assess interaction effects between "Ward atmosphere and relationship with fellow patients") and maxium-mean complexity, four individual groups (maximum-mean complexity high vs. low; "Ward atmosphere and relationship with fellow patients" high vs. low) were formed per median split. Median splits were used as no a priori assumptions were made on criteria for "high" or "low" complexity and for "good" or "bad" ward athmosphere. A two [low ($N = 12$) vs. high complexity ($N = 11$)] by two [good ($N = 12$) vs. bad ward atmosphere ($N = 12$)] ANOVA was applied to investigate group differences in the two measures of therapy outcome. The median of the complexity score was found to be 0.097 and the median of the ward atmosphere was at 4.05.

As shown in **Figure 1A**, the relative Y-BOCS change was greater in patients with higher local complexity scores [$F_{(1,19)} = 8.92$, $p = 0.008$, partial $\eta^2 = 0.319$]. No significant main effect of the ward atmosphere was found [$F_{(1,\ 19)} = 2.52$, $p = 0.129$, partial $\eta^2 = 0.117$]. When analyzing the group differences in relative Y-BOCS change, the complexity by ward atmosphere interaction was not significant [$F_{(1,\ 19)} = 0.163$, $p = 0.691$, partial $\eta^2 = 0.009$]. However, *post-hoc* *t*-tests indicated that in patients who reported to experience a positive ward atmosphere, the ones who also went through at least one intensive phase of critical instability (high local complexity score and by this, high maximum-mean difference in complexity) had a higher relative Y-BOCS change compared to patients with low complexity scores [$t_{(10)} = 2.29$, $p = 0.045$, Cohen's $d = 1.45$].

The analysis of relative symptom change as measured by the TPQ revealed a significant complexity by ward atmosphere interaction [$F_{(1,\ 19)} = 6.43$, $p = 0.020$, partial $\eta^2 = 0.253$]. As shown in **Figure 1B**, relative symptom change (TPQ) was greater in patients with higher local complexity scores [$F_{(1,\ 19)} = 17.62$,

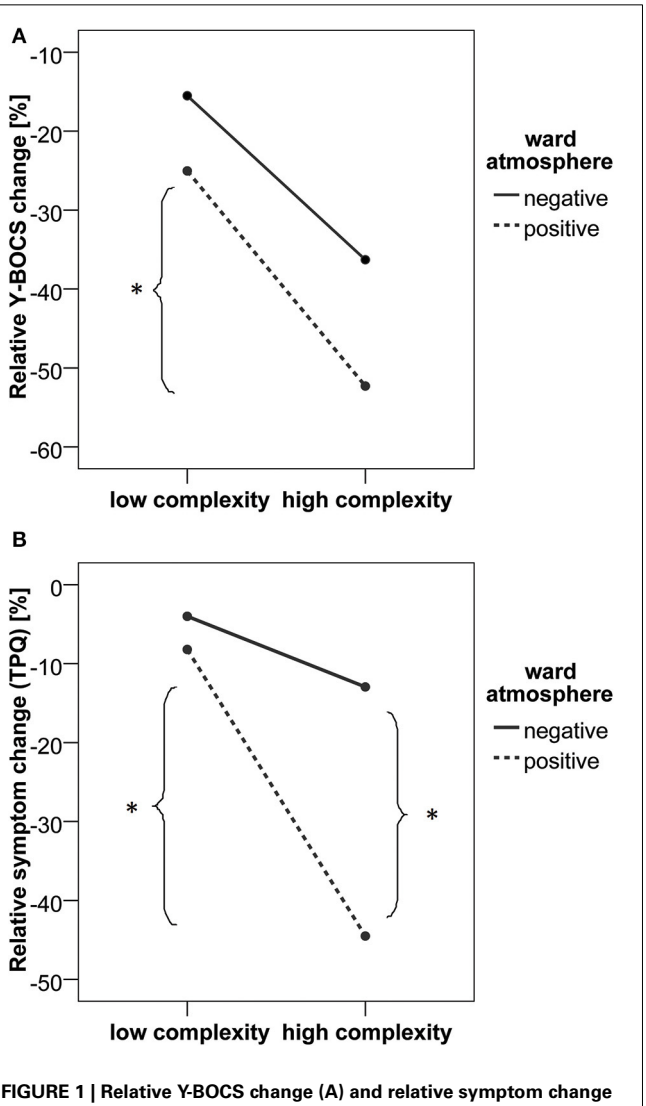

FIGURE 1 | Relative Y-BOCS change (A) and relative symptom change (TPQ, scale II) (B), related to the intensities of the local dynamic complexity (critical instability) of the change process and the ward atmosphere (stable boundary conditions of the change process). (*$p < 0.05$).

$p < 0.001$, partial $\eta^2 = 0.481$] compared to patients with lower local complexity scores. Also, a positive ward atmosphere was related to a higher symptom change [TPQ, $F_{(1, 19)} = 11.00$, $p = 0.004$, partial $\eta^2 = 0.367$]. *Post-hoc t*-tests showed that patients with high maximum-mean difference in complexity scores had higher relative symptom change (TPQ) only in the group of patients who reported a positive ward atmosphere [$t_{(10)} = 4.60$, $p = 0.001$, Cohen's $d = 2.91$]. A positive ward atmosphere was related to higher relative symptom change (TPQ) only in the high complexity group [$t_{(9)} = 4.70$, $p = 0.001$, Cohen's $d = 3.13$].

Taken together, the biggest therapy-related reduction of OCD symptoms was found within a group of patients that reported to experience a positive ward atmosphere and at least one intensive phase of critical instability (as was expected in hypothesis 3).

MOTIVATION TO CHANGE (HYPOTHESIS 4)

Therapy outcome and motivation levels through the entire course of therapy showed no significant correlation (relative Y-BOCS change: $r = -0.07$, $p = 0.736$; relative symptom change (TPQ): $r = -0.23$, $p = 0.282$). Significant correlations were only found between the motivation level within the ERP phase and the relative symptom change (TPQ, $r = -0.61$, $p = 0.007$), but motivation during ERP phase was not related to relative Y-BOCS change ($r = -0.15$, $p = 0.496$). By this, hypothesis 4 was not or only partially confirmed. But there was a connection between mean patient motivation level and the TPQ subscale "Relationship quality and trust in therapists" ($r = 0.49$, $p = 0.018$): A patient's high motivation for therapy is likely to facilitate the therapeutic relationship, and/or a trusting and stable working relationship will increase motivation for change.

OUTCOME PREDICTION BY REGRESSION MODELS (HYPOTHESES 1, 2, AND 4)

In two hierarchical linear regression models the predictors "Ward atmosphere and relationship with fellow patients" (ward atmosphere), motivation to change (motivation), intensity of local critical instabilities (complexity) were included block-wise into regression models to predict therapy outcome measured by relative Y-BOCS change (**Table 3A**) or by relative symptom change (TPQ, **Table 3B**). When predicting the relative Y-BOCS change, only the ward atmosphere contributed significantly to the model [R^2 change $= 0.244$, F change$_{(1, 20)} = 6.51$, $p = 0.019$]. The full model, including motivation, ward atmosphere, and complexity, explained 29.9% of the variance in relative Y-BOCS change (see **Table 3A**). The regression to the relative symptom change (TPQ) showed that ward atmosphere [R^2 change $= 0.244$, F change$_{(1, 20)} = 6.95$, $p = 0.016$] and complexity [R^2 change $= 0.145$, F change$_{(1, 20)} = 4.96$, $p = 0.038$] significantly improved the model by explaining additional variance. The full model including motivation, ward atmosphere, and complexity explained 44.4% of the variance in relative symptom change (TPQ). These results corroborate the hypotheses 1, 2, and partially 4.

PATTERNS OF CHANGE (HYPOTHESES 5 AND 6)

The principal intervention of the cognitive-behavioral therapy applied to clients was exposure with response prevention (ERP). Consequently, we related the individual symptom severity trajectories to the onset of ERP. For each client, the individual ERP-onset was set at time point = 0, and the trajectories of the total Y-BOCS scores were related to this event. In 13 of the 18 patients which underwent ERP, the steepest gradient of symptom change was located *before* ERP-onset (compare hypothesis 5). **Figure 2** represents this phase-transition-like phenomenon by the dynamics of a representative participant of our sample. If we calculate the mean of all individual trajectories of the ERP-subsample ($N = 18$), the effect is not abolished. The mean trajectory of the z-transformed individual total scores of the Y-BOCS has its steepest change gradient before ERP starts (time point = −4 days), and symptom severity reaches a significantly reduced level at the day of ERP onset at time point = 0 compared to the mean Y-BOCS level before the steepest change gradient [$t_{(17)} = 3.07$; $p = 0.007$].

The same procedure was accomplished with the mean dynamic complexity of all items of the TPQ, calculated within a moving window of 7 data points. This complexity dynamics was related to ERP-onset as well. When averaging the complexity curves of each individual treatment process, we can identify two distinct phases of critical instability on the group level. First, one can identify a clear-cut complexity peak at the beginning of treatment compared to the mean complexity outside of critical instabilities [$t_{(17)} = 3.61$, $p = 0.004$], which may be interpreted as an initial instability period representing individual doubts and varying degrees of working intensity at the start of the group process. Another clear-cut peak compared to mean complexity occurred 3 days before the steepest gradient of symptom reduction and about 7 days before the ERP-onset [$t_{(17)} = 2.48$, $p = 0.026$]. In terms of Synergetics, this corresponds to the assumed critical instabilities accompanying order transitions of a self-organizing system. The manifestation of complexity peaks at time-restricted windows of a change process is to be expected by the theory. This hypothesis could be confirmed by our data. The complexity peaks of each individual change process remain intact on group-level.

If we sum up the periods of significant critical complexities over all items (significance threshold $p < 0.05$) a frequency distribution results which itself can be examined for significant peaks. Compared to the mean relative frequency of critical instability over the whole process ($M = 24.8\%$, $SD = 13.5\%$), the relative frequency of critical instabilities is significantly increased at the beginning of the therapy [day −35 to −28, $M = 42.6\%$, $SD = 6.1\%$, $T_{(60)} = 3.66$, $p = 0.001$] and during a period of 11–4 days before ERP onset [$M = 41.7\%$, $SD = 4.2\%$, $T_{(60)} = 3.48$, $p = 0.001$, please refer to Heinzel et al. (2014) for a detailed description of the procedure]. The results corroborate hypotheses 5 and 6.

DISCUSSION

Conceptualizing psychotherapy as a self-organizing process leads to empirically testable hypotheses and thus appears to be inspiring for future research. In the current study, it was found that at least one period of increased complexity (critical instability) is necessary for effective treatment (hypothesis 2) and that temporally increased complexity is related to the steepest gradient of symptom reduction (hypotheses 5 and 6). In contrast

Table 3 | Hierarchical regression models.

Model	Included variables	β	*T*	*P*	R^2	R^2 change	*F* change	*P*
(A)								
1	Motivation	−0.074	−0.342	0.736	0.006	0.006	0.12	0.736
2	Motivation	0.081	0.398	0.695				
	Ward atmosphere	−0.518	−2.55	0.019	0.250	0.244	6.51	**0.019**
3	Motivation	0.142	0.686	0.502				
	Ward atmosphere	−0.488	−2.41	0.026				
	Complexity	−0.235	−1.16	0.262	0.299	0.049	1.34	0.262
(B)								
1	Motivation	−0.234	−1.10	0.282	0.055	0.055	1.22	0.282
2	Motivation	−0.079	−0.404	0.148				
	Ward atmosphere	−0.517	−2.58	0.016	0.299	0.244	6.95	**0.016**
3	Motivation	0.026	0.142	0.888				
	Ward atmosphere	−0.467	−2.58	0.018				
	Complexity	−0.403	−2.23	0.038	0.444	0.145	4.96	**0.038**

Predictors: Motivation, ward atmosphere, local dynamic complexity (maximum-mean-difference of the dynamic complexity of all items of the TPQ). (A) Dependent variable: Relative Y-BOCS change. (B) Dependent variable: Relative symptom change (TPQ). Bold p-values are significant at $p < 0.05$.

to catastrophe theory, Synergetics predicts that critical fluctuations are an almost necessary precursor of phase transitions due to the broadening of the potential valley when the system dynamics approaches an instability point in non-linear systems and their far-from-equilibrium dynamics (Haken, 2004). At the same time, a positive ward atmosphere and relationship with fellow patients was beneficial for the outcome (hypothesis 1). This refers to the necessity of stable boundary conditions for pattern formation in complex systems. In fact, our results indicate that those patients who experience both, at least one phase of critical instability and a constantly positive ward atmosphere, reached the best psychotherapy outcome (hypothesis 3). These findings support the synergetic perspective on change dynamics as a process of destabilization within stable boundary conditions (Haken and Schiepek, 2010). However, no definite relationship between motivation and symptom change was revealed in the current study (hypothesis 4). When analyzing patterns of change in the course of psychotherapy processes, it was found that symptom change was temporally related to an increase in complexity (hypothesis 6). Interestingly, in many therapy processes the strongest change in symptoms already occurred before the application of ERP (hypothesis 5).

A recent fMRI-study (Schiepek et al., 2009, 2013) supported the results on order transitions in psychotherapy. Significant changes of brain activity patterns during order transitions were to be seen, whereas during periods without critical instabilities only marginal changes of brain activity took place. In this study, repeated fMRI scans were related to the degree of stability or instability of the ongoing dynamics. This was measured by the dynamic complexity of daily TPQ-ratings, and the maxima of these dynamics were used as an indicator of the most intensive fluctuation periods associated with discontinuous transition(s) during the therapies. Three or four scans were realized during each of the psychotherapy processes of 9 OCD patients and compared to the scans of 9 matched healthy controls without therapy.

Eight regions of interest were identified that are important in OCD-related neuronal processing: the anterior and medial cingulate cortex as well as the supplementary motor area (CC/SMA), the dorsolateral prefrontal cortex (DLPFC) right and left, the insula right and left, the parietal cortex right and left, and the cuneus. When interscan-intervals with order transitions in between were compared to intervals without order transitions, the changes of the number of significant voxels for the contrast between individualized symptom provoking pictures and neutral pictures showed increased BOLD responses during order transitions in all relevant brain regions. In healthy controls no significant changes in brain activity were found between the scans.

Both studies provide evidence in support of the hypothesis of a discontinuous change after destabilization of the psychotherapeutic process and indicate that activity patterns of neuronal and mental systems behave in a synchronized way. Changes were not found to occur gradually in the sense of a linear transition from the actual state to a targeted state and also do not appear to be a passive reaction to an applied intervention. Modeling psychotherapy as a cascade of order-to-order transitions (Haken and Schiepek, 2010) seems also to be a suitable explanation for the meanwhile large amount of data on sudden gains and on early rapid responses (e.g., Ilardy and Craighead, 1999; Stiles et al., 2003; Busch et al., 2006; Kelly et al., 2007; Stulz et al., 2007). In addition, the assumption can be supported that critical instabilities accompany the occurrence of therapeutic order transitions and that stable boundary conditions as experienced by clients are necessary for self-organizing dynamics. According to the present results, the least obvious causal factor in terms of therapy results is the motivation to change. This would have been expected since control parameters are important conditions for order transitions, as theory states, and human change processes are driven by conditions generated within the system, i.e., the client. This might well-fit the important contribution of client variables to therapy success (e.g., Bohart and Tallman, 2010).

LIMITATIONS

One weakness of our study was operationalizing motivation to change as a control parameter equivalent by using only one TPQ item. Measurements based on only one item or one

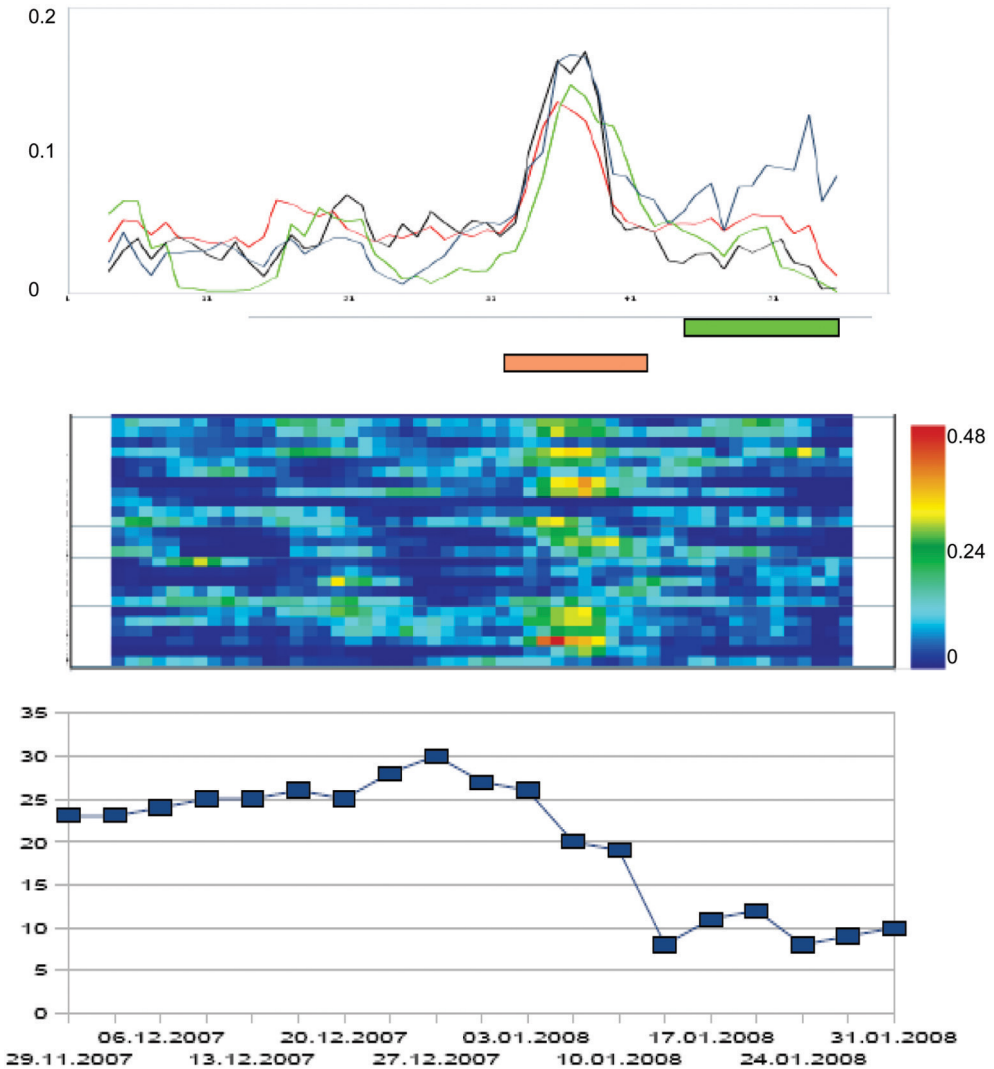

FIGURE 2 | Order transition during the therapy process of a patient with OCD. The x-axis represents time, i.e., the duration (days) of the psychotherapy in a day treatment center (in this case: 64 days = measurement points). The curves at the top of the diagram represent the dynamic complexity of 4 subscales of the Therapy Process Questionnaire (TPQ): "Therapy progress" (blue), "Complaints and problem pressure" (black), "Dysphoric affects" (red), and "Getting new insights and perspectives" (green; this subscale corresponds to a factor from a former factor analysis of the questionnaire, see Haken and Schiepek, 2010). Dynamic complexity is calculated within an overlapping running window (width: 7 measurement points = days). In the middle part of the figure, the Complexity Resonance Diagram of the therapy process is represented. Each line of the diagram corresponds to an item of the chosen subscales of the TPQ. The dynamic complexity values of the time series of each item are translated into colors (yellow, orange, and red correspond to high complexity values). The lower part of the diagram represents the course of the Y-BOCS which was completed two times per week. The steepest gradient of symptom reduction was realized during the period of critical instability. Brown bar: period of statistically significant increased dynamic complexity. Green bar: Period of ERP.

variable are on insecure footing. There are other change driving parameters which support patients' development besides their intrinsic motivation for change, such as level of suffering, activation of resources, experiencing self-efficacy, or therapeutic success. As mentioned in the introduction, a correlational approach generally allows only for a weak operationalization of what is meant by the control parameter concept. A control parameter in its specific sense, like temperature gradients for the emergence of convection streams in fluids, would need a gradual increase in its intensity and then be accompanied by an order transition at a specific threshold of the parameter value. In the case of psychotherapy this would ask for an experimental design for intrinsic variables which reaches its limitations by logical, ethical, and practical reasons. Another limitation of the study is the small number of subjects. However, with a small number of subjects, effects need to be relatively strong to be recognized as significant. A reexamination of the present hypotheses is in progress with a considerably larger sample from different clinical settings, diagnoses, and therapy concepts.

PERSPECTIVES

The synergetic model of human change processes would provide potential for the integration of the results on common factors (Duncan et al., 2010; Wampold, 2010), and furthermore, for an integration of the medical and the common factors model of psychotherapy. The only requirement and precondition would be that the medical model is not restricted to a linear model. Both—the medical model as well as the common factors model—can be subsumed under the following assumptions:

1. Psychotherapy consists in supporting self-organization processes.
2. Most common factors are conditions for self-organizing processes (they can be subsumed to the concept of "generic principles," see Haken and Schiepek, 2010) and thus they are "specific" in the sense of "theoretically founded."
3. There is no linear input-output mechanism of therapeutic actions (techniques).
4. An understanding and a specific modeling of intra-systemic mechanisms of systems re-organization is possible, as was shown for the neuronal mechanisms of self-organized desynchronization (coordinated reset) of pathologically oversynchronized neuronal systems underlying Parkinsonian Disease or Tinnitus by Tass and coworkers (e.g., Tass and Hauptmann, 2007).

Another reason for the possible integration of the common factors model (Wampold, 2010) into the self-organization model is that mental and brain dynamics follow the same principles of self-organization (Kelso, 1995; Haken, 2002; Orsucci, 2006; Tass and Hauptmann, 2007; Deco et al., 2011), thereby allowing for an integrated psychological and neurobiological psychotherapy (Grawe, 2004).

Another consequence of this approach might be that nonlinear features such as order transitions or critical instabilities can be measured and analyzed during ongoing psychotherapy processes, fed back immediately, and used for adaptive therapy planning, which justifies the application of real-time monitoring systems in psychotherapy (Lambert, 2010; Schiepek and Aichhorn, 2013).

We realized this real-time monitoring approach in several psychotherapy hospitals (Inpatient Treatment Center and Day Treatment Center of the Christian Doppler Clinic Salzburg, Austria; Systelios Health Center Siedelsbrunn, Germany; Psychosomatic Clinic Bad Zwischenahn, Germany; Day Treatment Center Munich, Germany; Fachklinik Hirtenstein, Oberstorf, Germany) and by this, we got 647 data sets from patients with different diagnoses (**Table 4**). More than 120 cases have a time series length of more than 100 measurement points. This might be one of the largest data sets with equidistant (daily) self-ratings available in psychotherapy research (mean: 73.4 measurement points, 3.0% missing data), which allows for detailed non-linear time series analyses and validation of theoretical modeling. As can be demonstrated, the patterns of change visualized and analyzed by such kind of high frequency measures are quite different from the time series we get from session-by-session ratings: non-linearity, chaos, and non-stationarity (pattern transitions) are quite evident. By this the Synergetic Navigation System offers new perspectives of data mining in routine practice, online data analysis (methods as Dynamic Complexity, Recurrence Plots, Complexity Resonance Diagrams, Permutation Entropy, or Correlation Pattern Analysis are integrated in the SNS), and therapy feedback (Schiepek et al., 2014).

One important aspect of continuous feedback could be the identification of precursors of critical instabilities—not only in psychotherapy or consulting, but also in suicide prevention. By this an early warning system could be developed for critical events (like suicidal attempts) in non-linear chaotic systems (like human beings) which cannot be predicted on the long run (Schiepek et al., 2011). Indicators of critical events could be locally increased dynamic complexity or other complexity markers, increased linear correlation or non-linear synchronization (e.g., Transinformation) between components, subsystems, or different dynamic aspects of the system, increased autocorrelation of the dynamics, increased coupling of system components or subsystems (e.g., Pointwise Conditional Coupling Divergence), or transition markers in Recurrence Plots (Orsucci et al., 2006; Haken and Schiepek, 2010; Schiepek et al., 2011; Dakos et al., 2012; Lichtwarck-Aschoff et al., 2012). Interestingly, Lichtwarck-Aschoff et al. (2012) used Recurrent Quantification Analysis

Table 4 | The data set resulting from several years of application of an internet-based device, the Synergetic Navigation System, at 6 psychotherapeutic hospitals or day treatment centers.

Diagnosis	*N*	% Women	Measurement points [days] (*SD*)	% Missings (*SD*)	Age (*SD*)
f1: psychoactive substance use	49	2	85.6 (27.3)	4.5 (4.04)	46.7 (10.0)
f2: delusional disorders	11	37	88.9 (31.3)	3.7 (4.1)	28.2 (7.8)
f3: mood disorders	299	55	67.4 (33.4)	2.9 (3.55)	44.2 (10.8)
f4: stress and somatoform disorders	172	69	72.3 (47.6)	2.8 (3.43)	38.3 (12.1)
f5: physiological disturbance	8	88	61.4 (23.5)	4.9 (4.35)	26.3 (6.6)
f6: personality disorders	107	73	86.4 (44.0)	2.4 (3.39)	33.3 (11.0)
Total	647	43	73.4 (39.7)	3.0 (3.6)	40.6 (12.1)

N = 647 cases, distributed over different diagnoses. Daily self-ratings are done by the Therapy Process Questionnaire or some setting-specific modifications of this questionnaire.

(Orsucci et al., 2006; Webber et al., 2009) and the entropy markers of this quantification in order to identify critical instabilities in therapeutic change processes of mother-child interaction dynamics. Recurrence Plots seem to be a very useful instrument for the visualization and quantification of critical instabilities and order transitions in human change processes. Besides methods based on dynamic complexity (like Complexity Resonance Diagrams) also Recurrence Plots are available in the SNS for routine application in therapy monitoring. Actually converging methods for the identification of discontinuous dynamics seem to be available which should be integrated and/or systematically tested against each other in order to develop a deeper understanding of critical transitions in human systems.

REFERENCES

Ahn, H., and Wampold, B. E. (2001). Where oh where are the specific ingredients? A meta-analysis of component studies in counselling and psychotherapy. *J. Couns. Psychol.* 48, 251–257. doi: 10.1037/0022-0167.48.3.251

Bak, P. (1996). *How Nature Works.* New York, NY: Springer.

Bak, P., Chen, K., and Creutz, M. (1989). Self-organized criticality and the 'Game of Life'. *Nature* 342, 780–782. doi: 10.1038/342780a0

Bohart, A. C., and Tallman, K. (2010). "Clients: the neglected common factor in psychotherapy," in *The Heart and Soul of Change, 2nd Edn.*, eds B. Duncan, S. Miller, B. Wampold, and M. Hubble (Washington, DC: American Psychological Association), 83–111.

Buchheim, A. (2011). "Sozio-emotionale Bindung," in *Neurobiologie der Psychotherapie (2. völlig überarbeitete und erweiterte Neuauflage)*, ed G. Schiepek (Stuttgart: Schattauer), 339–348.

Busch, A., Kanter, J., Landes, S., and Kohlenberg, R. (2006). Sudden gains and outcome: a broader temporal analysis of cognitive therapy for depression. *Behav. Ther.* 37, 61–68. doi: 10.1016/j.beth.2005.04.002

Carter, C., Sue, I., Lederhendler, I., and Kirkpatrick, B. (1997). *The Integrative Neurobiology of Affiliation.* New York, NY: Academy of Science.

Cohen, L. (1989). Time-frequency distributions – a review. *Proc IEEE* 77, 941–981. doi: 10.1109/5.30749

Dakos, V., Carpenter, S. R., Brock, W. A., Ellison, A. M., Guttal, V., Ives, A. R., et al. (2012). Methods for detecting early warnings of critical transitions in time series illustrated using simulated ecological data. *PLoS ONE* 7:e41010. doi: 10.1371/journal.pone.0041010

Deco, G., Jirsa, V. K., and McIntosh, A. R. (2011). Emerging concepts for the dynamical organization of resting state activity in the brain. *Nat. Rev. Neurosci.* 12, 43–56. doi: 10.1038/nrn2961

Duncan, B., Miller, S., Wampold, B., and Hubble, M. (eds.). (2010). *The Heart and Soul of Change*, 2nd *Edn.* Washington, DC: American Psychological Association.

Goodman, W. K., Price, L. H., Rasmussen, S. A., Mazure, C., Fleischmann, R. L., Hill, C. L., et al. (1989). The Yale-Brown obsessive compulsive scale. I. Development, use, and reliability. *Arch. Gen. Psychiatry* 46, 1006–1011. doi: 10.1001/archpsyc.1989.01810110048007

Granic, I., O'Hara, A., Pepler, D., and Lewis, M. (2007). A dynamic systems analysis of parent child changes associated with successful real-world interventions for aggressive children. *J. Abnorm. Child Psychol.* 35, 845–857. doi: 10.1007/s10802-007-9133

Grassberger, P., and Procaccia, I. (1983a). On the characterization of strange attractors. *Phys. Rev. Lett.* 50, 346–356. doi: 10.1103/PhysRevLett.50.346

Grassberger, P., and Procaccia, I. (1983b). Measuring the strangeness of strange attractors. *Phys. D* 9, 189–208. doi: 10.1016/0167-2789(83)90298-1

Grawe, K. (2004). *Neuropsychotherapie [Neuro-Psychotherapy]*. Göttingen: Hogrefe.

Guastello, S. J. (1995). *Chaos, Catastrophe, and Human Affairs: Applications of Nonlinear Dynamics to Work, Organizations, and Social Evolution*. Mahwah, NJ: Lawrence Erlbaum.

Gumz, A., Bauer, K., and Brähler, E. (2012). Corresponding instability of patient and therapist process ratings in psychodynamic psychotherapies. *Psychother. Res.* 22, 26–39. doi: 10.1080/10503307.2011.622313

Haken, H. (2002). *Brain Dynamics.* Berlin: Springer.

Haken, H. (2004). *Synergetics. Introduction and Advanced Topics*. Berlin: Springer. doi: 10.1007/978-3-662-10184-1

Haken, H., and Schiepek, G. (2010). *Synergetik in der Psychologie [Synergetics in Psychology], 2nd Edn.* Göttingen: Hogrefe.

Hayes, A. M., Laurenceau, J. P., Feldman, G. C., Strauss, J. L., and Cardaciotto, L. A. (2007). Change is not always linear: the study of nonlinear and discontinuous patterns of change in psychotherapy. *Clin. Psychol. Rev.* 27, 715–723. doi: 10.1016/j.cpr.2007.01.008

Hayes, A., and Strauss, J. (1998). Dynamic systems theory as a paradigm for the study of change in psychotherapy: an application to cognitive therapy for depression. *J. Consult. Clin. Psychol.* 66, 939–947. doi: 10.1037/0022-006X.66.6.939

Heinzel, S., Tominschek, I., and Schiepek, G. (2014). Dynamic patterns in psychotherapy - discontinuous changes and critical instabilities during the treatment of obsessive compulsive disorder. *Nonlinear Dynamics Psychol. Life Sci.* 18, 155–176.

Ilardy, S. S., and Craighead, W. E. (1999). Rapid early response, cognitive modification, and nonspecific factors in cognitive-behavior therapy for depression: a reply to Tang and DeRubeis. *Clin. Psychol. Sci. Pract.* 6, 295–299. doi: 10.1093/clipsy/6.3.295

Jacobson, E. (1990). *Entspannung als Therapie. [Relaxation as Therapy]*. München: Pfeiffer.

Kelly, M., Cyranowski, J., and Frank, E. (2007). Sudden gains in interpersonal psychotherapy for depression. *Behav. Res. Ther.* 45, 2563–2572. doi: 10.1016/j.brat.2007.07.007

Kelso, J. A. (1995). *Dynamic Patterns. The Self-Organisation of Brain and Behaviour*. Cambridge: MIT Press.

Kowalik, Z. J., Schiepek, G., Kumpf, K., Roberts, L. E., and Elbert, T. (1997). Psychotherapy as a chaotic process II: the application of nonlinear analysis methods on quasi time series of the client-therapist-interaction: a nonstationary approach. *Psychother. Res.* 7, 197–218. doi: 10.1080/10503309712331331973

Lakatos, A., and Reinecker, H. (2007). *Kognitive Verhaltentherapie bei Zwangsstörungen. Ein Therapiemanual. [Cognitive Behavioral Therapy in Obsessive Compulsive Disorder. A Therapy Manual]*. Göttingen: Hogrefe.

Lambert, M. J. (2010). "Yes, it is time for clinicians to routinely monitor treatment outcome," in *The Heart and Soul of Change, 2nd Edn.*, eds B. Duncan, S. Miller, B. Wampold, and M. Hubble (Washington, DC: American Psychological Association), 237–266.

Lambert, M. J., and Ogles, B. M. (2004). "The efficacy and effectiveness of psychotherapy," in *Bergin and Garfield's Handbook of Psychotherapy and Behavior Change*, ed M. J. Lambert (New York, NY: Wiley), 139–193.

Lambertz, M., Vandenhouten, R., Grebe, R., and Langhorst, P. (2000). Phase transitions in the common brainstem and related systems investigated by nonstationary time series analysis. *J. Auton. Nerv. Syst.* 78, 141–157. doi: 10.1016/S0165-1838(99)00072-7

Lichtwarck-Aschoff, A., Hasselman, F., Cox, R., Pepler, D., and Granic, I. (2012). A characteristic destabilization profile in parent-child interactions associated with treatment efficacy for aggressive children. *Nonlinear Dynamics Psychol. Life Sci.* 16, 353–379.

Mahoney, M. J. (1991). *Human Change Processes. The Scientific Foundation of Psychotherapy*. New York, NY: Basic Books.

Nischk, D., Grothe, A., and Schiepek, G. (2000). Beratungsprozesse aus Sicht der Klienten. Das mehrdimensionale Konstrukt der Prozessinvolviertheit als Grundlage für die Entwicklung eines Klientenstundenbogens. [Counseling as experienced by the client. the development of a session rating scale based on the theoretical construct of "process involvement"]. *Z. Klin. Psychol.Psychiatr. Psychother.* 48, 118–134.

Norcross, J. C. (2010). "The therapeutic relationship," in *The Heart and Soul of Change, 2nd Edn.*, eds B. Duncan, S. Miller, B. Wampold, and M. Hubble (Washington, DC: American Psychological Association), 113–141.

Orsucci, F. F. (2006). The paradigm of complexity in clinical neurocognitive science. *Neuroscientist* 12, 1–9. doi: 10.1177/1073858406290266

Orsucci, F., Giuliani, A., Webber, C., Zbilut, J., Fonagy, P., and Mazza, M. (2006). Combinatorics and synchronization in natural semiotics. *Phys. A* 361, 665–676. doi: 10.1016/j.physa.2005.06.044

Pilgram, B., and Kaplan, D. T. (1998). A comparison of estimators for 1/f noise. *Phys. D* 114, 108–122. doi: 10.1016/S0167-2789(97)00188-7

Pincus, D. (2009). "Coherence, complexity, and information flow: self-organizing processes in psychotherapy," in *Chaos and Complexity in Psychology. The Theory of Nonlinear Dynamical Systems*, eds S. Guastello, M. Koopmans, and D. Pincus (New York, NY: Cambridge University), 335–369.

Ramseyer, F., and Tschacher, W. (2008). "Synchronisation in dyadic psychotherapy sessions," in *Simulataneity: Temporal Structures and Observer Perspectives,* eds S. Vrobel, O. E. Rössler, and T. Marks-Tarlow (Singapore: World Scientific), 329–347.

Rapp, P. E., Jiménez-Montano, M. A., Langs, R. J., Thomson, L., and Mees, A. I. (1991). Toward a quantitative characterization of patient-therapist communication. *Math. Biosci.* 105, 207–227. doi: 10.1016/0025-5564(91)90082-T

Schiepek, G. (2009). Complexity and nonlinear dynamics in psychotherapy. *Eur. Rev.* 17, 331–356. doi: 10.1017/S1062798709000763

Schiepek, G., and Aichhorn, W. (2013). Real-Time Monitoring in der Psychotherapie [Real-time monitoring in psychotherapy]. *Psychother. Psychosom. Med. Psychol.* 63, 39–47. doi: 10.1055/s-0032-1327593

Schiepek, G., Aichhorn, W., and Strunk, G. (2012). Der Therapie-Prozessbogen (TPB). Faktorenstruktur und psychometrische Daten. [The Therapy Process Questionnaire: Factorial structure and psychometric data]. *Z. Psychosom. Med. Psychother.* 58, 257–266. doi: 10.13109/zptm.2012.58.3.257

Schiepek, G., Eckert, H., Wallot, S., and Wallot, A. (2014). *Integrative Psychotherapy. A Feedback-Driven Dynamic Systems Approach*. Toronto, ON: Hogrefe International Publishers.

Schiepek, G., Eckert, H., and Weihrauch, S. (2003). Critical fluctuations and clinical change: data-based assessment in dynamic systems. *Construct. Hum. Sci.* 8, 57–83.

Schiepek, G., Fartacek, C., Sturm, J., Kralovec, K., Fartacek, R., and Pöderl, M. (2011). Nonlinear dynamics: theoretical perspectives and application to suicidology. *Suicide Life Threat. Behav.* 41, 661–675. doi: 10.1111/j.1943-278X.2011.00062.x

Schiepek, G., Fricke, B., and Kaimer, P. (1992). "Synergetics of psychotherapy," in *Self-Organization and Clinical Psychology*, eds W. Tschacher, G. Schiepek, and E. J. Brunner (Berlin: Springer), 239–267.

Schiepek, G., Heinzel, S., Karch, S., Plöderl, M., and Strunk, G. (in press). "Synergetics in psychology: patterns and pattern transitions in human change process," in *Proceedings of the International Symposium "Self-Organization in Complex Systems: The Past, Present, and Future of Synergetics." Springer Series Understanding Complex Systems*, eds A. Pelster and G. Wunner (Berlin Heidelberg: Springer).

Schiepek, G., Kowalik, Z. J., Schütz, A., Köhler, M., Richter, K., Strunk, G., et al. (1997). Psychotherapy as a chaotic process I. coding the client-therapist-interaction by means of sequential plan analysis and the search for chaos: a stationary approach. *Psychother.Res.* 7, 173–194. doi: 10.1080/10503309712331331953

Schiepek, G., and Perlitz, V. (2009). "Self-organization in clinical psychology," in *Encyclopedia of Complexity and Systems Science*, ed R. A. Meyers (Heidelberg; New York: Springer), 7991–8009.

Schiepek, G., and Strunk, G. (2010). The identification of critical fluctuations and phase transitions in short term and coarse-grained time series – a method for the real-time monitoring of human change processes. *Biol. Cybern.* 102, 197–207. doi: 10.1007/s00422-009-0362-1

Schiepek, G., Tominschek, I., Heinzel, S., Aigner, M., Dold, M., Unger, A., et al. (2013). Discontinuous patterns of brain activation in the psychotherapy process of obsessive compulsive disorder: converging results from repeated fMRI and daily self-reports. *PloS ONE* 8:e71863. doi: 10.1371/journal.pone.0071863

Schiepek, G., Tominschek, I., Karch, S., Lutz, J., Mulert, C., Meindl, T., et al. (2009). A controlled single case study with repeated fMRI measures during the treatment of a patient with obsessive-compulsive disorder: testing the nonlinear dynamics approach to psychotherapy. *World J. Biol. Psychiatry* 10, 658–668. doi: 10.1080/15622970802311829

Shapiro, D. A., Harper, H., Startup, M., Reynolds, S., Bird, D., and Suokas, A. (1994). "The high-water mark of the drug metaphor. a meta-analytic critique of process-outcome research," in *Reassessing Psychotherapy Research*, ed R. L. Russell (New York, NY: Guilford Press), 1–35.

Skinner, J. E., Molnar, M., and Tomberg, C. (1994). The point correlation dimension: performance with nonstationary surrogate data and noise. *Integr. Physiol. Behav. Sci.* 29, 217–234. doi: 10.1007/BF02691327

Stiles, W., Leach, C., Barkham, M., Lucock, M., Iveson, S., Shapiro, D., et al. (2003). Early sudden gains in psychotherapy under routine clinic conditions: practice-based evidence. *J. Consult. Clin. Psychol.* 71, 14–21. doi: 10.1037/0022-006X.71.1.14

Stulz, N., Lutz, W., Leach, C., Lucock, M., and Barkham, M. (2007). Shapes of early change in psychotherapy under routine outpatient conditions. *J. Consult. Clin. Psychol.* 75, 864–874. doi: 10.1037/0022-006X.75.6.864

Tang, T., DeRubeis, R., Beberman, R., and Pham, T. (2005). Cognitive changes, critical sessions, and sudden gains in cognitive-behavioral therapy for depression. *J. Consult. Clin. Psychol.* 73, 168–172. doi: 10.1037/0022-006X.73.1.168

Tang, T., DeRubeis, R., Hollon, S., Amsterdam, J., and Shelton, R. (2007). Sudden gains in cognitive behavioral therapy of depression and depression relapse/recurrence. *J. Consult. Clin. Psychol.* 75, 404–408. doi: 10.1037/0022-006X.75.3.404

Tass, P. A., and Hauptmann, C. (2007). Therapeutic modulation of synaptic connectivity with desynchronizing brain stimulation. *Int. J. Psychophysiol.* 64, 53–61. doi: 10.1016/j.ijpsycho.2006.07.013

Thom, R. (1976). *Structural Stability and Morphogenesis.* Reading, MA: Benjamin.

Tschacher, W., Baur, N., and Grawe, K. (2000). Temporal interaction of process variables in psychotherapy. *Psychother. Res.* 10, 296–309. doi: 10.1093/ptr/10.3.296

Tschacher, W., Scheier, C., and Grawe, K. (1998). Order and pattern formation in psychotherapy. *Nonlinear Dynamics Psychol. Life Sci.* 2, 195–215. doi: 10.1023/A:1022324018097

van Orden, G. C., Holden, J. G., and Turvey, M. T. (2003). Self-organization of cognitive performance. *J. Exp. Psychol.* 132, 331–350. doi: 10.1037/0096-3445.132.3.331

Vittengl, J., Clark, L., and Jarrett, R. (2005). Validity of sudden gains in acute phase treatment of depression. *J. Consult. Clin. Psychol.* 73, 173–182. doi: 10.1037/0022-006X.73.1.173

Wampold, B. E. (2010). "The research evidence for common factors models: a historically situated perspective," in *The Heart and Soul of Change*, *2nd Edn*., eds B. Duncan, S. Miller, B. Wampold, and M. Hubble (Washington, DC: American Psychological Association), 49–82.

Webber, C. L. Jr., Marwan, N., Facchini, A., and Giuliani, A. (2009). Simpler methods do it better: success of recurrence quantification analysis as a general purpose data analysis tool. *Phys. Lett. A* 373, 3753–3756. doi: 10.1016/j.physleta.2009.08.052

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Received: 09 May 2014; accepted: 09 September 2014; published online: 02 October 2014.

Citation: Schiepek GK, Tominschek I and Heinzel S (2014) Self-organization in psychotherapy: testing the synergetic model of change processes. Front. Psychol. ***5****:1089. doi: 10.3389/fpsyg.2014.01089*

This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology.

frontiers in PSYCHOLOGY

ORIGINAL RESEARCH ARTICLE
published: 10 July 2014
doi: 10.3389/fpsyg.2014.00699

Metastable structures and size effects in small group dynamics

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In his seminal works on group dynamics Bion defined a specific therapeutic setting allowing psychoanalytic observations on group phenomena. In describing the setting he proposed that the group was where his voice arrived. This physical limit was later made operative by assuming that the natural dimension of a therapeutic group is around 12 people. Bion introduced a theory of the group aspects of the mind in which proto-mental individual states spontaneously evolve into shared psychological states that are characterized by a series of features: (1) they emerge as a consequence of the natural tendency of (both conscious and unconscious) emotions to combine into structured group patterns; (2) they have a certain degree of stability in time; (3) they tend to alternate so that the dissolution of one is rapidly followed by the emergence of another; (4) they can be described in qualitative terms according to the nature of the emotional mix that dominates the state, in structural terms by a kind of typical "leadership" pattern, and in "cognitive" terms by a set of implicit expectations that are helpful in explaining the group behavior (i.e., the group behaves "as if" it was assuming that). Here we adopt a formal approach derived from Socio-physics in order to explore some of the structural and dynamic properties of this small group dynamics. We will described data from an analytic DS model simulating small group interactions of agents endowed with a very simplified emotional and cognitive dynamic in order to assess the following main points: (1) are metastable collective states allowed to emerge in the model and if so, under which conditions in the parameter space? (2) can these states be differentiated in structural terms? (3) to what extent are the emergent dynamic features of the systems dependent of the system size? We will finally discuss possible future applications of the quantitative descriptions of the interaction structure in the small group clinical setting.

Keywords: small group dynamics, therapeutic group, complex systems, Sociophysics, Bion basic assumptions

1. GROUP AS A THERAPEUTIC DEVICE: A BRIEF HISTORICAL INTRODUCTION TO THE STRUCTURAL AND DYNAMIC APPROACH

In his 1909 work the sociologist Charles H. Cooley distinguished primary groups, where the individuals perceive themselves as members of a unified collectivity and share a common system of values and practices, and secondary groups, that meet in order to reach a specific target.

In the first two decades of the 20th century different health care professionals in the U.S. building up on Cooley's perspective adopted a collective setting within their therapeutic practices (Bertani et al., 2002).

Joseph Pratt, as a M.D. at the Massachusetts General Hospital in Boston, in 1905 started a weekly group activity with 15 patients suffering from tuberculosis: reading activities and discussions about the illness condition were proposed in order to provide education and psychological support to the participants. Edward Lanzell proposed in 1919 a group talking cure for his psychotic patients. Julius Metzl adopted the same method to treat alcohol dependence. In the same period Trigant Barrow, at that time an outstanding personality of the newborn psychoanalytic movement in the U.S. started to experiment group therapy with neurotic patients. The perspective adopted by Barrow is relevant for its theoretical as well as clinical implications (Burrow, 1927): he was deeply involved in exploring the disrupting effects of the authority position in the psychoanalytic relationship and attempted first to overcome it by experimenting, together with his collaborator, Clarence Shields, reciprocal analysis. They then moved to group psychotherapy in order to obtain a structural rearrangement of the classical asymmetry of the dyadic setting in terms of a more inclusive, egalitarian framework. This was the down of group analysis and the foundation of a new theoretic perspective in which the structure of the human mind is grounded in group interaction and social representations (Galt, 1958, 1991). Further development in the direction of exploiting groups in order to investigate human behavior was achieved by Jacob Levi

Moreno with the application of socio-metric techniques and with the shift to active group methods (Moreno, 1951).

Foulkes and Bion, around and after the Second World War in England, produced the first comprehensive systematization of the methodology of group-analysis (Foulkes, 1984) and of the paradigm of the small group with analytic function (Bion, 1961). Here we are mainly interested in Bion's approach, as he explores the structural nature of the "emergent" phenomena that can be observed in the clinical small group setting. With this respect, Bion's theory of small group dynamics can be seen as complementing the Freudian description of large group dynamics: Freud assumed that libidic bonds structure and support crowd phenomena, via the identification of the Leader as the Ideal of the Ego of the members of the group (Freud, 1921).

In describing the psychoanalytic function of the small group clinical setting, Bion stated that in his experience the group was where his voice arrived, a physical limit that is usually assumed to correspond to 8–12 people (Neri, 2011). Bion's approach is considered a psychotherapy "of" the group (in opposition to a psychotherapy performed within the group) as the group behaviors and its unconscious bases are seen as the target of the psychotherapeutic intervention. In fact he introduces a theory of the groupal aspects of the mind in terms of proto-mental states. These are individual mental states that spontaneously evolve into collective psychological states that are the proper observandum in this clinical setting. The collective states at issue correspond to some types of cognitive/emotional experiences that can be detected and described by the analyst. Bion called them basic assumptions, a term that is used in structural anthropology to describe a minimal set of implicit assumptions about the world that renders intelligible the culture of a given group or community under study. They are supposed to be characterized by a series of features: (1) they emerge as a consequence of the natural tendency of (both conscious and unconscious) emotions to combine into structured group patterns; (2) they have a certain degree of stability in time; (3) they tend to alternate so that the dissolution of one is rapidly followed by the emergence of another; (4) they can be described, in qualitative terms, according to the nature of the emotional mix that dominates the state, in structural terms by a kind of typical leadership pattern, and in cognitive terms by a set of implicit assumptions that are helpful in explaining the group behavior. For example, in the fight-flight basic group, the group behaves as if there was an enemy to fight or to flight away from, and as a consequence, appears to be in search of a leader that would be good in identifying such an enemy; in the dependence basic group, the group experiences a set of intense wishes to find an idealized leader that would solve all the group's problems and so on In Bion's view this is not the only relevant way to describe the analytic group's behavior, as the group can also function in a truly cooperative and rational way to fulfill the overt aim of reaching an insight about its own dynamics, with the help of the therapist. But Bion's view is that most of the time the group is dominated by the basic group dynamic, so that an effective, often painful, effort, based on the analytic clarification work, must be sustained in order to produce a real creative development in the state of the group. Although decades of work within this paradigm produced a somewhat more balance view about group dynamics (see for example, Correale, 2006), the fundamental view that the small group dynamics can be described in terms of coherent collective states has never been questioned in formal terms.

Here we propose to adopt a very simple formal model of human interaction and small group dynamics in order to investigate the structural constraints that should support the described phenomenology, in an attempt to address the following issues: (1) are metastable collective states allowed to emerge in the model and if so, under which conditions in the parameter space? (2) can these states be differentiated in structural terms? (3) to what extent are the emergent dynamic features of the systems dependent of the system size? A word of caution is required with respect to the nature of the model we adopt to describe interactions in the group. This is a model derived from a parallel line of investigation in Sociophysics, and therefore, it is not a model derived from psychoanalytic assumptions. Nevertheless, in line with the emergent and structural nature of the phenomena we would like to simulate, and resting on a classical universality assumption, we expect that it can provide a meaningful description of the coherent behaviors in small group dynamics. Our implicit assumption is therefore that in order to study and model groups behaviors in clinical settings it is useful to first consider the basic dynamic behavior of a set of interacting subjects, as approximated by the simulations.

1.1. A MULTIDISCIPLINARY APPROACH TO THE STUDY OF THE HUMAN GROUP DYNAMICS

A possible and very coarse grained picture describing the classification found in the classical psychological literature of the human collective dynamics is reported in **Figure 1**.

The recent and fruitful convergence between psychology and complex system science, already provided a new generation of mathematical models and frameworks to study the cognitive group dynamics. In order to reduce the complexity of the system taken into account (i.e., the human groups) the common and fundamental step of such research has been to identify a minimal set of microscopic variables, that capture the relevant mesoscopic representation of the macroscopical dynamics under scrutiny.

Among the large number of disciplines that have been attracted from the study of the human collective dynamics during the last century, Sociophysics represents one of the most powerful paradigm to characterize many relevant collective phenomena, such as culture dissemination, language evolution, spreading of opinions, social norms, credences and beliefs (Lorenz, 2007).

By adopting a multidisciplinary perspective incorporating psychology, sociology, physics of complex systems and computer sciences, Sociophysics developed a modeling approach to reach the mesoscopic approximation of the human systems that is able to capture the interactions between microscopical processes (e.g., psychological and cognitive models and theories), and the macroscopical and observable relevant dimensions (e.g., behaviors, opinions, social norms, and their dynamical features).

In a previous paper (Bagnoli et al., 2008b), we introduced a simple mathematical model describing the opinion dynamics within a group of artificial agents. The agents were equipped with a simple model implementing the cognitive dissonance theory of Festinger (Festinger, 1962), in order to describe,

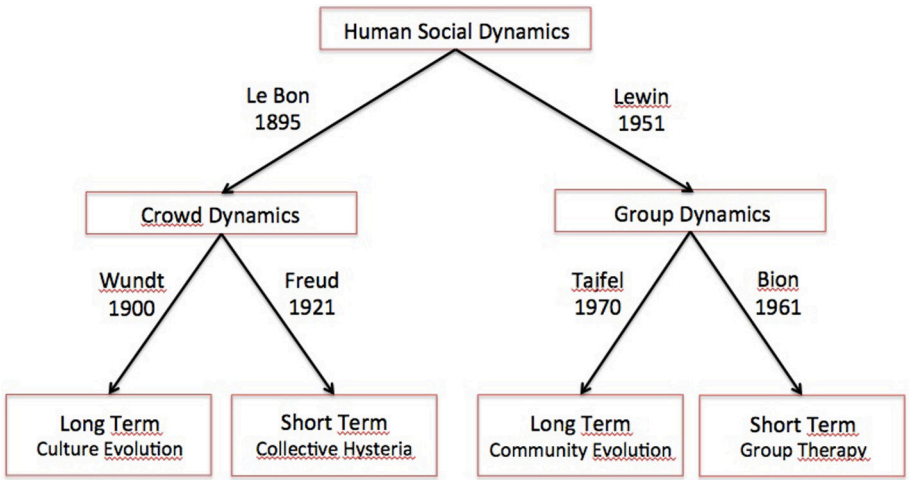

FIGURE 1 | A classification of the human social dynamics. A possible and very coarse grained picture describing the classification of human collective dynamics, provided by the classical psychological literature.

in an effective way, the dynamical interaction between the incoming (i.e., new/external) information and the knowledge of the decision-maker.

2. THEORY AND METHODS

2.1. THE AGENTS AND THE PARAMETERS

The fundamental building blocks of our framework are defined agents (or nodes), and links, representing respectively the subjects enrolled in the group dynamics and the quality of their relationships (i.e., affinity). The agents and their links are detailed in our model by means of two fundamental parameters, respectively labeled *opinion* of an agent (O_i^t), and affinity between two agents (α_{ij}^t). The environmental features, i.e., the other free parameters of the model, have been directly inspired from the sociophysical literature and are assumed as standards of the framework. Such parameters are: the convergence parameter μ, representing the average degree of convergence in in opinion/behavior after an effective interaction with another agent, and here set to the standard value of 0.5. The critical opinion (ΔO_c) and affinity (α_c) thresholds, representing respectively a sort of cultural related *Openness of Mind* and *Average Tolerance* toward the others. And finally the *Social Distances Space* (D_{ij}^t), described later in Section 2.3 and the *Social Temperature* (KT), incorporating respectively a dimension related with a basic probability of interaction between two subject i and j, and the degree of mixing (i.e., the probability of meeting a very distant subject on our social distances space) given a certain social setting.

The role and the theoretical meaning of the parameters considered by our model, have been quite well studied and described in the sociophysical literature (Lorenz, 2007). Nevertheless a brief qualitative description of their role is provided in order to clarify the key features of their interplay. The two principal variables used to describe the system dynamics (i.e., order parameters), represents the *opinion* of an agent at a certain time t (O_i^t), and the strength of his relations with the others (i.e., affinity, α_{ij}^t). The adoption of a numerical encoding for such dimensions allows us to define a sort of *distance* between subjects in terms of opinion, or expressed behavior, so taking into account the opinion space of the group and the relative position of an actor within it. With respect to the affinity between subjects (α_{ij}^t), such a parameter allows to describe in a continuous way (i.e., $\alpha_{ij}^t \in (0, 1)$) what we could label as the *strength of a relation*, or from another point of view, the influence a subject i is subjected to with respect to another subject j. As a consequence because of the Equation 1, an affinity close to 0 between two subject would determine a null convergence in the opinion space after an encounter between them (i.e., $\Delta O_{ij}^{t-1} = \Delta O_{ij}^t$). While an affinity close to 1 would produce a convergence between the agents (i.e., $\Delta O_{ij}^{t-1} > \Delta O_{ij}^t$), possibly making them *agree* to the same opinion/behavior. In other words with the previous parameters (i.e., O_i^t and α_{ij}^t) we introduce a formal description of the psychological field determined by the group.

The parameters introduced to mimic the dynamics among humans, respectively the convergence parameter μ, and the thresholds of the model ΔO_c and α_c, have the role to determine the mechanism affecting the inner state of the subjects after an encounter. The convergence parameter μ has the simple role of determining the degree of convergence, namely the maximum percentage of the distance between two interacting subject i and j that could be traveled by one subject toward the other. As such parameters has been very well studied in sociophysical terms (Weisbuch et al., 2002), proving how his role is affecting only the fastness of the convergence and not the qualitative final state of the system, it is nowadays always set to a convenience value of 0, 5. In this way such parameters is maintained in the model just to make it more readable in sociophysical terms, but actually treated as a constant. On the other hand to have a μ with a value of 0.5 means to simulate a situation in which, in the best case, two interacting subjects i and j characterized by a sufficient degree of affinity (i.e., $\alpha_{ij}^t, \alpha_{ji}^t > \alpha_c$), converge after an encounter on the

same final opinion, spanning the same distance in the opinion space. The role of the two thresholds of the model (i.e., ΔO_c and α_c) is fundamental to mimic the effect of the cognitive dissonance on the evolution of the group. The threshold defined on the opinion space ΔO_c, labeled as *Openness of Mind*, determines the maximum degree of distance in opinion tolerated by a subject in order to increase his affinity toward such interactor. A distance $\Delta O_{ij}^t > \Delta O_c$ between two interacting subjects determines a reduction of the affinity between the subjects, while the opposite case would have the opposite effect increasing their affinity. The same coupling is proposed for what concern the affinity threshold α_c, if the affinity between two interacting subjects is greater than the threshold (i.e., $\alpha_{ij}^t > \alpha_c$) then the two subjects converge in opinion, so reducing their distance ΔO_{ij}^t. The key mechanism implementing in the model the cognitive dissonance effect is represented by the coupling between the thresholds and the parameters evolution (2 and 1), i.e., the opinion threshold determines the affinity dynamics 2, and the affinity threshold drives the opinion dynamics 1. The consequence can be summarized as follows: the human tendency is to get along with people sharing our same opinion/behavior, or supporting our same issues, without considering or actively not supporting the others.

The last fundamental ingredient of our numerical recipe is represented by the dynamics of the encounters/interactions between the subjects. This fundamental aspect of a group dynamics is one of the classical weak aspects of the sociophysical approximation. In particular for what concern small group dynamics, taking place for short periods of time, the small number of possible interactions make such events very impacting on the overall dynamics of the group. In order to increase the ecologicity of our model, we represented the subjects belonging to the group as characterized by a *Social Distance* representing the probability to observe an interaction between them. To build such distance we started from two simple considerations, the first is that humans not have only random interactions, but at the contrary are used to affect a lot the probability of their encounters, choosing where to go, what to say and to who express their opinion. In order to introduce such an aspect, we implicitly stated in our Equation 3 that a subject would like to interact more likely with a *friend* close to him in the opinion/behavior space (i.e., $\Delta O_{ij}^t \to 0$), and linked with him by an high affinity (i.e., $\alpha_{ij}^t \to 1$).

In order to introduce the stocastic or random interactions always taking place during a group dynamics, in the Equation 4 the probability of an encounter is *thermalized* or *perturbed* by a gaussian noise with mean 0 (i.e., the sum of positive and negative noise/displacements on the social distances space of a subject is equal to 0). The gaussian perturbation determines that after a completely random extraction of a subject i (i.e., namely the first interactor), every subject j within his social space is moved in the two possible directions (i.e., far or close) of a term equal to the noise. A different noise term is extracted from the same distribution and added to the distance between i and j, and at the end the closest agent to i is selected for the interaction. Using such a mechanism we can simulate different scenarios characterized by different degrees of *social temperature* or social mixing, just by tuning the standard deviation of the gaussian noise distribution (i.e., $\sigma_{Noise} = KT$). As a consequence we have that there is always a probability different from 0 to observe any possible interaction, and that we can tune the degree of mixing in order to obtain the same probability for every possible interaction (i.e., high social temperature), or to give a greater relevance to the initial distances space (i.e., low social temperature).

Finally, by means of our framework, we are able to describe a subject enrolled in a group experience as a trajectory on a multidimensional space, describing at the same time his microscopical features (i.e., his opinion and his community), as well as the macroscopical factors affecting his dynamics.

Our numerical simulation are devoted to investigate the effect of the size of the group within our theoretical approximation, in search of any macroscopical feature, related with the free parameters of the model (i.e., *affinity* and *opinion thresholds*, *social temperature*, and *group size*) that could suggest that a phase shift is present in the collective dynamics.

At the beginning of each simulation the initial conditions of the system are set simply by assigning a random uniform distributed opinion (O_i^0), ranging in $(0, 1)$, as well as a random affinity (α_{ij}^0) value for each dyads, with $alpha_{ij}^0 \neq \alpha_{ji}^0$. In this way the vector O_i^t and the matrix A_{ij}^t are defined as respectively the opinion and the affinity spaces of the system.

Each iteration represents an encounter where two agents are extracted with a certain rule and interact, updating their parameters (i.e., *opinion* and *affinity*) accordingly with the rules of the model.

The macroscopical dynamics of the system can be considered in a stable/equilibrium (i.e., or metastable) state, if a relevant order parameter of the system (e.g., a macroscopical variable of interest, such as the number of sub-communities acting within the group) reaches a temporal stability, i.e., does not change for a long time and/or for a large number of subsequent interactions/communications. In our study we consider the final number of sub-communities (i.e., clusters) that emerge in the simulation along the time.

Finally, in order to get an insight about a possible critical size of the human groups, distinguishing between *crowd* and *small group* dynamics, we adopted as control parameter of our simulation the size of the group (N), and studied its effects on the dynamical behaviors of the vector O_i and of the matrix A_{ij}.

2.2. THE MODEL

The mathematical model we studied in Bagnoli et al. (2008a,b); Carletti et al. (2009) incorporated the Cognitive Dissonance theory of Leon Festinger in order to detail the mechanics of the evolution of the agents' parameters after the encounters. Briefly, when two agents meet, their opinions converge if between the agents the affinity level is larger than the *critical affinity threshold* (i.e., $\alpha_{ij}^t > \alpha_c$), remaining still otherwise (1). At the same time the coupled equation evolving the affinity between subjects (2), determines an increasing of α_{ij}^t if the absolute value of the difference in opinion between the two subjects (ΔO_{ij}^t) is smaller than the *Critical Opinion Threshold* ΔO_c, otherwise the affinity α_{ij}^t is

reduced, always ranging between 0 and 1.

$$O_i^{t+1} = O_i^t + \mu \Delta O_{ij}^t \frac{\tanh\left(\beta(\alpha_{ij}^t - \alpha_c^t)\right)}{2} \quad (1)$$

$$\alpha_{ij}^t + 1 = \alpha_{ij}^t + (1 - \alpha_{ij}^t)\alpha_{ij}^t \tanh\left(\beta(\Delta O_c - \Delta O_{ij}^t)\right) \quad (2)$$

where O_i^t is the Opinion (i.e., or a behavior) shown by a subject i at the time t, with $O \in (0, 1)$. While α_{ij}^t represents the strength of the relation between the subjects i and j, at the time t, with $\alpha \in (0, 1)$. More in detail ΔO_{ij}^t represents the difference (or distance) in Opinion/Behavior or Psychological State between two subjects i and j in a certain moment t. Of course this parameter allows to introduce a threshold, ΔO_c, to represent a sort of "*Openness of Mind*" of the group, or in other words, the average availability of the subjects to change their feelings toward those interactors characterized by a very different Psychological State/Opinion/Behavior with respect to them. The parameters μ and β, set respectively to values 0.5 and 1000, are just devoted to determine the speed of the convergence of the simulations, and do not alter the final qualitative results (Weisbuch et al., 2002).

The model implements different psychological assumptions, ranging from the Cognitive Dissonance of Festinger (1962), to the Psychological Field of Lewin (1951), and the Social Impact Theory of Asch and Sherif (Asch, 1956; Sherif and Hovland, 1961).

Within our model the dynamics of the evolution of the psychological state is coupled with the evolution of the affinity between the subjects belonging to the same group dynamics. More in details, the two hyperbolic tangent equipping the Equations 1 and 2, introduce two step functions to mimic the cognitive dissonance theory effect. The Psychological State of a subject (O_i^t) evolves as a consequence of the interaction with another subject, but the magnitude of the effect (i.e., of the change in the State variable) is modulated by the affinity toward that subject α_{ij}^t with respect to the critical affinity value (i.e., α_c). In other words, if the subject i has a strong "affective" link with the subject j, he would change his Psychological State easily. At the same time the evolution of the affinity between subjects is controlled by the critical difference in psychological state, or ΔO_{ij}^t parameter. The Equation 1 couples the evolution of the affinity between i and j, with their difference in term of Psychological State (i.e., ΔO_{ij}^t). In details, if the difference between the Psychological State of two interacting subjects is smaller than a certain critical value, here labeled as ΔO_c, their affinity after the encounter will increase. Obviously the opposite happens if the difference ΔO_{ij}^t is greater than ΔO_c.

2.3. A NUMERICAL RECIPE FOR THE GROUP SIMULATION

In order to get an effective, and *ecological*, representation of a real human group dynamics, we spent an effort even in the design of the dynamics of interactions among the agents. In our representation of a real dynamics, every subject i, at each time step, is equipped with a memory of his past interactions called Social Distances Space of i. Within such a dimension should be represented the probability to observe an interaction between the subject i and any other subjects belonging to the interaction. A first mathematical approximation of this dimension can be the following:

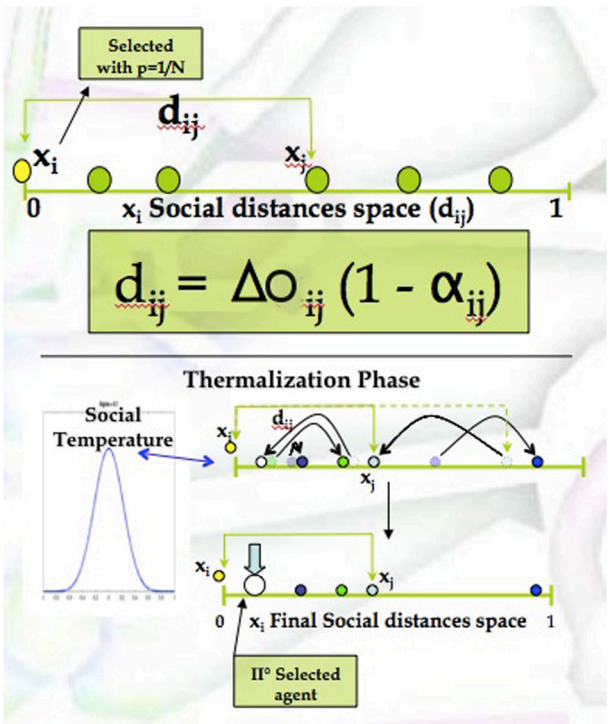

FIGURE 2 | The social distances space. Graphical representation of the mathematical recipe used to simulate the encounters dynamics among agents.

$$d_{ij}^t = \Delta O_{ij}^t (1 - \alpha_{ij}^t) \quad (3)$$

the two simple assumptions seeding the equation are the following: a subject has higher chances to iteract both with those who are nearer to him in terms of Psychological State, and with those toward whom he feels a higher affinity.

Once the Social Distances Space is defined, an important and still missing ingredient is the dynamics of the interactions. In order to refine the model we manipulated this phase by introducing a *thermalization phase* representing a certain level of unpredictability of the system; such an ingredient can make every event as a singularity.

The thermalization phase has been structured as follows and illustrated in **Figure 2**.

- Agent i Selection/Extraction:
  In the first step of the recipe an agent i is randomly selected from the community (i.e., using a uniform probability distribution).
- i-Social Space Thermalization:
  Once the individual i is selected, its social distances d_{ij}^t with respect to all other individuals are computed and randomly varied with a white random noise η_i^t, as reported in Equation (4). The standard deviation of the noise (η) is assumed as a control parameter of the system, and because

of its power of *mixing* and *shuffling* the system it is labeled as Social Temperature. The resulting social distances space for the subject i is, as a consequence, given by the equation:

$$d_{ij}^t = \Delta O_{ij}^t (1 - \alpha_{ij}^t) + \eta_i^t \quad (4)$$

- Agent j Selection:
  After the thermalization phase, the nearest agent to i is selected as interactor (i.e., j).

3. RESULTS

In order to study the effect of the size of the group on the spontaneously emerging dynamics, we varied the N parameter for different numerical simulation.

The model's dynamics is characterized by dynamical equilibrium states, as shown in **Figure 3**, defined as those state in which the affinity matrix as well as the opinion space do not show any further change in time.

The **Figure 3** represents an example of stable state condition, reached by one simulation run. In particular on the left is reported the temporal evolution of the opinion vector O_i^t, while on the right is shown the final state of the affinity matrix A_{ij}^t whit the affinity values ranging from yellow (i.e., large values) to green (i.e., small values). In the particular example reported, four clusters characterize the stable state, and the arrow suggests the correspondence between the two projection of the same system, so that the four clusters can be represented or using the affinity matrix, or considering the opinion space The equilibrium state can be described in terms of final number of clusters, and in terms of amount of time required to reach the stable state in the affinity space, as well as in the psychological state space (i.e., opinion space). Such times of convergence are going to be taken into account, later in this paper, in order to discriminate the two regimes emerging from our results.

As it is reported in **Figure 4**, the numerical simulations of our system suggest the existence of a self critical process. The fractal dimension for our system has been estimated to be $fd \simeq 1.6$, and the probability distribution of the "Psychological State Change" appears to be fitted by a power law distribution.

The Social Temperature effect is reported in **Figure 5**, and confirm the classical Sociophysical literature reporting as, the higher is the mixing of the agents' encounter (i.e., an high probability to have an interaction between subjects regardless their initial state or affinity), the greater is the probability to have a single final cluster as equilibrium of the system (i.e., a condition where all the subjects show the same Psychological State and have an high affinity which each other). As a consequence, decreasing the Social Temperature makes more probable to have a fragmented state (i.e., more than one final cluster) as an equilibrium state.

An appropriate scaling of the numerical simulations' data has shown, in a previous work (Bagnoli et al., 2008b), a second order phase transition on the order parameter related to the number of final cluster (**Figure 6**). The resulting law describes the relation between the final psychological coherence of a community, the critical affinity shared by the subjects, and the social temperature (ST) or degree of mixing (Equation 5). The Equation 5 suggests that the average final number of clusters decreases when the social temperature and the average critical affinities increase (**Figure 6**).

$$N_c = \frac{1}{\sqrt{\alpha_c ST}} \quad (5)$$

In order to assess the effect of the group size on the evolution dynamics of the system, we rescaled the convergence times of the two dimensions under scrutiny (i.e., Opinion space and affinity space), with the factor N^2. Such a transformation is sufficient, as shown in the subfigure on the right of the **Figure 7**, to make the different functions collapsing on the same plane. The upper diagram demonstrates how good is the approximation obtained by the scaling with N^2 of the convergence time of the affinity matrix, increasing the size of the system (N), for different critical values of openness of mind. The function suggests a typical value for "large" systems, and a divergence for "small" systems (i.e., groups). Finally, **Figure 7** reports, on the left bottom corner subfigure, the two functions representing, respectively, the affinity convergence time (in black), and the opinion convergence time (in red), with respect to the size N of the community. In our simulations the two functions cross each other for a value of N

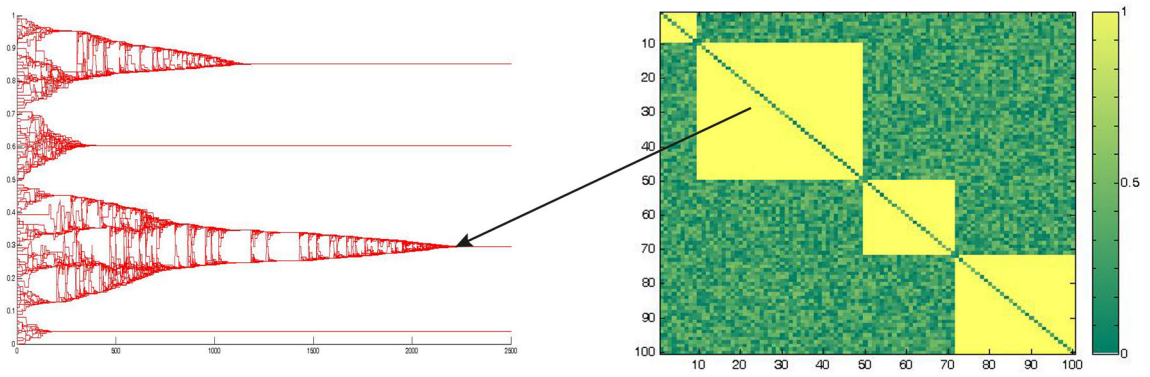

FIGURE 3 | Stable state of the group dynamics. An example of stable state condition of the system at the end of a typical simulation run is reported. On the left the opinion space of the group, on the y-axis, is represented with respect to the time on the x-axis. On the right the final affinity matrix is represented, on the axis are reported the nodes and the higher is the affinity between two subjects, the more the correspondent cell/value is yellow.

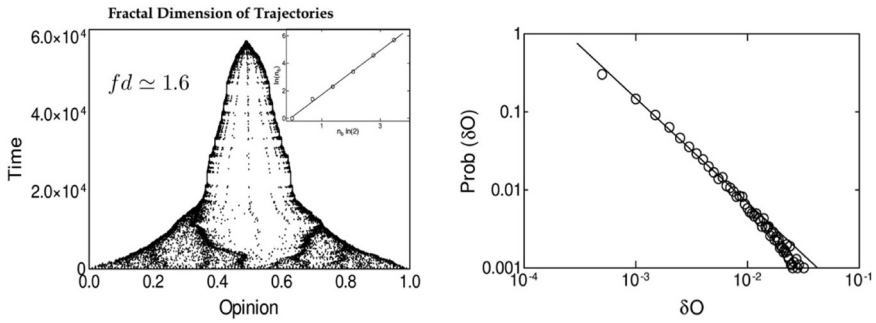

FIGURE 4 | Complex dynamics features. Among the interesting features suggesting the existence of a self organizing complex dynamics beyond the systems studied by our model, the figures above report probably the most important. On the left the agents' trajectories for a single simulation are reported and analyzed by mean of the box method, reporting a fractal dimension of such trajectories. On the right the distribution along three decades of the opinion jumps of the agents (i.e., the movements along the opinion space realized by the agents during the entire simulation) is reported using a logarithmic rescaling. The linearity of the interpolating function suggest a power law function controlling such a process.

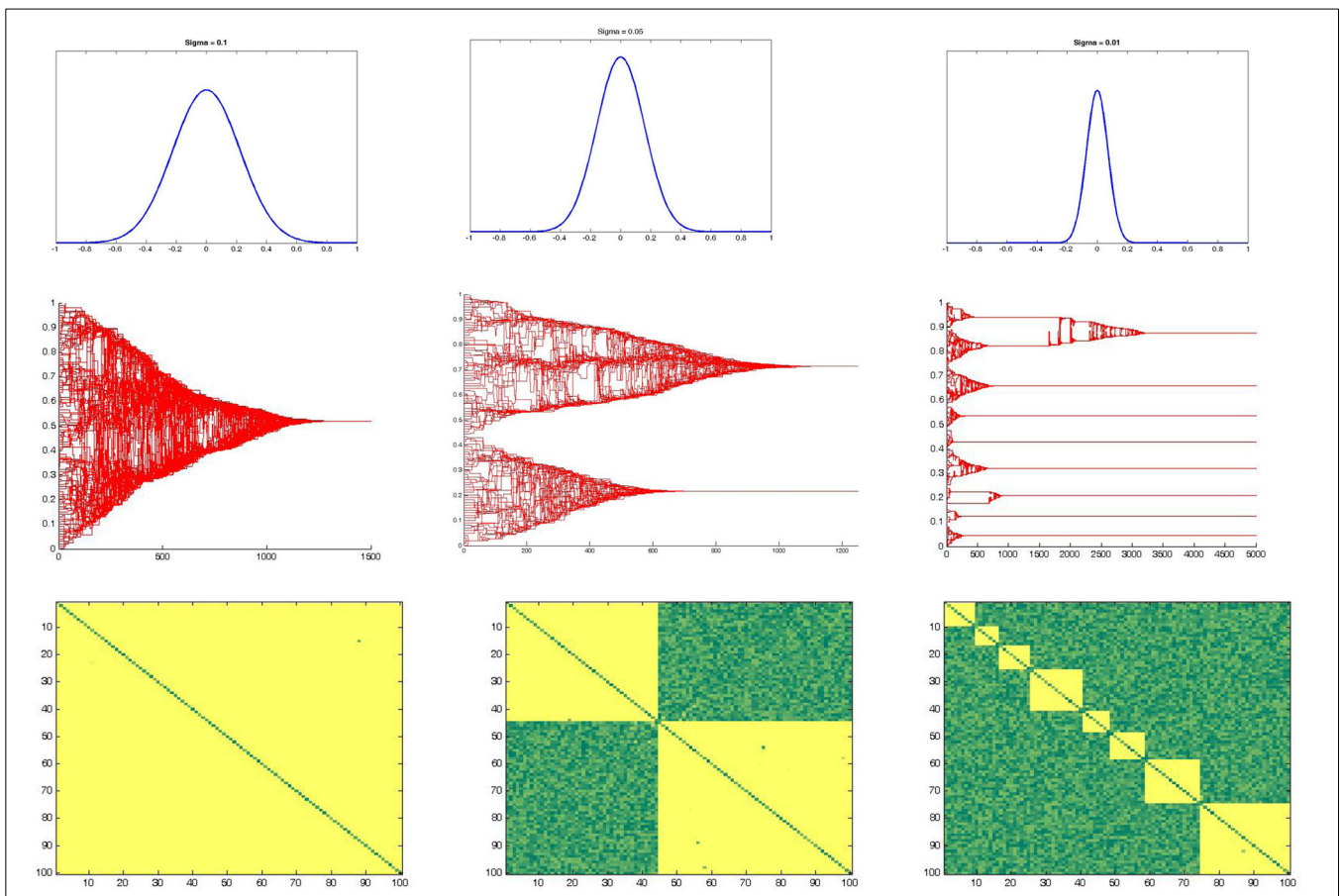

FIGURE 5 | Social temperature effect. The three pictures above report the effect of social temperature, which has been defined as the standard deviation of a white gaussian noise with mean equal to 0. Increasing the social temperature (i.e., from right to left) make the final number of clusters decreasing.

between 10 and 20. In other words, before such a critical size of the group the affinity matrix (i.e., the representation of the strength of the relationships between subjects) reaches the final state first, training subsequently the Psychological States dynamics. On the contrary, when the size of the system increases, the affinity dynamics become slower than the Psychological States dynamics, and it is this last one that drives the convergence of the affinity matrix once it reaches its stable state.

4. DISCUSSION

In our simulation study, we have explored the asymptotic behavior of the group dynamics in a model of interacting agents

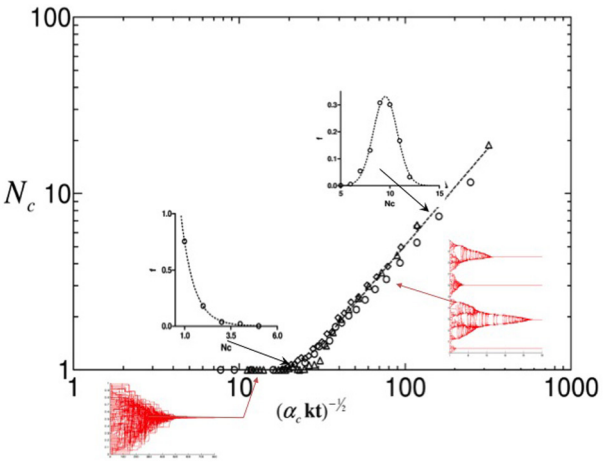

FIGURE 6 | System phase transition. The figure reports the average number of clusters as function of the rescaled quantity $(\sigma\alpha_C)^{-\frac{1}{2}}$. A phase transition is found at $(\sigma\alpha_C)^{-\frac{1}{2}} \simeq 20$. Above the transition, histograms of the number of clusters are computed and enclosed as insets in the main frame: symbols refer to the numerics, solid lines are fitted interpolation. Here, $\Delta Oc = 0.5$.

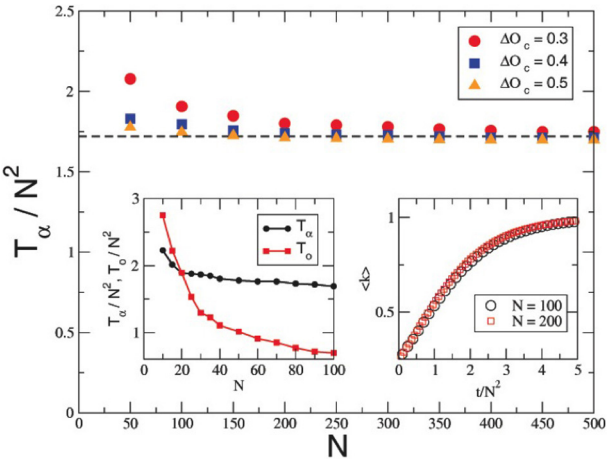

FIGURE 7 | Size effect on system dynamics. The main panel of the figure reports how T/N2 vs. N for dierent values of the parameter ΔO_c. The data approach a constant value ($\frac{T}{N^2} \simeq 1.72$) clearly indicating that the time of convergence of the anity matrix scales quadratically with the number of agents, in agreement with the theory. The asymptotic value estimated by our theory is 2.19, the discrepancy being therefore quantied in about 15%. Left inset: $\frac{T}{N^2}$ and $\frac{T_C}{N^2}$ vs. N for $\Delta Oc = 0.5$. As predicted by the theory and the numerics a crossover is found for groups for which opinions converge slower than the anities: this is the signature of a distinctive dierence in the behavior of small and large groups, numerically we found that this dierence is eective for $N \simeq 20$. Right inset: $\sigma(k)$ vs. $\frac{t}{N^2}$ is plotted for two dierent values of N. As expected the two curves nicely collapse together.

endowed with an Opinion state and a matrix of Affinity levels that evolve according to a coupled non-linear updating law. The aim of the simulations was to assess the plausibility, in dynamic terms, of the model proposed by Bion in the context of his analytic studies in the small group clinical setting (Bion, 1961). In particular, we wanted to verify the plausibility of the proposed hypothesis that the group dynamics is characterized by the spontaneous and rapid self-organization of coherent states that exhibit a degree of stability in time and that can be described in structural terms by specific patterns in the Opinion and Affinity spaces. These latter variables intend to represent, in the model, the cognitive and affective evolution of the participants taking place via interactions in the group.

The model is characterized by the presence of different control parameters; the dependence of the asymptotic behavior of the dynamics from these parameters and the eventual stability has been analytically explored in the simulations. We would like to stress that this model is not endowed with any *ad hoc* computational mechanism to enhance stability, such as symmetric interactions between the agents. The collective phenomenology is therefore a direct consequence of the interaction dynamics.

The first result that we obtained in the simulations is the emergence of collective coherent states that are quite rapidly stabilized in time. From the plot of the asymptotic Affinity matrices and Opinion states, it is evident that these asymptotic states are characterized by complex patterns of dynamic clustering (See **Figure 3**); this pattern tends to be simplified only in the presence of the higher levels of Gaussian Noise in the model (See **Figure 5**). The structure exhibited by the asymptotic state in the Opinion space can be further characterized in terms of a self critical phenomenon with fractal dimension 1.6, as shown in **Figure 4**.

The second result that we would like to stress, is obtained by considering the speed of convergence of the Opinion and Affinity variables toward their asymptotic values as a function of the group dimension N (see **Figure 7**). We remind that the Opinion and Affinity dynamics are coupled in the model and that the simulations are triggered by assuming random values of the Opinion and Affinity variables at time zero. Nevertheless, the model exhibits a very interesting behavior: when N is in the range of less than around 20 units, the convergence of the Affinity matrices is faster than the convergence of the Opinion variables, while the opposite is true for N larger than 20. This phenomenology in the simulations is suggestive of the existence of two different dynamic regimen in the model, the first corresponding to the classical small group dynamics and the other corresponding to the classical large group or crowd dynamics. In the small group case, the affective structure of the interpersonal links in the group remains the main determinant of the collective state of the system, while in the case of the large group, or crowd dynamics, the cognitive dimension of the Opinion dynamics is dominating the collective behavior. This is reminiscent of the Freudian hypothesis that an Common Ideal or a shared Value can very easily take the place of the "beloved" Leader in the mass condition (Freud, 1921). Overall the results support well the validity of the distinction between the small group and large group dynamics that is so well established in clinical practice. Furthermore the picture proposed by Bion, that the small group exhibits the tendency to be dominated by collective coherent states emerging from the immediate and incompressible tendency (i.e., named Valence in

Bionian terms) of individual cognitive/affective states to coalesce into collective asymptotic metastable patterns, seems to be plausible when considered within a formal non-linear group dynamic approach.

A point that is worthwhile mentioning is that, from the simulations, we see that the group dynamics exhibits a certain degree of stability even in the small group case. As a consequence, the tools on non-linear analysis, together with structural network analysis, can be applied to describe the group's behavior in principle even in ecological settings. The relevant issue is therefore to be able to operationally describe the interacting behavior of the participants in a convenient way. As a first step in this direction, our group is developing a dedicated Virtual Ambient for the study of group interactions (www.complexworld.net/virthulab) in which many relevant aspect of the subjects' interactions can be tracked *in vivo*. We are particularly interested in analyzing small group dynamics under different task constraints (Guazzini et al., 2012a,b; Cini and Guazzini, 2013). In the present paper, for example, the simulated condition corresponds to an "ecological" (*ICT-mediated*) situation where the participants can freely interact for a given amount of time (i.e., ICT is used for Information and Communication Technologies). The availability of dynamic and network analyses (that could even be related to an analysis of the content of the exchanged messages in the chat) provides a potentially new way to assess issue such as what is it that makes the leader a leader in the group or under which conditions does the group behave as a whole and why in some other conditions fragmented subgroups do emerge in the self-organization process. A further advantage of these new research perspective is that it provides a very natural way to contrast the classical description of a subject in terms of psychological observables with his or her behavior as a participant in the "ecological" group setting.

ACKNOWLEDGMENTS

The authors would like to thank to the Prof. Duccio Fanelli, Prof. Timoteo Carletti, and Prof. Alessio Guarino, for the precious efforts and for their fundamental contribution. The present work has been funded by the European project FOCAL, EU contract n. 288021 (EINS Network of Excellence in Internet Science).

REFERENCES

Asch, S. E. (1956). Studies of independence and conformity: I. a minority of one against a unanimous majority. *Psychol. Monogr. Gen. Appl.* 9, 1–70. doi: 10.1037/h0093718

Bagnoli, F., Carletti, T., Fanelli, D., Guarino, A., and Guazzini, A. (2008a). Birth and death in a continuous opinion dynamics model. the consensus case. *Eur. Phys. J. B* 64, 285–292. doi: 10.1140/epjb/e2008-00297-3

Bagnoli, F., Carletti, T., Fanelli, D., Guarino, A., and Guazzini, A. (2008b). Dynamical affinity in opinion dynamics modeling. *Phys. Rev. E* 76, 66105. doi: 10.1103/PhysRevE.76.066105

Bertani, B., Manetti, M., and Venini, L. (2002). *Psicologia dei Gruppi, Teoria, Contesti e Metodologie Dintervento*. Milano: Franco Angeli.

Bion, W. R. (1961). *Experiences in Groups*. New York, NY: Basic Books. doi: 10.4324/9780203359075

Burrow, T. (1927). *The Social Basis of Consciousness*. New York, NY: Harcourt, Brace.

Carletti, T., Fanelli, D., Guarino, A., and Guazzini, A. (2009). "Meet, discuss and trust each other: large versus small groups," in *Artificial Life and Evolutionary Computation: Proceedings of Wivace 2008*, eds R. Serra, M. Villani, and I. Poli (Singapore: World Scientific), 213–224.

Cini, A., and Guazzini, A. (2013). Human virtual communities: affinity and communication dynamics. *Adv. Comp. Sci.* 16, 1350034–1–1350034–24. doi: 10.1142/S0219525913500343

Correale, A. (2006). *Area Traumatica e Campo Istituzionale.* Roma, QLD: Borla.

Festinger, L. (1962). *A Theory of Cognitive Dissonance*. Redwood City, CA: Stanford university press.

Foulkes, S. H. (1984). *Therapeutic Group Analysis.* London: Karnac Books.

Freud, S. (1921). Group psychology and analysis of the ego. *S.E. London Hogarth* 18, 65–143.

Galt, A. (1991). The phenomenology of normality in the context of Trigant Burrows's group analysis. *J. Human. Psychol.* 31, 95–113. doi: 10.1177/0022167891311009

Galt, W. E. (1958). *A Search for Man's Sanity: The Selected Letters of Trigant Burrow.* New York, NY: Oxford University Press.

Guazzini, A., Bagnoli, F., Carletti, T., Vilone, D., and Lauro Grotto, R. (2012a). Cognitive network structure: an experimental study. *Adv. Comp. Sci.* 15, 12584–12599. doi: 10.1142/S0219525912500841

Guazzini, A., Cini, A., Lauro Grotto, R., and Bagnoli, F. (2012b). Virtual small group dynamics: a quantitative experimental framework. *Rev. Psychol. Front.* 1, 10–17. Available online at: http://www.academicpub.org/fpbs/paperInfo.aspx?PaperID=1359

Lewin, K. (1951). *Field Theory in Social Science*. New York, NY: Harper and Row.

Lorenz, J. (2007). Continuous opinion dynamics under bounded confidence: a survey. *Int. J. Mod. Phys. C* 18, 1819–1838. doi: 10.1142/S0129183107011789

Moreno, J. L. (1951). *Sociometry, Experimental Method and the Science of Society. An Approach to a New Political Orientation.* New York, NY: Beacon House.

Neri, C. (2011). *Gruppo*. Roma, QLD: Borla.

Sherif, M., and Hovland, C. I. (1961). *Social Judgment: Assimilation and Contrast Effects in Communication and Attitude Change*. New Haven, CT: Yale University Press.

Weisbuch, G., Deffuant, G., Amblard, F., and Nadal, J. (2002). Meet, discuss, and segregate. *Complexity* 3, 55–63. doi: 10.1002/cplx.10031

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Received: 30 April 2014; accepted: 18 June 2014; published online: 10 July 2014.
*Citation: Lauro Grotto R, Guazzini A and Bagnoli F (2014) Metastable structures and size effects in small group dynamics. Front. Psychol. **5**:699. doi: 10.3389/fpsyg.2014.00699*
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology.

frontiers in
PSYCHOLOGY

ORIGINAL RESEARCH ARTICLE
published: 30 May 2014
doi: 10.3389/fpsyg.2014.00452

An enactive and dynamical systems theory account of dyadic relationships

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Many social relationships are a locus of struggle and suffering, either at the individual or interactional level. In this paper we explore why this is the case and suggest a modeling approach for dyadic interactions and the well-being of the participants. To this end we bring together an enactive approach to self with dynamical systems theory. Our basic assumption is that the quality of any social interaction or relationship fundamentally depends on the nature and constitution of the individuals engaged in these interactions. From an enactive perspective the self is conceived as an embodied and socially enacted autonomous system striving to maintain an identity. This striving involves a basic two-fold goal: the ability to exist as an individual in one's own right, while also being open to and affected by others. In terms of dynamical systems theory one can thus consider the individual self as a self-other organized system represented by a phase space spanned by the dimensions of distinction and participation, where attractors can be defined. Based on two everyday examples of dyadic relationship we propose a simple model of relationship dynamics, in which struggle or well-being in the dyad is analyzed in terms of movements of dyadic states that are in tension or in harmony with individually developed attractors. Our model predicts that relationships can be sustained when the dyad develops a new joint attractor toward which dyadic states tend to move, and well-being when this attractor is in balance with the individuals' attractors. We outline how this can inspire research on psychotherapy. The psychotherapy process itself provides a setting that supports clients to become aware how they fare with regards to the two-fold norm of distinction and participation and develop, through active engagement between client (or couple) and therapist, strategies to co-negotiate their self-organization.

Keywords: enactive self, distinction and participation, dynamical systems theory, well-being in relationships, the self as attractor, relationship dynamics, couples counseling

INTRODUCTION

Many social relationships are a locus of struggle and suffering, either at the individual or interactional level. Dyadic exchange and the question of well-being in relationships constitute the core of the psychotherapeutic process, as well as the content of most narratives processed in everyday life. Our goal is to better understand why some couples manage to sustain their interactions whereas others terminate their relationships. We also wish to generate ideas for improving the quality of dyadic interactions and the psychological well-being of the participants. To this end we conjoin a dynamical systems theory perspective with an enactive approach to self and explore the dynamics underlying struggle in couples' relationships.

Dynamical systems theory (DST) is a branch of mathematics, and as such neither part of the natural sciences nor of the humanities (Salvatore and Tschacher, 2012). Its concepts, heuristics and methods can be used to interrelate theories and findings of the various disciplines and to facilitate the dialogue between them. DST describes the complex behavior of systems over time. It allows us to interrelate experiential findings associated with relationship struggle and to derive implications for improving dyadic interaction and enabling relationships.

However, before assessing problems at the level of the interaction we should clarify our understanding of the individuals involved in it. We need to reconsider their basic nature as individuals and what drives their behavior. We suggest characterizing the individuals in the dyad from an enactive perspective, according to which every individual self is genuinely social and purposeful. The enactive self is social because it exists through engagements with others, and it is purposeful because it thereby strives to survive as a social existence. The self follows a primordial two-fold existential norm: being distinct from, as well as connected to, others. We propose that such a basic normative structure of self exists in all individuals. It guides their behavior and how they evaluate and negotiate their relationships.

Our strategy is as follows. We begin with a brief summary of the enactive self in Section "Distinction and Participation: An Enactive Approach to Self." Based on this, as an intermediate step, we conceptualize in Section "Socially Enacted Autonomy from a Dynamical Systems Theory Perspective" the enactive self in terms of dynamical systems theory as a non-linear

dynamical system. In Section "Dyadic Relationship as Negotiation of Individual and Dyadic Attractor Regions" we introduce two everyday examples of couple relationships using our concepts to describe the dynamics underlying the struggle in these interactions, and to arrive at two simple models of relationship maintenance. In Section "Discussion" we compare the two examples and derive two styles of individual relationship engagement, the passive-closed and active-open style, hypothesizing that the latter is more apt to sustain a relationship and to improve well-being in a dyadic relationship. In the last part we outline how the findings in this paper may inspire research in psychotherapy.

DISTINCTION AND PARTICIPATION: AN ENACTIVE APPROACH TO SELF

In this section we provide a short summary of the enactive approach to self as a social autonomous system (Kyselo, submitted), a recent development in enactivism. Enactivism is a non-reductionist and integrative epistemological framework for cognitive science that adopts a process-based and biologically grounded perspective on cognition (Varela et al., 1993; Jonas, 1966; Varela, 1997; Weber and Varela, 2002; Thompson, 2007). It is rooted in the theory of autopoiesis and the idea that living beings can be minimally characterized as self-producing and self-organizing networks of biological processes that create a systemic identity (Maturana and Varela, 1980, 1987). Enactivism assumes that biological and mental phenomena are continuous and that therefore the identity of cognitive beings can be conceived as based on similar principles and concepts (Clark, 2001; Thompson and Varela, 2001; Di Paolo et al., 2010). It is thus inspired by the autopoietic idea of self-generated identity, but elaborates on this concept by suggesting the more general notion of *autonomy* to capture not only biological but also cognitive individuation (Di Paolo, 2005; Thompson, 2007; Barandiaran et al., 2009; Di Paolo et al., 2010). In the enactive view on autonomy there is no clear-cut separation between individual system and environment. Cognitive individuals emerge from active engagement with the environment through which they self-produce an identity. They thereby follow an intrinsic purpose, namely to survive and to maintain their self-generated identity (Weber and Varela, 2002). This implies a basic *tension* in the individual: a need to emancipate oneself from the environment as an individual, while at the same time having a structural dependence on it for material resources (Jonas, 1966).

Through being self-organized in this way, individuals always have their own basic perspective on the world, i.e., they evaluate their interactions with the world according to what these interactions mean with regards to the goal of generating and maintaining an identity. The enactivists call this sense-making, the value-driven active engagement with the environment that in turn creates meaning for the system itself (Weber and Varela, 2002; Thompson and Stapleton, 2009).

The enactive view on cognitive individuation has been recently elaborated to inspire a new look at the human self (Kyselo, submitted). According to this, the self is essentially a phenomenon of life and a question about the nature of human cognitive individuation. Usually the processes of cognitive individuation have been characterized in terms of embodiment (Kyselo and Di Paolo, 2013; Di Paolo and Thompson, forthcoming), but according to the enactive perspective on the human self the body is not the sole source of individuation. The world of humans is a world of others, so our social relations are what matter most to us. Much in line with theories of self that emphasize the social, processual or dialogical nature of self (Mead, 1934; Buber, 1947/2002; Vygotsky, 1986; Hermans et al., 1992; Tschacher and Rössler, 1996; Mahler et al., 2000) the enactive approach thus assumes that the social must play a vital role in any description of human cognitive individuation.

The enactive self is operationally defined as a *socially enacted* autonomous system, whose systemic network identity emerges as a result of an ongoing engagement in social interaction processes that can be qualified as moving in two opposed directions, *distinction* and *participation* (Kyselo, submitted). On this account, the self as identity is continuously co-generated through interacting and being related to others and at the time organizes interactions and relations. The individual self is therefore never fully separable from the social environment. It is determined precisely in terms of the types of social interactions and relations of which it is also a part. Yet in order to exist as an identifiable unity, the self also involves an ongoing process of emancipation from others. This basic tension between dependence and emancipation is primordial to the nature of human individuation, and for this reason, it is considered a fundamental drive for human behavior. Whereas living systems strive to survive by avoiding interactions with the environment that threaten their biological survival, the purpose of the human self is additionally to ensure its identity and survive as *social existence*[1]. In line with the enactive perspective on autonomy, every individual self thus has its own subjective perspective on the world, a perspective from which social interactions and relations are evaluated according to whether and how they serve the survival, i.e., maintenance, of the self. This maintenance follows a two-fold basic norm that mirrors the tension of the social individual to emancipate itself from the social environment while at the same time structurally relying on it: being able to exist as individual in one's own right (*distinction*) while at the same time remaining connected with others (*participation*). Distinction means that the person experiences herself as both emancipated and yet not fully independent of the social world. Participation means that she feels both connected and open to, but also not fully immersed in, the social world. Both dimensions can overlap. Distinction does not imply that the person does not interact or has to be alone (think of the familiar experience of feeling alone despite being surrounded by others). Participation, on the other hand, does not imply that the person must interact all the time. A person can feel very open or related to another person even when not actually engaged with her. Both distinction and participation are (experienced) types of social interactions and relations, yet

[1]This is not to say that the body does not matter but that individuation does not emerge through bodily processes in isolation. The body changes its status becoming a mediator of the self as socially enacted existence. The bodily sense of self can be biologically grounded but its meaning for the self *as individual being* can only be derived in dependence on how the self is in the world that is, based on and in relation to others. It must be seen as a *matrix* telling us (e.g., through emotions) how we fare in these interactions with regards to the minimal purpose of human existence: to be some*one* who is at the same time a person in her own right while also being a person that one can connect to. Bodily experiences thus acquire a social meaning.

they may say little about the amount or actuality of engagement. In every individual the amount and distribution of distinction and participation can come in different degrees: some individuals have a generally strong sense of being an individual in their own right, but feel not so open to others, while others feel equally open to others.

Throughout an individual's life there are phases when one may feel or strive for more or less distinction or participation; as a child, for instance, there might be a stronger openness to being affected by others and a lower experience of being separated, whereas during adolescence feelings of being or wanting to be separated are more dominant. Distinction or participation furthermore depend on a given cultural context, and on whether a greater value of one or the other is developed because it is socially more accepted (Markus and Kitayama, 2010). Furthermore, even though at times one of the dimensions may become extremely dominant and the other appears out of reach, the other dimension can or will, at some point or implicitly, drive the individual's behavior. Thus, for example, feeling very distinct at some point does not mean that there is no striving for connection and openness anymore.

An excessive degree of distinction would mean that the individual has no sense of openness or connection to others, while excessive participation would mean that the individual is completely immersed in the interaction. Humans thus strive to avoid the double risk of emancipation at the cost of being isolated and of connection at the cost of dissolution of the individual self. We can find examples that approximate such extreme cases in disorders of the self such as schizophrenia (Parnas and Sass, 2010) and symptoms like social or self-isolation (no participation) or loss of agency (no distinction). But even though these cases are exceptional, the suffering that accompanies these extreme states could actually be indicative of a persisting striving to balance both dimensions.

Importantly, the maintenance of the self according to the twofold normative structure of distinction and participation requires constant negotiation with others, that is, engaging with, and disengaging from them. The self is thus co-generated with others and since interactions with others can go wrong and fail to contribute to identity maintenance in the desired way, the self is genuinely vulnerable.

In the next section we conceptualize this view on self in terms of dynamical systems theory and then derive a model of interaction dynamics between two selves.

SOCIALLY ENACTED AUTONOMY FROM A DYNAMICAL SYSTEMS THEORY PERSPECTIVE

Dynamical systems theory (DST) allows describing a system at two levels: by variables that denote state changes of systems over time, and by parameters that constrain these changes (gradients). DST has been used in cognitive science to replace the input/output model of cognition, and propose a context- and time-sensitive account of cognition (Thelen and Smith, 1994; Van Gelder, 1998; Tschacher and Dauwalder, 1999) and neural dynamics (Haken and Tschacher, 2010). More recently, researchers in enactive cognitive science have appealed to DST to describe mind, social interaction, and sensorimotor skill-use (Thompson, 2007; De Jaegher and Di Paolo, 2007; Froese and Di Paolo, 2010; Buhrmann et al., 2013). In this section we use DST to conceptualize the self as socially enacted autonomy.

We begin with a brief reminder of some of the main concepts of DST. A core notion especially relevant for our purposes is the concept of *attractor,* which can be formally defined in terms of the *phase space* of a system. The phase space is a geometrical space with one or more dimensions, depending on the number of variables needed to fully describe the system (Abraham and Shaw, 1992). This can be exemplified by Euclidean space: Euclidean phase space has three spatial dimensions, i.e., the coordinate axes *x, y,* and *z*. Any state of an object situated in Euclidean phase space can simply be described by the three spatial coordinates. DST captures not only a particular state of the system, but also how the system changes in time.

Imagine a golf ball being hit, flying through space, landing on grass, rolling and ending up in a well or the hole of a golf course. The golf ball represents a simple dynamical system. While flying through the air, rolling on the grass, etc., the ball follows a specific *trajectory* (its flight or path) through Euclidean space (the three dimensions of space). Until it ends up at the bottom of a hole, the ball trajects the three dimensions of space (*x, y,* and *z*), changing its states over time. The state of the ball in the hole, after it has come to a rest, can be represented as a particular single point in phase space, to which the three dimensions of the system's trajectory through space have converged. Assuming that the ball will always end up in the hole after many different trajectories, we would arrive at a simple illustration of a dynamics in which the system's three dimensions are always compressed toward zero dimensions, which is indicative of so-called attractor dynamics. The unchanging, stable state, such as in the bottom of the hole in golf, is referred to as a *point attractor.*

As the example of the golf ball illustrates, DST concepts allow visualizing complex temporal behaviors of particular systems in terms of geometrical representations. We use the notions of *phase space*, *trajectory* and *attractor* to conceptualize the states and changes of a human self.

From a DST perspective the human self can be seen as a non-linear dynamical system that displays a particular behavior represented as movement through the "landscape" of *phase space* (Nowak et al., 2002; Tschacher and Munt, 2013). The phase space of the enactive self refers to the states of the self as created in its relations with the social environment. It consists of representations of social interactions and relations, covering idealized engagements with and disengagements from others throughout a life-time. The self's phase space is therefore a space of the two fundamental variables of *distinction* and *participation* as introduced in the previous section.

In order to define the phase space of an enactive self at the most *general* level we abstract over all possible variations of distinction and participation (individually preferred ranges, different cultures, at different times of life) and use distinction and participation as variables *D* and *P*. This is in line with abstract conceptualizations of psychological phenomena, such as Kurt Lewin's topological psychology (Lewin, 1936), in which personality and social relations are modeled in terms of regions and barriers in 'life space' (Tschacher and Dauwalder, 1999). Our model of phase space may also be associated with theoretical psychology

(Leary, 1957), according to which personality involves an interpersonal space that is similarly constituted by two dimensions, agency and communion (Horowitz et al., 2006). In terms of psychological development this resonates with the work of Mahler, who described the infant's self development as a process of individuation and separation through which the infant's self emerges subsequent to a post-natal period of symbiotic relation with the mother (Mahler et al., 2000).

The variables *D* and *P* span the self's phase space, which can thus be illustrated as a plane (**Figure 1**). We denote the states of the self by their locations in this plane (*D/P*). The higher the value of *D*, the higher the system's distinction, and vice versa, the higher the value of *P*, the higher is the system's participation. Since the enactive self is always relational, neither *D* nor *P* can ever have a value of zero. In addition to its value of *D* and *P*, each point (*D/P*) of the plane has a positive or negative "elevation," so that the corresponding slope represents repulsion from or attraction toward this point. The self's behavior is represented by trajectories, i.e., sequences of states in the phase space. Over time a self develops particular tendencies to balance *D* and *P* (becoming more or less distinct from others and more or less open to them). In terms of DST we can say that the trajectories tend toward particular regions of the phase space. When these tendencies become manifest, these regions can eventually exhibit attractors we define in terms of a particular value *D/P*. The attractor regions symbolize the location of the individual's developed and preferred zones of functioning (balancing *D* and *P*). The phase space of each self has regions with negative elevations ("wells" or "troughs" in the landscape of phase space) that indicate attractors toward which the system will move. Some regions are positively elevated and thus repulsive, which indicates so-called repellors (the opposite of attractors). Attractors and repellors emerge due to habitual tendencies and represent goals of the self throughout a particular time span. Attractors of distinction and participation must not mean that the individual evaluates them as positive. Such tendencies and goals may emerge due to the individual's increased well-being in that region, but they may also emerge due to system-external reasons (not controlled by the individual) or habitual tendencies with a negative connotation.

Attractors may exist in different regions with different values *D/P*. They represent that an individual self has developed or exhibits a certain degree of distinction in combination with a certain degree of participation. Consider a person who developed a strong preference for high distinction and low participation for particular life times. For example, a novelist who at some point during the writing process escapes her social life, locks herself up in a remote and quiet place in the mountains to finish her new book. The novelist has experienced this kind of solitude as useful, and so whenever she writes a book, she retreats to the cabin. In terms of DST, during the book writing phases the novelist's phase space shows a particular attractor *D/P* with a higher value of *D* and a lower value of *P* than usually. We may imagine the system starting at some point in *D/P* landscape. The inclination of the landscape at this point will then determine the direction of the trajectory, which is generally away from repellors and toward the deepest points of attractors. The system will change its distinction and participation values until it has reached the point attractor *D/P* (solitude and a minimum of engagement with others). The system will remain in the attractor region unless the phase space changes or until perturbations external to the system exert an influence.

To describe how systems' tendencies change through perturbation, we can refer to another concept in DST, the gradients. Gradients are often referred to as control parameters, but in the context of dynamics of the self's organization this term, borrowed from physics, is misleading. Gradients here are the environmental fluxes and affordances that drive, but do not control, a system's

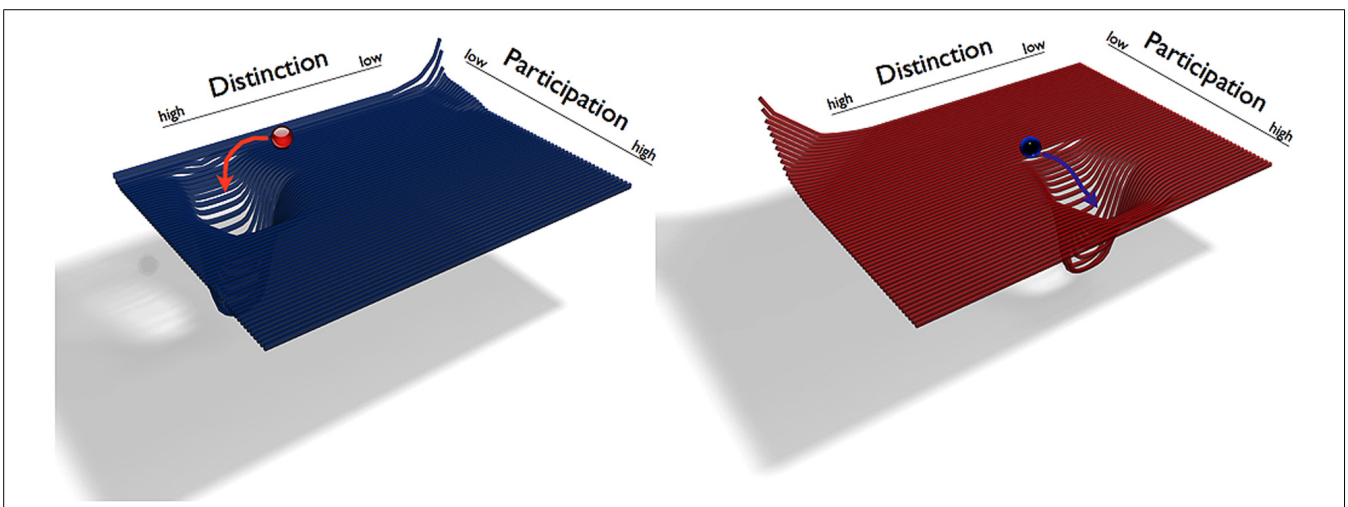


FIGURE 1 | An illustration of two generic individual phase spaces of the enactive self. The individual self states are symbolized as red and blue balls. Their respective phase spaces are spanned by the variables of Distinction *D* and Participation *P*. The attractors are wells in *D/P* landscape, into which the self systems move. The red and blue arrows indicate the trajectories of these movements. The graphic on the left side illustrates a self (red ball) with an attractor with a greater value of *D* and a lower value of *P*. The graphic on the right side illustrates a self (blue ball) with an attractor with a relatively high value of P and a lower value of *D*.

self-organization. At certain critical values of a gradient, a system may enter a novel, emergent state of its dynamics, and hence its phase space landscape may become completely modified. Because of these changes new attractors may arise, so that the phase space of the enactive self should be conceived of as a flexible landscape. In case of the enactive self, gradients can refer to the social environment. Imagine for example that during the writer's exile a friend in need reaches out asking for support in a difficult matter. This perturbates and might also change the novelist's current states in *D/P* landscape. In tension to her initially preferred region of low *P* she reacts to the friend's perturbation by turning toward a region with higher *P* values, thus adapting the current range of preference in *D/P*. Another example is attending some party or other obligatory social gathering, when one would actually prefer spending a quiet evening at home. Because the social event requires higher values of *P* it can signify a strong perturbation to the current disposition of *D/lower P*. The prospects of attending the party can therefore cause tension and actual struggle while being there.

Strong emotions and other motivational parameters may also be gradients that affect the self. For example, when the book is finished, the novelist's attractor may shift back to a different region, with a higher value of participation. Here the gradient is motivational (the author realizes that the book is finished). Persistent sadness may for instance change a person's *D/P* landscape and entail avoiding connection with others, shifting her states toward lower *P* values. Gradients can thus perturbate and change the values of the self's attractor.

A formerly active attractor may "close," leaving behind a quasi-attractor in the same location (Haken, 2006). An example of this is the perception of bistable stimuli, such as Rubin's vase-face figure (**Figure 2**). When the first perception is that of a white vase, i.e., the perceiver rests in the attractor "vase," this will eventually give way to the new perception "black faces." In terms of DST, the system has altered its display of attractors and the landscape of phase space has changed (Haken, 1992). By staying in one attractor ("vase"), the attention gradient that created this attractor becomes depleted (Tschacher and Haken, 2007), so that the system will explore other regions of phase space to eventually settle in a different attractor ("faces").

To sum up, we conceptualized the enactive self in terms of DST as an attractor landscape in a social phase space that is organized by the two variables of distinction and participation. Individual changes of distinction and participation are expressed in terms of trajectories through this landscape, and strong behavioral tendencies in terms of attractors *D/P*. The stability of such patterns of the self are constantly maintained and calibrated by external and system-inherent gradients, such that changes of gradients will generally change the self's whole landscape. In the following section we explore two examples of dyadic interactions on the basis of these considerations.

DYADIC RELATIONSHIP AS NEGOTIATION OF INDIVIDUAL AND DYADIC ATTRACTOR REGIONS

In this section we use the conception of the individual self in terms of a *D/P* attractor dynamics for understanding dyadic relationships. We will introduce two everyday examples of relationship

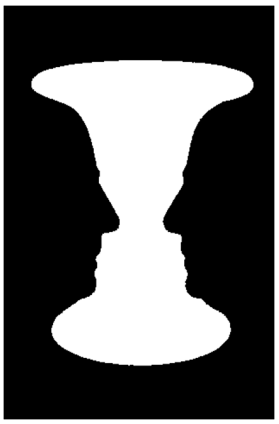


FIGURE 2 | A bistable stimulus according to Rubin (1921).

struggle, one in which interaction leads to a breakup the other in which interactions are sustained. We conceptualize the two couples in terms of DST as a dyadic relation between two individual phase spaces. That dyadic relationship can be described as a new kind of dynamical autonomous system (Luhmann, 1992; De Jaegher and Di Paolo, 2007). We conceive of it as a new dynamical system with a phase space that corresponds to sustained interactions between the individuals in the relationship, a joint phase space.

For reasons of simplicity, we assume that the formation of the couple's joint phase space is a summation of the phase spaces of the individuals: we thus add the elevation values of the individual phase spaces in each point of *D* and *P*. This means that when both participants previously had an attractor in the same region of their individual phase spaces, their dyadic joint phase space will have an even deeper attractor in this region.

We then assume that at each point in time the states of the interaction dynamic, represented through particular locations in the dyad's phase space, affect the partners, in that they act as perturbations on their individual phase spaces *D/P*. Such perturbations occur at all times during the relationship. It will be a task for the future to elaborate more concrete structures, but we offer a first idea of how a joint state could affect an individual. Firstly, interactions can perturbate one or both dimensions of the individual's developed or preferred range *D/P*, distinction and/or participation (they can act as gradients). Secondly, not every perturbation must lead to change in a current state or developed attractor *D/P*. Thirdly, it will depend on the frequency and the quality of particular interactions or patterns of interactions whether and how each state or attractor is affected. We can assume that for each dimension *D* or *P* there will be interaction qualities that currently matter more or less. For example, interactions that are too frequent and aggressive, or not frequent and gentle enough, may perturbate stronger on the dimension of *P* (*openness*) in some individuals, while interactions bringing forth a pattern of belittlement and shame on the one hand, or praise and recognition on the other, may be more relevant to the dimension of *D* (*distinction*). Whether and how much of the quality of

any of such interactions perturbates *D* or *P* depends on the individuals. In the following conceptualization of two case examples in terms of DST we chose to refrain from more precise description and restrict the analysis to a fairly general level of interrelating individual and joint action. It will provide a very basic answer to our question: why do couples struggle and what constitutes well-being in a relationship? Each example is approached based on two basic questions: firstly, how the individuals' particular negotiation tendency, i.e., their respective range of distinction and participation initially match, and secondly, whether and to what extent the actual interaction allows the participants to maintain or to negotiate their individual goals of balancing *D* and *P*.

EXAMPLE 1

She, an artist, has been exploring her inner experiential world continuously in recent years investing considerable time and effort in various practices of mindfulness such as yoga and meditation. Although she is, as a performing artist, used to present herself on stage, she is careful about the exhibition of her private self outside of the roles on stage. She is generally rather inhibited to engage in an intimate relationship. He, a scientist, is used to communicate his personal projects in public and has a strong communion motif privately, being eager to engage in an intimate relationship. After the two met at a workshop and with him taking the initiative, the two soon enter an intense romantic relationship. The initial months of the relationship are full of frequent meetings in a highly participatory mode. Soon, after a few months however, she begins to feel pressured and cornered by him. She experiences fears and crises, mainly as attempts to emancipate herself from the risk of becoming too dependent on him. "Isn't it true that people should learn to love themselves first?" she asks. To accommodate her struggle the couple decides to try a more detached and individualized style of relationship allowing her to spend more time by herself. After a while however, he begins to feel unhappy about the lack of frequency and intensity of their meetings. In his view they do not see each other enough. The next months of the relationship show a continuous oscillation between attempts to accommodate her need for more time by herself and his need for more time being together. While he experiences her effort for emancipation as too high, she experiences his effort for being together as too much. She insists that over-attachment to the other is not love. He complains that she is pushing him away. They have repeated arguments about the meaning and goals of a relationship, their attempts at improving the relationship do not reach consensus resulting in continuous emotional dissonance for both of them. The couple eventually splits up after about 1 year of being together.

Let us begin with the first question, the individuals' general tendencies of interrelating *D* and *P* with regards to the prospective romantic relationship *before* they enter the relationship. Based on the above case we derive that she has a stronger tendency toward distinction and toward a sense of self as being a separated individual, whereas his profile shows tendencies in the opposite direction, toward a more participatory mode of identity construction. We can state that the individuals' attractors dwell in different regions of phase space: as an individual, and with regards to romantic relationship, her attractor resides in a region with a greater value of *D* and a lower value of *P*. His attractor is in a region with low distinction and high participation, featuring a lower value of *D* and a greater value of *P*. Whenever these two individuals start from mid-range values of distinction and participation, the joint trajectory heads in opposition to her or his previous trajectory. This couple corresponds to the phase spaces of the example that we have given in the previous section "Socially Enacted Autonomy from a Dynamical Systems Theory Perspective" (**Figure 1**).

Let us now consider what happens when the two individuals in the couple of *example 1* enter a relationship. To this end we thus create a joint phase space adding the individuals' preferred attractors of *D/P*. The new dyadic phase space thus exhibits two attractors that correspond to the former individual attractors (**Figure 3**). Dividing the time of their relationship into temporal windows, we look at three states this coupled system goes through: *t1*, initial months; *t2*, adjustment phase I; *t3*, adjustment phase II.

At *t1*, corresponding to the closeness and intensity experienced in the initial phase of their relationship, we see that the dyad's states tend to reside in a range close to high values of participation and lower of distinction (**Figure 3**). This is in accordance with his previous individual attractor that showed a greater value of participation. It is in dissonance with her previous attractor that had a higher value of distinction.

At *t2* the dyad's state resides in a new region within *D/P* plane migrating to an attractor with higher distinction and lower participation levels. At the individual level this means that the dyad's trajectory thus moves closer to her individual range of preference and farther away from his. However, the system does not remain in this region but moves back again to the previous region of higher distinction and lower participation levels, in accordance with her and in tension with his individual preference.

Subsequently, during the adjustment phase II, the dyad's states keep oscillating between the two opposite attractors. Except for *t1* the trajectories of the dyad never persistently overlap with the individually preferred ranges (**Figure 4**). One might

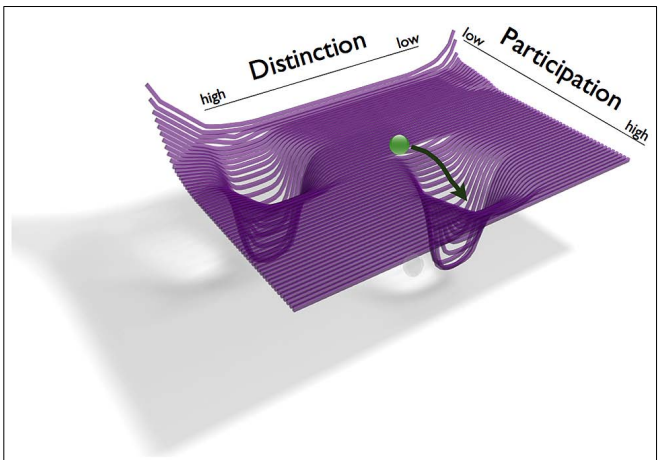


FIGURE 3 | Illustration of the joint phase space of the couple in *example 1*. The dyadic phase space is a summation of the individual phase spaces (his low *D* and high *P* and her high *D* and low *P*, see **Figure 1**). The graphic illustrates the couple's states during the initial months of the relationship (*t1*). The green ball symbolizes that they move in a region with higher values of participation.

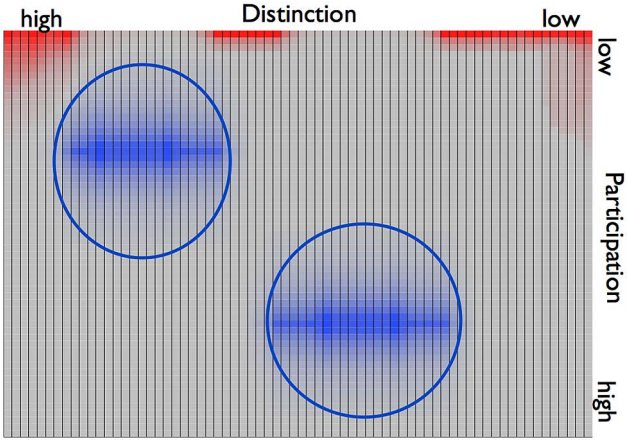


FIGURE 4 | 2D illustration of the joint phase space of the couple described by *example 1*. The attractors are depicted in blue, the repellors in red. Attractors are circled showing that there was no overlap of the basins of the two attractors.

describe this behavior in terms of a bistable quasi-attractor dynamics, as in the example of **Figure 2**. The dyad depletes a current attractor and subsequently revives a former quasi-attractor in the sense of Haken (2006), to then again deplete it and revive the previous one. The couple's transients between the two attractors eventually result in a collapse of the system at *t3*.

EXAMPLE 2

She, an artist, has been exploring her inner experiential world continuously in recent years investing considerable time and effort in various practices of mindfulness such as yoga and meditation. Although she is, as a performing artist, used to present herself on stage, she is more careful about the exhibition of her private self outside of the roles on stage and more reluctant to engage in an intimate relationship. He, a scientist, is used to communicate his personal projects in public and also has a strong communion motif privately being eager to engage in an intimate relationship. However, he also likes spending a lot of time by himself. Since the beginning of their relationship the couple experiences short-lasting but intensive crises. In these crises she feels pressure and fears of being overwhelmed and losing control. She would like to be by herself but at the same time she does not want to leave the interaction, afraid to lose the connection or to hurt him. He usually is shocked at the expression of her discontent and feels overwhelmed or afraid of failing to please her. At the same time he also experiences a strong pull to stay in the situation with her, either because he is afraid to hurt her or to lose her. Both are convinced that an intimate relationship requires efforts on both sides and so they try different strategies to deal with their crises. Occasionally the couple decides to briefly interrupt the interaction trying to become aware of individual feelings without worrying what the other does. At other times, overcoming feelings of panic and losing control, they are open and trusting toward the other and remain in the interaction. Both experience these phases as difficult and feel strong emotional dissonance. But they also learn that momentary disconnection does not necessarily threaten their relationship and that what initially seemed frustrating can actually lead to a better mutual understanding. The couple experiences this as nourishing and as deepening their connection.

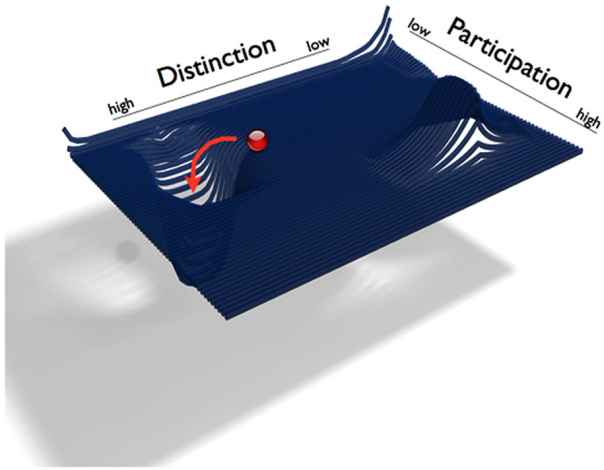
Let us begin with the first question, the individuals' general tendencies of interrelating *D* and *P* with regards to the prospective romantic relationship *before* they enter the relationship. Based on the above case we derive that she has a strong tendency toward distinction and toward a sense of self as being a separated individual whereas his profile shows tendencies in the opposite direction, toward a more participatory mode of identity construction. However he also shows relatively high tendencies toward distinction. The individuals thus have different preferences in negotiation of distinction and participation, i.e., the attractors of the individuals are in different, but not opposite regions of phase space: she has a *high D*/*low P* attractor, and a repellor at *low D*/*high P*. The repellor represents her inhibition for highly participatory states when the range of distinction is low. His attractor is also at greater values of *D* together with moderate to *high P* (**Figure 5**, please note that her attractor is identical to the attractor of the "she" protagonist of *example 1*, cf. **Figure 1** left), whereas his attractor slightly differs in the two narratives.

Let us now describe the situation once the individuals of *example 2* enter a relationship and the individual phase spaces are merged into one joint phase space (**Figure 6**). Corresponding to the couple's several instances of crises, the dyad's states in *example 2* oscillate between the two attractor regions. The dyad's behavior thus shows similarity to that of *example 1*. However, the transients between the "deepest" points of the attractors here are considerably shorter than in the dyad of *example 1*. Even though the oscillations occur between different levels of participation, the individuals show an overlap in their previous attractors with a high value of distinction. The couple in this example thus has a region in which the individuals share individual preferences. In terms of DST this is to say that the basins of the two individual attractor regions create an intersection, i.e., a region of overlap (**Figure 7**). Such connections between point attractors are called "saddles" (**Figure 6**). If the couple continues to sustain interactions leading to an overlap of their attractors, a saddle could "deepen" and turn into a new, jointly created attractor indicating the couple's sustained interaction tendencies.

Conceptualizing the two relationship examples in terms of dyadic movements away and toward greater distinction or participation that are either in accordance with or deviating from the individually developed attractor, we offer a simple model of co-negotiation of self maintenance in dyadic interaction. In the following section we compare the two couples and discuss what the observed state changes could mean for relationship sustainment and individual well-being.

DISCUSSION

In *example 1* we see that the dyad's interaction did not lead to a joint region or attractor that was in the same region as the attractors of both individuals. The couple's states continuously oscillate between two divergent attractor regions. Each attempt to approximate the participants' respective attractor zone implied a deviation from the developed zone of the other participant. Each experienced deviation was followed by a strong inclination to avoid the jointly enacted quality and to increase it toward the opposite direction and back to an initial preferred range.



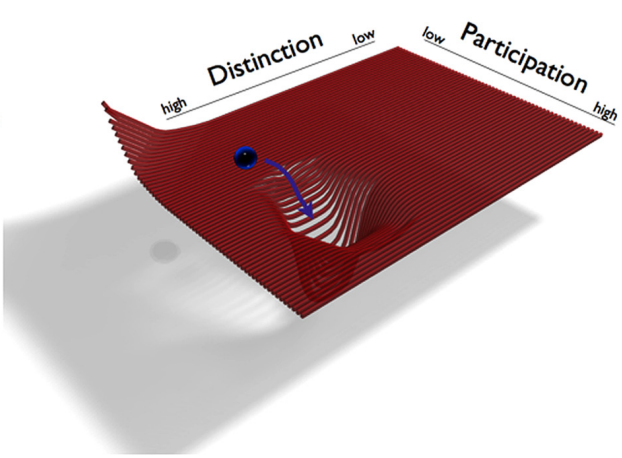


FIGURE 5 | Illustration of the phase spaces of the individuals in *example 2* (left: "She"; right: "He"). The phase spaces are spanned by the dimensions of Distinction *D* and Participation *P*. Individual system states are symbolized as locations of red and blue balls. The attractors are wells in the *D*/*P* landscape, into which the self systems (balls) tend to move. Arrows indicate trajectories from two arbitrary starting points.

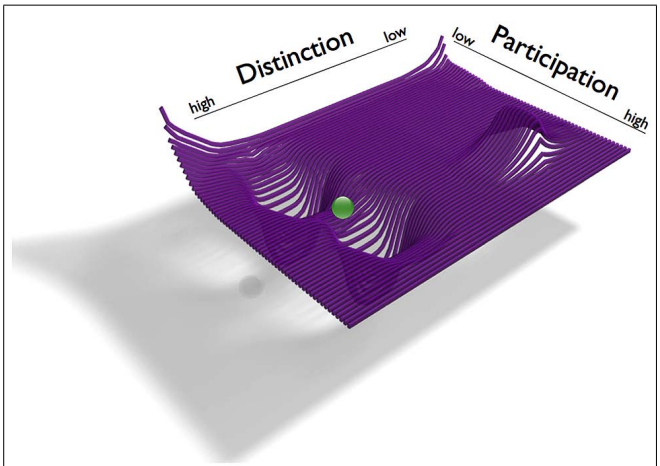


FIGURE 6 | Illustration of the dyadic phase space of *example 2*. The dyadic phase space corresponds to the individual phase spaces from **Figure 5**. The couple's state (green ball) is located in the saddle, the region connecting the individual attractor regions.

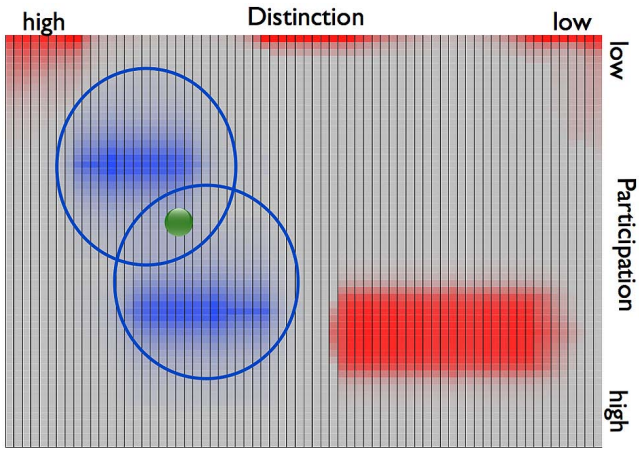


FIGURE 7 | 2D plane view on the dyadic phase space of *example 2*. The two attractor regions are depicted in blue, the repellors in red. The attractors are circled. Their intersection represents the saddle region in which the dyad's state (green ball) resides.

Comparing the couple's states to the individual attractor region we observe that a greater value of *D* for him is in tension with his preferred zone of well-being that entails lower values of *D*. Yet when the couple's states show a greater value of *P*, then this implies a tension for her. For both individuals the quality of interaction therefore turns out to be in continuous tension with their individual preference for self maintenance (the preferred balance between *D*/*P*). The tendencies of the individuals to respond to the tension by fully going back to their own preferred zone of well-being leads to a breakdown of the relationship.

Based on this simple model we hypothesize that individuals whose initial ranges of preferences of distinction and participation are highly opposed are less likely to engage in sustained interactions when for both participants the quality of interaction is in non-negotiable tension to their developed preferences.

In *example 2* a joint region (the saddle) was created based on a partial match of the two individual attractor regions and shorter transients back to original individual attractors. As in the previous example the experienced quality of the interaction (more or less *D* or *P*) perturbates the individual participants' preferred range and is in tension with their attractors. However, in contrast to *example 1*, the individuals do not fully go back to their initial range *D*/*P*. Instead they remain within the vicinity of the other's range of preference. In *example 1* the individuals are affected by the interaction and act in accordance with their own individual goals. In *example 2* the individuals are affected

by the interaction (experienced perturbation to *D/P*), but they also adapt their own preference in dependence on and *through* the interaction. As a result, their interaction not only perturbates the individuals' preferred range but actually alters it. In this example, a higher value of *P* implied staying within some region of higher *P* despite a tension with individual preference for low *P* or, when the interaction showed a higher level of *D* and this was in tension with a developed low value of *D*, it implied approaching a higher *D* than usual. In this way both partners increased the tolerance toward the interaction to act as a gradient on one's own individually preferred range of *D/P*. This activity allowed for the development of a new, shared zone of preference.

Based on this simple model we hypothesize that individuals who have attractors that show overlap (here, in the dimension of distinction) are more likely able to negotiate tensions caused by perturbations and to jointly adapt their individually developed attractors so that they allow for sustained interactions.

From the dynamical systems conceptualization of the two relationships we derive two styles of negotiation of *D/P*. The first style, corresponding to couple 1, shows that both individuals avoid deviations from their original range of preference. We call this style *passive-closed* as the individuals enter the relationship and react to the tension it creates but do not actively shape the interaction nor adapt their own attractor.

The second style, corresponding to the couple from *example 2*, shows tolerance for perturbation and potential change for both individuals. We call this style *active-open* as the individuals enter the relationship and gradually adapt their movement. An experienced tension is not reacted to independently from the ongoing interaction. The active-open style appears to delegate some of the tension caused by perturbation into the individuals' joint negotiation of *D/P*, creating new, shared spaces of balancing their individually developed ranges of *D/P*.

One can speculate that in this way some interactions can create *corrective experiences* (Castonguay and Hill, 2012) to form new, previously unavailable, evaluation and negotiation strategies, thus effectively changing the individuals' previously developed attractors.

We hypothesize that the active-open style is more likely to ensure well-being in a relationship, i.e., not only that a relationship is sustained but also that the quality of the interaction can meet the needs of both individuals. That said, we do not suggest that the accommodation of participants' well-being must always imply an ongoing or actual engagement. There are cases, like *example 1*, where a couple is unable to negotiate the individually experienced tension in a way that still allows for sustaining their relationship. But it is easy to conceive of couples who manage to stay together and are unhappy nevertheless, simply because the negotiation of tension occurs at the expense of the needs of one or both. Negotiation of well-being in a relationship is not only finding continuity in interaction, it is also finding it under specific conditions, namely by considering whether the interaction quality is in tension or in accordance with the individuals' needs, and their developed preferences for *D* and *P*. Compatibility or well-being therefore does not necessarily require individuals to share high values of participation and remain constantly open and ready to be affected by one another. As *example 2* shows, it may also involve a greater amount of separateness or even periods of disconnection. In the example both partners might need to strongly feel valuable as a person also independently from the other partner or simply wish to spend more time by themselves. This could make them compatible despite a difference in participation preference. This couple can sustain a relationship with actual interactions and some extent of connectivity but also with spaces of disengagement or disconnection, allowing individuals to experience themselves independently from each other[2].

We should emphasize again that our suggestions apply for close relationships and not for every social interaction. There is an abundance of potential and actual social interactions that are not even remotely considered to be relevant for a person's self maintenance. Certain types of relationships however, such as romantic relationships, friendships or family bonds, but also some relations dictated merely by cultural agreement such as between employer and employee, are usually considered as fundamentally important or closer than others. Based on our model we can speculate that this is the case precisely because they are considered as important sources for self maintenance and spaces for engaging in the existentially needed *joint* negotiation of both norms of distinction and participation. The more a relationship is deemed to provide such a space the more relevant it will appear. In this sense, being in a relationship is also always an individual choice.

Our account suggests that struggle in a dyadic relationship is in principle unavoidable. This is because any sustained interaction implies that there are two individuals that each have their own goals of social survival and that thus have developed perspectives on how interactions can contribute to them. This leads to constant perturbations that individuals can experience as tension and that can manifest as struggle. Whether or not the couple can maintain the relationship will depend on the individuals' range of preference and their capacities to tolerate deviations from that range, but also on how the individuals adaptively evaluate and re-evaluate the interaction.

CONCLUSION

In this paper we conjoined the enactive approach to self with dynamical systems theory to shed light on some basic dynamics underlying struggle and communion in dyadic relationships. We proposed a model of relationship dynamics in terms of a dyadic phase space emerging through the summation of individuals' phase spaces and assessed struggle or well-being in terms of movements of dyadic states in tension or in harmony with individual attractors. The model predicts that a relationship is sustained when the couple develops a new joint attractor toward which dyadic states tend to move. This is most likely when there is (1) overlap in preferred ranges of distinction and participation

[2]As stated in the famous expression "opposites attract," individuals can also have no overlap at all and still experience each other as compatible because their different attractors may complement one another. And vice versa, individuals might have a great overlap, sharing high participation and low distinction and still struggle because of a lack of feeling acknowledged as being more than a partner for another person.

in combination with a high estimation of the relationship's potential to accommodate balancing individual ranges of distinction and participation, as well as (2) an active-open style, in which participants adapt their individual ranges according to their interaction. Because such a relationship has greater potential to meet the needs of both participants to feel more or less connected, and more or less recognized in their own right, it is more likely to lead to well-being.

Presently, we must note some divergences and limitations in conceptualizing an enactive approach to self in terms of DST. In the enactive view, the self is generally co-determined in interaction, and thus already entails perturbations through social interactions. The dimensions of distinction and participation not only mirror the individual's trajectories but also entail that these trajectories depend on interactions with others. At later stages of the individual's development, not every interaction matters for self-organization. And yet, at the same time, a self also has developed particular tendencies (dispositions) that constrain to which extent these trajectories are open to perturbations by others, allowing a more flexible evaluation of interactions. Future elaborations on our model have to account for the fact that social interactions and relations matter at different but inextricably linked levels, such as development, dispositional as well as situational enactment of the self. They require clarifications of enactive or dialectical conceptions of identity and the development of corresponding mathematical concepts to arrive at closer approximations for the model and what the model represents. Levins' work on the relation of dialectical and systemic theory (Levins, 1998) and Van Geert's DST approach to cognitive development in children (Van Geert, 1998) could serve as inspirations to this end.

Our considerations are exploratory, but we believe they can serve as a starting point to deepen our understanding of the complex interrelation between individual and dyad. They might further help to shed light on interrelations of important phenomena and aspects associated with struggle in dyadic relationships, such as vulnerability and shame, mutual recognition, intimacy, co-dependency, and trauma.

Apart from its potential to assist theoretical integration our proposal may be supported by further quantitative research, for example, through repeated measurements of *D* and *P* preferences of people in a relationship. Methods are available for the assessment of communion and agency (the FAMOS: Grosse Holtforth and Grawe, 2000; the IIP: Horowitz et al., 1994), which may be used as an approximation of the enactive concepts proposed here. It also promises applicability to various empirical fields, for example psychotherapy, and a variety of existing methods of measurement could be used or re-evaluated in light of it.

In this vein, a goal of therapy could be to raise individuals' awareness that they have existential goals (distinction and participation) that are continuously at play and that affect their interactions. At the same time, they should be encouraged to recognize that this equally applies to the partner and that their relationship is thus a jointly negotiated dynamic of their own individual goals (Stern, 2004). In therapy a couple's current relationship status could be assessed in terms of individuals' current *D/P* attractors, how the interactions tend to perturbate them, and the strategies that the couple uses to negotiate these perturbations. This could be complemented by an assessment of individuals' attractors developed before the relationship *D/P* (e.g., through questionnaires), and by determining the general likelihood of overlap between their attractor regions. For this purpose it might be crucial to evaluate the actual capacities of the individuals for tolerating perturbations and allowing for adaptive change in their developed attractors *D/P*, taking for instance into account factors such as stress level, emotion regulation capacities, attachment styles, past traumata and how they might constitute hindrances (repellors).

Since psychotherapy is itself a dynamic social interaction, it provides a setting in which participants can develop, through active engagement of client/couple and therapist, novel strategies to co-calibrate their self-organization, i.e., narrow the window of oscillation between the opposing attractors or secure a shared zone of well-being. To this end, especially, systemic or interactional approaches to psychotherapy such as the "open-dialogue" approach (e.g., Seikkula and Olson, 2003; Seikkula, 2008) could serve as useful resources. We propose that evaluations and improvements can and should also account for the fact that enactment of relational processes is bodily mediated. Inspiration for reconsidering interventions and assessments in terms of co-negotiation of self maintenance might therefore also come from areas such as mindfulness training, body psychotherapy and dance therapy (e.g., Kabat-Zinn, 1994; Koch et al., 2007; Röhricht, 2009; Tschacher et al., 2014).

Last but not least, from an ethical point of view our proposal is also meant to encourage a greater tolerance for negativity and struggle as necessary aspects of social life. The self individually is a locus of tension and conflicting tendencies: one needs others, and yet at the same time one also needs to feel capable and recognized independently of them. When two people come together the potential for conflict is increased even more. The recognition that we contribute to one another's self maintenance, and that this is not an easy endeavor, could be a way of affirming the socially existential basis of life as such. Like life, the self resists rigidity. Like life, it is ever moving and not fully determined as long as it exists. Because of this openness of self, relationship struggle must be a necessary aspect of life.

ACKNOWLEDGMENTS

We would like to thank Gabriel Levy and Ezequiel Di Paolo for helpful comments. This work is supported by the Marie-Curie Initial Training Network, "TESIS: Towards an Embodied Science of InterSubjectivity" (FP7-PEOPLE-2010-ITN, 264828).

REFERENCES

Abraham, R. H., and Shaw, C. D. (1992). *Dynamics - The Geometry of Behavior*. Redwood City: Addison-Wesley.

Barandiaran, X., Rohde, M., and Di Paolo, E. (2009). Defining agency: individuality, normativity, asymmetry and spatio-temporality in action. *Adapt. Behav.* 17, 367–386. doi: 10.1177/1059712309343819

Buber, M. (1947/2002). *Between Man and Man*. London: Routledge Press.

Buhrmann, T., Di Paolo, E., and Barandiaran, X. (2013). A dynamical systems account of sensorimotor contingencies. *Front. Psychol.* 4:285. doi: 10.3389/fpsyg.2013.00285

Castonguay, L. G., and Hill, C. E. (eds). (2012). *Transformation in Psychotherapy: Corrective Experiences Across Cognitive Behavioral, Humanistic, and Psychodynamic Approaches.* Washington, DC: American Psychological Association. doi: 10.1037/13747-000

Clark, A. (2001). *Mindware.* Oxford: Oxford University Press.

De Jaegher, H., and Di Paolo, E. (2007). Participatory sensemaking: an enactive approach to social cognition. *Phenomenol. Cogn. Sci.* 6, 485–507.

Di Paolo, E. (2005). Autopoiesis, adaptivity, teleology, agency. *Phenomenol. Cogn. Sci.* 4, 429–452. doi: 10.1007/s11097-005-9002-y

Di Paolo, E., and Thompson, E. (forthcoming). "The enactive approach," in *The Routledge Handbook of Embodied Cognition*, ed. L. Shapiro (New York: Routledge Press).

Di Paolo, E., Rohde, M., and De Jaegher, H. (2010). "Horizons for the enactive mind: values, social interaction and play," in *Enaction: Towards a New Paradigm for Cognitive Science*, eds J. Stewart, O. Gapenne, and E. Di Paolo (Cambridge: MIT Press), 33–87.

Froese, T., and Di Paolo, E. A. (2010). Modelling social interaction as perceptual crossing: an investigation into the dynamics of the interaction process. *Connect. Sci.* 22, 43–68. doi: 10.1080/09540090903197928

Grosse Holtforth, M., and Grawe, K. (2000). Fragebogen zur Analyse motivationaler Schemata (FAMOS). *Z. Klin. Psychol.* 29, 170–179. doi: 10.1026//0084-5345.29.3.170

Haken, H., and Tschacher, W. (2010). A theoretical model of intentionality with an application to neural dynamics. *Mind Matter* 8, 7–18.

Haken, H. (2006). Beyond attractor neural networks for pattern recognition. *Nonlinear Phenomena Complex Syst.* 9, 163–172.

Haken, H. (1992). "Synergetics in psychology," in *Self-Organzation and Clinical Psychology*, eds W. Tschacher, G. Schiepek, and E. J. Brunner (Berlin: Springer), 32–54.

Hermans, H. J. M., Kempen, J. G., and Van Loon, R. J. P. (1992). The dialogical self. *Am. Psychol.* 47, 23–33. doi: 10.1037/0003-066X.47.1.23

Horowitz, L. M., Wilson, K. R., Turan, B., Zolotsev, P., Constantino, M. J., and Henderson, L. (2006). How interpersonal motives clarify the meaning of interpersonal behavior: a revised circumplex model. *Pers. Soc. Psychol. Rev.* 10, 67–86. doi: 10.1207/s15327957pspr1001_4

Horowitz, L. M., Strauss, B., and Kordy, H. (1994). IIP-D. *Inventar zur Erfassung Interpersonaler Probleme - Deutsche Version.* Weinheim: Beltz.

Jonas, H. (1966), *The Phenomenon of Life: Toward a Philosophical Biology*. Chicago: University of Chicago Press.

Kabat-Zinn, J. (1994). *Wherever You Go, There You Are: Mindfulness Meditation in Everyday Life.* New York: Hyperion.

Koch, S., Morlinghaus, K., and Fuchs, T. (2007). The joy dance. Specific effects of a single dance intervention on psychiatric patients with depression. *Arts Psychother.* 34, 340–349. doi: 10.1016/j.aip.2007.07.001

Kyselo, M., and Di Paolo, E. (2013). Locked-in syndrome: a challenge for embodied cognitive science. *Phenomenol. Cogn. Sci.* doi: 10.1007/s11097-013-9344-9

Leary, T. F. (1957). *Interpersonal Diagnosis of Personality*. New York: Ronald Press.

Levins, R. (1998). Dialects and system theory. *Sci. Soc.* 62, 375–399.

Lewin, K. (1936). *Principles of Topological Psychology*. New York: McGraw-Hill. doi: 10.1037/10019-000

Luhmann, N. (1992). *Die Wissenschaft der Gesellschaft.* Frankfurt am Main: Suhrkamp.

Mahler, M., Pine, F., and Bergman, A. (2000). *The Psychological Birth Of The Human Infant: Symbiosis and Individuation.* New York, NY: Basic Books.

Markus, H., and Kitayama, S. (2010). Cultures and selves: a cycle of mutual constitution. *Perspect. Psychol. Sci.* 5, 420–430. doi: 10.1177/1745691610375557

Maturana, H. R., and Varela, F. J. (1980). *Autopoiesis and Cognition: The Realization of the Living.* Dordrecht: D. Reidel Pub. Co.

Maturana, H., and Varela, F. J. (1987). *The Tree of Knowledge: The Biological Roots of Human Understanding.* Boston, MA: Shambhala.

Mead, G. H. (1934). *Mind, Self and Society from the Standpoint of a Social Behaviorist,* ed. C. W. Morris. Chicago: University of Chicago Press.

Nowak, A., Vallacher, R. R., and Zochowski, M. (2002). "The emergence of personality: personal stability through interpersonal synchronization," in *Advances in Personality Science 1*, eds D. Cervone and W. Mischel (New York: Guilford Publications), 292–331.

Parnas, J., and Sass, L. A. (2010). "The spectrum of schizophrenia," in *The Embodied Self*, eds T. Fuchs, H. C. Sattel, and P. Henningsen (Stuttgart: Schattauer), 227–243.

Röhricht, F. (2009). Body oriented psychotherapy. The state of the art in empirical research and evidence-based practice: a clinical perspective. *Body Mov. Dance Psychother.* 4, 135–156. doi: 10.1080/17432970902857263

Rubin, E. (1921). *Visuelle wahrgenommene Figuren.* Copenhagen: Gyldendalske.

Salvatore, S., and Tschacher, W. (2012). Time dependency of psychotherapeutic exchanges: the contribution of the theory of dynamic systems in analyzing process. *Front. Psychol.* 3:253. doi: 10.3389/fpsyg.2012.00253

Seikkula, J., and Olson, M. (2003). The open dialogue approach to acute psychosis: its poetics and micropolitics. *Fam. Process* 42, 403–418. doi: 10.1111/j.1545-5300.2003.00403.x

Seikkula, J. (2008). Inner and outer voices in the present moment of family and network therapy. *J. Fam. Ther.* 30, 478–491 doi: 10.1111/j.1467-6427.2008.00439.x

Stern, D. (2004). *The Present Moment in Psychotherapy and Everyday Life.* New York: W. W. Norton.

Thelen, E., and Smith, L. B. (1994). *A Dynamic Systems Approach to the Development of Cognition and Action.* Cambridge, MA: Bradford Books, MIT Press.

Thompson, E., and Stapleton, M. (2009). Making sense of sense-making: reflections on enactive and extended theories. *Topoi* 28, 23–30. doi: 10.1007/s11245-008-9043-2

Thompson, E. (2007). *Mind in Life: Biology, Phenomenology, and the Sciences of Mind.* Cambridge: Harvard University Press.

Thompson, E., and Varela, F. (2001). Radical embodiment: neural dynamics and consciousness. *Trends Cogn. Sci.* 5, 418–425. doi: 10.1016/S1364-6613(00)01750-2

Tschacher, W., Storch, M., and Munt, M. (2014). Tanz: eine psychotherapeutische Technik? *Psychother. Psychiatr. Psychother. Med. Klin. Psychol.* 19, 1–13.

Tschacher, W., and Munt, M. (2013). Das Selbst als Attraktor: das psychologische Selbst aus systemtheoretischer und achtsamkeitsbasierter Sicht. *Psychother. Psychiatr. Psychother. Med. Klin. Psychol.* 18, 18–37.

Tschacher, W., and Haken, H. (2007). Intentionality in non-equilibrium systems? The functional aspects of self-organized pattern formation. *New Ideas Psychol.* 25, 1–15. doi: 10.1016/j.newideapsych.2006.09.002

Tschacher, W., and Dauwalder, J.-P. (1999). "Situated cognition, ecological perception, and synergetics: a novel perspective for cognitive psychology?" in *Dynamics, Synergetics, Autonomous Agents*, eds W. Tschacher and J.-P. Dauwalder (Singapore: World Scientific), 83–104.

Tschacher, W., and Rössler, O. (1996). The self: a processual gestalt. *Chaos Solitons Fractals* 7, 1011–1022. doi: 10.1016/0960-0779(95)00096-8

Van Geert, P. (1998). A dynamic systems model of basic developmental mechanisms: Piaget, Vygotsky, and beyond. *Psychol. Rev.* 105, 634–677. doi: 10.1037/0033-295X.105.4.634-677

Van Gelder, T. (1998). The dynamical hypothesis in cognitive science. *Behav. Brain Sci.* 21, 615–665. doi: 10.1017/S0140525X98001733

Varela, F. J., Thompson, E., and Rosch, E. (1993). *The Embodied Mind: Cognitive Science and Human Experience.* Cambridge, MA: MIT Press.

Varela, F. J. (1997). Patterns of life: intertwining identity and cognition. *Brain Cogn.* 34, 72–87. doi: 10.1006/brcg.1997.0907

Vygotsky, L. (1986). *Thought and Language.* Cambridge, MA: MIT Press.

Weber A., and Varela, F. (2002). Life after Kant: natural purposes and the autopoietic foundations of biological individuality. *Phenomenol. Cogn. Sci.* 1, 97–125. doi: 10.1023/A:1020368120174

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Received: 28 February 2014; accepted: 28 April 2014; published online: 30 May 2014. Citation: Kyselo M and Tschacher W (2014) An enactive and dynamical systems theory account of dyadic relationships. Front. Psychol. ***5****:452. doi: 10.3389/fpsyg.2014.00452 This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology.*

frontiers in Psychology

ORIGINAL RESEARCH
published: 16 April 2015
doi: 10.3389/fpsyg.2015.00378

Discourse-voice regulatory strategies in the psychotherapeutic interaction: a state-space dynamics analysis

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This study seeks to provide evidence of the dynamics associated with the configurations of discourse-voice regulatory strategies in patient–therapist interactions in relevant episodes within psychotherapeutic sessions. Its central assumption is that discourses manifest themselves differently in terms of their prosodic characteristics according to their regulatory functions in a system of interactions. The association between discourse and vocal quality in patients and therapists was analyzed in a sample of 153 relevant episodes taken from 164 sessions of five psychotherapies using the state space grid (SSG) method, a graphical tool based on the dynamic systems theory (DST). The results showed eight recurrent and stable discourse-voice regulatory strategies of the patients and three of the therapists. Also, four specific groups of these discourse-voice strategies were identified. The latter were interpreted as regulatory configurations, that is to say, as emergent self-organized groups of discourse-voice regulatory strategies constituting specific interactional systems. Both regulatory strategies and their configurations differed between two types of relevant episodes: Change Episodes and Rupture Episodes. As a whole, these results support the assumption that speaking and listening, as dimensions of the interaction that takes place during therapeutic conversation, occur at different levels. The study not only shows that these dimensions are dependent on each other, but also that they function as a complex and dynamic whole in therapeutic dialog, generating relational offers which allow the patient and the therapist to regulate each other and shape the psychotherapeutic process that characterizes each type of relevant episode.

Keywords: psychotherapeutic interaction, discursive positions, vocal quality patterns (VQP), state space grid (SSP), dynamic systems

OPEN ACCESS

Edited by:
Omar Carlo Gioacchino Gelo, Universita del Salento, Italy

Reviewed by:
Marcello Gallucci, Università del Salento, Italy
Beate M. Herbert, University of Tuebingen, Germany

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Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *23 April 2014*
Accepted: *17 March 2015*
Published: *16 April 2015*

Citation:
Tomicic A, Martínez C, Pérez JC, Hollenstein T, Angulo S, Gerstmann A, Barroux I and Krause M (2015) Discourse-voice regulatory strategies in the psychotherapeutic interaction: a state-space dynamics analysis. Front. Psychol. 6:378. doi: 10.3389/fpsyg.2015.00378

Introduction

Thanks to research on developmental psychology, neuroscience, and attachment theory, a growing consensus has emerged highlighting the importance of affect regulation for the development of the self and of emotional interaction repertoires that determine relationships in life. These repertories are initially non-verbal but subsequently become systems of cognitions, emotions, and

bodily responses which characterize ways of being with others. Furthermore, these repertoires or relational patterns, through the acquisition of language and the experience of multiple relationships, are embodied within a discourse (see Derek, 2006). This embodied relational history of an individual is expressed conjointly through verbal and non-verbal regulatory behaviors. These behaviors consist of explicit and implicit interactive processes, which are permanent and occur moment to moment. These are meant to organize the emotional and psychological experience of people in their relationship with others. They involve a number of psychological processes (e.g., mentalization), as well as non-verbal and verbal communication strategies. Particularly, in the psychotherapeutic context, each participant of the dyad is believed to be affected at every moment both by his/her own verbal and non-verbal self-regulation behaviors and by those of his/her partner, in a contingent and circular process of mutual regulation (Tronick, 1989; Tronick and Cohn, 1989; Schore, 1996; Tronick et al., 1998; Beebe and Lachmann, 2002; Fonagy et al., 2002; Beebe et al., 2005; Beebe, 2006).

Within the psychotherapeutic scenario, verbal regulatory behaviors are studied using the framework of psychotherapy as a discursive genre (Salvatore et al., 2010; Salvatore and Tschacher, 2012; Martínez et al., 2014a). Therapeutic discourse can be characterized by certain positions or perspectives adopted by speakers in the discourse as a whole that are equivalent to "positions of the self." They are points of view expressed in an utterance, and it has been established that an utterance may contain more than one point of view, valuation, or position (Bakhtin, 1984). For example, we have described a positioning model for the patient's and the therapist's discursive positions. In the case of the patients, the *Reflexive*, *Dependent*, and *Independent* positions interact with each other in an internal dialog, and also in a dialog with others. We have observed the same in the therapists, who deploy three discursive positions: the *Proposer*, the *Professor*, and *Avoidant* (Martínez et al., 2014b).

On the other hand, it has been advanced that discursive positions are embodied within individuals in different manners (e.g., sound profiles, facial expression patterns, etc.), and are enacted within an interactive network in the psychotherapeutic dialog (Salgado et al., 2013). In other words, these positions are thought to be self-states which are structured in the language of an individual and which are expressed verbally and non-verbally. For example, it is believed that within the psychotherapeutic dialog the relationship between these discursive positions and their voice qualities constitutes an expression of regulatory and self-regulatory strategies of the participants (e.g., Osatuke et al., 2004; Tomicic et al., 2014). Discursive positions are thought to be expressed verbally using more than one vocal quality [e.g., Vocal Quality Patterns (VQP); Tomicic et al., 2011, 2014], which may be related to the idea that the implicit/primary level of experience (e.g., acoustic expressions) gives rise to a more integrative and explicit reflective-verbal level (e.g., Boston Change Process Study Group [BCPSG], 2002).

This study seeks to provide evidence of the emergence of configurations of recurring and stable discourse-voice regulatory strategies[1] in patient–therapist exchanges in relevant episodes within each psychotherapeutic session as well as throughout the psychotherapy. Its central assumption is that discursive positions differ in terms of their prosodic characteristics in the therapeutic interaction according to their specific regulatory functions. In this regard, the hypothesis is that the patient and the therapist differently use each of their discourse-voice regulatory strategies according to their regulatory functions in different relevant episodes and moments over the psychotherapeutic process.

The Triadic Model of Discursive Positioning

A multiplicity of discursive positions constitutes the identity of a person, not only in his/her dialog with another person, but also with the other positions of his or her own inner world (i.e., polyphonic metaphor; Bakhtin, 1986). Some of these positions could be under conscious control, temporally or permanently, and could dominate external and internal dialogs (Crits-Christoph et al., 1999; Gonçalves and Guilfoyle, 2006; Dimaggio and Stiles, 2007). Sometimes, this excessive control impedes dialog and the consideration of his or her other positions. Hence, excessive control could provoke rigidity in the way a person behaves and interacts with others in the world. Psychotherapy contributes to the modulation of and the dialog between the multiple positions of the patient. In this regard, the psychotherapeutic interaction helps activate the relationship between them, favoring those less conscious (or dissociated) to become more conscious and integrated for the patient. This is believed to allow a new discursive position to emerge: a metaposition with novel meanings (Stiles, 1999; Angus and McLeod, 2004; Bromberg, 2004; Hermans and Hermans-Jansen, 2004; Neimeyer and Buchanan-Arvay, 2004; Dimaggio and Stiles, 2007; Salvatore and Gennaro, 2012; Salvatore et al., 2012; Lehmann, 2013; Martínez and Tomicic, 2013).

We have described a triadic organization for the patient's discursive positions (Martínez et al., 2014b). First, we identified a position called Reflexive, in which the patient is able to take a distant, but not disconnected, perspective of emotional situations, listening and critically looking at other positions while encouraging dialog between them in the manner of a metaposition (Bertau, 2008). Second, we described a position named Dependent, in which the patients subjectively position themselves as needy, weak, damaged, and/or vulnerable. Finally, we depicted a third position called Independent, which subjectively positions the patient as strong, self-sufficient, and/or as someone who does not need help from others (Martínez and Tomicic, 2013; Martínez et al., 2014b).

Similarly, we observed three discursive positions of the therapist. The first therapeutic discursive position was called the Proposer, in which the therapist subjectively positions him/herself as someone who shows what he/she observes, and offers the patient a new perspective, thus generating a dialogical space for the patient's positions. In addition, therapists have

[1]Here, we are using the term "strategy" in its original meaning as a noun: "A method that is worked out in advance for achieving some objective [in this case self or mutual regulation aim]" (Merriam-Webster). Since it is not a verb, the strategy constitutes not an action of the individual, but an object or a tool that the individuals use, consciously or not consciously, to achieve a goal.

a discursive position that we labeled the Professor, which is more dominant and monological, because it subjectively positions them as having a truth or knowledge that is imposed or taught to the patient as a sole alternative. Finally, we described a third position called Avoidant, in which the therapists subjectively distance themselves from the most problematic and difficult issues presented in the discourse of the patient, thereby closing any possibility of opening a dialogical space (Martínez et al., 2014b).

From an empirical perspective, the Positioning Model depicted seeks to establish regulatory strategies—verbal in this case—which are specific for psychotherapy. For example, the use of this model has shown that the patient adopts a Reflexive position as a metaposition that reveals other positions in him/herself (Dependent and Independent). Here, the Proposer position of the therapist has been shown to be very important, because it can reinforce this metaposition of the patient in a regulatory process that accomplishes a good therapeutic alliance and psychotherapeutic changes (Martínez et al., 2014b). However, these regulatory strategies are not only verbal; they occur moment by moment and at the same time in a non-verbal dimension that includes prosody.

The Model of Vocal Quality Patterns

In the psychotherapeutic interaction, psychological meanings are exchanged not only through the participants' speech, but also through the quality of their voices (Tomicic and Martínez, 2011; Tomicic et al., 2014). In this regard, the quality of the speaker's voice may influence the emotional state of the listener. For instance, a voice that reflects the therapist's relaxedness and confidence could calm the patient's agitation and its associated emotions as reflected in the patient's voice (Knoblauch, 2000, 2005). Similarly, it has been observed that, in the psychotherapeutic interaction, participants infer and cause emotions in each other through the prosody of their speech (Tomicic et al., 2009; Bauer et al., 2010).

To study the vocal patterns of self-regulation and mutual regulation between patient and therapist, we have developed a coding system called VQPs (Tomicic et al., 2011, 2014). VQPs are defined as a combination of specific vocal parameters—tone, intensity, duration, and pitch— in the utterances of speakers whose speech gives a specific impression to a listener, regardless of the contents transmitted. Six VQPs were identified and characterized: (a) *Report*, (b) *Connected*, (c) *Affirmative*, (d) *Reflexive*, (e) *Emotional-Expressive*, and (f) *Emotional-Restrained*. In addition, for utterances in which these VQP codes do not apply, the following categories were created: (g) *Full Pause*, (h) *Overlapping*, and (i) *Not Codable*. As shown in **Table 1**, each of the VQPs is described according to the manner in which it impresses the person who is listening.

In a previous study (Tomicic et al., 2014), we were able to observe the process of change embodied in the expressive vocal styles of the participants of psychotherapeutic dyads, and to uncover regulatory sequences between them. This showed us that it is possible to detect the emergence of regulatory patterns in therapeutic interaction in the form of vocal expressions, and that these patterns are involved in the process of change in psychotherapy. Based on the assumption that these vocal qualities impress the patient and the therapist who are listening in the same way that they impress the coders, these results may imply that, in psychotherapeutic practice, the participants not only take into account the content of the speech they produce and listen to, but also unconsciously integrate prosody in their regulatory behaviors as another dimension of their experience of the psychotherapeutic encounter.

The Micro-Process Analysis of the Relationship Between Discourse and Voice as Regulatory Strategies in the Psychotherapeutic Interaction

Sequential analyses have shown us that the association of two different discursive positions or the association of two different VQPs can be interpreted as micro-regulatory strategies (Martínez, 2011; Tomicic et al., 2014). We have identified two types of these regulatory strategies: self-regulatory strategies (a sequence of two different discursive positions or a sequence of two different VQPs that take place in the same patient or therapist utterance) and mutual regulation strategies (a sequence of two different discursive positions or a sequence of two different VQPs that correspond to the interaction between the members of the therapeutic dyad; Martínez and Tomicic, 2013; Tomicic et al., 2014). These analyses revealed different discursive and vocal micro-regulatory strategies depending on the type of relevant episode considered (i.e., Change Episodes and two types of non change episodes: Stuck Episodes or Rupture Episodes). For example, in a single case study with a long-term psychoanalytically oriented therapy, it was observed that the Reflexive position of the patient followed by the Proposer position in the therapist constituted a mutual regulatory strategy more prevalent in Change Episodes compared to Rupture Episodes (Martínez and Tomicic, 2013). In addition, another study showed that the Connected VQP of the patient followed by the same VQP of the therapist constituted a mutual regulatory strategy that was more prevalent in Change Episodes compared to Stuck Episodes (Tomicic et al., 2014). In the present study only Change Episodes and Rupture Episodes were analyzed.

Even though we have observed the deployment of micro-regulatory strategies, the scope of these observations cannot account for the dynamics involved in the emergence and self-organization of configurations of discursive or vocal regulatory strategies of the psychotherapeutic process. That is to say, our previous analyses were not pertinent enough to approach the study of patient–therapist regulation in terms of discourse and prosody as aspects of a dynamic system, considering it in the therapeutic context as a set of co-occurring elements that have clinical value (Salvatore and Tschacher, 2012; Hollenstein, 2013). In this regard, the purpose of the current study was to explore the dynamics associated with the emergence of configurations of recurring and stable regulatory strategies in patient–therapist interaction in terms of discourse and voice associations over time (Osatuke et al., 2004), in two different relevant episodes (Change Episodes and Rupture Episodes), and within psychotherapeutic sessions. Following Fogel (2006, 2011), our intention was to

TABLE 1 | Characterization of vocal quality patterns.

VQP	Phenomenological characterization
Report	It adds to the speech the quality of *something already known*, of a speech disconnected from what is being said and/or of a certain emotional distance. It sounds as if the speaker was reporting, narrating, or exploring content without any emotional involvement. In this pattern, the central element is the listener's impression of a disconnected speech. *Main Vocal Parameters*: INTENSITY: increased volume and large variations; DURATION: speed augmented.
Connected	It conveys the quality of being oriented toward the other (the partner in the dialog) and of being carefully prepared while it is uttered. In this pattern, the central element is the listener's impression of an elaborative speech geared toward the partner in the dialog. *Main Vocal Parameters*: TONE: dynamic-agogic accent, half-suspended anti-cadence at the end of the phrase; INTENSITY: increased volume, sustained-crescendo dynamics, and small variations.
Affirmative	It conveys the quality of certainty and conviction. It sounds as if the speaker were teaching or instructing the listener, or as if he/she were very sure of what he/she is saying. In this pattern, the central element the listener's impression of a secure and instructive speech. *Main Vocal Parameters*: TONE: dynamic-tonic accent and suspended end of phrase; INTENSITY: dynamics sustained-crescendo; DURATION: Hard vocal attack.
Reflection	It conveys the quality of being directed *toward oneself* (the speaker). It sounds as if the speaker was connected with her/his internal world or in a dialog with her/himself. In this pattern, the central element is the listener's impression of an introverted speech. *Main Vocal Parameters*: TONE: dynamic-agogic accent and half-suspended cadence at the end of the phrase; INTENSITY: decreased volume and small variations; DURATION: speed reduced.
Emotional-expressive	It conveys affection and/or the sensation that the speech has a heavy emotional load. It sounds like the speaker's emotion (joy, anger, sadness, fear, etc.). In this pattern, the central element is the listener's impression of an emotionally charged speech, regardless of the type of emotion. *Main Vocal Parameters*: TIMBRE: Clear/Bright; Clear/Opaque; Dark/Bright; and Dark/Opaque.
Emotional-restrained	It conveys affection and/or the sensation that the speech has a heavy emotional load. However, even though in this case the speaker's emotion is not audible, what does impress the listener is an effort to contain her/his *emotion*. In this pattern, the central element is the listener's impression of suffocation and control to avoid being overwhelmed by emotion. *Main Vocal Parameters*: DURATION: speed decreased, non-fluid pace, and long pauses.
Exclusion Categories for VQPs	
Overlapping	It is an instance of simultaneous speech, which, in VQP coding, makes it impossible to distinguish the vocal characteristics of the participants in a full segment or speaking turn. When coding this conversation phenomenon, the overlapping of the actors is noted.
Full pause	Short utterances with para-verbal content (hmm, aha, okay). They are usually ways of agreeing, showing attention, disagreeing, or displaying the wish to end a conversation. Their meaning depends mainly on the context and on certain vocal characteristics of the utterance; however, due to their brevity, they are hard to analyze in terms of the vocal parameters that define the VQPs described.
Non codable	These are units of analysis which do not meet the phenomenological characteristics and the parameters of the VQPs. This label can also be applied to the cases in which the recording is not completely audible due to ambient noises, mispronunciations, or other errors by the speakers. They are neither full pauses nor instances of overlapping.

seek individual recurrent and stable discourse-voice associations (i.e., microscopic level) that lead to the emergence of patterns involving these associations (i.e., macroscopic level). Specifically, our aims were:

- To observe recurrent and stable discourse-voice associations that could be interpreted as regulatory strategies of patient–therapist interaction.
- To determine differences in the use of these discourse-voice regulatory strategies in Change Episodes and Rupture Episodes, and session to session.
- To identify specific groups of recurrent and stable discourse-voice regulatory strategies that could be interpreted as regulatory configurations.
- To determine differences in the prevalence of these regulatory configurations in Change Episodes and Rupture Episodes, and session to session.

We used the dynamic systems theory (DST) approach (Kaplan and Glass, 1995; Fogel, 2011), specifically the concept of *attractor*. From this perspective, the behavior of a system can be understood as a path within a landscape with its topology, in which the system gets stabilized in some states of the set of possible states of that territory. Therefore, attractors are recurring and stable states where systems remain more often and to which they tend to return (Salvatore and Tschacher, 2012).

In this case, the association between discourse and voice was analyzed with the state space grid (SSG) method, a graphical tool based on a dynamic system approach (Hollenstein, 2013). Phenomena that involve two synchronous variables are plotted in a two-dimensional space as a trajectory or sequence of states that move from cell to cell on the grid. SSGs can be used to identify which states are more frequent and stable (i.e., attractors). In our research, the system comprises the therapeutic activity in the relevant episodes considered: Change Episodes (Krause et al., 2006) and Rupture Episodes (Safran and Muran, 1996). In addition, the possible states through which this system moves reflect the combinations of the discursive positions of patients and therapists with each VQPs. Each of the system's trajectories accounts for a different state sequence as part of the psychotherapeutic process.

Considering previous studies (see above), and the conceptual association between some discursive positions and certain VQPs (e.g., the Reflexive position with the Connected VQP; see above), it was expected that the identified attractors would empirically reveal the presence of such relationships. Thus:

(1) It was expected that, for patients, there would be three discourse-voice regulatory strategies working as attractors: Reflexive position with Connected VQP; Dependent position with Emotional VQP (Expressive and Restrained conjointly), and Independent position with Affirmative VQP. For therapists, two discourse-voice regulatory strategies working as attractor were expected: Proposer position with Connected VQP and Professor position with Affirmative VQP.
(2) The regulatory strategies working as attractors Reflexive position with Connected VQP (patient's) and Proposer position with Connected VQP (therapist's) were expected to be more frequent in Change Episodes.
(3) Different configurations of discourse-voice regulatory strategies working as attractors were expected to emerge in the patient and the therapist, each having different values for therapeutic activity.
(4) These different configurations of discourse-voice regulatory strategies working as attractors were expected to be present in dissimilar proportions in Change Episodes and Rupture Episodes.

Materials and Methods

Participants

Change Episodes ($N = 67$) and Rupture Episodes ($N = 86$) were considered as interactional scenarios, and were taken from five therapies. The mean age of patients was 34.7 years (SD = 12.1), and 80% were female. Patients received an average of 32.8 (SD = 6.4) therapy sessions, with a psychodynamic or cognitive focus, in a context of outpatient treatment. The therapists, three males and two females, had between 3 and 15 years of professional experience. All the treatments were evaluated by means of an outcome measurement using the Outcome Questionnaire 45.2 (OQ-45.2, Lambert and Burlingame, 1996; von Bergen and de la Parra, 2002; see **Table 2**). Successful therapies were defined as those that met the criterion of resulting in a reliable change index (RCI) of 15 or more (von Bergen and de la Parra, 2002). According to this instrument, three of five therapies were successful.

Procedures

All sessions were video and audio recorded. Patients and therapists were extensively informed before commencing therapy, and all of them consented to video and audio recordings and to data collection at all times. Also, all participants provided a written informed consent concerning the use of their data for research purposes. The study was approved by the research ethics committee of Universidad Diego Portales (CEI-UDP, Chile).

The sessions were coded using two sequential procedures: first, to identify relevant episodes; second, to analyze the discourse and vocal behavior of the participants in said episodes.

Determination of Relevant Episodes

The units of analysis used were relevant episodes. These are special segments of the therapeutic session that are chosen from a theoretical point of view. These episodes make it possible to understand the connection between the therapeutic exchange and its outcome (Elliott, 1984; Timulak, 2007). In this study, Change Episodes (Krause et al., 2006, 2007) and Rupture Episodes (Safran and Muran, 1996, 2000, 2006) were used.

The method for determining Change Episodes is based on the subjective notion of generic change (Krause, 2005; Krause et al., 2007). Subjective change is operationalized by means of "Generic Change Indicators" (Krause et al., 2006), which make it possible to identify a change moment based on its content (see Krause et al., 2007). For its part, a Change Episode is an interaction segment where a change moment takes place. In the rating procedure, this moment marks the end of the episode. At this point, a rater establishes the beginning of the episode by tracking back when the participants start conversing about the content of the change (Krause, 2005).

For the identification of Rupture Episodes, we used the Rupture Resolution Rating System Manual (Eubanks-Carter et al., unpublished), which specifies communication markers derived from the two main types of rupture of the alliance indicated by Safran and Muran (1996, 2000, 2006): withdrawal and confrontation. With respect to the temporal delimitation of Rupture Episodes, their beginning was established by the very first communicational hints of rupture, while their end was established by the very first hints of their resolution or overcoming (Martínez, 2011).

Coding of Discursive Positions

This analysis consists in identifying the positions that appear in the discourse of each participant and which shed light on his/her way of being, interacting with others, and interpreting the world. These positions are identified in the transcripts of the episodes by

TABLE 2 | Description of the psychotherapeutic processes and relevant episodes.

	Patient	Therapist	Diagnosis	Modality	Initial OQ	RCI	Session	*N*	Change E. *fc* (%)	Rupture E. *fc* (%)
1	Female	Female	Adaptive disorder	Psychodynamic	80	6	88[a]	45[a]	19 (42.2%)	26 (57.8%)
2	Male	Male	Anxietydisorder	Cognitive-behavioral	50	28	11	16	6 (37.5%)	10 (62.5%)
3	Female	Male	Depression	Psychodynamic	49	7[b]	31[b]	37	23 (62.2%)	14 (37.8%)
4	Female	Male	Personality disorder	Cognitive-behavioral	55	15	15	45	11 (24.4%)	34 (75.6%)
5	Female	Female	Adaptive disorder	Psychodynamic	75	19	19	10	8 (80.0%)	2 (20.0%)

The diagnosis was reported by each therapist. E = Episodes. Outcome: Successful therapies were defined as those that met the criterion of attaining a reliable change index (RCI = 15 or more; von Bergen and de la Parra, 2002). [a]*The first 20 sessions of the full psychotherapeutic process were analyzed in this study; 45 Episodes were identified in this period of the psychotherapeutic process.* [b]*This psychotherapy was restarted after 4.5 months of suspension; the 31 sessions that were coded correspond to the first period of therapy (RCI was measured at session 31).*

paying attention to the patient's and the therapist's discourse and by depicting the main discursive features present in the speech of both participants.

The identification of discursive positions was carried out in a previous study (Martínez et al., 2014b,c) using a device that considered two analytical steps:

Step 1: identification and characterization of discursive voices

The first three sessions of the five therapies were coded. Each speaking turn was read and coded with the aim of answering the question "What are the participants talking about?" This made it possible to identify recurrent enunciators in the speech of the patient and the therapist in each therapy. These enunciators were preliminarily labeled according to their main predicate, which resulted in a set or repertoire of specific discursive voices for each therapy. Discursive markers were identified and a phenomenological description of each of the discursive voices was performed. The purpose was to answer the question "How do the discursive voices speak?" The discursive markers considered were (a) subject of the utterance, (b) subject of the enunciation, and (c) modalizers (see Martínez et al., 2014a).

Step 2: categorization of the set of discursive voices and labeling of each category as a discursive position

The discursive voices of each actor were grouped into inclusive categories of a higher abstraction level. Each category was labeled according to the subjectivity involved in that specific repertoire of discursive voices. The purpose was to answer the question "From which perspective does each voice speak?" For instance, in Therapy 1, the repertoire of discursive voices of the patient constituted by "hopeless," "distrustful," "pampered," "rejectable," and "abused" were interpreted as the position "Dependent." This choice was made because, in this set of voices expressed in her speech, the patient subjectively takes the place of a defenseless little girl, someone who has been abused and harmed, and who is rejectable and unable to make decisions or think for herself.

The discursive positions determined through this process were used to code the relevant episodes of each of the five therapies. The transcriptions of each of the relevant episodes were coded by two raters using ATLAS.ti 7.0.5 (1993-2015), a type of Computer Assisted Qualitative Data Analysis Software (CAQDAS).

Coding Vocal Quality Patterns

Each episode was analyzed by raters trained in the use of the VQP coding system (Tomicic et al., 2011). With the VQP coding system, the raters categorized the patient's and the therapist's speech in terms of vocal quality. This system identifies six mutually exclusive VQPs: (a) Report, (b) Connected, (c) Affirmative, (d) Reflexive, (e) Emotional-Expressive, and (f) Emotional-Restrained. Also, for the utterances in which the VQP coding does not apply, the following categories were created: (g) Full Pause, (h) Overlapping, and (i) Non Codable (see **Table 1**).

The VQP coding procedure was carried out in four analytic steps for each episode: (1) Listening to the full episode, so as to become familiar with the timbre of the participants' voices; (2) Listening from the start of the episode, reading the text speaking turn by speaking turn, and performing a preliminary segmentation considering changes or breakdowns in vocal quality as revealed by changes in a vocal parameter; (3) Listening from the start of the selected episode, speaking turn by speaking turn and segment by segment, and performing a preliminary coding considering the phenomenological description of the VQPs; and (4) Listening from the start of the selected episode to confirm or discard the presence of the VQP coded in step three considering the auditory perception of the vocal quality parameters involved.

Coding Validation Process

Relevant Episodes Coding

For the selection and temporal delimitation of the Change Episodes and Rupture Episodes, five pairs of coders trained by the Chilean Research Program on Psychotherapy and Change analyzed videotapes and transcriptions of the therapeutic sessions and carried out an intersubjective validation procedure. This procedure is a process in which the observations by a researcher or rater are compared with the independent observations of other researchers or raters. The validation of observations is attained through consensus or agreement between these different perspectives (see Flick, 2009). In this case, inter-rater reliability was not calculated because it was considered that the independent coding of the episodes was only carried out in preparation for their intersubjectively validated coding.

Discursive Positions and VQP Coding

In order to ensure the quality of the data resulting from these two coding processes, a couple of raters trained in the use of each of the systems coded all the relevant episodes independently; afterward, their codings were combined to generate a single consensus coding through an intersubjective validation procedure.

In addition, as a checking procedure, a reliability study was performed for the discursive positions and VQPs, using Cohen's Kappa (Cohen, 1968) to measure the independent raters' agreement. We considered all of the episodes ($n = 153$). Discursive positions coding (6575 segments) resulted in $k = 0.762$, $p < 0.05$. On the other hand, VQP coding (4553 segments) resulted in $k = 0.658$, $p < 0.05$.

Identification of Regulatory Strategies (by Means of SSGs)

To account for the discourse-voice association, the independent data of discourse and VQPs obtained were matched at the level of turn-taking. If an instance of turn-taking occurred across more than one segment, the correspondence of the categories of discourse and voice was determined by the researchers using the transcription of the episode, creating new segments if necessary in order to adequately make the two variables coincide.

Once the joint database was constructed, it was imported into the GridWare SSG software (Lamey et al., 2004). The SSG allowed the joint analysis of the data, considering both the discursive and the prosodic behavior of the patient or the therapist during the course of the episodes. As shown in **Figure 2**, the X-axis represents the categories of the discursive positions of the patient and the therapist, while the Y-axis represents the categories of the VQPs for both. In each cell of the SSG, the size of the plot point represents the *number of visits* [Rate of Visit (RV)] of a given

association of a Discursive Position with a VQP of the patient or the therapist, which makes it possible to identify the attractors.

Data Analyses

With the purpose of determining the attractors, that is to say, the most recurring and stable discourse-voice regulatory strategies, the data obtained with the SSG were analyzed using the *Winnowing* technique (Lewis et al., 1999; Hollenstein, 2013). Afterward, in order to determine the configurations of discourse-voice regulatory strategies working as attractors, a cluster analysis was performed using SSPS-17 (SPSS Inc., 2008). Finally, to compare the prevalence of the discourse-voice regulatory strategies and their configurations in Change Episodes and Rupture Episodes, Logistic Hierarchical Regression analyses were conducted using HLM 7.0 (Raudenbush et al., 2011).

Results

Discourse-Voice Regulatory Strategies: The Attractors

The RVs within each episode was used to identify Discourse-Voice Regulatory Strategies that were defined as attractors. Following a conceptual model named "*Virginia Model,*" which establishes the association of verbal and non-verbal behaviors in a nested manner (Martínez et al., 2014b), attractors were determined with respect to each discursive position[2] (i.e., the X-axis of the SSG; see **Figure 2**). In this conceptual model, the discursive position is the explicit dimension of regulation with the other, which makes it possible to understand the meaning of the implicit and non-verbal dimensions of the interaction. Thus, the model considers two levels of analysis. The first one concerns the analysis of the non-verbal profiles of the discursive positions of each member of the therapeutic dyad. The second involves the microanalysis of the regulatory function of the combined manifestations of the discursive and non-verbal expressions of patient–therapist interaction (i.e., discourse-voice regulatory strategies) within Change Episodes and Rupture Episodes of the psychotherapeutic process (Martínez et al., 2014b).

In order to identify the attractors (i.e., recurrent and stable discourse-voice regulatory strategies), the *Winnowing* technique (Lewis et al., 1999; Hollenstein, 2013) was used. This method consists of a series of runs, starting with all occupied cells and shifting to a smaller set of cells each time. A mean-squared *heterogeneity* value for the whole set of cells, corresponding to each Discursive Position combined with the seven VQPs (1×7 grids), was calculated with the following formula:

$$\text{Heterogeneity}_j = \frac{\Sigma\,(\text{Observed}_i - \text{Expected}_j)^2/\text{Expected}_j}{\#\text{ of Cells}_j}$$

Then the cell with lowest visits value was excluded, and the calculation was repeated on the next subgroup of cells. This procedure was repeated eliminating one cell visits value at a time, until only the attractor cells remained. As is exemplified in a hypothetical 2×7 grid in **Figure 1**, the mean square for heterogeneity dropped from run to run as the subgroup of cells got smaller (see **Figure 1B**). By means of visual inspection the attractors were identified as the most homogeneous group of cells, shown in this case by the flattening of the scree plot at run nine (see **Figure 1B**). Eliminating any of the cells that remained at run nine would not decrease heterogeneity and hence, in this example, six cells are considered as attractors (see **Figure 1A**).

In the case of the patients, the cells Reflexive position-Connected VQP and Reflexive position-Affirmative VQP were visited more frequently than the other combinations (see **Table 3**). Therefore, as was expected (see hypothesis 1), the combination Reflexive position-Connected VQP is a discourse-voice regulatory strategy working as attractor; for its part, the combination Reflexive position-Affirmative VQP was an unexpectedly discovered attractor.

In the case of the Dependent discursive position, the strategies Dependent position-Report VQP, Dependent position-Connected VQP, and Dependent position-Emotional VQP received more visits than the other discourse-voice regulatory strategies. Thus, as was expected (see hypothesis 1), the combination Dependent position-Emotional VQP was found to be an attractor, while the other two combinations were unexpectedly discovered attractors (see **Table 3**).

Finally, for the Independent discursive position, no attractors were identified, because neither of the heterogeneity values of the cells showed a significant drop or 'scree' (see **Table 3**). Therefore, in this case the hypothesized attractor was not confirmed (see hypothesis 1).

In sum, the attractors identified for the patients were: (a) Reflexive position-Connected VQP, (b) Reflexive position-Affirmative VQP, (c) Dependent position-Report VQP, (d) Dependent position-Connected VQP, and (e) Dependent position-Emotional VQP (see **Figure 2A**).

In the case of the therapists, the results presented in **Figure 2B** and **Table 3** indicate that the Proposer position-Connected VQP regulatory strategy received more visits than the other combinations. Therefore, as was expected (see hypothesis 1), this combination was an attractor. For the Professor discursive position, the combinations Professor position-Connected VQP and Professor position-Affirmative VQP received more visits than the other discourse-voice strategies. Thus, as was expected (see hypothesis 1), the combination Professor position-Affirmative VQP was found to be an attractor. On the other hand, the combination Professor position-Connected VQP was an unexpected attractor (see **Table 3**).

In brief, the attractors identified for the therapists were (a) the combination Proposer position-Connected VQP and (b) the combinations Professor position-Connected VQP or Affirmative VQP (see **Figure 2**).

Discourse-Voice Regulatory Strategies: Attractors in Relevant Episodes

The discourse-voice regulatory strategies working as attractors identified were compared according to their presence in

[2]The Avoidant discursive position was not analyzed in detail because it was observed in only two of the analyzed psychotherapies.

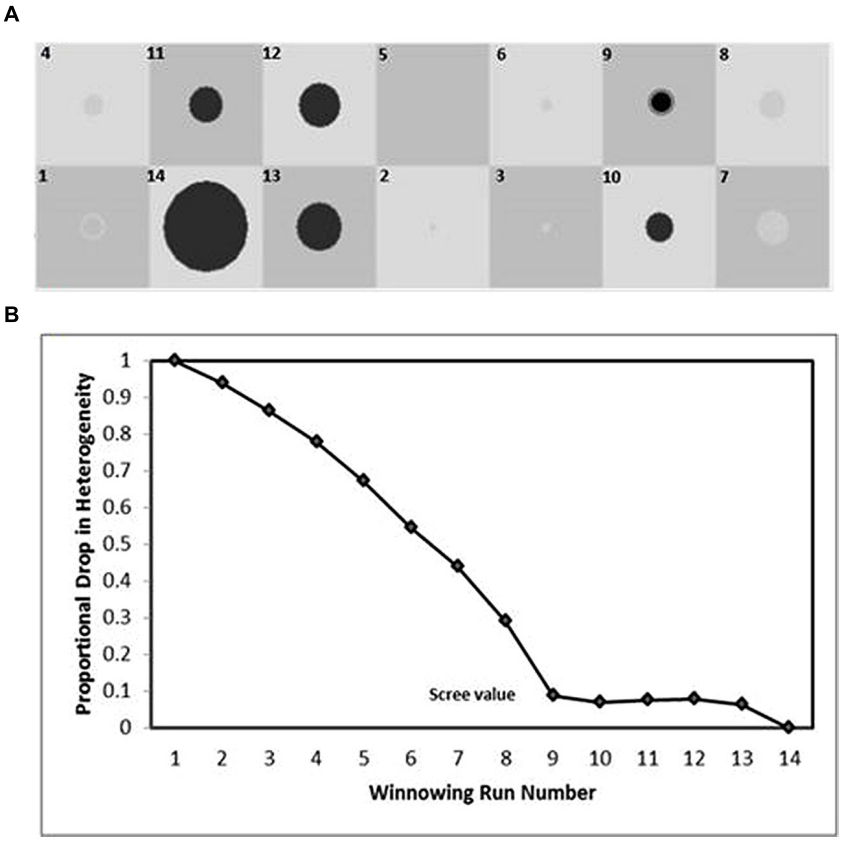

FIGURE 1 | Identifying attractors by using the Winnowing procedure (based on Lewis et al., 1999). Each winnowing run denotes grid cells with greater visits whose removal decreases the heterogeneity of the set **(B)**. After the steepest drop in heterogeneity (scree value), the remaining cell or cells (in black) comprise the attractors **(A)**.

TABLE 3 | Total visits for each discursive position-VQP combination in patients and therapists.

Discursive positions/VQPs	Report	Connected	Affirmative	Reflexive	Emotional	Full pause	Overlapping	Total
Patient								
Reflexive	46 (9.97%)	184* (39.91%)	87* (18.87%)	27 (5.85%)	50 (10.84%)	47 (10.19%)	20 (4.33%)	461
Dependent	93* (22.51%)	93* (22.51%)	51 (12.34%)	18 (4.35%)	120* (29.05%)	25 (6.05%)	13 (3.14%)	413
Independent	50 (10.46%)	131 (27.40%)	103 (21.54%)	15 (3.13%)	80 (16.73%)	55 (11.50%)	44 (9.20%)	478
Therapist								
Proposer	53 (7.48%)	307* (43.36%)	146 (20.62%)	12 (1.69%)	10 (1.41%)	132 (18.64%)	48 (6.77%)	708
Professor	46 (10.43%)	154* (34.92%)	118* (26.75%)	7 (1.58%)	15 (3.40%)	57 (12.92%)	29 (6.57%)	441

The asterisks indicate the identified attractors. N = 153 episodes.

Change Episodes and Rupture Episodes. Thus, the dependent variable was the presence (0 = absence or 0 RV; 1 = presence or 1 RV or more) of each of the attractors at the episode level (the discourse-voice strategies marked with an asterisk in **Table 3**). The probability of each of the attractors was compared according to the type of episode considered. A Logistic Hierarchical Regression analysis (using HLM version 7.0, Full-PQL estimation method, Bernoulli distribution at Level-1) in a 2-Level model was used for establishing the differences between the attractors by type of episode.

In the model, the episodes (Level-1) were nested in the patient (Level-2)[3]. The type of Episode was the predictor at Level-1 (0 = Rupture Episode and 1 = Change Episode). The Level-2 predictors were Initial Patient Functionality[4] (Functional, indicating

[3]Because episodes are nested in the sessions (that is, a session may have one or more events), we explored whether there was variability associated with this level. We found that none of the dependent variables considered showed variability in association with the session level. The information on the upper level (patient) was collapsed.

[4]Given the small sample size of patients ($N = 5$) that could be used to reveal differences in the behavior of the episodes in terms of discourse-voice strategies, the

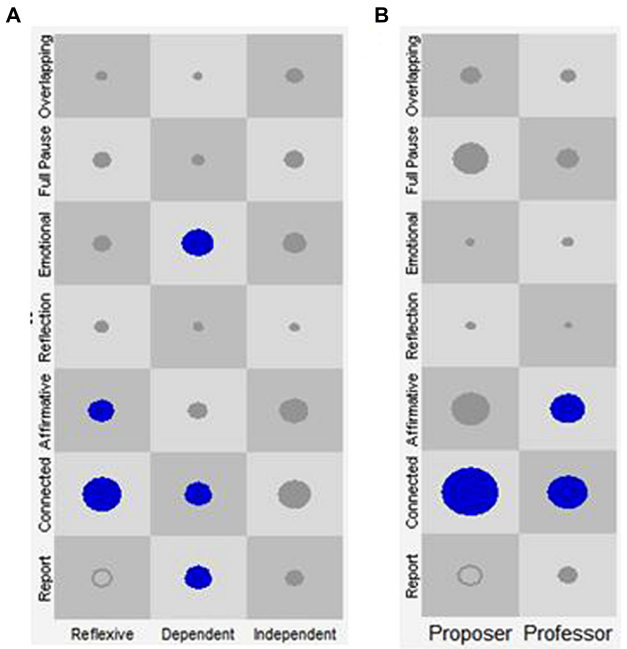

FIGURE 2 | Discourse-voice regulatory strategies of patients and therapists regardless of episode type. The *X*-axis represents the discursive positions of the patient (**A**: Reflexive, Dependent, and Independent) and of the therapist (**B**: Proposer, and Professor). The *Y*-axis represents the Vocal Quality Patterns (VQP) for patient and therapist. Each one of the cells represents all the state-spaces resulting from the combination of the discursive positions with the VQPs. The circles and their size represent the visits in each cell and their frequency, respectively. Only the circles in blue represent the identified attractors.

the level of functioning of the patient when starting the therapy; 0 = Beginning the psychotherapy in the dysfunctional population and 1 = Beginning the psychotherapy in the functional population), and Reliable Change Index in the Patient (RCI, indicating the outcome of the therapy; 0 = without RCI and 1 = with RCI)[5].

Separate HLM analyses were conducted for each selected discourse-voice strategy at the episode level (eight attractors). Three steps were followed for each analysis:

(a) A fully unconditional model was fitted in order to estimate dependent variable reliability and the adequacy of the multilevel analysis.
(b) The type of Episode was included in the Level-1 equation and modeled as a random effect in order to determine whether the coefficients varied among patients. If there was no variability to explain, its variance was fixed at zero.
(c) Finally, Initial Patient Functionality and/or Reliable Change Index in the Patient were included as predictors at the Level-2 intercept and/or slope (Type of Episode). Whenever these predictors did not explain significant variances of the Level-2 equations, they were also dropped out of the model. **Tables 4** and **5** present the final models of each discourse-voice regulatory strategy at the episode level.

The results indicated that the regulatory strategy working as attractor Reflexive position-Connected VQP was more likely to be used in Change Episodes than in Rupture Episodes (Odds ratio 8.09, 95% CI 3.24; 19.01), thereby confirming hypothesis 2. The same was observed for the attractor Reflexive position-Affirmative VQP (Odds ratio 4.21, 95% CI 1.90; 9.32).

Finally, a comparison of the therapists' use of discourse-voice regulatory strategies working as attractors at the episode level revealed that the Proposer position-Connected VPQ regulatory strategy was the only one whose presence was significantly different in Change Episodes and Rupture Episodes (see **Table 5**). Therefore, as was expected (see hypothesis 2), therapists were more likely to use the attractor Proposer position-Connected VQP in Change Episodes than in Rupture Episodes (Odds ratio 3.33, 95% CI 1.34; 8.27).

In these models, Initial Patient Functioning was included as a control variable. Nevertheless, the results indicate that the Dependent position-Report VQP and the Dependent position-Emotional VQP attractors were more likely to be used as regulatory strategies by the patients who began the psychotherapy in the dysfunctional population. The opposite was true for the attractors Reflexive position-Affirmative VQP when used by the patient and Professor position-Affirmative VQP when used by the therapist. These strategies were applied more frequently when the patients began therapy in the functional population.

Configurations of Discourse-Voice Regulatory Strategies: Identification of Patterns of Attractors

To test hypothesis 3, a Cluster analysis was performed to determine emerging patterns of attractors (see Fogel, 2006, 2011), that is to say, patterns of recurrent and stable discourse-voice regulatory strategies within relevant episodes. Thus, this analysis was performed considering the total number of episodes as the subject to be classified ($N = 151$[6]). Using the classification command K-Means (Quick Cluster in SPSS-17.0) 3-, 4-, and 5-cluster solutions were explored. The 4-cluster solution was selected using as criterion the parsimony and interpretability of each cluster.

Each cluster was qualitatively interpreted according to its global regulatory configuration, especially the specific attractors of each one. The *Winnowing* technique (explained above)

predictors of initial functionality and the RCI were modeled at level 2 as a way to resolve the difficulty of accounting for the impact that the differences among patients might have on the results.

[5]Both indicators were measured using the Outcome Questionnaire OQ-45.2 (Lambert and Burlingame, 1996).

[6]Two episodes/trajectories were left out of the analysis because they were outliers: one Rupture Episode from session 5 and one Rupture Episode from session 13, both from therapy 4.

TABLE 4 | Discourse -voice regulatory strategies of patients according to type of episode (HLM).

Fixed Effects[a]	Reflexive-connected[c] Coefficient (SE) Odds (95% CI)	Reflexive-affirmative[d] Coefficient (SE) Odds (95% CI)	Dependent-report[d] Coefficient (SE) Odds (95% CI)	Dependent-connected[c] Coefficient (SE) Odds (95% CI)	Dependent-Emotional[e] Coefficient (SE) Odds (95% CI)
Intercept (γ_{00})	−1.04 (0.53) 0.35 (0.08–1.54)	−1.58 (0.31)* 0.21 (0.08–0.56)	−1.69 (0.56) 0.18 (0.03–1.09)	−1.67 (0.57) 0.51 (0.10–2.45)	−1.15 (0.27)* 0.32 (0.13–0.75)
Initial patient functioning (γ_{01})[b]	–	2.93 (18.81)* 18.81 (1.65–215.01)	−3.63 (1.10)* 0.27 (0.001–0.89)	–	−1.60 (0.42)* 0.20 (0.05–0.77)
Type of episode (γ_{10})	2.09 (0.43)*** 8.09 (3.45–19.01)	1.44 (0.40)*** 4.21 (1.90–9.32)	−0.44 (0.50) 0.65 (0.24–1.73)	−0.32 (0.40) 0.73 (0.33–1.60)	0.37 (0.52) 1.32 (0.31–5.65)
Random variance components					
Level-2 Intercept(u_0)	0.939*** 31.09 (4)	0.001 4.43 (3)	0.737 14.03 (3)	1.220 26.21 (4)	0.012 4.78 (3)
Level-2 type of episode(u_1)	–	–	–	–	0.53* 10.30 (43)

Level-1 N = 153, Level-2 N = 5. Type of episode, 0 = Rupture Episodes and 1 = Change Episodes. Functional, 1 = Beginning the psychotherapy in the functional population and 0 = Beginning in the dysfunctional population. [a]*Gamma (γ) coefficients in fixed effects and variance components in random effects. Standard errors (SE) follow parameter estimates in parentheses and 95% Confidence Interval (CI) Odds Ratio follow Odds Ratio estimator in parentheses (Fixed Effects). Ch^2 and df below variances in parentheses (Random effects).* [b]*Initial Patient Functioning centered around the grand mean. Final Models:* [c]*Log (Probability of Dependent Variable) = $\gamma_{00} + \gamma_{10}$*Type of Episode+ u_0;* [d]*Log (Probability of Dependent Variable) = $\gamma_{00} + \gamma_{01}$*Functional + γ_{10} * Type of Episode+ u_0;* [e]*Log (Probability of Dependent Variable) = $\gamma_{00} + \gamma_{01}$ *Functional + γ_{10}*Type of Episode+ u_0+ u_1. *p < 0.05, ***p < 0.001.*

TABLE 5 | Discourse-voice regulatory strategies of therapists according to type of episode (HLM).

	Discursive position-VQP (Therapists)		
Fixed effects[a]	**Proposer-connected[c] Coefficient (SE) odds (95% CI)**	**Professor-affirmative[d] Coefficient (SE) odds (95% CI)**	**Professor–connected[e] Coefficient (SE) odds (95% CI)**
Intercept (γ_{00})	0.86 (0.56) 2.36 (0.49–11.35)	−0.09 (0.27) 0.90 (0.38–2.17)	0.47 (0.27) 1.60 (0.75–3.42)
Initial patient functioning (γ_{01})[b]	–	2.06 (0.49)* 7.78 (1.62–38.27)	–
Type of Episode (γ_{10})	1.20 (0.45)* 3.33 (1.34–8.27)	−0.07 (0.73) 0.93 (0.13–7.02)	−0.51 (0.63) 0.60 (0.14–3.47)
Random variance components			
Level-2 Intercept(u_0)	1.12*** 23.99 (4)	0.09 3.13 (3)	0.11 5.31 (4)
Level-2 Type of Episode(u_1)	–	1.79** 16.03 (4)	1.32** 14.23 (4)

Level-1 N = 153, Level-2 N = 5. Type of episode, 0 = Rupture Episodes and 1 = Change Episodes. Functional, 1 = Beginning the psychotherapy in functional population and 0 = Beginning in the dysfunctional population. [a] *Gamma (γ) coefficients in fixed effects and variance components in random effects. Standard errors (SE) follow parameter estimates in parentheses and 95% Confidence Interval (CI) Odds Ratio follow Odds Ratio estimator in parentheses (Fixed Effects). Ch^2 and df below variances in parentheses (Random effects).* [b]*Initial Patient Functioning centered around the grand mean. Final Models:* [c]*Log (Probability of Dependent Variable) = $\gamma_{00} + \gamma_{10}$*Type of Episode+ u_0; Log (Probability of Dependent Variable) = $\gamma_{00} + \gamma_{01}$*Functional + γ_{10} *Type of Episode + u_0+ u_1;* [e]*Log (Probability of Dependent Variable) = $\gamma_{00} + \gamma_{10}$*Type of Episode+ u_0 + u_1.*
**p < 0.05, **p < 0.01, ***p < 0.001*

was used to identify the recurrent and stable discourse-voice regulatory strategies for each regulatory configuration. On this occasion, the mean-squared *heterogeneity* value was calculated for the whole set of cells corresponding to the discursive positions of the patient combined with the seven VQPs (3 × 7 grids) and for the set of cells corresponding to the discursive positions of the therapist also combined with the VQPs (2 × 7 grids). Therefore, each of these configurations represents a group of discourse-voice strategies working as attractors that shape an interaction as a specific form of mutual regulation between patient and therapist.

Description of the Discourse-Voice Regulatory Configurations

Cluster 1: the "general therapeutic work" discourse-voice regulatory configuration

This configuration seems to indicate an exploratory and deconstructive therapeutic activity in which different discursive positions participate, shaped by a vocal combination that conveys the impression of connection with the other, and at the same time, a strong conviction and elaboration of what is being said. Specifically, in the case of the patient, the Independent discursive position co-occurred with a wide range of regulatory resources

TABLE 6 | Total visits for each discursive position- VQP combination in patients and therapists of each cluster.

	Discursive positions/VQPs	Report	Connected	Affirmative	Reflexive	Emotional	Full pause	Overlapping	Total
Cluster 1	**Patient**								
	Reflexive	7 (1.62%)	46* (10.69%)	16 (3.72%)	2 (0.46%)	10 (2.32%)	2 (0.46%)	2 (0.46%)	
	Dependent	4 (0.93%)	18 (4.18%)	14 (3.25%)	2 (0.46%)	10 (2.32%)	2 (0.46%)	2 (0.46%)	
	Independent	24 (5.58%)	89* (20.69%)	67* (15.58%)	8 (1.86%)	54* (12.55%)	18 (4.18%)	33 (7.67%)	430
	Therapist								
	Proposer	10 (3.10%)	141* (43.78%)	41 (12.73%)	1 (0.31%)	2 (0.62%)	16 (4.96%)	22 (6.83%)	
	Professor	9 (2.79%)	23 (7.14%)	36 (11.18%)	0 –	3 (0.93%)	4 (1.24%)	14 (4.34%)	322
Cluster 2	**Patient**								
	Reflexive	8 (10.38%)	1 (1.29%)	0 –	0 –	1 (1.29%)	1 (1.29%)	0 –	
	Dependent	42* (54.54%)	10 (12.98%)	1 (1.29%)	3 (3.89%)	6 (7.79%)	2 (2.59%)	0 –	
	Independent	1 (1.29%)	0 –	0 –	0 –	0 –	0 –	1 (1.29%)	77
	Therapist								
	Proposer	10* (16.39%)	7* (11.47%)	0 –	1 (1.63%)	0 –	9* (14.75%)	0 –	
	Professor	14* (22.95%)	9* (14.75%)	1 (1.63%)	0 –	1 (1.63%)	9* (14.75%)	0 –	61
Cluster 3	**Patient**								
	Reflexive	13 (2.69%)	131* (27.12%)	69* (14.28%)	19 (3.93%)	22 (4.55%)	38 (7.86%)	17 (3.51%)	
	Dependent	2 (0.41%)	19 (3.93%)	14 (2.89%)	3 (0.62%)	8 (1.65%)	1 (0.20%)	4 (0.82%)	
	Independent	9 (1.86%)	35 (7.24%)	33 (6.83%)	6 (1.24%)	16 (3.31%)	13 (2.69%)	11 (2.27%)	483
	Therapist								
	Proposer	4 (0.82%)	100* (20.53%)	115* (23.61%)	4 (0.82%)	5 (1.02%)	59* (12.11%)	21 (4.31%)	
	Professor	2 (0.41%)	50* (10.26%)	90* (18.48%)	2 (0.41%)	3 (0.61%)	20 (4.10%)	12 (2.46%)	487
Cluster 4	**Patient**								
	Reflexive	18 (5.02%)	18 (5.02%)	2 (0.55%)	6 (1.65%)	17 (4.74%)	6 (1.65%)	1 (0.27%)	
	Dependent	45* (12.56%)	48* (13.40%)	22 (6.14%)	11 (3.07%)	98* (27.37%)	20 (5.58%)	7 (1.95%)	
	Independent	16 (4.46%)	7 (1.95%)	3 (0.83%)	1 (0.27%)	10 (2.79%)	2 (0.55%)	0 –	358
	Therapist								
	Proposer	29 (8.35%)	91* (26.22%)	13 (3.74%)	6 (1.72%)	3 (0.86%)	48* (13.83%)	5 (1.44%)	
	Professor	21 (6.05%)	71* (20.46%)	20 (5.76%)	5 (1.44%)	8 (2.30%)	24 (6.91%)	3 (0.86%)	347

The asterisks indicate the identified attractors. Cluster 1, N = 44 episodes; Cluster 2, N = 11 episodes; Cluster 3, N = 56 episodes; Cluster 4, N = 40 episodes.

in terms of vocal quality (Connected, Affirmative, and Emotional VQPs). This gives the impression that this position—one that signals that the patient probably needs therapeutic help—is in tension between elaboration, emotional regulation, and conviction. The Dependent discursive position and its prosodic characteristics, however, do not occur at all in the General Therapeutic Work configuration. Finally, the Reflexive discursive position appears together with the Connected VQP as a prosodic characteristic that displays connection with the other and an orientation toward elaboration. In the case of the therapist, in this configuration the Proposer discursive position appears in combination with the Connected VQP, a vocal quality that conveys elaboration and an orientation toward the interlocutor (see **Table 6** and **Figure 3**).

Cluster 2: the "disconnected" discourse-voice regulatory configuration

This configuration appears only in Rupture Episodes of therapy 1 and makes reference to the prevalence of discourse-voice regulatory strategies working as attractors in both participants that conjointly indicate a disconnection of the therapeutic activity (see **Table 6** and **Figure 4**). Five attractors take place in this configuration (one of the patient and six of the therapist), mainly occurring with the Report VQP, giving the impression of a lack of affective commitment with what is being said.

Specifically for the patient, the Dependent discursive position mainly employs the Report VQP. For the therapist, both the Proposer and the Professor discursive positions use mostly the Report and Connected VQPs and the Full Pause category. Particularly, the use of Full Pause in the disconnected configuration—a category that by itself constitutes a regulatory strategy with the interlocutor—seems to account merely for the promotion of continuity in the other's communication.

Cluster 3: the "productive therapeutic work" discourse-voice regulatory configuration

This configuration seems to indicate a productive and constructive therapeutic activity in which several discursive positions participate combined with a prosody that gives the impression of connection with the other, and at the same time, of strong conviction in and elaboration of what is being said (see **Table 6**; **Figure 5**).

Specifically for the patient, the frequent use of the Reflexive discursive position combined with the Connected and Affirmative VQPs as regulatory strategies shows that, in the "Productive Therapeutic Work" regulatory configuration, the

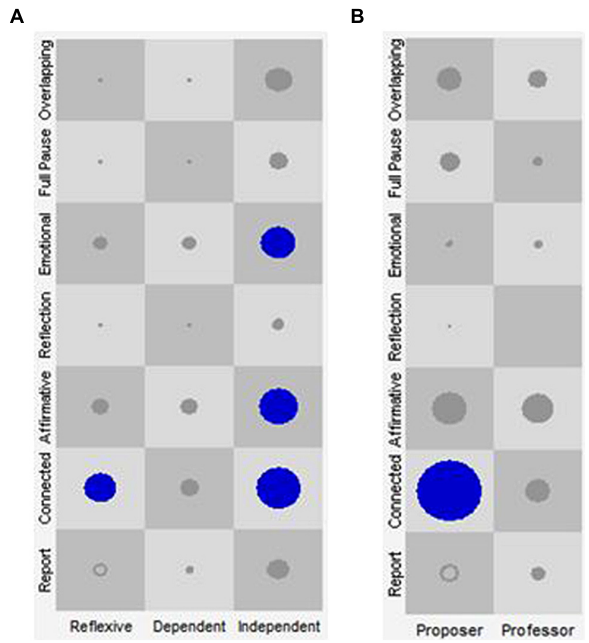

FIGURE 3 | SSG of Cluster 1: general therapeutic work. The *X*-axis represents the discursive positions of the patient (**A**: Reflexive, Dependent and Independent) and of the therapist (**B**: Proposer and Professor). The *Y*-axis represents the VQPs for patient and therapist. Each one of the cells represents all the state space resulting from the combination of the discursive positions with the VQPs. The circles and their size represent the visits in each cell and their frequency, respectively. Only the cells in blue represent the identified attractors.

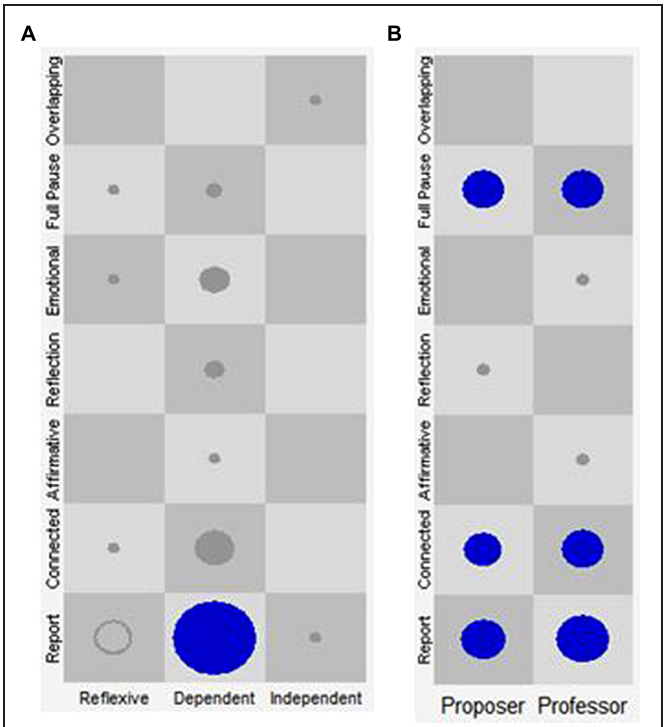

FIGURE 4 | State space grid (SSG) of Cluster 2: disconnected. The *X*-axis represents the discursive positions of the patient (**A**: Reflexive, Dependent, and Independent) and of the therapist (**B**: Proposer and Professor). The *Y*-axis represents the VQPs for patient and therapist. Each one of the cells represents all the state space resulting from the combination of the discursive positions with the VQPs. The circles and their size represent the visits in each cell and their frequency, respectively. Only the circles in blue represent the identified attractors.

Reflexive position is central for the constructive nature of therapeutic work. Regarding the therapist, both the Proposer and the Professor discursive positions are combined with the Affirmative and Connected VQPs. Therefore, overall and in terms of their vocal quality, the therapist's positions appear to be directed to enhancing the elaborative and constructive characteristics of the regulatory strategies employed by the patient.

Cluster 4: the "emotional therapeutic work" discourse-voice regulatory configuration

This configuration refers to the prevalence of discourse-voice regulatory strategies working as attractors that together seem to indicate a therapeutic activity characterized by an affective component. In this configuration, the Dependent discursive position of the patient gives the impression of vocal expression and suppression of emotions in speech, but also of detachment in relation to what is being said (see **Table 6**; **Figure 6**). It seems that the strong presence of the emotional vocal quality is shaped by a more elaborative quality of the speaker's words and his/her disengagement in the Reflexive and Independent positions, expressed by the Connected and Report VQPs respectively. For the therapist, both the Proposer and the Professor discursive positions are combined with the Connected VQP. This prosodic characteristic could have the function of regulating the affection–disaffection polarity in the patient.

Configurations of Discourse-Voice Regulatory Strategies: Patterns of Attractors in Relevant Episodes

To test hypothesis 4, the probability of encountering each of the four configurations of discourse-voice regulatory strategies working as attractors (clusters) was compared according to the type of episode. Thus, four dichotomous variables were created for this analysis, acquiring value 1 when an episode (or trajectory) displayed a certain configuration of discourse-voice regulatory strategies (i.e., Cluster 1) and 0 if any of the other configurations were present (e.g., Clusters 2, 3, or 4).

A Logistic Hierarchical Regression analysis (using HLM version 7.0, Full PQL estimation method, Bernoulli distribution at Level-1) in a two-level model was used. In the model, the episodes (Level-1) were nested in the patient (Level-2). The type of Episode was the predictor at Level-1 (0 = Rupture Episode and 1 = Change Episode). The Level 2 predictors were Initial Patient Functionality (Functional; indicating the level of functioning, of the patient at the beginning of the therapy; 0 = Beginning the psychotherapy in the dysfunctional population and 1 = Beginning the psychotherapy in the functional population) and Reliable Change Index in the Patient (RCI, indicating the outcome of the therapy; 0 = without RCI and 1 = with RCI).

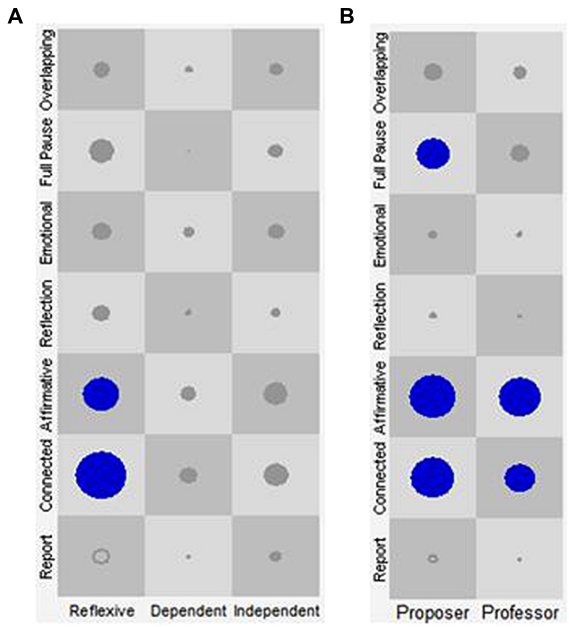

FIGURE 5 | State space grid of Cluster 3: productive therapeutic work. The *X*-axis represents the discursive positions of the patient (**A**: Reflexive, Dependent, and Independent) and of the therapist (**B**: Proposer and Professor). The *Y*-axis represents the VQPs for patient and therapist. Each one of the cells represents all the state space resulting from the combination of the discursive positions with the VQPs. The circles and their size represent the visits in each cell and their frequency, respectively. Only the circles in blue represent the identified attractors.

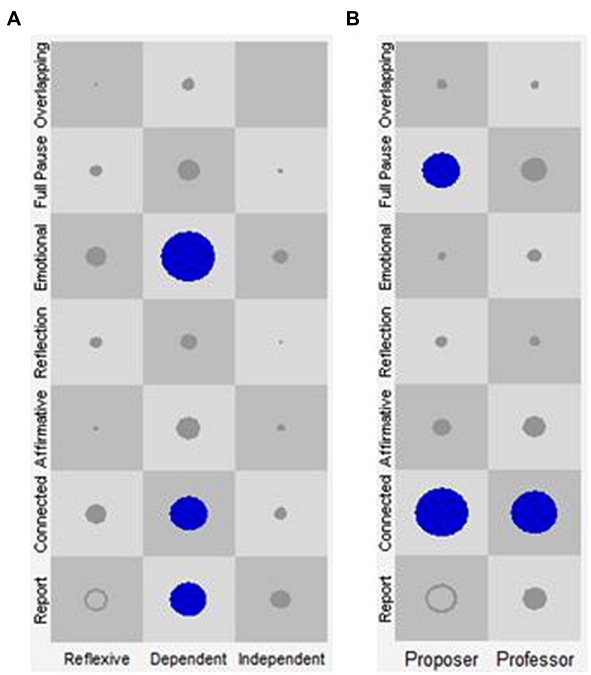

FIGURE 6 | State space grid of Cluster 4: emotional therapeutic work. The *X*-axis represents the discursive positions of the patient (**A**: Reflexive, Dependent, and Independent) and of the therapist (**B**: Proposer and Professor). The *Y*-axis represents the VQPs for patient and therapist. Each one of the cells represents all the state space resulting from the combination of the discursive positions with the VQPs. The circles and their size represent the visits in each cell and their frequency, respectively. Only the circles in blue represent the identified attractors.

Separate HLM analyses were conducted for three of the clusters. Given that cluster 2 appears only in Rupture Episodes of therapy 1, it was not analyzed. Three steps were followed for each analysis:

(a) A fully unconditional model was fitted in order to estimate dependent variable reliability and the adequacy of the multilevel analysis.

(b) The Type of Episode was included in the Level-1 equation and was modeled as a random effect in order to determine if the coefficients varied among patients. If there was no variability to explain, its variance was fixed at zero.

(c) Finally, Initial Patient Functionality and/or Reliable Change Index in the Patient were included as predictors at Level-2

TABLE 7 | Configurations of discourse-voice regulatory strategies according to type of episode.

Fixed Effects[a]	Cluster 1[c] Coefficient (SE) Odds (95% CI)	Cluster 3[c] Coefficient (SE) Odds (95% CI)	Cluster 4[c] Coefficient (SE) Odds (95% CI)
Intercept(γ_{00})	−0.74 (0.63) 0.48 (0.08–2.78)	−1.20 (0.60) 0.30 (0.06–1.59)	−1.73 (0.33)* 0.18 (0.06–0.58)
Initial patient functioning (γ_{01})[b]	–	–	−2.42 (0.43)* 0.09 (0.02–0.35)
Type of episode (γ_{10})	−0.90 (0.41)* 0.23 (0.17–0.71)	1.29 (0.44)** 3.62 (1.51–8.70)	0.49 (0.43) 1.64 (0.70–3.87)
Random variance components			
Level-2 Intercept(u_0)	1.29*** 38.01 (4)	1.27*** 41.11 (4)	0.001* 8.39 (3)

Level-1 N = 151, Level-2 N = 5. Type of episode, 0 = Rupture Episodes and 1 = Change Episodes. Functional, 1 = Beginning the psychotherapy in the functional population and 0 = Beginning in the dysfunctional population. [a]*Gamma (γ) coefficients in fixed effects and variance components in random effects. Standard errors (SE) follow parameter estimates in parentheses and 95% Confidence Interval (CI) Odds Ratio follow Odds Ratio estimator in parentheses (Fixed Effects). Ch^2 and df below variances in parentheses (Random effects).* [b]*Initial Patient Functioning centered around the grand mean. Final Models:* [c]*Log (Probability of Dependent Variable) = $\gamma_{00} + \gamma_{10}$*Type of Episode+ u_0; Log (Probability of Dependent Variable) = $\gamma_{00} + \gamma_{01}$*Functional + γ_{10} *Type of Episode + u_0. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.*

intercept and/or slope (Type of Episode). Whenever these predictors did not explain significant variances of the Level-2 equations, they were also dropped out of the model. **Table 7** presents the final models of each discourse-voice regulatory configuration at the episode level.

The results indicate that the "Productive Therapeutic Work" configuration (cluster 3) showed statistically significant differences in its probability of occurrence according to the type of episode. Specifically, this configuration was more likely to appear in Change Episodes (Odds ratio 3.62, 95% CI 1.51; 8.70). The opposite happens in the case of the "General Therapeutic Work" configuration (cluster 1), which was used more frequently in Rupture Episodes (Odds ratio 0.23, 95% CI 0.17; 0.71). Meanwhile, the probability of occurrence of the "Emotional Therapeutic Work" configuration (cluster 4) did not show significant differences regardless of the type of episode considered.

Discussion

The questions addressed in this study were whether it was possible to observe discourse-voice regulatory strategies working as attractors—along with configurations of these strategies—and also if these configurations of recurrent and stable discourse-voice regulatory strategies changed in different interactional scenarios and over the psychotherapeutic process.

In the case of this study, we observed the dynamics of verbal and non-verbal behaviors in the psychotherapeutic interaction by means of a pattern analysis (Salvatore and Tschacher, 2012). Specifically, using the SSG, we analyzed the co-occurrence of discursive and vocal behaviors considering the relationship among them. By means of this method, we explored all possible states of the analyzed system (i.e., combinations of each Discursive Position with all VQPs). The chosen organization level was one that combined micro-elements (i.e., VQPs) nested within a more macro organization (i.e., discursive positions). This system was comprised of moment-by-moment dynamics (i.e., the patient–therapist interaction) and was nested within a larger social structure (i.e., the psychotherapy; Hollenstein, 2007). Thus, the method of analysis used in this study, inspired by the DST, allowed the results to acquire ecological validity and clinical value when considering and modeling them as phenomena that emerge from the dynamics of the elements of a complex system: the psychotherapy.

The results show that the regulation occurs between the participants of the therapeutic dyad, and also between different dimensions of the behavior of each one of them (i.e., verbal and non-verbal). In this regard, discourse-voice regulatory strategies are considered to be discursive expressions of the multiple subjectivity in patient–therapist interaction which are modulated non-verbally by vocal qualities.

With respect to our first hypothesis, the recurrent and stable discourse-voice regulatory strategies observed matched theoretical definitions in some cases (Triadic Model of Positioning- Martínez et al., 2014b; VOQs- Tomicic et al., 2011) and empirical results in others (e.g., Martínez et al., 2014c; Tomicic et al., 2014). However, the hypothesized combination Independent position-Affirmative VQP was not confirmed. Also, four unexpected discourse-voice regulatory strategies working as attractors were observed: three for the patients (Reflexive position-Affirmative VQP as well as Dependent position-Report and Connected VQPs), and one for the therapists (the Professor position-Connected VQP). These combinations may be self-regulatory phenomena associated with specific moments of the psychotherapeutic interaction and not necessarily predictable from the theory.

On the other hand, the Dependent and Independent discursive positions—that is, those aspects of the patient's self related to his/her psychological problems that motivated him/her to seek psychotherapeutic help—present a less consistent non-verbal regulatory profile, at least with respect to their prosodic characteristics (e.g., no attractors were found in the case of the Independent discursive position of the patients). Also, this could be associated with the typical variability of patients' non-verbal expressions as observed by Tomicic et al. (2014).

Related with the second hypothesis, the results show that discourse-voice regulatory strategies working as attractors change as the interactional scenario changes. This can be understood considering that the dynamics (time, self-organization) associated with the regulatory processes represent the emergence of recurring patterns of association of different patient–therapist behaviors within interactional scenarios. Therefore, with regard to the use of the regulatory strategies in Change Episodes and Rupture Episodes, the consistent association established between the specific verbal and non-verbal expressions of the regulation within these different interactional scenarios helps to comprehend the dynamic and emergent nature of the psychotherapeutic interaction. This was differently observed in several attractors (i.e., recurrent and stable discourse-voice regulatory strategies) depending on the type of episode in which they were analyzed. The fact that the combination of the Reflexive discursive position of the patient with the Connected and Affirmative VQPs was more prevalent in Change Episodes indicates that the patient's prosody—elaborative and oriented toward the other, and simultaneously, with a quality of certainty and conviction—is coherent with the dialogical characteristics of this discursive position and also with the construction of a new subjective theory, a notion underlying Change Episodes.

In terms of dynamic systems, as was mentioned before, these interactional scenarios—Change Episodes and Rupture Episodes—are interpreted as part of a bigger system (all the sessions of a psychotherapeutic process) which shows phase transitions, that is to say, transformations at a structural level or reconfigurations of the state-space (Hollenstein, 2007). In this study, these phase transitions were characterized by reorganizations of the elements when the system was strained, for example the emergence of some specific discourse-voice regulatory strategies working as attractors in a Rupture Episode. Then, in the reorganization process, the system could return to the previous

organization or present a new one. This was true for Change Episodes, in which a variety of these attractors were observed. In the case of the therapists, the same can be said for the regulatory strategy Proposer position-Connected VQP, in which the consistency between its discursive and prosodic dimensions reveals a specific therapeutic activity deployed in this type of interactional scenarios.

On the other hand, confirming the third hypothesis, different configurations of recurrent and stable discourse-voice regulatory strategies were identified. These could be interpreted as a self-organized group of discourse-voice regulatory strategies working as attractors that constitutes an interactional system with its own characteristic global property (i.e., configuration as a whole; Fogel, 2006, 2011). From this perspective, the same discursive position combined with the same vocal quality would acquire distinct meanings and regulatory functions in two different configurations of regulatory strategies. And, in this respect, as in the case of relevant episodes, these configurations would themselves constitute an interactional scenario with their own purposes and results. This global property allows us to comprehensibly describe the dynamic behaviors of the configurations of discourse-voice regulatory strategies of the therapeutic relationship as a complex system that involves different levels of organization, from the specific psychotherapeutic moment to the cultural conditions in which this system is embedded (Salvatore and Tschacher, 2012; Martínez et al., 2014a).

Finally, we can confirm the fourth hypothesis, in which we expected to find that different configurations of patients' and therapists' discourse-voice regulatory strategies working as attractors would not be observed in the same proportion in Change Episodes and Rupture Episodes. Specifically, we found that the "Productive Therapeutic Work" configuration was more probable in Change Episodes, whereas the "General Therapeutic Work" configuration was more probable in Rupture Episodes. On the one hand, it was fairly expectable that the "Productive Therapeutic Work" configuration would emerge more frequently in Change Episodes, since in this type of interactional scenario participants have been observed to deploy behaviors that tend to show attunement, dialogicity, and collaborative work toward the therapeutic aims (Arístegui et al., 2009; Dagnino et al., 2012; Fernández et al., 2012; Tomicic et al., 2014). On the other hand, in a difficult and tense interactional scenario such as a Rupture Episode, it makes sense for the patient to display several regulatory strategies. But what is remarkable is that the therapist uses the other configuration in the same way, acquiring in this case a different regulatory function. As Safran and Kraus (2014) point out, specific interpersonal behaviors and subtle non-verbal cues on the part of the patient can "tug" or "pull" the therapist in a rupture which particularly taxes his/her therapeutic role.

With respect to the limitations of this study, we must highlight the small size of the sample (five patients) and the heterogeneity in the length of the therapies (short and long term psychotherapies were analyzed together). This shortcoming, which made it impossible to model the patient level, could not be solved by considering the functionality of the participants before and after the therapy. On the other hand, regarding the different lengths of the therapies, one could ask if the fact that no association was found between the configurations of recurrent and stable discourse-voice regulatory strategies and their deployment over time has anything to do with the different dynamics which are reasonable to expect in short term therapeutic process versus long term ones. For this reason, these findings must be carefully interpreted when weighing the possibility of generalizing themed *vis-a-vis*. However, considering that these configurations can emerge from the particular characteristics of a therapeutic dyad (e.g., the case of the disconnected configuration), it is relevant to describe them to understand the various forms that verbal and non-verbal regulation can acquire, and, in turn, to specify the meaning of such regulations for these interactions and therapeutic interventions. In this regard, it is possible to hypothesize that the levels of complexity in the observations increase from regulatory strategies to configurations of groups of these strategies. That is to say, the distinctions became more specific and idiographic in scope. Despite this, the results regarding configurations of discourse-voice regulatory strategies working as attractors do not appear to be random, and in terms of their regulatory functions, are also consistent with the settings where they are deployed.

The microscopic observations carried out in this study account for implicit interaction processes that are not necessarily part of the conscious experience of the therapists in their clinical practice. However, the results presented here could be useful for them to make distinctions regarding the regulatory functions of different combinations of discursive and prosodic features in the interaction with their patients. This information may allow psychotherapists, for example, to extend their therapeutic listening and assess the state of the relationship with their patients and its variations throughout the psychotherapeutic process.

Acknowledgments

This work was supported by the National Council for Science and Technology of the Chilean Government [FONDECYT grant number 1110361 and FONDECYT Postdoctoral grant number 3150029], and the Fund for Innovation and Competitiveness (FIC) of the Chilean Ministry of Economy, Development and Tourism, through the *Millennium Scientific Initiative* [grant number IS 130005].

References

Angus, L., and McLeod, J. (eds). (2004). *The Handbook of Narrative and Psychotherapy: Practice, Theory and Research*. Thousand Oaks, CA: Sage Publications.

Arístegui, R., Gaete, J., Muñoz, G., Salazar, J., Vilches, O., Krause, M., et al. (2009). *Diálogos y Autorreferencia: Procesos de Cambio en Psicoterapia Desde la Perspectiva de Los Actos de Habla* [Dialogues and Self-reference: Change Processes in Psychotherapy from Speech act's Perspective]. *Rev. Latinoam. Psicol.* 4, 277–289.

ATLAS ti 7.0.5. (1993-2015). [*Computer Software*]. Berlin: GmbH.

Bakhtin, M. (1984). *Problems of Dostoevsky's Poetics. Edited and Trans. by Caryl Emerson*. Minneapolis, MN: University of Michigan Press.

Bakhtin, M. (1986). *Speech Genres and Others Late Essays*. Austin, TX: University of Texas Press.

Bauer, S., Tomicic, A., Martínez, C., Reinoso, A., Schäfer, H., Peukert, A., et al. (2010). *Die Bedeutung von Stimme und StimmklangimpsychotherapeutischenProzessaus der Sicht der Patienten und Patientinnen* [The Meaning of the Voice and the Tone of Voice in the Psychotherapeutic Process from the Perspective of Patients]. *Psychoanal. Körper* 17, 27–50.

Beebe, B. (2006). Co-constructing mother-infant distress in face-to-face interactions: contributions of microanalysis. *Infant Obs.* 9, 151–164. doi: 10.1080/13698030600810409

Beebe, B., Knoblauch, S., Rustin, J., and Sorter, D. (2005). "Forms of intersubjectivity in infant research an adult treatment: a system view," in *Forms of Intersubjectivity in Infant Research and Adult Treatment,* eds B. Beebe, S. Knoblauch, J. Rustin, J. D. Sorter (New York: Other Press), 1–28.

Beebe, B., and Lachmann, F. (2002). *Infant Research and Adult Treatment: Co-Constructing Interactions*. Hillsdale, NJ: Analytic Press.

Bertau, M.-C. (2008). Voice: a pathway to consciousness as "social contact to oneself." *Integr. Psychol. Behav. Sci.* 42, 92–113. doi: 10.1007/s12124-007-9041-8

Boston Change Process Study Group [BCPSG]. (2002). Explicating the implicit: the local level and the microprocesses of change in the analytic situation. *Inter. J. Psychoanal.* 83, 1051–1062. doi: 10.1516/B105-35WV-MM0Y-NTAD

Bromberg, P. (2004). "Standing in the spaces. the multiplicity of self and the psychoanalytic relationship," in *The Dialogical Self in Psychotherapy*, eds H. Hermans and G. Dimaggio (New York: Taylor & Francis Group), 138–151. doi: 10.4324/9780203314616_chapter_9

Cohen, J. (1968). Weighed kappa: nominal scale agreement with provision for scaled disagreement or partial credit. *Psychol. Bull.* 70, 213–220. doi: 10.1037/h0026256

Crits-Christoph, P., Connolly, M. D., Shappell, S., Elkin, I., Krupnick, J., and Sotsky, S. (1999). Interpersonal narratives in cognitive and interpersonal psychotherapies. *Psychother. Res.* 9, 22–35. doi: 10.1080/10503309912331332571

Dagnino, P., Krause, M., Pérez, J. C., Valdés, N., and Tomicic, A. (2012). The evolution of communicative intentions during change episodes and throughout the therapeutic process. *Res. Psychother. Psychopathol. Process Outcome* 15, 75–86. doi: 10.7411/RP.2012.008

Derek, E. (2006). "Managing subjectivity in talk," in *Discursive Research in Practice: New Approaches to Psychology and Interaction*, eds A. Hepburn and S. Wiggins (Cambridge: Cambridge University Press).

Dimaggio, G., and Stiles, W. B. (2007). Psychotherapy in light of internal multiplicity. *J. Clin. Psychol.* 63, 119–127. doi: 10.1002/jclp.20335

Elliott, R. (1984). "A discovery-oriented approach to significant events in psychotherapy: interpersonal process recall and comprehensive process analysis," in *Patterns of Change,* eds L. Rice and L. Greenberg (New York: Guilford Press), 249–286.

Fernández, O., Herrera, P., Krause, M., Pérez, J. C., Valdés, N., Vilchez, O., et al. (2012). *Episodios de Cambio y Estancamiento en Psicoterapia: Características de la Comunicación Verbal Entre Pacientes y Terapeutas* [Change and Stuck Episodes in Psychotherapy: Characterization of Verbal Communication between Patients and Therapists]. *Terapia Psicol.* 30, 5–22. doi: 10.4067/S0718-48082012000200001

Flick, U. (2009). *An Introduction to Qualitative Research*, 4th Edn. London: Sage.

Fogel, A. (2006). *Change Processes in Relationships: A Relational-Historical Research Approach*. New York: Cambridge University Press. doi: 10.1017/CBO9780511489686

Fogel, A. (2011). Theoretical and applied dynamic systems research in developmental science. *Child Dev. Perspect.* 5, 267–272. doi: 10.1111/j.1750-8606.2011.00174.x

Fonagy, P., Gergely, G., Jurist, E. L., and Target, M. (2002). *Affect Regulation, Mentalization, and the Development of the Self*. New York, NY: Other Press.

Gonçalves, M., and Guilfoyle, M. (2006). Dialogism and psychotherapy: therapists' and clients' beliefs supporting monologism. *J. Constr. Psychol.* 19, 251–271. doi: 10.1080/10720530600691723

Hermans, H., and Hermans-Jansen, E. (2004). "The dialogical construction of coalitions in a personal position repertoire," in *The Dialogical Self in Psychotherapy*, eds H. Hermans and G. Dimaggio (New York: Taylor & Francis Group), 124–137.

Hollenstein, T. (2007). State space grids: analyzing dynamics across development. *Int. J. Behav. Dev.* 31, 384–396. doi: 10.1177/0165025407077765

Hollenstein, T. (2013). *State Space Grids*. New York: Springer. doi: 10.1007/978-1-4614-5007-8

Kaplan, D., and Glass, L. (1995). *Understanding Nonlinear Dynamics*. New York: Springer. doi: 10.1007/978-1-4612-0823-5

Knoblauch, S. H. (2000). *The Musical Edge of Therapeutic Dialogue*. Hillsdale, NJ: The Analytic Press.

Knoblauch, S. H. (2005). Body rhythms and the unconscious: toward an expanding of clinical attention. *Psychoanal. Dialogues* 15, 807–827. doi: 10.2513/s10481885pd1506-2

Krause, M. (2005). *Psicoterapia y cambio. Una mirada desde la Subjetividad [Psychotherapy and Change. A View From Subjectivity]*. Santiago: Ediciones Universidad Católica de Chile.

Krause, M., de la Parra, G., Arístegui, R., Dagnino, P., Tomicic, A., Valdés, N., et al. (2007). The evolution of therapeutic change studied through generic change indicators. *Psychother. Res.* 17, 673–689. doi: 10.1080/10503300601158814

Krause, M., de la Parra, G., Arístegui, R., Tomicic, A., Dagnino, P., Echavarri, O., et al. (2006). *Indicadores de Cambio Genéricos en la Investigación Psicoterapéutica* [Generic Change Indicators in the Psychotherapeutic Process]. *Rev. Latinoam. Psicol.* 38, 299–325.

Lambert, M., and Burlingame, G. L. (1996). *Outcome Questionnaire (OQ-45.2)*. Washington, DC: American Professional Credentialing Services.

Lamey, A., Hollenstein, T., Lewis, M. D., and Granic, I. (2004). *GridWare (Version 1.1). [Computer Software]*. Available at: http://statespacegrids.org

Lehmann, O. (2013). Book review. Handbook of dialogical self theory, edited by Hurbert Hermans and Thorsten Gieser. *Cult. Psychol.* 19, 414–420. doi: 10.1177/1354067X13489321

Lewis, M., Lamey, A., and Douglas, L. (1999).A new dynamic system method for the analysis of early socioemotional development. *Dev. Sci.* 2, 457–475. doi: 10.1111/1467-7687.00090

Martínez, C. (2011). *Regulación mutua y Dialogicidad en Psicoterapia: Un Análisis Empírico de la Subjetividad e Intersubjetividad En el Discurso Terapéutico [Mutual Regulation and Dialogue in Psychotherapy: An Empirical Analysis of Subjectivity and Intersubjectivity in Thetherapeutic Discourse]*. Saarbrucken: EAE Publishing.

Martínez, C., and Tomicic, A. (2013). "Dialogical reorganization of the subjectivity in a long-term psychoanalytic psychotherapy: a case study," in *Proceedings of the SPR 44th International Annual Meeting*, Brisbane, QLD.

Martínez, C., Tomicic, A., and Medina, L. (2014a). Psychotherapy as a discursive genre: a dialogic approach. *Cult. Psychol.* 20, 501–524. doi: 10.1177/1354067X14551292

Martínez, M., Tomicic, A., Pérez, C., Altimir, C., and Krause, M. (2014b). *Manifestaciones Verbales y no Verbales de la Regulación Mutua en Episodios Relevantes de Psicoterapia y su Relación Con el Proceso de Cambio [Verbal and Nonverbal Expressions of Mutual Regulation in Relevant Psychotherapeutic Episodes and Their Relation with the Change Process]. (Final Report of Project FONDECYT N° 1110361)*. Santiago: Universidad Diego Portales.

Martínez, C., Tomicic, A., and Pérez, C. (2014c). "Discourse in psychotherapeutic interaction: a discursive positioning model (DPM) of the mutual regulation process," in *Proceedings of the 45th International Annual Meeting of SPR*, Copenhagen.

Neimeyer, R. A., and Buchanan-Arvay, M. (2004). "Performing the self: therapeutic enactment and the narrative integration of traumatic loss," in *The Dialogical Self in Psychotherapy*, eds H. J. M. Hermans and G. Dimaggio (New York: Brunner-Routledge), 173–189. doi: 10.4324/9780203314616_chapter_11

Osatuke, K., Gray, M. A., Glick, M. J., Stiles, W. B., and Barkham, M. (2004). "Hearing voices: Methodological issues in measuring internal multiplicity," in *The Dialogical Self in Psychotherapy*, eds H. J. M. Hermans and G. Dimaggio (London: Brunner-Routledge), 237–254. doi: 10.4324/9780203314616_chapter_15

Raudenbush, S. W., Bryk, A. S., and Congdon, R. (2011). *HLM 7 for Windows (Version 7.1) [Computer software]*. Skokie, IL: Scientific Software International, Inc.

Safran, J. D., and Kraus, J. (2014). Alliance ruptures, impasses, and enactments: a relational perspective. *Psychotherapy* 51, 381–387. doi: 10.1037/a0036815

Safran, J. D., and Muran, J. C. (1996). The resolution of ruptures in the therapeutic alliance. *J. Consult. Clin. Psychol.* 64, 447–458. doi: 10.1037/0022-006X.64.3.447

Safran, J. D., and Muran, J. C. (2000). *Negotiating the Therapeutic Alliance*. New York: Guilford Press.

Safran, J. D., and Muran, J. C. (2006). Has the concept of the therapeutic alliance outlived its usefulness? *Psychotherapy* 43, 286–291. doi: 10.1037/0033-3204.43.3.286

Salgado, J., Cunha, C., and Bento, T. (2013). Positioning microanalysis: studying the self through the exploration of dialogical processes. *Integr. Psychol. Behav. Sci.* 47, 325–353. doi: 10.1007/s12124-013-9238-y

Salvatore, G., Carcione, A., and Dimaggio, G. (2012). The dependent self in narcissistic and dependent personality disorders. *Dial. Anal.* 6, 31–49.

Salvatore, S., Gelo, O., Gennaro, A., Manzo, S., and Al Radaideh, A. (2010). Looking at the psychotherapy process as an intersubjective dynamic of meaning-making. A case study with Discourse Flow Analysis. *J. Constr. Psychol.* 23, 195–230. doi: 10.1080/10720531003765981

Salvatore, S., and Gennaro, A. (2012). The inherent dialogicality of the clinical exchange Introduction to the special issue. *Int. J. Dial.* 6, 1–14.

Salvatore, S., and Tschacher, W. (2012). Time dependency of psychotherapeutic exchanges: the contribution of the theory of dynamic systems in analyzing process. *Front. Psychol.* 3:253. doi: 10.3389/fpsyg.2012.00253

Schore, A. N. (1996). The experience-dependent maturation of a regulatory system in the orbital prefrontal cortex and the origin of developmental psychopathology. *Dev. Psychopathol.* 8, 59–87. doi: 10.1017/S0954579400006970

SPSS Inc. (2008). *SPSS Statistics for Windows (Version 17.0) [Computer software]*. Chicago, IL: SPSS Inc.

Stiles, W. B. (1999). Signs and voices in psychotherapy. *Psychother. Res.* 9, 1–21. doi: 10.1080/10503309912331332561

Timulak, L. (2007). Identifying core categories of client-identified impact of helpful events in psychotherapy: a qualitative meta-analysis. *Psychother. Res.* 17, 305–314. doi: 10.1080/10503300600608116

Tomicic, A., Bauer, S., Martínez, C., Reinoso, A., and Guzmán, M. (2009). *La voz Como una Herramienta Psicoterapéutica: La Perspectiva de los Terapeutas* [The Voice as a Psychotherapeutic tool: The Perspective of Therapists]. *Rev. Argentina de Clín. Psicol.* 18, 197–207.

Tomicic, A., and Martínez, C. (2011). Voice and psychotherapy: introduction to a line of research on mutual regulation in psychotherapeutic dialog. *PRAXIS. Rev. Psicol.* 13, 109–139.

Tomicic, A., Martínez, C., Chacón, L., and Reinoso, A. (2011). *Patrones de Cualidad Vocal en Psicoterapia: Desarrollo y Estudio de Confiabilidad de un Sistema de Codificación* [Vocal Quality Patterns in psychotherapy: development and Reliability Study of a Coding System]. *Psykhé* 20, 77–93. doi: 10.4067/S0718-22282011000100208

Tomicic, A., Martínez, C., and Krause, M. (2014). The sound of change: a study of the psychotherapeutic process embodied in vocal expression. laura rice's ideas revisited. *Psychother. Res.* 25, 263–276. doi: 10.1080/10503307.2014.892647

Tronick, E. (1989). Emotions and emotional communications in infants. *Am. Psychol.* 44, 112–119. doi: 10.1037/0003-066X.44.2.112

Tronick, E., Bruschweiler-Stern, N., Harrison, A. M., Lyons-Ruth, K., Morgan, A. C., and Nahum, J. P. (1998). Dyadically expanded states of consciousness and the process of therapeutic change. *Infant Ment. Health J.* 19, 290–299. doi: 10.1002/(SICI)1097-0355(199823)19:3<290::AID-IMHJ4>3.0.CO;2-Q

Tronick, E., and Cohn, J. (1989). Infant-mother face-to-face interaction: age and gender differences in coordination and the occurrence of miscoordination. *Child Dev.* 60, 85–92. doi: 10.2307/1131074

von Bergen, A., and de la Parra, G. (2002). OQ-45.2, Cuestionario para evaluación de resultados y evolución en psicoterapia: adaptación, validación e indicaciones para su aplicación e interpretación [OQ-45.2, Questionnaire for assessing outcomes and progress in psychotherapy: adaptation, validation and indications for its application and interpretation]. *Rev. Terapia Psicológica* 20, 161–176.

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in
PSYCHOLOGY

REVIEW ARTICLE
published: 20 May 2014
doi: 10.3389/fpsyg.2014.00472

The mind–body relationship in psychotherapy: grounded cognition as an explanatory framework

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As a discipline, psychology is defined by its location in the ambiguous space between mind and body, but theories underpinning *the application of psychology in psychotherapy* are largely silent on this fundamental metaphysical issue. This is a remarkable state of affairs, given that psychotherapy is typically a real-time meeting between two embodied agents, with the goal of facilitating behavior change in one party. The overarching aim of this paper is to problematize the mind–body relationship in psychotherapy in the service of encouraging advances in theory and practice. The paper briefly explores various psychotherapeutic approaches to help explicate relationships between mind and body from these perspectives. Themes arising from this analysis include a tendency toward dualism (separation of mind and body from the conceptualization of human functioning), exclusivism (elimination of either mind or body from the conceptualization of human functioning), or mind–body monism (conceptualization of mind and body as a single, holistic system). We conclude that the literature, as a whole, does not demonstrate consensus, regarding the relationship between mind and body in psychotherapy. We then introduce a contemporary, holistic, psychological conceptualization of the relationship between mind and body, and argue for its potential utility as an organizing framework for psychotherapeutic theory and practice. The holistic approach we explore, "grounded cognition," arises from a long philosophical tradition, is influential in current cognitive science, and presents a coherent empirically testable framework integrating subjective and objective perspectives. Finally, we demonstrate how this "grounded cognition" perspective might lead to advances in the theory and practice of psychotherapy.

Keywords: embodiment, embodied cognition, psychosocial treatments, psychotherapy, naturalism, phenomenology, mind–body, grounded cognition

INTRODUCTION

As a discipline, psychological science is "mounted above the philosophical gap between mind and body" (Tschacher and Haken, 2007, p. 1). The inherent challenges of this position are clearly seen in psychology's primary application, psychotherapy (the use of psychological science to improve mental health and wellbeing). The theoretical foundation of psychopathology (the study of the nature and treatment of mental disorders) has been described as akin to that of biology's before Darwin (Frances and Egger, 1999), and arguably, the elephant in the room is the lack of consensus, both implicit, and explicit, about the relationship between mind and body (Kendler, 2008). Whether expressed as human versus natural sciences, hermeneutic versus positivist methods, or understanding versus explanation, Cartesian or substance dualism (mind and body are two types of substance) is yet to be resolved in psychopathology and psychotherapy. The field is consequently characterized by polarized schools of thought, identifying it as an immature science in Kuhnian terms (Kuhn, 1962).

In the absence of a consensus position on the mind–body relationship, psychotherapists juggle tangible and intangible features of their clients without integrative models (Murray, 2011). It is noteworthy that international guidelines for psychology training programs rarely require a competency around this ontological issue, suggesting that the discipline may have relegated it to the "too hard" basket. Contemporary research across multiple disciplines, however, suggests that the case should be re-opened.

Recent research in philosophy (Clark, 1997; Lakoff and Johnson, 1999), cognitive science (Brooks, 1991; Chemero, 2009) and psychology itself (Barsalou, 1999; Glenberg and Robertson, 1999) advocates a fundamental reappraisal of the relationship between mind and body. The "embodied cognition" research program has many strands, but all commence with a rejection of the dualistic separation of body and mind (Shapiro, 2011). Here, we propose grounded cognition as an embodied, psychological framework which provides a holistic conceptualization of body and mind. It is our position that articulating the relationship between body and mind from a psychological perspective will provide a consensus position and an organizing framework for the mind–body relationship for psychotherapy research and practice. We contend that this will encourage practitioners to reflect on their assumptions about cognitions and how they conceptualize body and mind in treatment, leading to a better understanding of the tensions between psychotherapy theory and practice and the identification of gaps in existing therapies and consequently an expansion of the range of therapies offered to the patient.

The paper is structured in four sections. First, we briefly consider a range of approaches to psychotherapy through the lens of their apparent assumptions about mind–body. Themes arising from this analysis include a tendency toward an uncritical dualism (separation of mind and body from the conceptualization of human functioning), exclusivism (elimination of either mind or body from the conceptualization of human functioning), or mind–body monism (conceptualization of mind and body as a single, holistic system) and we conclude that the psychotherapy literature, as a whole, does not demonstrate consensus, regarding the relationship between mind and body. We propose that an organizing framework for the mind–body relationship, underpinned by a holistic conceptualization of the relationship, would benefit psychotherapy research and practice. Second, philosophical accounts which portray a holistic mind–body relationship from phenomenological and objective perspectives are outlined. Third, we propose that these perspectives are integrated, psychologically, by "grounded cognition," constituting a comprehensively articulated, empirically informed, organizing framework for conceptualization of the mind–body relationship in psychotherapy. In the final section we consider how the application of psychological science in psychotherapy might advance through a thoroughgoing consideration of "grounded cognition."

MIND–BODY ASSUMPTIONS UNDERLYING CURRENT PSYCHOTHERAPIES

There is no agreed taxonomy of psychological therapies (e.g., Kahl et al., 2012; Tschacher et al., 2014), but to achieve an adequate coverage of existing approaches for the present purposes, we categorise psychotherapies into five fuzzy-bordered groups: psychoanalysis, behavioral therapies, cognitive therapies, mindfulness-based therapies, and body psychotherapies. Each of these has many branches and extensive literatures – thus, in this brief review we aim only to explore different ideas regarding the relationship between mind and body from within each approach, and across approaches, rather than attempting to assign particular conceptualizations of the mind–body relationship to particular approaches.

PSYCHOANALYSIS

Although psychoanalytic theory and practice have fallen out of favor in contemporary psychological science, aspects of Freud's thinking can still be discerned in current psychotherapy (Dowd, 2004). An important aspect of psychoanalytic theory is the "cognitive unconscious," or the "unconscious mind." In opposition to the popular enlightenment view at the time, Freud argued that behavior is driven by unconscious motivations and drives, rather than rational choice (Luborsky et al., 2008; Wolitzky, 2011). As discussed by Luborsky et al. (2008), central therapeutic strategies of psychoanalysis include free association (expressing any thoughts which come to mind during therapy), therapeutic listening and responding (examining the content and emotion of thought), and interpretation (drawing inferences about unconscious underpinnings of conscious experience).

However, the body also figures strongly in psychoanalytic theory. For Freud, structures of the mind (e.g., id, ego, superego) arise out of tensions between the organism's bodily drives and societal structures (Muller and Tillman, 2007). This is reflected in the psychoanalytic conception of psychosomatic illness, which was the idea that emotions and unconscious desires caused bodily symptoms; for example Gregor Groddeck, a psychoanalyst who developed Freud's ideas about psychosomatic illness proposed that a tumorous abdominal growth could result from a warded-off unconscious wish to be pregnant. Furthermore it has been suggested that the "ego," in psychoanalysis, commences as an embodied entity, and emphasizes the continuity between animals and humans, suggesting a monist, or holistic mind–body conceptualization (Muller and Tillman, 2007).

BEHAVIOR THERAPY

Traditional behavior therapy arose in an American setting in the early 1950s and saw a shift from the psychoanalytical ideas of studying the mind to the pragmatic, evidence-based study of behavior (Dowd, 2004). This shift was triggered by J. B. Watson's criticism of subjectivity and mentalism as the subject matter of psychology and his advocacy of the objective study of behavior. This was followed by the advent of "modern learning theory," which referred to the principles of classical and operant conditioning. These early ideas underlying traditional behavior therapy were exclusivist, rejecting the notion of mind and cognition, on the grounds that they are unobservable entities and therefore unfit for scientific study (Wilson, 2008; Zinbarg and Griffith, 2008).

However, later theories stemming from behaviorism developed a more complex account of the mind–body relationship. For example, Bandura (1977) spoke of a reciprocal determination between behavior and the environment, stating that "it is largely through their actions that people produce the environmental conditions that affect their behavior in a reciprocal fashion" (p. 345). Bandura also seemed to encourage conceptualization of the mind as a part of the same system as behavior and environment, for example, ". . .experiences generated by behavior also partly determine what individuals think, expect, and can do, which in turn affects their subsequent behavior" (p. 345).

This holistic conceptualization of the mind–body relationship is also apparent in popular behavior therapies for children with autism spectrum disorder, such as music therapy, Floortime, rhythm therapy, and reciprocal imitation training which are broadly underpinned by behavioral and functional developmental approaches (Greenspan and Wieder, 1999; Ingersoll and Schreibman, 2006; Overy, 2008; Vismara and Rogers, 2010; Srinivasan and Bhat, 2013). For example, reciprocal imitation training teaches children the spontaneous social use of imitation, which as targeted at attention, language and communication cognitions (Ingersoll and Schreibman, 2006) and Floortime utilizes child-led playful interactions, experiential problem-solving interactions and motor, sensory and spatial play, which is targeted at language and other cognitive skills (Greenspan and Weider, 1997).

COGNITIVE THERAPY

With the advent of the cognitive revolution, pure behavioral therapies begun to fade out in favor of cognitive therapies, which

followed the prominent model of human functioning at the time; computational theory (Hayes et al., 1999). Computational theory conceptualized the body as an "input-output device," or the "hardware," and the mind as the "central processor," the "software," or the "controller" (Shapiro, 2007). Due to their concurrent rise, articulation of the relationship between mind and body in cognitive therapy has been influenced by this computational perspective (Dowd, 2004).

Cognitive therapies are defined by their elevation of the cognitive system in the adjustment of information processing and initiation of positive change (Beck and Weishaar, 2008). This perspective is fundamental to a family of theories underpinning cognitive therapy, including those of Ellis (1962) and Beck (1967). Beck's (1967) cognitive theory remains one of the most influential to this day, in particular his major contribution to cognitive therapy, the cognitive model (Triad) of depression. This model suggests that depression is underpinned by automatic, negative thoughts about the self, others and the world. Beck contends that these negative cognitions also activate negative motivational, behavioral, emotional, and physical symptoms (Beck and Weishaar, 2008). Thus, for Beck and his contemporaries, it is implied that the mind should be the primary target of psychotherapy.

One of Ellis' major contributions to cognitive therapy was the A-B-C method used in his rational emotive behavior therapy (REBT). The A-B-C method challenged the assumption that when a consequence (C) follows and activating event (A), A causes C. Ellis posited a cognitive construct, beliefs (B), which he argued was the greatest determinate of (C). Thus, the idea was that (C) could be modified by (B), even if (A) remains stable (Dowd, 2004; Ellis, 2008). Ellis' REBT explicitly considered the importance of content of the "mind" (i.e., thinking, feeling, wanting etc.), and of operations of the "body" (i.e., behavior). However, the relationship between mind and body was conceptualized in terms of cognitive modification to change behavior or behavior change to modify thought (Ellis, 2008). Thus, despite acknowledgment of both mind and body, REBT, akin to Beck's cognitive therapy, implies a dualist conception of their relationship.

MINDFULNESS-BASED PSYCHOTHERAPIES

Recently, there has been an influx of so-called "third wave" psychotherapies which have their roots in learning theory and are held together by their subordination of content-oriented cognitive interventions (Kahl et al., 2012). One of the key features of *some* of these psychotherapies (e.g., Acceptance and Commitment Therapy, Mindfulness-Based Cognitive Therapy etc.) is their focus on "mindfulness." One of the features of mindfulness as applied in psychological therapies is to develop an awareness of the present experience by self-regulating attention to momentary sensations, thoughts, and feelings (Keng et al., 2011). Thus, in contrast to standard cognitive and behavioral therapies, one of the aims of mindfulness-based psychotherapies is to increase awareness of the body.

Awareness is contrasted with "thinking" during mindfulness exercises such as breathing meditation (Michalak et al., 2012). Awareness is not about cognition but more about feeling; and the body is seen as the reference point for awareness. Thus changes in cognitions (e.g., restricting rumination) following mindfulness practices are bought about by becoming more aware of the body, without referring to cognitive dominion (i.e., conscious thought) to bring about this awareness (Burg and Michalak, 2011). It is difficult to articulate the relationship between mind and body implied by mindfulness-based psychotherapies due to two reasons. First, awareness is not conceptualized as a cognitive feature, but may still be a feature of the "mind." Second, the body is not conceptualized as a physical agent of change like behavior is assumed to influence cognition in cognitive behavior therapy (CBT); rather it is awareness of the body which is the agent of change in mindfulness-based therapies. These questions illustrate some of the issues which arise when dualistic thinking is reflected upon carefully.

BODY PSYCHOTHERAPY

Body psychotherapy (BP) refers to a variety of schools (e.g., dance/movement therapy, analytical body psychotherapy, concentrative movement therapy etc.) which share the aim of enhancing self-awareness, modifying behavior, and facilitating insight-oriented psychological problem solving via a mode of action concerning perceptive/self-awareness, affective-cathartic, interactive, and/or movement oriented therapy (Röhricht, 2009). Although, there have been randomized controlled trials (RCTs) conducted for some schools of body psychotherapies, they are not empirically supported to the same extent that cognitive and behavioral therapies have been (Röhricht, 2009). In practice, BP primarily works on releasing and re-shaping somatic memories in order to release associated psychological constraints (Totton, 2003). The theoretical foundation for BP has been explained as the way "core beliefs are embodied, and that until we begin to experience the pain held in them directly through our bodies they will continue to run our lives" (Staunton, 2002, p. 4).

The practice of BP implies a very close relationship between body and mind, to the point that they are seemingly undifferentiated during therapy. BP has been described as being fundamentally underpinned by an explicit theory of mind–body functioning which assumes a functional unity between body and mind in which there is no separation or hierarchical relationship between the two (www.eabp.org).

SUMMARY

This brief review exposes a lack of consensus, both implicit and explicit, regarding the mind–body relationship across psychotherapeutic approaches. Themes arising from this analysis include a tendency toward dualism (separation of mind and body from the conceptualization of human functioning), exclusivism (elimination of either mind or body from the conceptualization of human functioning), or mind–body monism (conceptualization of mind and body as a single, holistic system). It is our position that psychotherapeutic research and practice would benefit from an organizing framework for the mind–body relationship, which could be applied across all psychotherapies. Recent research in philosophy (Clark, 1997; Lakoff and Johnson, 1999), cognitive science (Brooks, 1991;

Chemero, 2009) and psychology itself (Barsalou, 1999; Glenberg and Robertson, 1999) suggests that this framework should be underpinned by a holistic conceptualization of the mind–body relationship.

Embodied cognition offers a psychological framework underpinned by a holistic conceptualisation of the mind–body relationship. Some of the abovementioned psychotherapies which have *implied* a holistic mind–body perspective have already started to draw on embodied cognition and related ideas. For example, Totton (2009) has recently highlighted the utility of drawing on embodiment from a social perspective to enhance the practice of body psychotherapy, while Michalak et al. (2012) has described how embodied cognition could describe some of the processes involved in mindfulness. Before describing the psychological framework of embodied cognition, it is important to briefly examine its philosophical underpinnings which form the foundation for its conceptualisation of a holistic mind–body relationship, from both phenomenological and objective perspectives.

HOLISTIC MIND–BODY PHILOSOPHIES

MERLEAU-PONTY'S LIVED-BODY

Edmund Husserl developed the philosophical approach of phenomenology as a reaction to his concern that the assumptions of naturalistic, Western science about the nature of the mind, body, and world had caused it to miss fundamental questions about human nature (Marcum, 2004). He argued that primary consideration should be given to the subject's experience in the world, before studying the mind, body, and world objectively (Marcum, 2004; Gallagher and Zahavi, 2007). Husserl's argument was progressed by Merleau-Ponty, who proposed that this would both uncover the subjective element of knowledge, which was being overlooked by naturalistic sciences, and provide a stronger framework for its enquiries (Gallagher and Zahavi, 2007). Thus, phenomenology does not provide a mechanistic account of mind in the vein of naturalism, or psychological and biological accounts because it focuses on giving a proper description of humans' experience in life, rather than attempting to forge an objective account of mind (Gallagher and Zahavi, 2007; Marshall, 2008).

Merleau-Ponty's phenomenology argues for the prioritization of the subjective, lived-body in cognition and more specifically that cognitions cannot be understood without reference to the body which engages with the world (Merleau-Ponty, 1962, 1965; Marshall, 2008). Merleau-Ponty provides a comprehensive theory of the "lived-body," or the "subject-body," contrasting it to the "thing-body," or the "object-body" (Merleau-Ponty, 1962, 1965; Marshall, 2008). The subject-body can be considered the body experienced from a first-person perspective which acts on the world, whereas the object-body can be considered the body as an object of the world experienced from a third-person perspective. Merleau-Ponty emphasizes the subject-body in cognition, implying that humans fundamentally are, and thus should be studied as embodied beings who form cognitions via interaction in the world with their bodies, rather than cognition as an activity of the "mind" which utilizes the object-body (Merleau-Ponty, 1962, 1965; Borrett et al., 2000; Matthews, 2004).

DEWEY'S PRINCIPLE OF CONTINUITY

In contrast to Merleau-Ponty's phenomenological approach, an alternative holistic account of the mind–body relationship starts from an objective position. American pragmatism offers an objective, philosophical account of a holistic mind and body in the form of naturalism (Johnson, 2006). As Horst (2002) explicates, there have been various definitions and strands of naturalism. The account we refer to in this section aligns with the Darwinian paradigm and, more specifically with physicalism, emergence, and supervenience (Harbecke, 2013; Montero, 2013; McLaughlin and Bennett, 2014).

This form of naturalism is committed to an account in which all things in the world, including body and mind are natural or *naturally emergent* (Horst, 2002; Aikin, 2006). In turn, it posits that all explanation should be causal and reducible to natural explanations and is consequently committed to the study of the person as an *object* and the natural evolution of all human functions (Aikin, 2006; Johnson, 2006). One account of naturalism, from this emergent, supervenient perspective is Dewey's "principle of continuity" (Dewey, 1981, 1991).

The principle of continuity posits that there is no break in experience between the processes of perceiving, feeling, moving, and thinking; instead they are levels of organic functioning from which higher function emerges. It describes three levels of organization: the "physical" level of inanimate material processes; the "psycho-physical" level of living things which have needs, interests, and satisfactions; and the "mental" level of organisms which can perform higher level cognitions. The principle explains the progression from the physical level to the level of the mind without introducing new ontological entities, structures, or forces. Dewey argues that new organization is the reason that organisms with minds can do things which psycho-physical entities cannot do, and why psycho-physical entities can do things which physical entities cannot do. Thus, according to Dewey, what we refer to as "mind" is a complex *new organization* of what we refer to as "body," but they are in essence the same entity. According to the principle of continuity, what is termed "mind" and "body" are simply ways to identify aspects of the organism–environment interaction which have arisen from an organic process (Dewey, 1981, 1991; Johnson, 2006, 2007).

PHENOMENOLOGY AND NATURALISM AS COMPLEMENTARY APPROACHES

Phenomenology is committed to describing subjective experience, which is where meaning putatively arises for humans, while naturalism as characterized here provides an objective explanation of how meaning arises ontogenetically, organically and biologically, independent of the personal experience of the individual (Gallagher and Zahavi, 2007; Marshall, 2008). As Aikin (2006, p. 326) puts it "Lovers may love, and pains may pain, but the naturalistic perspective can attend only to the lovers, not their love; to the pains, but not their feelings of pain." Similarly, the phenomenological perspective can attend only to the love, not the lovers and to the feelings of pain rather than the pains. Thus, phenomenologists can provide to naturalists, psychologists and neuroscientists a more precise model of the phenomenon which

they attempt to explain than they would if they were to start only with an "objective" scientific theory of cognition (Gallagher and Zahavi, 2007). Thus, phenomenology and naturalism are contrasting, but complementary approaches (Aikin, 2006; Zahavi, 2010).

Accordingly, the different directions from which Merleau-Ponty's phenomenology and Dewey's principle of continuity approach the question of the relationship between mind and body are complementary, providing ultimately a more comprehensive, pluralistic understanding of the holistic mind–body relationship. Merleau-Ponty's phenomenological account can inform Dewey's objective account of how a person experiences the holistic mind–body described in his theory.

Thus, a philosophical integration of these perspectives may be possible (Zahavi, 2010), but our aim here is to provide a framework for psychotherapeutic research and practice. Therefore, it is necessary to provide a psychological account which integrates subjective and objective perspectives of a holistic mind–body relationship. We propose that grounded cognition provides such a framework.

GROUNDED COGNITION AS A PSYCHOLOGICAL FRAMEWORK REFLECTING A HOLISTIC MIND–BODY RELATIONSHIP

Embodied cognition is a research program consisting of a number of accounts and topics, held together by the underlying assumption that the body functions as a *constituent* of the mind rather than a perceiver and actor serving the mind, thus being *directly,* and *subjectively* involved in cognition (Borrett et al., 2000; Shapiro, 2007). Different accounts of embodied cognition provide various models of this underlying assumption, so it is useful to focus on one to explore the holistic conceptualization of body and mind and how it aligns with the principles of Merleau-Ponty's phenomenology and Dewey's principle of continuity.

"Grounded cognition" reflects the underlying embodied cognition assumption by proposing that cognition is derived from, and dependent on, bodily interactions with the world which are represented in the brain (Barsalou, 2008). Grounded cognition has been comprehensively articulated and critiqued in the literature (Barsalou, 1999, 2008), has a strong empirical foundation (e.g., Schubert, 2005; Chandler and Schwarz, 2009; Jostmann et al., 2009; Natanzon and Ferguson, 2012 etc.) and most importantly, clearly explicates the holistic relationship of body and mind, aligning with both Merleau-Ponty's phenomenology and Dewey's principle of continuity as considered next.

Grounded cognition is underpinned by two major assumptions, namely that cognition is dependent on the body's interaction with the world and that these interactions are represented in the brain (Barsalou, 2008). Grounded cognition's first assumption is illustrated neatly by Shapiro (2011) in considering the concept of a morel mushroom for Sally, a mycologist, Charles, a provencal chef, and Lucy, a young child. Sally conceptualizes a morel as an epigenous ascocarp, Charles conceptualizes a morel as a delicacy to be sautéed with butter, and Lucy conceptualizes a morel as the yucky thing she has to eat before being allowed dessert. Thus, each according to their bodily experiences with morels forms different conceptualizations of it. However, these concepts are not determinate: for example, if Lucy grows up to become a mycologist, her concept of a morel would be more similar to Sally's. Furthermore, it is important to note that there is nothing stopping Sally, Charles, and Lucy from having the same concept for a morel, it is simply their differing bodily interactions with the morel which has determined their conceptualizations. Finally, it can be assumed that they have the same visual conceptualization of a morel; they all know one when they see it. However, if Lucy were to have been born blind, she would never be able to obtain the same concept of a morel as Sally and Charles. Thus, grounded cognition aligns with Merleau-Ponty's phenomenology by emphasizing the importance of subjective body-in-the-world experience for cognition (Johnson, 2006).

The second major assumption of grounded cognition is that the body's relationship with the world is represented in the brain (Barsalou, 2008). Theories within grounded cognition differ on how these bodily interactions are represented in the brain, with some theories positing "image schemas" of bodily interactions in the world which are proposed to underpin abstract conceptual knowledge (Lakoff and Johnson, 1999). However, most grounded cognition theories propose "simulations," which are neural reconstructions of experience using representations contained in modal systems of the brain (Glenberg, 1997; e.g., the sensorimotor system; Barsalou, 1999; Gallese and Lakoff, 2005). Thus grounded cognition is also consistent with Dewey's principle of continuity in that from an objective, neuroscientific perspective, cognitions are emergent from, and inextricably intertwined with the body.

In sum, grounded cognition implies that cognition is emergent from and inextricably tied to the subjective, lived, experience of the body-in-the-world. Thus, "mind" and "body" only function as labels attached to properties of human functioning which we *perceive* as originating either mentally or physically. Conceiving of the relationship between body and mind from this holistic, psychological perspective can be expected to have a number of important implications for psychotherapy theory and practice.

IMPLICATIONS FOR PSYCHOTHERAPY THEORY AND PRACTICE

First, a holistic conceptualization of the mind–body relationship leads to a better understanding of the tensions between psychotherapy theory and practice. When the mind–body relationship is conceptualized from a dualist or exclusivist perspective, a tension is created between the phenomenological needs of the patient who is present mind *and* body and the emphasis on either mind *or* body according to the theoretical assumptions of the psychotherapy practiced by the therapist. One example of this is the de-emphasis of the body during the practice of psychotherapies whose underlying theory disembodies the mind. During such therapies (e.g., cognitive therapy), touch is purposefully excluded from therapeutic practice since the mind is conceptualized as the agent of change, even though therapeutic practice could possibly be enhanced by touch (Feltham, 2008).

Second, a psychologically articulated, holistic framework for the mind–body relationship encourages *theoretical* reflection about this relationship by challenging dualist and exclusivist assumptions inherent in some psychotherapies. In turn, this helps to clarify some of the points of difference between the psychotherapies described above. Numerous psychotherapies discussed in "Mind–Body Assumptions Underlying Current Psychotherapies," have similar theoretical background and similar therapeutic practices. An example of this is traditional behavioral therapy and body psychotherapy. Both emphasize the body and conceptualize it as the agent of change and as a consequence, both prioritize the body in therapy. One of the primary differences between the two can be ascertained by reflecting on the mind–body relationship. Traditional behavior therapy is very much exclusivist, dismissing the mind and cognition and emphasizing the body and behavior, both methodologically and theoretically. Contrastingly, body psychotherapy recognizes cognitions whilst treating them via the body, thus implying a holistic conceptualization of mind and body.

Third, a holistic conceptualization of the mind–body relationship has the potential to further de-stigmatize mental illness (Thomas, 2013; Ungar and Knaak, 2013a,b). Ungar and Knaak (2013a) suggest that dismissive and blaming attitudes toward mental health issues can be attributed to the absence of an organic explanation for most mental health issues. Thomas (2013) suggests that promoting mental illness to non-psychiatric health professionals as an interaction between cognitive, behavioral, emotional, biological, and environmental factors would reduce dualistic thinking around mental health issues and help with de-stigmatization in these settings. The psychologically articulated, holistic conceptualization of the mind–body relationship presented here elaborates on Thomas' idea by conceptualizing cognitive, behavioral, emotional, biological, and environmental factors as part of the same functional system, implying that "organic" causes are inseparable from "mental" causes. Thus, we propose that the holistic conceptualization of the mind–body relationship presented here will further help with de-stigmatization of mental illness in non-psychiatric settings.

Fourth, the clearly articulated, explicit position of a holistic mind–body portrayed by grounded cognition encourages a more reflective approach to the issue *in practice*. Theories underlying most current psychotherapies do not explicitly state their position regarding the relationship between mind and body. Consequently, practitioners unreflectively adopt the assumptions inherent in the psychotherapies they utilize. The clear articulation of a holistic mind–body from both phenomenological and objective perspectives may assist practitioners to reflect on this relationship. For example, from a grounded cognition perspective "mind" and "body" are only labels attached to properties of human functioning which we *perceive* as originating either mentally or physically. The issue for psychotherapy practice is that in using these labels with patients, they automatically divide psychopathologies into arbitrary categories and thus portray dualist or exclusivist agendas. This then restricts the patient's conceptualization of what the psychopathology is and how to manage it. A grounded cognition perspective would encourage a broader language around psychopathologies as disorders of the "system," whether the symptoms are perceived as mental or physical. This will encourage the patient to focus on the holistic nature of their symptoms during treatment, as opposed to the idea that some treatments are behavioral/bodily and others are mind/cognitive. This is but one example of changes which may come of reflecting on the mind–body relationship in practice.

Finally, a new perspective on the mind–body relationship will guide the identification of gaps in existing therapies and consequently promote an expansion of the range of therapies offered to the patient. For example, grounded cognition implies that one way to change cognitions is through the subjective, lived, bodily experience of the individual. Encouraging practitioners to reflect on a holistic mind–body approach may result in a wider range of therapies they can offer their patients stemming from this idea. Further development of these ideas may also result in the creation of new and innovative therapeutic methods to augment those already in existence.

CONCLUSION

Psychological science sits awkwardly between mind and body, and its application in psychotherapy inherits this awkwardness in a lack of clarity about how therapists should conceptualize their patients. By reviewing how mind and body are traditionally understood in major psychotherapies, we have attempted to underscore some of the tensions in this area. By introducing and outlining grounded cognition as a holistic psychological approach consistent with both radically subjectivist (Merleau-Ponty) and objectivist (Dewey) philosophical approaches, we hope to have proposed a new way forward for theorists and practitioners of psychotherapy. This new way forward throws light on the relationship between existing psychotherapies, the relationship between theory and practice, and highlights opportunities for new approaches to psychotherapy.

REFERENCES

Aikin, S. F. (2006). Pragmatism, naturalism, and phenomenology. *Hum. Stud.* 29, 317–340. doi: 10.1007/s10746-006-9026-5

Bandura, A. (1977). *Social Learning Theory*. Englewood Cliffs, NJ: Prentice-Hall.

Barsalou, L. W. (1999). Perceptual symbol systems. *Behav. Brain Sci.* 22, 577–609.

Barsalou, L. W. (2008). Grounded cognition. *Annu. Rev. Psychol.* 59, 617–645. doi: 10.1146/annurev.psych.59.103006.093639

Beck, A. T. (1967). *Depression: Clinical, Experimental, and Theoretical Aspects*. New York, NY: Harper & Rowe.

Beck, A. T., and Weishaar, M. E. (2008). "Cognitive therapy," in *Current Psychotherapies*, eds R. J. Corsini and D. Wedding (Belmont, CA: Thomson), 263–292.

Borrett, D., Kelly, S., and Kwan, H. (2000). Bridging embodied cognition and brain function: the role of phenomenology. *Philos. Psychol.* 13, 261–266. doi: 10.1080/09515080050075744

Brooks, R. A. (1991). Intelligence without representation. *Artif. Intell.* 47, 139–159. doi: 10.1016/0004-3702(91)90053-M

Burg, J. M., and Michalak, J. (2011). The healthy quality of mindful breathing: associations with rumination and depression. *Cognit. Ther. Res.* 35, 179–185. doi: 10.1007/s10608-010-9343-x

Chandler, J., and Schwarz, N. (2009). How extending your middle finger affects your perception of others: Learned movements influence concept accessibility. *J. Exp. Soc. Psychol.* 45, 123–128. doi: 10.1016/j.jesp.2008.06.012

Chemero, A. (2009). *Radical Embodied Cognitive Science.* Cambridge, MA: MIT Press.

Clark, A. (1997). *Being There: Putting Brain, Body, and World Together Again.* Cambridge, MA: MIT Press.

Dewey, J. (1981). *John Dewey, The Later Works, 1925–1953*, Vol. 1, *Experience and Nature (1925)*. Carbondale, IL: Southern Illinois University Press.

Dewey, J. (1991). *John Dewey, The Later Works, 1925-1953, Volume. 12, Logic: The Theory of Inquiry (1938)*. Carbondale: Southern Illinois University Press.

Dowd, E. T. (2004). Cognition and the cognitive revolution in psychotherapy: promises and advances. *J. Clin. Psychol.* 60, 415–428. doi: 10.1002/jclp.10253

Ellis, A. (1962). *Reason and Emotion in Psychotherapy.* New York: Lyle Stuart.

Ellis, A. (2008). "Rational emotive behavior therapy," in *Current Psychotherapies*, eds R. J. Corsini and D. Wedding (Belmont, CA: Thomson), 187–221.

Feltham, C. (2008). Here comes everybody: multicultural perspectives on the body in counselling, psychotherapy and mysticism. *Couns. Psychol. Q.* 21, 133–142. doi: 10.1080/09515070802030157

Frances, A. J., and Egger, H. L. (1999). Whither psychiatric diagnosis. *Aust. N. Z. J. Psychiatry* 33, 161–165. doi: 10.1046/j.1440-1614.1999.00534.x

Gallagher, S., and Zahavi, D. (2007). *The Phenomenological Mind: An Introduction To Philosophy of Mind and Cognitive Science.* Oxon: Routledge.

Gallese, V., and Lakoff, G. (2005). The brain's concepts: the role of the sensory-motor system in conceptual knowledge. *Cogn. Neuropsychol.* 22, 455–479. doi: 10.1080/02643290442000310

Glenberg, A. M. (1997). What memory is for. *Behav. Brain Sci.* 20, 1–19.

Glenberg, A. M., and Robertson, D. A. (1999). Indexical understanding of instructions. *Discourse Process.* 28, 1–26. doi: 10.1080/01638539909545067

Greenspan, S. I., and Weider, S. (1997). Developmental patterns and outcomes in infants and children with disorders in relating and communicating: a chart review of 200 cases of children with autistic spectrum diagnoses. *J. Dev. Learn. Disord.* 1, 87–141.

Greenspan, S. I., and Wieder, S. (1999). A functional developmental approach to autism spectrum disorders. *J. Assoc. Pers. Sev. Handicaps* 24, 147–161. doi: 10.2511/rpsd.24.3.147

Harbecke, J. (2013). The role of supervenience and constitution in neuroscientific research. *Synthese* 191, 725–743. doi: 10.1007/s11229-013-0308-y

Hayes, S. C., Strosahl, K. D., and Wilson, K. G. (1999). *Acceptance and Commitment Therapy: An Experiential Approach to Behavior Change.* New York: Guilford.

Horst, S. (2002). Evolutionary explanation and consciousness. *J. Psychol. Theol.* 30, 41–50.

Ingersoll, B., and Schreibman, L. (2006). Teaching reciprocal imitation skills to young children with autism using a naturalistic behavioral approach: effects on language, pretend play, and joint attention. *J. Autism. Dev. Disord.* 36, 487–505. doi: 10.1007/s10803-006-0089-y

Johnson, M. (2006). Mind incarnate: From Dewey to Damasio. *Daedalus* 135, 46–54. doi: 10.1162/daed.2006.135.3.46

Johnson, M. (2007). "The origin of meaning in organism-environment coupling: a non-representational view of mind," in *The Meaning of The Body: Aesthetics of Human Understanding* (Chicago, IL: Chicago University Press), 113–134. doi: 10.7208/chicago/9780226026992.001.0001

Jostmann, N. B., Lakens, D., and Schubert, T. W. (2009). Weight as an embodiment of importance. *Psychol. Sci.* 20, 1169–1174. doi: 10.1111/j.1467-9280.2009.02426.x

Kahl, K. G., Winter, L., and Schweiger, U. (2012). The third wave of cognitive behavioural therapies: what is new and what is effective? *Curr. Opin. Psychiatry* 25, 522–528. doi: 10.1097/YCO.0b013e328358e531

Kendler, K. (2008). *Philosophical Issues in Psychiatry: Explanation, Phenomenology, and Nosology.* Baltimore: Johns Hopkins University Press.

Keng, S. L., Smoski, M. J., and Robins, C. J. (2011). Effects of mindfulness on psychological health: a review of empirical studies. *Clin. Psychol. Rev.* 31, 1041–1056. doi: 10.1016/j.cpr.2011.04.006

Kuhn, T. (1962). *The Structure of Scientific Revolutions.* Chicago: University of Chicago Press.

Lakoff, G., and Johnson, M. (1999). *Philosophy in the Flesh: The Embodied Mind and Its Challenge to Western Thought.* New York, NY: Basic Books.

Luborsky, E. B., O'Reilly-Landry, M., and Arlow, J. A. (2008). "Psychoanalysis," in *Current Psychotherapies*, eds R. J. Corsini and D. Wedding (Belmont, CA: Thomson), 15–60.

Marcum, J. A. (2004). Biomechanical and phenomenological models of the body, the meaning of illness and quality of care. *Med. Health Care Philos.* 7, 311–320. doi: 10.1007/s11019-004-9033-0

Marshall, G. J. (2008). *A Guide to Merleau-Ponty's Phenomenology of Perception.* Milwaukee, WI: Macquarie University Press.

Matthews, E. H. (2004). Merleau-Ponty's body-subject and psychiatry. *Int. Rev. Psychiatry* 16, 190–198. doi: 10.1080/09540260400003867

McLaughlin, B., and Bennett, K. (2014). "Supervenience," in *The Stanford Encyclopedia of Philosophy,* ed. N. Zalta (Stanford, CA: The Metaphysics Research Lab).

Merleau-Ponty, M. (1962). *Phenomenology of Perception.* English translation by C. Smith with revisions by F. Williams and D. Gurriere. London: Routledge.

Merleau-Ponty, M. (1965). *The Structure of Behaviour.* English translation by A. L. Fisher. London: Methuen.

Michalak, J., Burg, J., and Heidenreich, T. (2012). Don't forget your body: mindfulness, embodiment, and the treatment of depression. *Mindfulness* 3, 190–199. doi: 10.1007/s12671-012-0107-4

Montero, B. G. (2013). Must physicalism imply the supervenience of the mental on the physical? *J. Philos.* 110, 93–110.

Muller, J. P., and Tillman, J. G. (2007). *The Embodied Subject: Minding the Body in Psychoanalysis.* Plymouth: Rowman & Littlefield Publishers, Inc.

Murray, G. (2011). "Scientific, historical and social context of DSM," in *A Critical Introduction to DSM*, ed. G. Murray (New York, NY: Nova Science Publishers), 19–45.

Natanzon, M., and Ferguson, M. J. (2012). Goal pursuit is grounded: the link between forward movement and achievement. *J. Exp. Soc. Psychol.* 48, 379–382. doi: 10.1016/j.jesp.2011.06.021

Overy, K. (2008). "Classroom rhythm games for literacy support," in *Music and Dyslexia: A Positive Approach,* eds J. Westcombe, T. Miles and D. Ditchfield (Chichester: John Wiley & Sons Ltd.), 26–44.

Röhricht, F. (2009). Body oriented psychotherapy. The state of the art in empirical research and evidence-based practice: a clinical perspective. *Body Mov. Dance Psychother.* 4, 135–156. doi: 10.1080/17432970902857263

Schubert, T. W. (2005). Your highness: vertical positions as perceptual symbols of power. *J. Pers. Soc. Psychol.* 89, 1–21. doi: 10.1037/0022-3514.89.1.1

Shapiro, L. (2007). The embodied cognition research programme. *Philos. Compass* 2, 338–346. doi: 10.1111/j.1747-9991.2007.00064.x

Shapiro, L. (2011). *Embodied Cognition.* Oxon: Routledge.

Srinivasan, S. M., and Bhat, A. N. (2013). A review of "music and movement" therapies for children with autism: embodied interventions for multisystem development. *Front. Integr. Neurosci.* 7:22. doi: 10.3389/fnint.2013.00022

Staunton, T. (2002). *Body Psychotherapy.* New York, NY: Brunner-Routledge.

Thomas, N. (2013). Responding to mental health's mind-body problem. *Aust. N. Z. J. Psychiatry* 47, 973. doi: 10.1177/0004867413487232

Totton, N. (2003). *Body Psychotherapy: An Introduction.* Maidenhead: Open University Press.

Totton, N. (2009). Body psychotherapy and social theory. *Body Mov. Dance Psychother.* 4, 187–200. doi: 10.1080/17432970802079018

Tschacher, W., and Haken, H. (2007). Intentionality in non-equilibrium systems? The functional aspects of self-organized pattern formation. *New Ideas Psychol.* 25, 1–15. doi: 10.1016/j.newideapsych.2006.09.002

Tschacher, W., Junghan, U. M., and Pfammatter, M. (2014). Towards a taxonomy of common factors in psychotherapy-results of an expert survey. *Clin. Psychol. Psychother.* 21, 82–96. doi: 10.1002/cpp.1822

Ungar, T., and Knaak, S. (2013a). The hidden medical logic of mental health stigma. *Aust. N. Z. J. Psychiatry* 47, 611–612. doi: 10.1177/0004867413476758

Ungar, T., and Knaak, S. (2013b). Mental health stigma and the mind-body problem: making the case for strategic collusion. *Aust. N. Z. J. Psychiatry* 47, 1088. doi: 10.1177/0004867413498279

Vismara, L. A., and Rogers, S. J. (2010). Behavioral treatments in autism spectrum disorder: what do we know? *Annu. Rev. Clin. Psychol.* 6, 447–468. doi: 10.1146/annurev.clinpsy.121208.131151

Wilson, T. G. (2008). "Behavior therapy," in *Current Psychotherapies*, eds R. J. Corsini and D. Wedding (Belmont, CA: Thomson), 223–263.

Wolitzky, D. L. (2011). "Contemporary freudian psychoanalytic psychotherapy," in *Essential Psychotherapies*, eds S. B. Messer and A. S. Gurman (New York, NY: The Guilford Press), 33–72.

Zahavi, D. (2010). "Naturalized phenomenology," in *Handbook of Phenomenology and Cognitive Science*, eds D. Schmicking and S. Gallagher (Netherlands: Springer), 2–19. doi: 10.1007/978-90-481-2646-0_1

Zinbarg, R. E., and Griffith, J. W. (2008). "Behavior therapy," in *Twenty-First Century Psychotherapies*, ed. J. L. Lebow (Hoboken, NJ: John Wiley & Sons), 8–43.

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Received: 31 January 2014; accepted: 01 May 2014; published online: 20 May 2014.
*Citation: Leitan ND and Murray G (2014) The mind–body relationship in psychotherapy: grounded cognition as an explanatory framework. Front. Psychol. **5**:472. doi: 10.3389/fpsyg.2014.00472*
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology.

frontiers in PSYCHOLOGY

HYPOTHESIS AND THEORY ARTICLE
published: 06 June 2014
doi: 10.3389/fpsyg.2014.00508

Embodied affectivity: on moving and being moved

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There is a growing body of research indicating that bodily sensation and behavior strongly influences one's emotional reaction toward certain situations or objects. On this background, a framework model of embodied affectivity[1] is suggested: we regard emotions as resulting from the circular interaction between affective qualities or affordances in the environment and the subject's bodily resonance, be it in the form of sensations, postures, expressive movements or movement tendencies. Motion and emotion are thus intrinsically connected: one is *moved by movement* (perception; impression; affection[2]) and *moved to move* (action; expression; e-motion). Through its resonance, the body functions as a medium of emotional perception: it colors or charges self-experience and the environment with affective valences while it remains itself in the background of one's own awareness. This model is then applied to emotional social understanding or *interaffectivity* which is regarded as an intertwinement of two cycles of embodied affectivity, thus continuously modifying each partner's affective affordances and bodily resonance. We conclude with considerations of how embodied affectivity is altered in psychopathology and can be addressed in psychotherapy of the embodied self.

Keywords: embodiment, affect, emotion, body feedback, embodied intersubjectivity, interaffectivity, psychopathology, embodied therapies

INTRODUCTION

Emotions may be considered some of the most complex phenomena of subjective experience. This is mirrored by the host of different and often opposing emotion theories both in philosophy and psychology. Of the many attempts to reduce the complexity of emotions to a more simplified concept, two should be mentioned. The first focuses on their bodily component, as in the famous theory of James and Lange (James, 1884), simply put: we do not shiver because we are scared of the lion, but we shiver, and *this is* what we feel as our fear. In other words, emotions are feelings of bodily changes. This counter-intuitive assumption has been widely criticized for neglecting the intentional content or "aboutness" of emotions.

On the other hand, the contrary theory seems no less one-sided: according to prevailing cognitive approaches (Solomon, 1976; Lyons, 1980; Nussbaum, 2001), an emotion mainly consists in an act of evaluation or appraisal of a given situation. The bodily experience of emotions is then regarded as just an additional quale without further relevance (Gordon, 1987) or serving the limited purpose to assure us that an emotion is going on (Lyons, 1980). Again simplified: we believe or judge the lion to be dangerous, want to run away, and *this is* our fear of him. However, belief-desire concepts of emotions have been notoriously unable to capture their experiential and phenomenal aspect. A purely cognitive or functional approach to the phenomenon loses its peculiar self-affecting character. In particular, it fails to account for the changing *intensity* of emotions: it seems virtually impossible to indicate what a more intense anger, shame, or fear should be without referring to bodily experience (e.g., to one's increased sense of muscle tension, breath restriction, heated face or pounding heart). Cognitions as such do not differ in intensity. We may put the belief that "the lion is dangerous" into the comparative "the lion is very dangerous," or we may repeat the thought with high frequency, but this does not yield a different affective experience unless we feel the "very" or the repetition as expressing a more activated, tense or stressful bodily state (Lang et al., 1993; Reisenzein, 1994). There is, however, no necessity and no indication to impose a linear causality model upon the complex phenomena of emotions (Boettinger, 2012). Given the divergent and inconclusive findings under the assumption of linear causality, models of circular causality may lead to a more appropriate understanding of emotional phenomena.

In the past decades a growing body of research on embodiment has demonstrated that not only bodily sensations, but also bodily postures, gestures and expressions are inherent components of emotional experience and tacitly influence the evaluation of persons, objects and situations as well as memory recall. To provide some examples:

- Riskind (1984) found that individuals recalled more negative life events when sitting in a slumped position, and more positive events when sitting in an upright position.
- Strack et al. (1988) demonstrated that activation of the smiling muscle (by asking participants to hold a pen between their

[1] This model has formerly been introduced in a chapter on "The phenomenology of affectivity" by T. Fuchs in Fulford et al. (2013). Some parts are reprinted here with kind permission by the publisher.
[2] The term "affection" is used in the model in the sense of "being affected by something."

teeth) caused participants to judge cartoons to be funnier than when smiling was inhibited by holding the pen between their lips.

- Cacioppo et al. (1993) reported that Chinese ideographs presented during arm flexion (an approach motion) were evaluated more positively than ideographs presented during arm extension (an avoidance motion; see also Neumann and Strack, 2000).
- Koch (2014; this issue) showed that an approach movement of the arms and a receptive movement of the hands caused a more positive attitude toward target objects than an avoidance movement; similarly, dynamic qualities of movement with smooth transitions caused more positive affect and a higher receptivity toward the environment than movement with sharp transitions.
- Cuddy et al. (2012) found that when people stood or sat for 7 min in a "power position" (different forms of extension of the body), they performed better in a subsequent mock job interview.
- Williams and Bargh (2008) showed that holding a hot cup of coffee elicits a "warmer" (more generous, caring) impression of a target person than holding a cup of iced coffee. Bodily felt warmth thus directly affected the interpersonal impression of warmth.
- Conversely, Zhong and Leonardelli (2008) found that people estimated the room temperature as being colder than before after they had experienced social exclusion from a group. Interpersonal coldness was thus felt as physical coldness. Correspondingly, Bargh and Shalev (2012) found that persons who experience social loneliness show an increased tendency to take warm baths or showers.
- The cleaning away of guilt is another interesting case: Meier et al. (2012) report a number of studies showing that cleansing can wash away feelings of guilt (Lee and Schwarz, 2011) or sin (Zhong and Liljenquist, 2006), and had a mildness influence on one's moral judgment (Schnall et al., 2008).
- Last but not least, Havas et al. (2010) found that the injection of botulinum toxin (Botox) into the frowning muscles impaired the understanding of negative semantic content such as criticism in a text which subjects had to read. This indicates that such understanding normally affords a slight frowning movement. On the other hand, injection of botulinum toxin into these muscles may significantly improve depressive symptoms in patients as has been shown in a randomized controlled trial by Wollmer et al. (2012). Obviously, negative evaluation of oneself as well as of semantic content is supported by corresponding facial expressions.

These and related research results may be summarized as follows:

1. When individuals adopt or produce emotion-specific postures, facial expressions or gestures, (a) they tend to experience the associated emotions, and (b) their behavior and also their preferences, judgement and attitudes toward objects or persons are thereby tacitly influenced.
2. Conversely, when individuals' expressive movements are *inhibited*, the experiencing of the associated emotions as well as the processing of corresponding emotional information is impaired. This is even the case when the information is presented in a merely cognitive or non-expressive way (as shown by the study of Havas et al., 2010, above).

Empirical findings thus show that embodiment has a far reaching influence on our emotional life. How may this influence be adequately understood? While we know that proprioceptive body feedback (based on afferent neural pathways from the body to the brain) is one of the responsible mechanisms (Hatfield et al., 1994; Koch, 2011), its interplay with the emotional perception and evaluation of a given situation still needs to be clarified. If we want to integrate the existing empirical research results into a comprehensive model of embodied affectivity, it seems advisable to follow a step-by-step approach: We will first consider emotions under different aspects, then we will try to integrate these aspects into an embodied and enactive concept of emotions. Finally, we will apply this concept to the special situation of social interactions or what may be called "embodied interaffectivity."

WHAT ARE EMOTIONS?

In a first approximation, emotions may be regarded as affective responses to certain kinds of events of concern to a subject, implying conspicuous bodily changes and motivating a specific behavior (De Sousa, 2010). Accordingly, we will consider emotions under the aspects of (a) affective intentionality, (b) bodily resonance, (c) action tendency, and (d) function and significance.

(a) Affective intentionality. There is wide agreement among philosophers and psychologists that emotions are characterized by intentionality—they relate to persons, objects, events and situations in the world (see e.g., Solomon, 1976; Frijda, 1994; De Sousa, 2010). However, this intentionality is of a special kind: it is not neutral, but concerns what is particularly *valuable and relevant* for the subject. In a sense, emotions are ways of perceiving, namely attending to salient features of a situation, giving them a significance and weight they would not have without the emotion. Referring to Gibson's (1979) concept of affordances (that means, offerings in the environment that are available to animals, such as a tree being "climbable," water "drinkable," etc.), one could also speak of *affective affordances*: things appear to us as "important," "worthwhile," "attractive," "repulsive," "expressive," and so on. Without emotions, the world would be without meaning or significance; nothing would attract or repel us and motivate us to act.

Of course, this meaning-making implies an evaluative or appraising component which should not, however, be conceived in terms of propositional attitudes (*believing that p is the case,* for example, believing that a lion is dangerous; cf. Lyons, 1980); otherwise, emotions could not be experienced by small children or higher animals lacking language. The evaluative aspect of affective intentionality is not dependent on verbally structured judgements, but on more basic cognitive-emotional schemes which are acquired in the course of affect-inducing experiences. Thus, an approaching lion will be immediately perceived *and* felt as a dangerous object once one has heard a lion's terrible roaring before, seen its leap toward a prey, etc. It has then acquired a threatening appearance which does not necessarily imply a belief such as "this is a lion," "lions are dangerous," etc. Of course there are emotional situations which are largely determined by higher forms of cognition (e.g., if an emotionally relevant information is provided

in written form, or requires abstract concepts such as knowledge about an imminent stock market crash). But even then it is only the embodied response to the recognized situation that mediates its affective appeal and significance [see (b)]. Appraisal theories are highly relevant for explaining different emotional reactions of individuals on the basis of their preset attitudes, biases, beliefs, or judgements. But they are insufficient, when it comes to explain the holistic phenomenon of emotional experience itself [3].

Moreover, the appraisal component may not be regarded as a mere cognitive judgement, because in emotions, *oneself is affected*. They always imply a particular relation to the feeling subject in its very core: through emotions, I experience *how it is for me* to be in this or that situation. *It is me* who is surprised, hurt, angry, joyful, etc. Affective intentionality is thus twofold: it discloses an affective or value quality of a given situation as well as the feeling person's own state in the face of it (Slaby and Stephan, 2008). To be afraid of an approaching lion (world-reference) means at the same time being afraid for oneself (self-reference). To feel envy toward another person means to begrudge her an advantage or success as well as to feel inferior and dissatisfied with oneself. Each emotion, thus, implies the two poles of feeling *something* and feeling *oneself* as inextricably bound together.

(b) Bodily resonance. How do we experience the affective qualities or affordances of a given situation? Emotions are experienced through what we call bodily resonance. This includes all kinds of local or general bodily sensations: feelings of warmth or coldness, tickling or shivering, pain, tension or relaxation, constriction or expansion, sinking, tumbling or lifting, etc. They correspond, on the one hand, to autonomic nervous activity (e.g., raised heartbeat, accelerated respiration, sweating, trembling, visceral reactions), on the other hand, to various muscular activations, bodily postures, movements and related kinaesthetic feelings (e.g., clenching one's fist or one's jaws, moving backwards or forwards, bending or straightening oneself, etc.). Particularly rich fields of bodily resonance are the face and the gut. Thus, for example, sadness may be felt locally as a lump in the throat, a tightening in the chest or in the belly, a tension around the eyes, a tendency to weep, or globally as a sagging tendency or a painful wave spreading through the entire body (Gendlin, 1967). Bodily resonance is also related to Damasio's concept of the "somatic markers," consisting of interoceptive and proprioceptive feedback from the body that needs to be integrated with other more cognitive information in the frontal lobe of the brain in order to guide one's behavior, in particular in every day decision-making (Damasio, 1994, 1996).

In sum, as William James put it, the body is a most sensitive "sounding-board" in which every emotion reverberates (James, 1884), both within and between us. In addition, our bodies have a varying degree of permeability ("Durchlässigkeit"; Lewin, 1935), affectability and responsivity (e.g., Stern, 1985; Trevarthen, 2009) at any given point in time. The tired body is more permeable than the wake body, the drunk body more permeable than the sober body (Lewin, 1935). At the same time, these bodily feelings have an immediate repercussion on the emotion as a whole: Feeling one's heart pound in fear raises one's anxiety, feeling one's cheeks burn with shame increases the painful experience of exposure and humiliation (Ekman et al., 1972). Therefore, bodily feelings should not be conceived as a mere by-product or add-on, distinct from the emotion as such, but as the *very medium* of affective intentionality. Being afraid, for instance, is not possible without feeling a bodily tension or trembling, a beating of the heart or a shortness of breath, and a tendency to withdraw. It is *through* these sensations that we are anxiously directed toward a frightening situation.

According to traditional appraisal-theories (Lazarus, 1982), the evaluation of a given situation is a primary and separate component of emotions which precedes any bodily changes. From an embodied perspective, however, it is the lived body with its background sensations that is co-constitutive of the evaluation, which means that we should rather speak of an "embodied appraisal" (Prinz, 2004). For example, when feeling tired or exhausted, a familiar way uphill appears steeper and longer than normally. This appraisal does not result from a separate evaluative judgement, but from the very mismatch between one's bodily capacity and the task one faces. The hill is "too high," that means it is perceived in this way *through* the tired, incapable body. Even in cases where emotionally relevant information is presented in merely abstract form (such as the text with negative content in the Botox study by Havas et al. see above), the evaluation obviously also depends on the simultaneous bodily resonance. More generally, our feeling body is the way we are emotionally related to the world, or in other words, affective experiences *are* bodily feelings-toward (Goldie, 2000). In emotions, there is no separation between an appraisal and a bodily component for they are only realized as a synthesis or "full circle" of all mutually interacting components.

(c) Action tendency. Bodily resonance of emotions is not restricted to autonomic nervous system activity or facial expression (which are in the focus of most empirical studies), but includes the whole body as being moved and moving. Fear, for example, does not only mean a raised heart beat or widely opened eyes but also the urge to break free, to flee or to hide (Sheets-Johnstone, 1999). The term "emotion" is derived from the Latin *emovere*, "to move out," implying that inherent in emotions is a potential for movement, a directedness toward a certain goal (be it attractive or repulsive) and a tension between possible and actual movement. Correspondingly, Frijda (1986) has characterized emotions in terms of *action readiness*, according to the different patterns of action which they induce: approach (e.g., desire), avoidance (e.g., fear), being-with (enjoyment, confidence), attending (interest), rejecting (disgust), non-attending (indifference), agonistic (anger), interrupting (shock, surprise), dominating (arrogance), and submitting (humility, resignation).

[3]The focus of this article is on emotions. The various interfaces with cognition result naturally from the intrinsic connection of emotion and cognition (e.g., Zajonc and Markus, 1984); to address them in the article would exceed its scope and length. It would in fact not even be necessary, since each situation that affects us emotionally does also concern us cognitively, and vice versa. I have to recognize the lion in order to feel afraid of it; I have to understand the words that insult me cognitively before they can create an affective affordance for me. Just as there is no cognition without emotion, at least in the sense of emotionally driven attention and interest, there is also no emotion without a cognitive grasp of the given situation.

Similarly, according to Kafka (1950) and De Rivera (1977), there exist four basic emotional movements: moving oneself "toward the other" (e.g., affection, mourning), moving the other "toward oneself" (e.g., desire, greed), moving the other "away from oneself" (e.g., disgust, anger) and moving oneself "away from the other" (e.g., fear, disgust). The four are related to the gestures of giving, getting, removing and escaping. These basic movements are connected to a bodily felt sense of expansion or contraction, relaxation or tension, openness or constriction, etc. In anger, for example, one feels a tendency of expansion toward an object in order to push it away from self. In affection, one feels a relaxation, opening and emanation toward an object or person. Emotions can thus be experienced as the directionality of one's potential movement, although this movement need not necessarily be realized in physical space; they are phenomena of lived space (Fuchs, 2007).

(d) Functions and significance. On the basis of the analysis so far, the role of emotions for the individual may be determined as follows: Emotions "befall us"; they interrupt the ongoing course of life in order to inform us, warn us, tell us what is important and what we have to react upon. They (re)structure the field of relevance and values; some of our plans, intentions or beliefs must be revised (Downing, 2000). Emotions thus provide a basic *orientation* about what really matters to us; they contribute to defining our goals and priorities. At the same time, they sketch out a certain scope and direction of possible responses, which are complementary to the *meaning* the emotion gives to the situation. Bodily resonance, autonomic arousal and musular activations make us become *ready to act*: in anger we prepare for attack, in fear we prepare for flight, in shame we want to hide or disappear, in love we want to approach and be approached. Emotion may thus be regarded as a bodily felt transformation of the subject's world, which solicits the lived body to action. However, even when the action tendency of emotions does not win through, they still retain an *expressive* function: by indicating the individual's state and possible action to others, they serve a communicative function in social life which will be explained in the section on "interaffectivity."

AN EMBODIED AND EXTENDED CONCEPT OF EMOTIONS

We now have gathered the necessary components that may be integrated into an embodied and extended model of emotions:

1. Emotions emerge as specific forms of a subject's bodily directedness toward the valences and affective affordances of a given situation[4]. They encompass subject and situation and therefore may not be localized in the interior of persons (be it their psyche or their brain). Rather, the affected subject is engaged with an environment that itself has affect-like qualities. For example, in shame, an embarrassing situation and the dismissive gazes of others are experienced as a painful bodily affection which is the way the subject *feels* the sudden devaluation in others' eyes. The emotion of shame is extended over the feeling person and his body as well as the situation as a whole (on this extended concept of affectivity cf. Schmitz et al., 2011).
2. Emotions imply two components of bodily resonance:
   - *a centripetal or affective component,* i.e., being affected, "moved" or "touched" by an event through various forms of bodily sensations (e.g., the blushing and "burning" of shame);
   - *a centrifugal or "emotive" component,* i.e., a bodily action readiness, implying specific tendencies of movement and directedness (e.g., hiding, avoiding the other's gaze, "sinking into the floor" from shame).

On this basis, feelings may be regarded as *circular interactions or feedback cycles* between centripetal affection and centrifugal e-motion (cf. **Figure 1**). Being affected by affective affordances of a situation triggers a specific bodily resonance ("affection") which in turn influences the emotional perception and evaluation of the situation *and* implies a corresponding action readiness ("e-motion"). Affective intentionality consists in the entire interactive cycle, which is mediated by the resonance of the feeling body. Thus, in affectivity we are *moved by movement* (impression, affection) and *moved to move* (expression, e-motion), indicating the kinetic-kinaesthetic ambiguity of the body (Sheets-Johnstone, 1999).

3. Bodily resonance thus acts as the medium of our affective engagement in a given situation. It imbues, taints and permeates the perception of this situation without necessarily stepping into the foreground. In Polanyi's terms, bodily resonance is the *proximal*, and the perceived situation is the *distal,* component of affective intentionality, with the proximal component receding from awareness in favor of the distal (Polanyi, 1967). This may be compared to the sense of touch which is at the same time a self-feeling of the body ("proximal") and a feeling of the touched surface ("distal"); or to the subliminal experience of thirst ("proximal") which first becomes conspicuous as the perceptual salience of water flowing nearby ("distal").
4. If the resonance or *affectability* of the body is modified in specific ways, this will change the person's affective perception accordingly. This is the common basis of the studies on embodiment and emotions that we mentioned above. Thus, a lack of resonance (e.g., after injection of botulinum toxin) will impede the perception of corresponding affective affordances in the environment. Conversely, increasing a certain bodily feeling (e.g., holding a hot cup of coffee), adopting a certain position or moving in a certain way favors the correlated affective perception. Thus, the different components of the affection-intention-motion cycle influence one another.

[4]As pointed out above, the concept of affective intentionality and affective affordances also implies components of cognition (schemes, attitudes, beliefs, etc.) which shape the individual's emotional perception of, and response to a situation. Perceiving a goal in a football match, for example, will elicit quite different emotional responses depending on which team one supports. However, the focus of our model lies not on such preset attitudes, beliefs, biases etc. but on explaining the phenomenon of emotional experience as a whole (for which the term "embodied appraisal" (Prinz, 2004) seems much more adequate than the predominantly discussed "emotional appraisal").

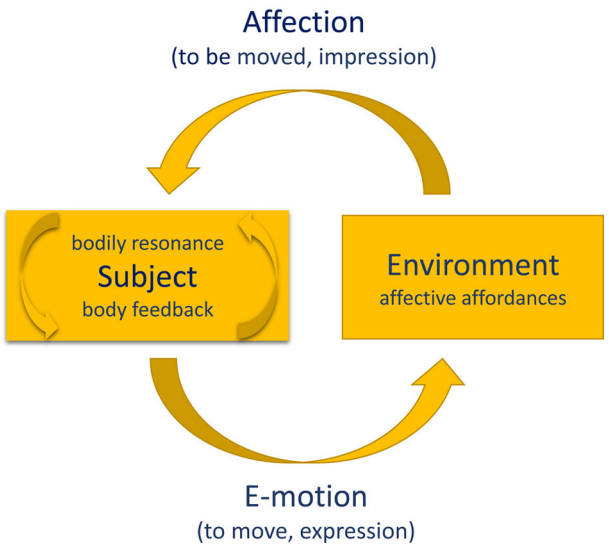

FIGURE 1 | Embodied affectivity. We use phenomenological terminology in the model; in psychological terminology *subject* could be replaced by *person*, and *affection* by *affect*. Expression is constitutive of *e-motion* (centrifugal), impression is constitutive of *affection* (centripetal), resulting in interoceptive and proprioceptive body feedback or bodily resonance (arrows in *subject*). Emotion is mediated by the expressive ability (e.g., Laban, 1980), and affection is mediated by the permeability of the person system (Lewin, 1935). Both expression and impression (Wallbott, 1990) constitute the unity of movement and perception (cf. Weizsäcker, 1940), and form an integral part of our *personality*.

The last point is of particular psychotherapeutic importance, for it shows that emotions may not only be influenced by cognitive means (i.e., by changing the cognitive component of the cycle), but also by modifying the bodily resonance. It can be diminished as well as increased. The first is the case in habitual *body defences*: When an emotion emerges, one often tends to defend against it by bodily counteraction: suppressing one's tears or cries, compressing one's lips, tightening one's muscles, keeping a stiff posture, "pulling oneself together," etc. This often happens unconsciously, as part of one's early acquired bodily *habitus* (cf. Bourdieu, 1990). On the other hand, the experience of vague or diffuse emotions may be enhanced and differentiated by carefully attending to the bodily feelings and kinaesthetic tendencies which these emotions imply, in order to render them accessible to verbal explication in psychotherapy.

In concluding the section, we may add that the connections of affectivity and embodiment that we have presented in a general model show considerable cultural and individual variations. The culture-specific forms of emotional expression or restraint as well as the habitus of a person which has incorporated basic attitudes such as introversion or extroversion, shyness or pride, submissiveness or dominance, etc., have become part of the individual body memory (Fuchs, 2012) and thus influence the circular relations between affective affordances, bodily resonance and emotional response in a given situation. Here lies a rich field for future research into the impact of culture and biography on the embodiment of emotions.

INTERAFFECTIVITY

As we have seen, emotions imply embodied action tendencies. More specifically, in the social sphere they are characterized by various potential movements toward, or away from, an actual or implicit *other* (Kafka, 1950; De Rivera, 1977), i.e., they are essentially *relational*. As such, they are not only felt from the inside, but also displayed and visible in expression and behavior, often as bodily tokens or rudiments of action[5]. The facial, gestural and postural expression of a feeling is part of the bodily resonance that feeds back into the feeling itself, but also induces processes of *interaffectivity:* Our body is affected by the other's expression, and we experience the kinetics and intensity of his emotions through our own bodily kinaesthesia and sensation.

Emotions thus imply two components of bodily resonance or feedback:

- Self- or individual resonance: proprio- and interoceptive feedback providing the organism with useful information from body postures, gestures or sensations (Zajonc and Markus, 1984; Hatfield et al., 1994: the body as "interface" between cognition and affect).
- Interactional or interbodily resonance: dynamic mutual feedback between two bodies (e.g., you lift your arms and I feel slightly "uplifted"). This body feedback can occur through the visual, auditory or tactile channel (such as from a handshake or an embrace; Koch, unpublished Manuscript), but also through the kinaesthetic channel (such as from directional movements; e.g., Koch et al., 2011).

This means that in every social encounter, two cycles of embodied affectivity (cf. **Figure 1** above) become intertwined, thus continuously modifying each subject's affective affordances and resonance. This complex process may be regarded as the bodily basis of empathy and social understanding.

To illustrate this (**Figure 2**), let us assume that the SELF (A) is a person whose emotion, e.g., anger, manifests itself in typical bodily (facial, gestural, interoceptive, etc.) changes. He feels the anger as the tension in his face, the sharpness of his voice, the arousal in his body etc. This resonance is an *expression* of the emotion at the same time, i.e., the anger becomes visible and is perceived as such by the OTHER (B). But what is more, the expression will also produce an *impression*, namely by triggering corresponding or complementary bodily feelings in the OTHER. Thus, A's sinister gaze, the sharpness of his voice or expansive bodily movements might induce in B an unpleasant tension or even a jerk, a tendency

[5]According to (Darwin, 1872/1904), emotional expressions once served particular action functions (e.g., baring one's teeth in anger to prepare for attack), but now accompany emotions in rudimentary ways in order to communicate these emotions to others. Evolutionary psychologists have advanced the hypothesis that hominids have evolved both with increasingly differentiated facial expressions and with sophisticated capabilities of understanding these affect displays. In any case, though strongly varying between and within cultures, emotional expression is a crucial facet of interpersonal communication in all societies.

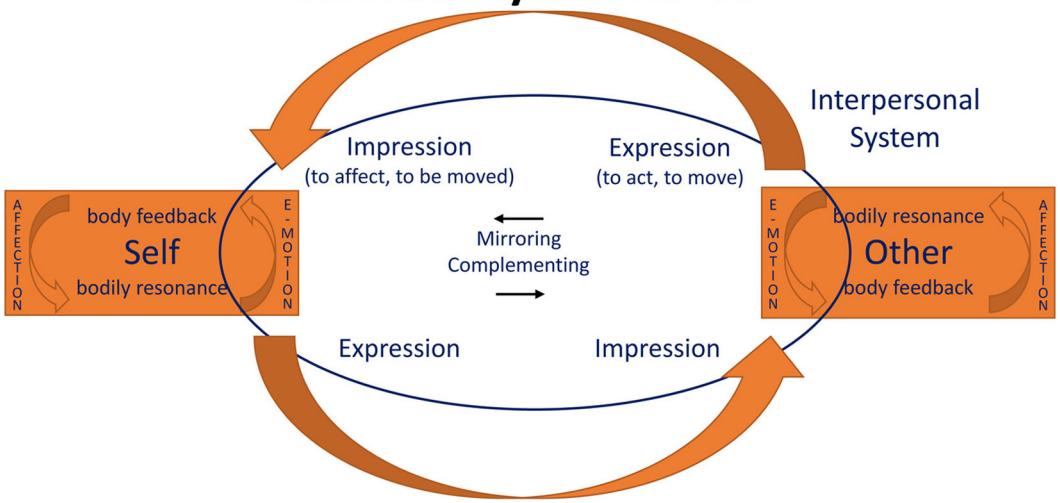

FIGURE 2 | Interaffectivity. The figure is an integration of Koch (2011), Froese and Fuchs (2012), and Fuchs (2013). Interaffectivity includes body feedback (i.e., the impression function within self and other) which is necessary for interbodily resonance. Components of interbodily resonance are: mirroring or complementing movements, body awareness (via proprioceptive body feedback), and kinaesthetic empathy; they are psychotherapeutically important in phenomena such as somatic countertransference (Pallaro, 2002).

to withdraw, etc. (similarly, shame that one witnesses may induce embarrassed aversion, sadness a tendency to connect and console, and so forth). Thus, B not only sees the emotions in the A's face and gesture, but also senses it with his own body, through his own bodily resonance.

However, it does not stay like this, for the impression and bodily reaction caused in B in turn becomes an expression for A. It will immediately affect his bodily reaction, change his own expression, however slightly (e.g., increasing or decreasing his expression of anger), and so forth. This creates a circular interplay of expressions and reactions running in split seconds and constantly modifying each partner's bodily state. They have become parts of a dynamic sensorimotor and interaffective system that connects both bodies in *interbodily resonance* or *intercorporality* (Merleau-Ponty, 1964). Of course, the signals and reactions involved proceed far too quickly to become conscious as such. Instead, both partners will experience a specific feeling of being connected with the other in a way that may be termed "mutual incorporation" (Fuchs and De Jaegher, 2009). Each lived and felt body reaches out, as it were, to be extended by the other. In both partners, their own bodily resonance mediates the perception of the other. It is in this sense that we can refer to the experience of the other in terms of an embodied perception, which, through the interaction process, is at the same time an embodied communication.

No mental representation is necessary for this process. There is no strict separation between the inner and the outer, as if a hidden mental state in X produced certain external signs, which Y would have to decipher. For X's anger may not be separated from its bodily expression; and similarly, Y does not perceive X's body as a mere object, but as a living, animate and expressive body that she/he is coupled with.

Nor is a simulation required for the process of mutual incorporation. We certainly do not simulate the other's angry gaze or voice, even less his anger, but rather feel tense, threatened or even invaded by his expressive bodily behavior. Bodily sensations, tensions, action tendencies, etc. that arise in the interaction do not serve as a separate simulation of the other person, but are fed into the mutual perception. In Polanyi's terms, one could also say that the felt bodily resonance is the *proximal*, the other's perceived body is the *distal* component of one's empathic perception, with the proximal component receding from awareness in favor of the distal (Polanyi, 1967). Stuart (2012) has recently coined the term "enkinesthesia," that means, "feeling one's own movements into the other," or: empathy through subliminal co-movement. It is in this sense that we can refer to the experience of the other in terms of "embodied" perception, which, through the interaction process, is at the same time an "embodied" communication. In Merleau-Ponty's account:

> "The communication or comprehension of gestures comes about through the reciprocity of my intentions and the gestures of others, of my gestures and the intentions discernible in the conduct of other people. It is as if the other person's intentions inhabited my body and mine his" (Merleau-Ponty, 1962).

As we can see, the concept of mutual incorporation leads to the opposite of the representationalist account: Primary social understanding is not an inner modeling in a detached observer, but the other's body extends onto my own, and my own extends onto the other.

This can perhaps best be studied in early childhood. Emotions primarily emerge from and are embedded in dyadic interactions of infant and caregiver. Stern (1985) has shown in detail

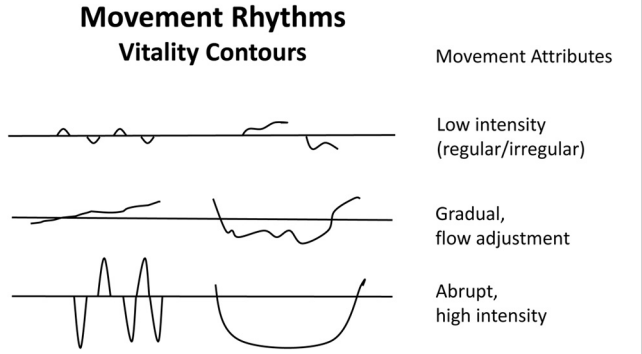

FIGURE 3 | Movement rhythms. Example of rhythm writing to capture affect expression and vitality contours (Kestenberg and Sossin, 1973, 1979; Stern, 2010).

how emotions are cross-modally expressed, shared, and regulated. Infants and adults experience joint affective states in terms of dynamic flow patterns, intensities, shapes, and vitality affects (for example, *crescendo* or *decrescendo*, fading, bursting, pulsing, effortful or easy, etc.) in just the way that music is experienced as affective dynamics. This includes the tendency to mimic and synchronize each other's facial expressions, vocalizations, postures, movements, and thus to converge emotionally (Condon, 1979; Hatfield et al., 1994). All this may be summarized by the terms *affect attunement* and *interaffectivity* (Stern, 1985; p. 132): The emerging affect during a joyful playing situation between mother and infant may not be divided and distributed among them. It arises from the "in-between," or from the over-arching process in which both are immersed. *Affect attunement* is carried by *kinaesthetic empathy* (Kestenberg, 1975; Fischman, 2008), which is also employed in dance/movement therapy diagnostics and intervention (for a systematization of forms of attunement and mirroring see Eberhard-Kaechele, 2012).

Affect attunement was first investigated by Kestenberg (1975); Kestenberg and Sossin (1973, 1979), who systematized it into quality and shape attunement and described developmental regularities and sequences. Kestenberg emphasized that in the individuation process, partial attunement of mother and child was more productive than complete attunement to serve the child's development. A basic dimension of meaning are smooth vs. sharp reversals between rhythms (Koch, 2011). Via kinaesthetic empathy, researchers can notate body rhythms (**Figure 3**) that may be used to analyse affect attunement differentially (Koch, 2014). These rhythm curves reflect what Stern calls "vitality affects" or "vitality contours" (Stern, 1985, 2010). Shared vitality affects then form a vital part of our emotions.

Thus, emotions are not inner states that we experience only individually or that we have to decode in others, but primarily *shared states* that we experience through interbodily affection. Even if one's emotions become increasingly independent from another's presence in the course of childhood, intercorporality remains the basis of empathy: There is a bodily link which allows emotions to immediately affect the other and thus enables empathic understanding without requiring a Theory of Mind or verbal articulation (Fuchs and De Jaegher, 2009). On this basis, we have created a short scale that measures the degree of feeling understood by and understanding of others through movement. The *Embodied Intersubjectivity Scale* (*EIS*; see Appendix) consists of ten items measuring the degree of closeness created by different forms of attuning and mirroring in movement. It complements the *Body Self-Efficacy Scale* (*BSE;* see Appendix), which measures the body-based "I can't" of a person (Husserl, 1952) also with 10 items. Perceived body self-efficacy is related to a positive body image, positive movement-based affect (MBAS; Koch, 2014) and the ability for embodied interaffectivity (Appendix).

(PSYCHO)PATHOLOGICAL IMPLICATIONS

The model of embodied affectivity that we have presented may gain additional plausibility from different kinds of disturbances which occur in psychopathology. We will illustrate its implications by using the examples of (1) anxiety disorder, (2) depression, (3) Parkinson's disease, (4) alexithymia, and (5) autism.

(1) *Anxiety disorders* are characterized by a heightened alert of the body which reacts to threatening affective affordances in the environment with intense feelings of oppression mainly in throat, breast or gut (corresponding physiologically to muscular tension, trembling, palpitation, hyperventilation, sweating, etc.)[6]. This bodily affection motivates, on the one hand, a hypervigilant perception: The anxious person scans the environment for threatening cues and anticipates lurking danger. On the other hand, the bodily resonance also implies a specific action tendency, namely to escape the oppressing situation through flight or to avoid it in advance. Phobias particularly related to space, such as agoraphobia, claustrophobia or acrophobia, dynamize the otherwise static quality of experienced space and illustrate the overall spatial structure of anxiety as encompassing body and environment.

(2) In contrast, a lack or loss of bodily affectability is characteristic of severe *depression*. The constriction, rigidity and missing tension-flow modulation (neutral flow; Kestenberg, 1975) of the lived body in depression leads to a general emotional numbness and finally to affective depersonalization (Fuchs, 2005). The deeper the depression, the more the affective qualities and atmospheres of the environment fade. The patients are no longer capable of being moved and affected by things, situations or other persons. They complain of a painful indifference, a "feeling of not feeling" and of not being able to sympathize with their relatives any more. In his autobiographical account, Solomon describes his depression as "... a loss of feeling, a numbness, (which) had infected all my human relations. I didn't care about love; about my work; about family; about friends ... " (Solomon, 2001; p. 45). Thus patients feel disconnected from the world; they

[6]Similarly, in Posttraumatic Stress Disorder (PTSD) there is an increased bodily responsivity (racing heart, dyspnea, fear-sweat, sickness) to certain environmental triggers that are related to former traumatic experiences (sights, sounds, smells, etc.), that means, the body resonance is shaped by a traumatic body memory (van der Kolk, 1994; Fuchs, 2012).

lose their participation in the interaffective space that we normally share with others (Fuchs, 2013).

(3) In some way similar to depression, we find in progressed *Parkinson's disease* a "freezing" of face and body, which leads to loss of emotional expressivity. As a result, patients tend to experience a decreased intensity of their emotions and complain of no longer being able to participate in interaffective exchange with others as before. Studies have also found that patients with Parkinson's disease were less accurate than healthy controls in decoding angry, sad and disgusted facial expressions of others, pointing to a lack of bodily resonance as the proximal component of affective perception (see Mermillod et al., 2011, for an overview).

(4) Persons characterized by *alexithymia* have marked difficulties to identify, differentiate and describe their own emotions, while at the same time being unable to recognize the affective nature of bodily sensations associated with certain emotions (Taylor and Taylor, 1997). This is often accompanied by a lack of understanding of the feelings of others, which leads to unempathic emotional responding (Hesse and Floyd, 2008). Alexithymia is particularly frequent in patients with *somatoform disorders* who are have often problems to relate their bodily resonance to corresponding affective situations, leading to detached feelings of pressure, burning, pain, etc., which are then attributed to assumed somatic illnesses (Duddu et al., 2003). Moreover, interoceptive sensitivity, measured as a person's ability to accurately perceive one's heartbeats at rest, has been found to be reduced in somatoform patients which was associated with a reduced capacity of emotional self-regulation (Pollatos et al., 2011; Weiß et al., 2014). Interoceptive sensitivity normally facilitates successful self-regulation by providing a fine-tuned feedback of the present emotional state (Füstös et al., 2011).

What is obviously lacking in alexithymia is the proximal-distal structure of affective intentionality: Whereas bodily resonance normally functions as the proximal medium of our affective perception, for alexithymic patients their bodily reactions seem unrelated to affective affordances of a given situation, which means that the full circle of affectivity does not come about. Bodily sensations of resonance either are not felt at all, or they may come to the fore separately, instead of receding from awareness in favor of affective intentionality. In both cases, this is connected to a sense of emotional detachment of patients from themselves. Pathogenetically, a lack of interaffective mirroring and feedback in early childhood seems to play a major role: If caregivers are incapable of recognizing and validating emotional expressions in the child, this can impair the child's capacity to understand and differentiate emotional states within himself as well as in others (Graerne and Bagby, 2000).

(5) Finally, *autism* or *autistic spectrum disorder* may be regarded as a disturbance of embodied interaffectivity, namely as a lack of perceiving others' expressions, gestures and voicings in terms of affective affordances. Correspondingly, eye tracking studies have shown that children with autism focus on inanimate and irrelevant details of interactive situations while missing the relevant social cues, e.g., neglecting the eyes and mouths of protagonists (Klin et al., 2002). Another study asked children to sort people who varied in terms of age, sex, facial expressions of emotion and the hat that they were wearing (Weeks and Hobson, 1987). In contrast to typical children who grouped pictures by emotional expressions, the participants with autism grouped the people by the type of hat they were wearing. Generally, they prefer to attend to inanimate objects over other humans (Klin et al., 2003; Jones et al., 2008). Furthermore, while imitation and co-movement serves as a major instrument for early affect attunement and social cognition, several studies have found that autistic children do not readily imitate the actions of others (Smith and Bryson, 1994; Hobson and Lee, 1999).

As a result of these deficiencies, there is a general lack of the embodied or kinaesthetic empathy that normally mediates the affective perception of the other. The feedback cycles of mutual incorporation are not achieved; instead, for children with autism the others remain rather mysterious, detached objects whose behavior is troublesome to predict. According to embodied and enactive approaches, what these children primarily lack is not a theoretical concept of others' minds (Klin et al., 2003; Gallagher, 2004; De Jaegher, 2013). This is supported by the fact many autistic symptoms such as lack of emotional contact, anxiety or agitation are already present in the first years of life, i.e., long before the supposed age of 4–5 years to acquire a Theory of Mind. Much rather, high-functioning autistic persons often develop precisely an explicit "Theory of Mind" approach to emotions, i.e., they learn to infer or "figure out" what emotion the other is experiencing (Grandin, 1995).

EMBODIED THERAPIES

Our model of embodied affectivity can be elucidating for the interpersonal processes taking place on a non-verbal level in psychotherapy and for the explicit thematization of bodily experience in body psychotherapy and dance movement therapy. These approaches use non-verbal modalities to start change processes, to gain access to affect and memories that dominated in a former situation—actualizations that are important, for example, in trauma treatment (Caldwell, 2012; Eberhard-Kaechele, 2012). Embodied therapies are increasingly framed in non-linear causality, enactive, ecological and dynamic systems approaches (cf. Koch and Fishman, 2011), to account for the complexity of motor processes and their interwovenness with brain functions and sociocultural/environmental factors.

The embodied affectivity model allows us to locate disorders on the continuum of e-motion and affectivity and to plan embodied interventions accordingly. *Anxiety* (1) for example, can be addressed and be alleviated by engagement in low intensity and gradual swaying movements—particularly with advancing movement in the horizontal plane—which are part of many meditative circle dances (Koch, 2011), strengthening their ability to calm down and perceive their environment as less threatening. *Depression* (2) can be temporarily alleviated by moving into high arousal, high intensity, abrupt movements with round reversals (such as in jogging or dancing) particularly in the vertical plane

(Koch et al., 2007) which awakens joy and vitality, and decreases negative affect. Persons affected from *Parkinson* (3) profit from Tango Argentino (Duncan and Earhart, 2012),—characterized by its mostly low intensity abrupt movements and turns with flow adjustment, which address initiation, balance and gait, but also intersubjective sensitivity,—and from expressive dance training, which strengthens their expressive abilities. *Alexithymia* (4) is common in both somatoform and autistic populations. *Somatoform patients* benefit from structured authentic movement interventions (*The Body Mind Approach (TBMA)*, Payne and Stott, 2010) including a partner exchange, which support the connections between feeling and verbalization; and *autists* (5) from mirroring in movement—including structured authentic movement—, which can improve their intersubjective abilities (Koch et al., 2014b). This mostly evidence-based literature on the effects of movement therapy on (psycho-)pathological conditions has been summarized in Koch et al. (2014a).

Dance movement therapy starts on the moving and e-motion side (e.g., Levy, 2005), whereas embodied therapies such as focusing (Gendlin, 1967) and functional relaxation (Fuchs, 1997) start on the sensing and affectivity side of the model. Most experienced body psychotherapists—no matter which background they work from—integrate both sides in a balance of sensing and moving (e.g., Lahmann et al., 2010; Caldwell, 2012). A focus on breathing can help find the basis of this balance (e.g., Williams et al., 2007). Rogers (1951) already pointed out that persons entering into a sensing, reflective, and affective mode during the process of therapy, pausing and giving room to integrate the bodily feedback into the progression of a therapeutic session, are the ones that profit most from psychotherapy. Damasio (1994, 1996), in his somatic marker hypothesis, specified that no decision of practical relevance can produce authentic results without interoceptive and proprioceptive feedback from the body. Embodied therapies can help the individual to access this somatic information and to take it into account for daily living—a step that becomes increasingly difficult for many persons in Western societies with their largely exteroceptive focus.

CONCLUSION

In sum, emotions result from the body's own feedback and the circular interaction between affective affordances in the environment and the subject's bodily resonance, be it in the form of sensations, postures, expressive movements, or movement tendencies. Through its resonance, the body functions as a *medium* of emotional perception.

Our account places particular emphasis on the intersubjective dimension of affectivity. In interaffectivity, our body is tacitly affected by the other's expression, and we experience the kinetics and intensity of his emotions through our own bodily kinaesthesia and sensation. This means that in every social encounter, two cycles of embodied affectivity become intertwined, thus continuously modifying each partner's affective affordances and resonance. Infant research demonstrates how the mutual bodily resonance of facial, gestural and vocal expression engenders our primary affective attunement to others. From birth on, the body is embedded in intercorporality, and thus becomes the medium of interaffectivity. Hence, affects are not enclosed in an inner mental sphere to be deciphered from outside, but come into existence, change and circulate between self and other in the interbodily dialog. Emotions are neither individual nor unidirectional phenomena; they operate in cycles that can involve multiple people in processes of mutual influence and bonding. These processes of embodied interaffectivity as well as their disturbances are of major importance for psychiatry, psychosomatics, and psychotherapeutic interactions and can be addressed in embodied therapies.

ACKNOWLEDGMENTS

We thank the German Ministry of Education and Research (BMBF) for the national grant 01UB0930A to Sabine Koch and Thomas Fuchs for developing a theory model in the context of the project *Body Language of Movement and Dance*. We thank Michela Summa and Boris Böttinger for their input on the model in various discussions, and Rixta Fambach for proof reading. We acknowledge the financial support of the Deutsche Forschungsgemeinschaft and Ruprecht-Karls-Universität Heidelberg within the funding program "Open Access Publishing."

REFERENCES

Bargh, J. A., and Shalev, I. (2012). The substitutability of physical and social warmth in daily life. *Emotion* 12, 54–62. doi: 10.1037/a0023527

Boettinger, B. (2012). *Embodied Affectivity*. Unpublished thesis, Heidelberg. Available online at: http://www.researchgate.net/profile/Boris_Boettinger/publication/235635839_Embodied_Affectivity/file/9fcfd512225aacdfc9.pdf

Bourdieu, P. (1990). "Structures, habitus, practices," in *The Logic of Practice*, ed P. Bourdieu (Stanford, CA: Stanford University Press), 52–79.

Cacioppo, J. T., Priester, J. R., and Berntson, G. (1993). Rudimentary determinants of attitudes II: arm flexion and extension have differential effects on attitudes. *J. Pers. Soc. Psychol.* 65, 5–17. doi: 10.1037/0022-3514.65.1.5

Caldwell, C. (2012). "Sensation, movement and emotion. Explicit procedures for implicit memories," in *Body Memory, Metaphor and Movement*, eds S. C. Koch, T. Fuchs, M. Summa, and C. Müller (Amsterdam: John Benjamins), 255–265. doi: 10.1075/aicr.84.20cal

Condon, W. S. (1979). "Neonatal entrainment and enculturation," in *Before Speech*, ed M. Bullowa (Cambridge: Cambridge University Press), 131–148.

Cuddy, A. J. C., Wilmuth, C. A., and Carney, D. R. (2012). "The benefit of power posing before a high-stakes social evaluation," in *Harvard Business School Working Paper,* No. 13-027. Available online at: http://dash.harvard.edu/bitstream/handle/1/9547823/13-027.pdf?sequence=1

Damasio, A. R. (1994). *Descartes' Error*. New York, NY: Random House.

Damasio, A. R. (1996). The Somatic marker hypothesis and the possible functions of the prefrontal cortex. *Philos. Trans. R. Soc. Lond. B Biol. Sci.* 351, 1413–1420. doi: 10.1098/rstb.1996.0125

Darwin, C. (1872/1904). *The Expression of the Emotions in Man and Animals*. London: Murray.

De Jaegher, H. (2013). Embodiment and sense-making in autism. *Front. Integr. Neurosci.* 7:15. doi: 10.3389/fnint.2013.00015

De Rivera, J. (1977). *A structural Theory of the Emotions.* New York, NY: International Universities Press.

De Sousa, R. (2010). *Emotion.* Stanford Encyclopedia of Philosophy. Available online at: http://plato.stanford.edu/archives/spr2010/entries/emotion

Downing, G. (2000). "Emotion theory reconsidered," in *Heidegger, Coping, and Cognitive Science: Essays in Honor of Hubert L. Dreyfus*, Vol. 2, eds M. Wrathall and J. Malpas (Cambridge, MA: MIT Press), 254–270.

Duddu, V., Isaac, M. K., and Chaturvedi, S. K. (2003). Alexithymia in somatoform and depressive disorders. *J. Psychosom. Res.* 54, 435–438. doi: 10.1016/S0022-3999(02)00440-3

Duncan, R. P., and Earhart, G. M. (2012). Randomized controlled trial of community-based dancing to modify disease progression in Parkinson disease. *Neurorehabil. Neural Repair* 26, 132–143. doi: 10.1177/1545968311421614

Eberhard-Kaechele, M. (2012). "Memory, metaphor, and mirroring in movement therapy with trauma patients," in *Body Memory, Metaphor and Movement,* eds S. C. Koch, T. Fuchs, M. Summa, and C. Müller (Amsterdam: John Benjamins), 267–287. doi: 10.1075/aicr.84.21ebe

Ekman, P., Friesen, W. V., and Ancoli, S. (1972). *Emotion in the Human Face*. New York, NY: Pergamon.

Fischman, D. (2008). "Therapeutic relationships and kinesthetic empathy," in *Life is Dance: the Art and Science of Dance Movement Therapy*, eds S. Chaiklin and H. Wengrover (New York, NY: Routledge Press), 33–54.

Frijda, N. H. (1986). *The Emotions*. Cambridge: Cambridge University Press.

Frijda, N. H. (1994). "Varieties of affect: emotions and episodes, moods, and sentiments," in *The Nature of Emotion: Fundamental Questions*, eds P. Ekman and R. J. Davidson (New York, NY: Oxford University Press), 59–67.

Froese, T., and Fuchs, T. (2012). The extended body: a case study in the neurophenomenology of social interaction. *Phenomenol. Cogn. Sci.* 11, 205–236. doi: 10.1007/s11097-012-9254-2

Fuchs, M. (1997). *Funktionelle Entspannung*. Stuttgart: Hippokrates.

Fuchs, T. (2005). Corporealized and disembodied minds: a phenomenological view of the body in melancholia and schizophrenia. *Philos. Psychiatr. Psychol.* 12, 95–107. doi: 10.1353/ppp.2005.0040

Fuchs, T. (2007). Psychotherapy of the lived space: a phenomenological and ecological concept. *Am. J. Psychother.* 61, 432–439.

Fuchs, T. (2012). "The phenomenology of body memory," in *Body Memory, Metaphor and Movement*, eds S. C. Koch, T. Fuchs, M. Summa, and C. Müller (Amsterdam: John Benjamins), 9–22. doi: 10.1075/aicr.84.03fuc

Fuchs, T. (2013). Depression, intercorporality and interaffectivity. *J. Conscious. Stud.* 20, 219–238.

Fuchs, T., and De Jaegher, H. (2009). Enactive intersubjectivity: participatory sensemaking and mutual incorporation. *Phenomenol. Cogn. Sci.* 8, 465–486. doi: 10.1007/s11097-009-9136-4

Fulford, B., Davies, M., Gipps, R., Graham, G., Sadler, J., Stanghellini, G., et al. (eds.). (2013). *Oxford Handbook of the Philosophy of Psychiatry.* Oxford: Oxford University Press.

Füstös, J., Gramann, K., Herbert, B. M., and Pollatos, O. (2011). On the embodiment of emotion regulation: interoceptive awareness facilitates reappraisal. *Soc. Cogn. Affect. Neurosci.* 8, 911–917. doi: 10.1093/scan/nss089

Gallagher, S. (2004). Understanding interpersonal problems in autism: interaction theory as an alternative to Theory of Mind. *Philos. Psychiatr. Psychol.* 11, 199–217. doi: 10.1353/ppp.2004.0063

Gendlin, E. T. (1967). "Values and the process of experiencing," in *The Goals Of Psychotherapy*, ed A. Mahrer (New York, NY: Appleton-Century), 180–205.

Gibson, J. (1979). *The Ecological Approach to Visual Perception*. Boston, MA: Houghton Mifflin.

Goldie, P. (2000). *The Emotions: A Philosophical Exploration*. Oxford: Clarendon Press.

Gordon, R. (1987). *The Structure of Emotions*. Cambridge: Cambridge University Press.

Graerne, J. T., and Bagby, R. M. (2000). "An overview of the alexithymia construct," in *The Handbook of Emotional Intelligence: Theory, Development, Assessment, and Application at Home, School, and in the Workplace*, eds R. Bar-On and J. D. A. Parker (San Francisco, CA: Jossey-Bass), 40–67.

Grandin, T. (1995). *Thinking in Pictures: and Other Reports From My Life With Autism.* New York, NY: Vintage.

Hatfield, E., Cacioppo, J., and Rapson, R. L. (1994). *Emotional Contagion.* New York, NY: Cambridge University Press.

Havas, M., Gutowski, K. A., Lucarelli, M. J., Davidson, R. J., Havas, D. A., and Glenberg, A. (2010). Cosmetic use of Botulinum Toxin-A affects processing of emotional language. *Psychol. Sci.* 21, 95–900. doi: 10.1177/0956797610374742

Hesse, C., and Floyd, K. (2008). Affectionate experience mediates the effects of alexithymia on mental health and interpersonal relationships. *J. Soc. Pers. Relat.* 25, 793–810. doi: 10.1177/0265407508096696

Hobson, R. P., and Lee, A. (1999). Imitation and identification in autism. *J. Child Psychol. Psychiatry* 40, 649–659. doi: 10.1111/1469-7610.00481

Husserl, E. (1952). *Ideen zu Einer Reinen Phänomenologie und Phänomenologischen Philosophie II. Husserliana Bd. 4*. Den Haag: Nijhoff.

James, W. (1884). What is an emotion? *Mind* 9, 188–205. doi: 10.1093/mind/os-IX.34.188

Jones, W., Carr, K., and Klin, A. (2008). Absence of preferential looking to the eyes of approaching adults predicts level of social disability in 2-year-old toddlers with autism spectrum disorder. *Arch. Gen. Psychiatry* 65, 946–954. doi: 10.1001/archpsyc.65.8.946

Kafka, G. (1950). Über Uraffekte. *Acta Psychol.* 7, 256–278. doi: 10.1016/0001-6918(50)90018-7

Kestenberg, J. S. (1975). *Parents and Children.* New York, NY: Routledge.

Kestenberg, J. S., and Sossin, K. M. (1973). *The Role of Movement Patterns in Development*, Vol. 1. New York, NY: Dance Notation Bureau Press.

Kestenberg, J. S., and Sossin, K. M. (1979). *The Role of Movement Patterns in Development*, Vol. 2. New York, NY: Dance Notation Bureau Press.

Klin, A., Jones, W., Schultz, R., and Volkmar, F. (2003). The enactive mind, or from actions to cognition: lessons from autism. *Philos. Trans. R. Soc. Lond. B Biol. Sci.* 358, 345–360. doi: 10.1098/rstb.2002.1202

Klin, A., Jones, W., Schultz, R., Volkmar, F. R., and Cohen, D. J. (2002). Visual fixation patterns during viewing of naturalistic social situations as predictors of social competence in individuals with autism. *Arch. Gen. Psychiatry* 59, 809–816. doi: 10.1001/archpsyc.59.9.809

Koch, S. C. (2011). "Basic body rhythms and embodied intercorporality: from individual to interpersonal movement feedback," in *The Implications of Embodiment: Cognition and Communication*, eds W. Tschacher and C. Bergomi (Exeter: Imprint Academic), 151–171.

Koch, S. C. (2014). Rhythm is it: effects of dynamic body-feedback on affect attitudes and cognition. (accepted).

Koch, S. C., and Fishman, D. (2011). Embodied enactive dance therapy. *Am. J. Dance Ther.* 33, 57–72. doi: 10.1007/s10465-011-9108-4

Koch, S. C., Glawe, S., and Holt, D. (2011). Up and down, front and back. movement and meaning in the vertical and sagittal axis. *Soc. Psychol.* 42, 159–164. doi: 10.1027/1864-9335/a000065

Koch, S. C., Kunz, T., Lykou, S., and Cruz, R. (2014a). Effects of dance and dance movement therapy on health-related psychological outcomes. A meta-analysis. *Arts Psychother.* 41, 46–64. doi: 10.1016/j.aip.2013.10.004

Koch, S. C., Mehl, L., Sobanski, E., Sieber, M., and Fuchs, T. (2014b). Therapeutic mirroring: a feasibility study of the effects of dance movement therapy on young adults with Autism Spectrum Disorder. *Autism.*

Koch, S. C., Morlinghaus, K., and Fuchs, T. (2007). The joy dance. Effects of a single dance intervention on patients with depression. *Arts Psychother.* 34, 340–349. doi: 10.1016/j.aip.2007.07.001

Laban, R. (1980). *The Mastery of Movement*, *4th Edn.*, ed L. Ullmann (London: Mac Donald and Evans).

Lahmann, C., Röhricht, F., Sauer, N., Ronel, J., Noll-Hussong, M., Henrich, G., et al. (2010). Functional relaxation as complementary treatment in irritable bowel syndrome: a randomized, controlled clinical trial. *J. Altern. Complement. Med.* 16, 47–54. doi: 10.1089/acm.2009.0084

Lang, P. J., Greenwald, M. K., Bradley, M. M., and Hamm, A. Q. (1993). Looking at pictures: affective, facial, visceral, and behavioral reactions. *Psychophysiology* 30, 261–273. doi: 10.1111/j.1469-8986.1993.tb03352.x

Lazarus, R. S. (1982). Thoughts on the relations between emotion and cognition. *Am. Psychol.* 37, 1019–1024. doi: 10.1037/0003-066X.37.9.1019

Lee, S. W. S., and Schwarz, N. (2011). Clean slate effects: the psychological consequences of physical cleansing. *Curr. Dir. Psychol. Sci.* 20, 307–311. doi: 10.1177/0963721411422694

Levy, F. (2005). *Dance Movement Therapy. A Healing Art*. Reston, VA: National Dance Association.

Lewin, K. (1935). *A Dynamic Theory of Personality.* New York, NY: McGraw-Hill.

Lyons, W. (1980). *Emotion*. Cambridge: Cambridge University Press. doi: 10.1017/CBO9780511609244

Meier, B. P., Schnall, S., Schwarz, N., and Bargh, J. A. (2012). Embodiment in social psychology. *Top. Cogn. Sci.* 4, 705–716. doi: 10.1111/j.1756-8765.2012.01212.x

Merleau-Ponty, M. (1962). *The Phenomenology of Perception*. New York, NY: Humanities Press.

Merleau-Ponty, M. (1964). "Eye and mind," (Transl. C. Dallery), in *The Primacy of Perception*, ed J. Edie (Evanston, IL: Northwestern University Press), 159–190.

Mermillod, M., Vermeulen, N., Droit-Volet, S., Jalenques, I., Durif, F., and Niedenthal, P. (2011). Embodying emotional disorders: new hypotheses about possible emotional consequences of motor disorders in parkinson's disease and tourette's syndrome. *ISRN Neurol.* 2011:306918. doi: 10.5402/2011/306918

Neumann, R., and Strack, F. (2000). Approach and avoidance: the influence of proprioceptive and exteroceptive cues on encoding of affective information. *J. Pers. Soc. Psychol.* 79, 39–48. doi: 10.1037/0022-3514.79.1.39

Nussbaum, M. C. (2001). *Upheavals of Thought. The Intelligence of Emotions.* Cambridge: Cambridge University Press.

Pallaro, P. (2002). "Somatic countertransference: the therapist in relationship," in *Authentic Movement: Moving the Body, Moving the Self, Being Moved*, ed P. Pallaro (London: Jessica Kingsley), 176–193.

Payne, H., and Stott, D. (2010). Change in the moving bodymind: quantitative results from a pilot study on the BodyMind Approach (BMA) as groupwork for patients with medically unexplained symptoms (MUS). *Couns. Psychother. Res.* 10, 295–307. doi: 10.1080/14733140903551645

Polanyi, M. (1967). *The Tacit Dimension*. Garden City, NY: Anchor Books.

Pollatos, O., Herbert, B. M., Wankner, S., Dietel, A., Wachsmuth, C., Henningsen, P., et al. (2011). Autonomic imbalance is associated with reduced facial recognition in somatoform disorders. *J. Psychosom. Res.* 71, 232–239. doi: 10.1016/j.jpsychores.2011.03.012

Prinz, J. (2004). *Gut reactions: A Perceptual Theory of Emotion.* Oxford: Oxford University Press.

Reisenzein, R. (1994). Pleasure-arousal theory and the intensity of emotions. *J. Pers. Soc. Psychol.* 67, 525–539. doi: 10.1037/0022-3514.67.3.525

Riskind, J. H. (1984). They stoop to conquer: guiding and self-regulatory functions of physical posture after success and failure. *J. Pers. Soc. Psychol.* 47, 479–493. doi: 10.1037/0022-3514.47.3.479

Rogers, C. R. (1951). *Client-Centered Therapy. Its Current Practice, Implications and Theory.* New York, NY: Guilford.

Ryckman, R. M., Robbins, M. A., Thornton, B., and Cantrell, P. (1982). Development and validation of a physical self-efficacy scale. *J. Pers. Soc. Psychol.* 42, 891–900. doi: 10.1037/0022-3514.42.5.891

Schmitz, H., Müllan, R. O., and Slaby, J. (2011). Emotions outside the box—the new phenomenology of feeling and corporeality. *Phenomenol. Cogn. Sci.* 10, 241–259. doi: 10.1007/s11097-011-9195-1

Schnall, S., Benton, J., and Harvey, S. (2008). With a clean conscience: cleanliness reduces the severity of moral judgments. *Psychol. Sci.* 19, 1219–1222. doi: 10.1111/j.1467-9280.2008.02227.x

Sheets-Johnstone, M. (1999). Emotion and movement. A beginning empirical-phenomenological analysis of their relationship. *J. Conscious. Stud.* 6, 259–277.

Slaby, J., and Stephan, A. (2008). Affective intentionality and self-consciousness. *Conscious. Cogn.* 17, 506–513. doi: 10.1016/j.concog.2008.03.007

Smith, I. M., and Bryson, S. E. (1994). Imitation and action in autism: a critical review. *Psychol. Bull.* 116, 259–273. doi: 10.1037/0033-2909.116.2.259

Solomon, A. (2001). *The Noonday Demon: An Atlas of Depression*. London: Vintage Books.

Solomon, R. (1976). *The Passions*. New York, NY: Anchor/Doubleday.

Stern, D. N. (1985). *The Interpersonal World of the Infant: A View From Psychoanalysis and Developmental Psychology*. New York, NY: Basic Books.

Stern, D. N. (2010). *Forms of Vitality. Exploring Dynamic Experience in Psychology and the Arts*. Oxford: Oxford University Press.

Strack, F., Martin, L., and Stepper, S. (1988). Inhibiting and facilitating conditions of the human smile: a non-obtrusive test of the facial feedback hypothesis. *J. Pers. Soc. Psychol.* 54, 768–777. doi: 10.1037/0022-3514.54.5.768

Stuart, S. (2012). Available online at: http://embodiedknowledge.blogspot.de/2012/06/enkinaesthesia.html

Taylor, G. J., and Taylor, H. S. (1997). "Alexithymia," in *Psychological Mindedness: A Contemporary Understanding*, eds M. McCallum and W. E. Piper (Munich: Lawrence Erlbaum Associates), 28–31.

Trevarthen, C. (2009). "The functions of emotion in infancy: the regulation and communication of rhythm, sympathy, and meaning in human development," in *The Healing Power of Emotion: Affective Neuroscience, Development, and Clinical Practice*, eds D. Fosha, D. J. Siegel, and M. F. Solomon (New York, NY: Norton), 55–85.

van der Kolk, B. A. (1994). The body keeps the score: memory and the evolving psychobiology of posttraumatic stress. *Harv. Rev. Psychiatry* 1, 253–265. doi: 10.3109/10673229409017088

Wallbott, H. G. (1990). *Mimik im Kontext: Die Bedeutung Verschiedener Informationskomponenten für das Erkennen von Emotionen. [Facial Expression in Context: The Meaning of Different Information Components for Emotion Recognition*]. Goettingen: Hogrefe.

Weeks, S., and Hobson, R. (1987). The salience of facial expression for autistic children. *J. Child Psychol. Psychiary* 28, 137–151. doi: 10.1111/j.1469-7610.1987.tb00658.x

Weiß, S., Sack, M., Henningsen, P., and Pollatos, O. (2014). On the interaction of self-regulation, interoception and pain perception. *Psychopathology*. (in press).

Weizsäcker, V. (1940). *Der Gestaltkreis. Theorie der Einheit von Wahrnehmen und Bewegen.* [*The Gestalt Circle. Theory of the Unity of Perception and Movement*]. Leipzig: Thieme.

Williams, J. M. G., Teasdale, J. D., Segal, Z. V., and Kabat-Zinn, J. (2007). *The Mindful Way Through Depression: Freeing Yourself from Chronic Unhappiness*. New York, NY: Guilford Press.

Williams, L. E., and Bargh, J. A. (2008). Experiencing physical warmth promotes interpersonal warmth. *Science* 24, 606–607. doi: 10.1126/science.1162548

Wollmer, M. A., de Boer, C., Kalak, N., Beck, J., Götz, T., Schmidt, T., et al. (2012). Facing depression with botulinum toxin: a randomized controlled trial. *J. Psychiatr. Res.* 46, 574–581. doi: 10.1016/j.jpsychires.2012.01.027

Zajonc, R. B., and Markus, H. (1984). "Affect and cognition: the hard interface," in *Emotions, Cognition and Behavior*, eds C. Izard, J. Kagan, and R. B. Zajonc (Cambridge: Cambridge University Press), 73–102.

Zhong, C. B., and Leonardelli, G. J. (2008). Cold and lonely: does social exclusion feel literally cold? *Psychol. Sci.* 19, 838–842. doi: 10.1111/j.1467-9280.2008.02165.x

Zhong, C. B., and Liljenquist, K. (2006). Washing away your sins: threatened morality and physical cleansing. *Science* 313, 1451–1452. doi: 10.1126/science.1130726

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Received: 24 March 2014; paper pending published: 14 April 2014; accepted: 09 May 2014; published online: 06 June 2014.

*Citation: Fuchs T and Koch SC (2014) Embodied affectivity: on moving and being moved. Front. Psychol. **5**:508. doi: 10.3389/fpsyg.2014.00508*

This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology.

APPENDIX

BODY SELF-EFFICACY-SCALE (BSE; KOCH, UNPUBLISHED MANUSCRIPT)

Please answer how the following statements apply to you on a scale from 0 to 5 with 0 representing "applies not at all" and 5 representing "applies exactly":

1. I can move well.	0	1	2	3	4	5
2. My movements are beautiful.	0	1	2	3	4	5
3. My body is flexible.	0	1	2	3	4	5
4. I have many bodily constraints.	0	1	2	3	4	5
5. My body is lifeless and inert/numb.	0	1	2	3	4	5
6. I can easily jump over an obstacle of medium size.	0	1	2	3	4	5
7. My body feels like "in pieces."	0	1	2	3	4	5
8. My body often feels like it does not belong to me.	0	1	2	3	4	5
9. I can move elegantly/with grace.	0	1	2	3	4	5
10. I can express myself in movement.	0	1	2	3	4	5

Internal Consistency BSE: Cronbach's alpha = 0.75 (students; n = 63) and 0.83 (patients; n = 83) on the German version.

EMBODIED INTERSUBJECTIVITY SCALE (EIS; KOCH, UNPUBLISHED MANUSCRIPT)

Please think about the last situation in which you have moved with others in a group (e.g., in movement therapy, in dancing). In how far did the following statements apply to you on a scale from 0 to 5 with 0 representing "applies not at all" and 5 representing "applies exactly":

1. I can pick up the movements of others.	0	1	2	3	4	5
2. Through movement I can transmit/communicate aspects of myself.	0	1	2	3	4	5
3. Through the movement of others, I realize how they feel (e.g., joy, tension).	0	1	2	3	4	5
4. I can accompany others in movement ("mirror" movement).	0	1	2	3	4	5
5. I can recognize how others feel through joint movement.	0	1	2	3	4	5
6. Through joint movement a connectedness arises.	0	1	2	3	4	5
7. If others move in synch with me, I feel accepted by them.	0	1	2	3	4	5
8. Something new can emerge in moving with others.	0	1	2	3	4	5
9. I can understand, what others want to express with movement.	0	1	2	3	4	5
10. If another person moves in synch with me I feel understood.	0	1	2	3	4	5

Internal Consistency *EIS*: *Cronbach's alpha* = 0.87 (students; $n = 63$) and 0.90 (patients; $n = 83$) on the German version.

Both measures had been pretested in a longer version on a sample of 80 psychology students at the University of Heidelberg and had been cut down from an item pool of twice the amount of items using the criterion of internal consistency scores. Both, the BSE and the EIS, were then tested with a sample of 63 students of therapy sciences at SRH University of Heidelberg, resulting in a *Cronbach's alpha* (*BSE*) of 0.75; and a *Cronbach's alpha* (*EIS*) of 0.87 (Kelbel, unpublished thesis). They were further employed in the context an RCT on movement therapy with schizophrenic and autistic populations ($n = 83$; 42 schizophrenic patients and 41 Autism Spectrum Disorder, mostly high functioning) and were found reliable for these patient groups (*Cronbach's alpha BSE* = 0.83; *Cronbach's alpha EIS* = 0.90; Kelbel, unpublished thesis).

The BSE (of both student and patient sample data) was validated with the Ryckman Scale (Ryckman et al., 1982) a standardized questionnaire on perceived physical ability. The two scales showed a correlation of $r = 0.55$, $p < 0.01$, indicating high agreement, even though, Ryckman et al. did not cover the aesthetic aspects included in the BSE.

frontiers in
PSYCHOLOGY

ORIGINAL RESEARCH ARTICLE
published: 10 June 2014
doi: 10.3389/fpsyg.2014.00537

Rhythm is it: effects of dynamic body feedback on affect and attitudes

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Body feedback is the proprioceptive feedback that denominates the afferent information from position and movement of the body to the central nervous system. It is crucial in experiencing emotions, in forming attitudes and in regulating emotions and behavior. This paper investigates effects of dynamic body feedback on affect and attitudes, focusing on the impact of movement rhythms with smooth vs. sharp reversals as one basic category of movement qualities. It relates those qualities to already explored effects of approach vs. avoidance motor behavior as one basic category of movement shape. Studies 1 and 2 tested the effects of one of two basic movement qualities (smooth vs. sharp rhythms) on affect and cognition. The third study tested those movement qualities in combination with movement shape (approach vs. avoidance motor behavior) and the effects of those combinations on affect and attitudes toward initially valence-free stimuli. Results suggest that movement rhythms influence affect (studies 1 and 2), and attitudes (study 3), and moderate the impact of approach and avoidance motor behavior on attitudes (study 3). Extending static body feedback research with a dynamic account, findings indicate that movement qualities – next to movement shape – play an important role, when movement of the lived body is an independent variable.

Keywords: embodiment, body feedback, approach and avoidance motor behavior, attitudes, movement qualities, movement rhythms, movement analysis, dance movement therapy

INTRODUCTION

Movement is central to the human condition (Sheets-Johnstone, 1999). It is dynamic and as pervasive as the air that we breathe. Movement therapies use this basic human capacity in order to restore health, access resources, and diminish suffering (e.g., Koch et al., 2013). Movement also provides us with central cues for indications and can predict therapy outcomes (e.g., Ramsayer and Tschacher, 2011). Dance movement therapy (e.g., Levy, 2005) assumes that next to the *shape* of a movement (e.g., approach vs. avoidance movement), its' *quality* is of central importance (Kestenberg, 1995; Laban, 1960). Next to the *what*, the *how* of the movement (e.g., indulgent vs. fighting movement) can have an influence on our affect and attitudes, cognition and interpersonal relations (Kestenberg and Sossin, 1973; Stern, 1985; Rizzolatti, 2013).

With the change from a computer metaphor-based to a more organismic understanding of the human condition (Smith and Semin, 2004) in embodiment research, human movement has moved back into a scientific focus. Research in psychology and neuroscience demonstrated that the observation of the movement of our conspecifics in a goal related task sets of our own motor programs in order to understand the intentions of the others (e.g., Buccino et al., 2001). The bodily reactions of our conspecifics cause empathic bodily reactions in ourselves (Bavelas et al., 1986; Chartrand and Bargh, 1999; Wilson and Knoblich, 2005); and the congruency of motor behavior with a cognitive task influences the effectiveness of our performance (e.g., Wells and Petty, 1980; Förster and Strack, 1996).

Body feedback from postures can cause differential affect (Strack et al., 1988), attitudes (Cacioppo et al., 1993; Neumann and Strack, 2000; Maass and Russo, 2003; Förster, 2004; Schubert, 2004), and cognition (Mussweiler, 2006; Cuddy et al., 2012; for a review of these effects see Niedenthal et al., 2005). Since most of the latter studies have focused on static but not dynamic body feedback, it seems timely to analyze influences of movement on affect, attitudes, and cognition, and to specify clinical implications of these findings.

The expressive function of movement has been a scientific topic ever since Darwin had published "The expression of emotions in men and animals" (Darwin, 1872/1965). The impressive function of movement (Wallbott, 1990) has been a focus in psychology starting with James–Lange theory, and has thrived empirically with the postulation of the facial feedback hypothesis (Buck, 1980; Laird, 1984). Body feedback approaches have subsequently further extended to include postural feedback (e.g., Riskind, 1984; LaFrance, 1985; Rossberg-Gempton and Poole, 1992), and vocal feedback (Hatfield et al., 1995; for a general overview on body feedback research see Hatfield et al., 1994) but most of this research has remained in the static realm of held postures or facial expressions to date.

For clinical applied fields such as body psychotherapy or dance movement therapy working with movement of the lived body as an independent variable all the time, body feedback research needs to move on to investigate effects of movement on affect, cognition, and health-related outcomes. The dynamic character of movement has not yet been fully accounted for by embodiment

research in general and body feedback research in particular, which so far focused on effects of static facial expressions and postures on affect and cognitions. Movement, however, is characterized and defined by its dynamic properties: its relation to space, weight (gravity/force), and time (Laban, 1960), and its proprioceptive and kinesthetic properties (Sheets-Johnstone, 1999; Gibbs, 2006). In body feedback studies using held postures, these properties of movements have not been taken into account leading to a lack of knowledge if it comes to effects of movement interventions. Moreover, almost all embodiment research so far has focused exclusively on movement shape (i.e., changes in the form or direction of the movement), and has not considered changes in movement quality (i.e., changes in muscle tension and the dynamic properties related to space, weight, and time).

ROUND vs. SHARP REVERSALS

An exception is the study of Aronoff et al. (1992) who considered the impact of movement qualities on perception. Aronoff et al. (1992) investigated emotional implications of round vs. angular movement (study 1), and round and angular facial cues (study 2) reporting that round properties are related to perception of emotional warmth, cordiality and positive roles of actors on stage, whereas angular properties are related to perceptions of threat and negative roles of actors on stage. Angular shapes and sharp transitions had already been demonstrated to cause more attributions of aggressiveness in the classic movie of Heider and Simmel (1944) on the antropomorphization of animated geometric forms. In a similar vein, a study of Bar and Neta (2006) using stimuli from everyday objects (watches, sofas, etc.) found that attitudes toward curved shapes were significantly more positive than attitudes toward sharp-angled shapes. This basic smooth vs. sharp distinction was already found in a classic experiment by gestalt psychologist Köhler (1929). People were asked to assign the names *bouba* and *kiki* to one of two shapes (later also exchanged by the words *maluma* and *takete*), one looking like a round-curved inkblot and the other like a sharp-edged star. Between 95 and 98% of people asked assigned *kiki* to the angular shape and *bouba* to the rounded shape. The effect has been demonstrated in different cultural contexts and also in children as early as two and a half years of age (Maurer et al., 2006). Yet, Aronoff et al. (1992) remain the only researchers to have empirically looked at these properties in movement (study 1). However, they focused on perceptual effects and did not account for body feedback effects (i.e., the effects from peripheral movement on more central processes such as affect or cognition), nor did they explicitly distinguish movement shape from movement quality. Our findings extend Aronoff's work with a body feedback approach, distinguishing the effects of movement shape from the effects of movement qualities more explicitly than Aronoff et al. (1992).

A THEORY ON MOVEMENT AND MEANING

Early attempts to specify dynamic movement qualities have been made by movement analysts[1] (e.g., Laban, 1960) and later have been selectively related to psychological properties (e.g., Kestenberg, 1995). One of the most complete and differentiated theory-systems on how movement maps to semantics is the Kestenberg Movement Profile (KMP; Kestenberg and Sossin, 1973, 1979; Kestenberg-Amighi et al., 1999; Koch and Sossin, 2013). With a focus on clinical and developmental applications such as early mother–child interaction, Kestenberg developed nine perspectives on movement (yielding nine diagrams) based on the three dimensions of space, weight (gravity/force) and time, and the three planes of horizontal, vertical and sagittal movement. Following Laban (1960) and Lamb (1965), Kestenberg distinguished two basic movement systems: movement qualities and movement shape. On the basis of psychodynamic theories (Freud, 1965), she related those to the first years of child development as well as to clinical issues and personality traits in the adult. She thereby offered a comprehensive theory-system for a wide range of applications in non-verbal diagnosis and intervention. Since her predictions are directly related to human movement as an observable independent variable her theory is testable and offers a wealth of hypotheses to clinical embodiment research. This article focuses on the movement rhythms and the underlying principles of the Kestenberg system (for a more complete account on the KMP see Kestenberg-Amighi et al., 1999; Koch and Sossin, 2013).

MOVEMENT RHYTHM

When we hear of rhythms we may think of music rather than of movement. Yet, just like there are external rhythms that can make us move to the beat (Grahn and Brett, 2007), there are internal ones that are related to our own situational needs and affect. They are expressed by the constant subtle alternations in muscle tension and relaxation in the body (Kestenberg and Sossin, 1973, 1979; Kestenberg, 1995). KMP-theory distinguishes 10 prototypical movement rhythms[2] (see **Figure 1**) that correspond to physiological and psychological needs of a person (Kestenberg, 1995; Kestenberg-Amighi et al., 1999). They belong to the broader system of movement qualities and fall in two basic categories: indulgent rhythms and fighting rhythms. Indulgent rhythms have smooth reversals (reversals are the transitions from tension to relaxation and vice versa; examples for smooth rhythms are sucking or swaying) and serve joyful indulgence into new behavior, while fighting rhythms have sharp reversals (e.g., snapping transitions such as in cutting or biting) and serve necessary separation from old behavior and defense against outer or inner demands. These movement rhythms already start to develop in the fetal stage (Loman, 2007). In each developmental phase, one indulgent rhythm that facilitates acquisition, mobilization into new patterns, and libidinal repetition of predominant movements precedes a fighting rhythm that facilitates stabilization, differentiation, and separation from that particular phase (cf. Erikson, 1950). The sucking rhythm is the first rhythm that organizes the body of the child. It has smooth reversals, low intensity, and regular amplitudes spreading from the mouth to all other body parts, particularly

[1] Most movement analysis systems have been developed in dance-related contexts. Just like note writing in music, there was a need for notational systems of movement in dance; movement analysis developed alongside movement notation (Laban, 1960; Kestenberg and Sossin, 1973, 1979).

[2] The 10 rhythms corresponding to 10 developmental movement stages are: sucking, snapping/biting, twisting, straining-release, running–drifting, starting–stopping, swaying, surging/birthing, jumping and spurting/ramming (Kestenberg and Sossin, 1973).

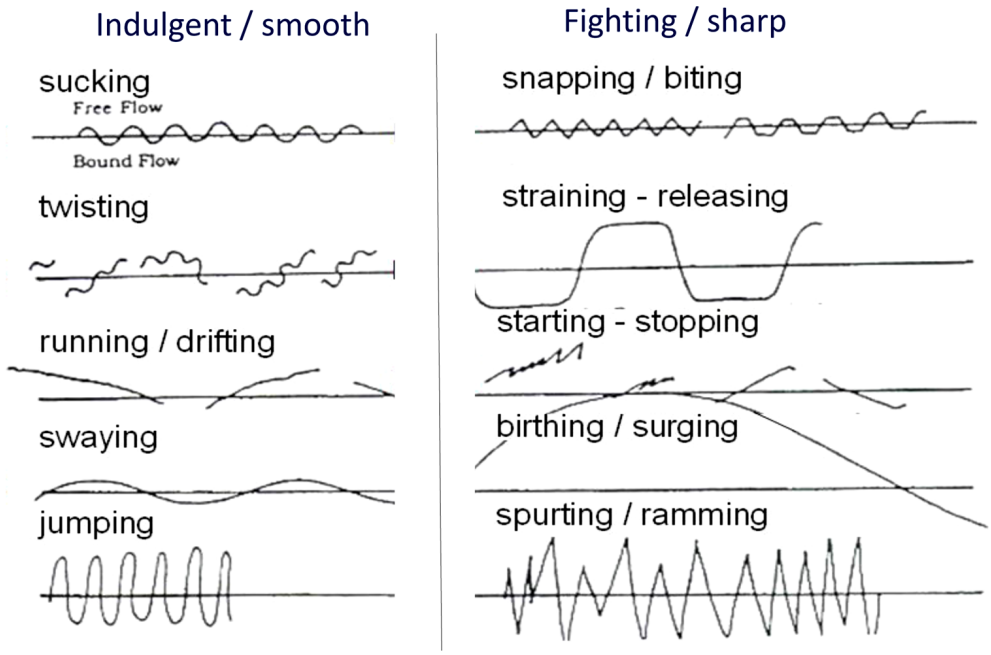

FIGURE 1 | Overview of the Kestenberg tension-flow rhythms. The 10 prototypical developmental movement rhythms following KMP-theory (cf. Kestenberg-Amighi et al., 1999). Study 1 used jumping vs. spurting/ramming rhythm, study 2 used swaying vs. snapping/biting and starting–stopping rhythm, and study 3 used sucking and jumping vs. starting–stopping and spurting/ramming rhythm (depending on the intensity and timing participants used). Rhythms may vary in three sets of parameters (*attributes*): regularity of amplitude (*even* vs. *flexibile*), intensity-level (*high* vs. *low intensity;* indicated in height of vertical stroke), and timing (*abrupt* vs. *gradual;* indicated in steepness of slope), and are related to the three dimensions of space, weight and time respectively while rhythms indicate needs on the individual level, shapes indicate relations to persons or objects.

when children need to soothe themselves, for example, immediately before falling asleep (Lotan and Yirmiya, 2002). The biting rhythm has sharp reversals and helps the child to cut and separate things, first with the teeth, then with the hands and the entire body. It later serves analytic thinking and separation of categories, and can be observed, for example, when we bite our pencils or finger nails. Thus finding oneself biting on a pen might indicate the need to focus, concentrate and get concepts straight; if one finds oneself curling one's hair or rocking in a sucking rhythm this can indicate the need to soothe oneself. Likewise, these rhythms are employed to address needs of others (e.g., soothing a baby; consider that all lullabies consist of sucking rhythms) and usually lie at the implicit level of our experience.

The method of rhythms notation, done in hand-writing on a blank sheet with a time line, makes use of kinesthetic empathy (Kestenberg, 1995). Observing the target person, notators take the changes in muscle tension and relaxation into their own body (by motor simulation) and from there into their writing arm, fingers and pencil (as bodily extension), finally producing a "tension-flow line" on the sheet. By convention, moving the pencil down thereby indicates an increase of tension in the body of the target, while moving the pencil up indicates a decrease of tension in the body of the target. Once notated, the rhythms are categorized and counted. Rhythm counts usually yield inter-rater reliabilities of *Cronbach's Alphas* between 0.74 and 0.91 (Sossin, 1987; Koch, 2006).

MOVEMENT SHAPE

Cacioppo et al. (1993) conducted an experimental series on approach and avoidance motor behavior, demonstrating that the application of pressure toward the body from below a table (held approach movement) produced more positive attitudes toward Chinese ideographs (arbitrary characters) than the application of pressure away from the body from above the table. The experiment was groundbreaking in two respects: it showed that the movement of the basic categories *approach and avoidance* directly produced pronounced attitudes, and researchers consciously applied the first dynamic variable, i.e., the application of directional force, to demonstrate the meaning of directional movement (toward and away from the body). Neumann and Strack (2000) replicated and extended these findings in Germany.

KMP-theory postulates that changes in shape-flow (i.e., rudimentary directional movement on the basic dimensions of growing/open vs. shrinking/closed) are related to affect and attitudes: approach behavior is expected to be related to positive affect and attitudes, avoidance behavior is expected to be related to negative affect and attitudes (e.g., the child grows toward the smiling mother; the child shrinks away from the angry dog). Shape-flow movements toward and away from the body (shape-flow design) are related to self-object-differentiation as well as to giving and taking. Cacioppo et al. (1993) use an evolutionary account to explain the effect of approach and avoidance motor behavior on attitudes:

during ontogenesis – and also phylogenesis – persons have learned to take in good things (e.g., food) and to push away bad things (e.g., angry persons); this life-long learning process causes a conditioned evaluative preparedness of our cognitive-affective system. Similarly, Eberhard-Kaechele (2007) points out that in KMP-theory shape-flow differentiates on a preconscious level between toxic and nourishing stimuli and provides the appropriate response (i.e., growing toward or shrinking away from a stimulus). Thus, KMP-theory predicts an effect of movement qualities on affect and of movement shape on affect as well as on attitude.

HYPOTHESES

Based on the approaches of Kestenberg and Sossin (1979) and Cacioppo et al. (1993), and on the grounds of theories of embodied cognition (Barsalou, 1999; Niedenthal et al., 2005; Niedenthal, 2007), we predicted how movement will influence affect and attitudes. The study extends existing findings in body feedback research using dynamic movement instead of statically held postures. Following KMP-theory, movement quality was included through the manipulation of movement rhythms with smooth vs. sharp reversals assuming that smooth rhythms would cause more indulgent affect in movers.

We employed two one-factorial (smooth vs. sharp rhythms) and one two-factorial (movement rhythm × movement shape) designs. Studies 1 and 2 tested the hypotheses that indulgent vs. fighting movement rhythms (smooth vs. sharp rhythms) would cause congruent[3] answers on cognitive and affect measures (one-factorial between-group design). Study 3 tested the hypotheses that approach vs. avoidance motor behavior and smooth vs. sharp movement rhythms would cause congruent answers on an affect and attitude measure. The relative magnitude of the main effects and the interaction was explored (2 × 2 between-group design).

STUDY 1: DYNAMIC BODY FEEDBACK FROM MOVEMENT RHYTHMS ON AFFECT AND COGNITION

Study 1 focused on systematic effects of dynamic body feedback from rhythms on affect and cognition. In addition to the expectation that movement rhythms with smooth reversals would cause more positive affect, we expected two motor congruency effects on the cognitive level. In a categorization task (online embodiment; i.e., embodiment effects directly caused in the situation), participants in the indulgent groups were expected to categorize "smooth" words (e.g., *sway*) faster than "sharp" words (e.g., *bite*), and participants in the fighting groups were expected to categorize "sharp" words faster than "smooth" words. In the memory task of study 1 (offline embodiment; i.e., embodiment effects from memory), participants were expected to remember more congruent words, respectively.

METHOD

SAMPLE

Sixty participants (30 women, 30 men; mean age = 23.83; SD = 8.54) were tested in a one-factorial between group designs. Thirty used jumping rhythm (indulgent; smooth reversals), and thirty used spurting/ramming rhythm (fighting; sharp reversals). Participants had been either recruited in the psychology department at the local university or in the local central pedestrian zone (about 50% from each location). Most participants were students. In all studies, we matched men and women to the otherwise randomized groups. Gender was controlled in all studies but did not account for any differences related to the main hypotheses. Participants signed an informed consent form before the experiments started. A debriefing was provided at the end of the experiments. In all studies, participants received either course credit or sweets for their participation.

COVER STORY

Participants were told in the beginning that this experiment aimed to measure the influence of different levels of physical arousal on a number of tasks. In all three studies, their pulse was taken before and after the movement, and served as a control variable, but did not have any significant influence. Their attention was thus turned away from the movement qualities.

MOVEMENT MANIPULATION

We chose jumping rhythm vs. spurting/ramming rhythm as examples of indulgent vs. fighting rhythms because due to their high intensity and magnitude they were particularly easy to observe and embody, and particularly clear and easy to distinguish from one another (**Figure 1**). Participants in the indulgent condition were told to bounce on both feet, almost as if rope skipping, but without leaving the floor; those in the fighting condition were told to kick an imaginary ball with the left and right leg in alternation. Both movements were performed in high intensity and abrupt, differing merely in smoothness vs. sharpness of reversals (bouncing/jumping: smooth; kicking: sharp). Movements were performed for ∼2 min, while participants categorized verbs into *smooth* ("*rund*") and *sharp* ("*eckig*") by mouse-clicks.

INSTRUMENTS AND SCALES

Reaction time measure

Reaction times were measured for the semantic categorization task. Participants had to categorize 22 pretested verbs into the two categories of "smooth" or "sharp." Verbs were taken directly from the rhythms terminology of the KMP translated to German, for example, "swaying" (wiegen) or "sucking" (saugen) for *smooth*, and "biting" (beissen) or "knocking" (klopfen) for *sharp*. We conducted a pretest with 20 participants and finally only used words correctly categorized by at least 14 persons. The presentation was programmed in Experimental Runtime System (ERTS, Beringer, BeriSoft, Frankfurt, Germany), verbs were presented in random order. Reaction time was measured computing the duration from display of the verbs to the mouse click by the participant.

Recall

The recall of the formerly categorized words was to be given in free format. We calculated with both number of "smooth" and "sharp" words recalled.

[3]The word *congruent* is always used in the sense that the content of the answers matches the assumed semantics of the movement.

How do you feel at present:

relaxed	1	2	3	4	5	6	7	tense
loaden, fighting	1	2	3	4	5	6	7	joyful, excited
drifting, layed back	1	2	3	4	5	6	7	impatient, driven
comfortable	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*uncomfortable*
indulgent	1	2	3	4	5	6	7	distancing oneself
holding back, retentive	1	2	3	4	5	6	7	playful, coy
yielding	1	2	3	4	5	6	7	fighting
letting go	1	2	3	4	5	6	7	nervous
open	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*closed*
resenting	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*taking in*
approaching	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*avoiding, refraining from*
inclined / drawn toward	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*disinclined / repelled from*
peaceful	1	2	3	4	5	6	7	aggressive

FIGURE 2 | Movement-based affect scale (MBAS; Koch and Müller, 2007). The movement-based affect scale (13 items; originally "Brief KMP affect scale," Koch and Müller, 2007) consists of eight items related to movement qualities and five items related to movement shapes and is based on the tension-flow and shape-flow concepts of Kestenberg (1995), Kestenberg and Sossin (1973, 1979); items related to movement shape are set in italics; those were added for study 3, when movement shape was introduced. All items have been derived from the KMP textbook of Kestenberg-Amighi et al. (1999) via the KMP-questionnaire (Koch and Müller, 2007) yielding good internal consistencies of scales of the German version (with *Cronbach's Alphas* between 0.70 and 0.95). The affect scale in our studies showed *Cronbach's Alphas* of 0.70 and 0.82 (without shape items in studies 1 and 2) and of 0.89 including shape items (in study 3).

Affect measure

Participants were asked "How do you feel? Please take some time to sense the effects of the movement just performed." We employed a self-constructed movement based-affect scale (MBAS; Koch and Müller, 2007; **Figure 2**; non-italicized items) consisting of seven bipolar adjective items on a 7-point scale from a longer pretested version of the affect scale (KMP-questionnaire; Koch and Müller, 2007) containing the interpretative semantic terms from KMP-theory from the KMP-book by Kestenberg-Amighi et al. (1999) on the level of movement rhythms (indulgent vs. fighting; Koch and Müller, 2007). Sample items were *tense* vs. *relaxed, nervous* vs. *letting go*, etc., *Cronbach's Alpha* was 0.70. Factor analysis revealed the expected one-factor solution with 63% of the variance explained. We used the sum score for computations. After reversion of polarization, higher values indicated more negative affect.

PROCEDURE

Informed consent was obtained for participation and the fact that the session was video-taped. Then participants received the following instruction: "In this study we investigate the effects of bodily exhaustion on performance in a number of areas. For each of these areas you will complete a short task." Heart rate and blood pressure were then obtained as a base-rate. Participants received instructions on how to move in the according condition (jumping vs. spurting ramming rhythm) with a short description and demonstration by the experimenter. On correct repetition, the person was asked to rehearse the movement for 15 more seconds before moving on to the first task. Subsequently, they received instructions for the categorization task. They had to hold a wireless mouse in both hands and categorize verbs that appeared via beamer on a white 2 m × 2 m screen in a distance of about 2 m. Words had to be categorized as fast as possible into the categories smooth vs. sharp by pressing the right or left mouse button using the right or left thumb respectively. After two exercise trials the categorization task started. Participants had to continue to perform the movement during the entire categorization task (∼2 min). Immediately after the task, heart rate and blood pressure were taken again. Then the experimenter asked the participants to do the movement for another 15 s focusing on "how the movement feels" (without being distracted by the categorization task). Thereafter, participants had to characterize their impression using the affect scale (**Figure 2**). After that, participants had to recall as many words as possible from the categorization task writing them on a blank sheet. Finally, participants completed a demographic data sheet and were then debriefed about the aims of the study. In the end, they either received course credit or selected a small present from a selection of sweets. The study took ∼30 min altogether.

DATA ANALYSIS

We computed an analysis of variance (ANOVA) with movement rhythm (jumping vs. spurting/ramming) as independent variable, and reaction times, recall, and affect (measured with the MBAS) as dependent variables, using SPSS (2002, SPSS Inc., Chicago, IL, USA) and an 0.05 alpha-level.

RESULTS AND DISCUSSION

Results indicate that indulgent vs. fighting rhythms led neither to a faster classification of congruent words, nor to a more frequent recall of congruent words (cognitive measures). They did, however, cause congruent affect in participants $F(60,1) = 4.34$, $p = 0.042$, $\eta^2 = 0.07$. Descriptive statistics are provided in **Table 1**.

Table 1 | Descriptives of studies 1 and 2.

	Study 1 (N = 60)	
	Smooth ***M (SD)***	***Sharp*** ***M (SD)***
Reaction times (in ms)	1780 (337)	1731 (298)
Recall (M freq words)	2.02 (1.35)	1.40 (0.96)
Affect (sum)*	23.23 (5.56)	26.43 (6.12)
	Study 2 (N = 62)	
	Smooth ***M (SD)***	***Sharp*** ***M (SD)***
Face evaluation[a]	−6.62 (11.65)	−8.21 (15.35)
Face recognition[b]	4.75 (0.43)	4.60 (0.56)
Affect (sum)**	40.03 (11.19)	49.13 (14.40)

*Affect (sum) = sum value of the affect scale; higher values indicate more negative affect; [a] judgment of 60 faces on a scale from −100 (very unsympathetic) to +100 (very sympathetic); [b] recognition of 10 previously seen faces among 40 faces (frequency); *p < 0.05, **p < 0.01.*

The use of indulgent vs. fighting rhythms affected the affective level in the hypothesized direction: participants who performed indulgent movement felt more relaxed, joyful, indulgent, peaceful, playful, etc. Whereas participants who performed fighting movement felt more tense, intruding, fighting, aggressive, retaining, etc. The "missing effect" on the cognitive measures may indicate that movement qualities – at least on the rhythm level, i.e., the earliest and most implicit level – do not affect cognition, but it could also mean that our cognitive measures were not sensitive enough to the experimental manipulation or on a different cognitive level. We speculated that – consistent with KMP-theory – an evaluative measure may have been more adequate than a reaction time measure.

In sum, the manipulation of prototypical movement rhythms as basic dimensions of movement qualities showed the hypothesized effects on the affective level only. In order to investigate whether the changes in affect were in fact due to differential effects of movement qualities (indulgent vs. fighting), or just to this particular combination of rhythms (jumping vs. spurting/ramming), to any laterality effects (alternating vs. parallel leg movement), or even just to the very specific movements used in study 1 (pretending to bounce similar to rope-jumping vs. pretending to kick a ball), we conducted study 2. One of the cognitive measures was replaced by an evaluative measure in order to further investigate which dependent variables are generally affected by movement rhythms.

STUDY 2: CONSISTENCY OF DYNAMIC BODY FEEDBACK FROM MOVEMENT RHYTHMS

In order to investigate the generalizability of the effects of study 1 to other combinations of rhythms, we conducted a second study similar to the first study using swaying rhythm (indulgent/smooth) vs. biting rhythm (fighting/sharp). Variables, design, cover story, instruments, procedure and hypotheses were parallel to those of study 1, except for the replacement of the categorization and recall task by a face evaluation and recognition task.

METHOD

SAMPLE

Sixty-seven participants, mostly psychology students from the local university, were tested. Sixty-two (22 men, 40 women; mean age = 22.75; SD = 3.97) were included into the final analyses. The others did not perform the movement correctly or consistently enough, as determined by a blind expert rater. Students received course credits for participation.

MOVEMENT MANIPULATION AND HYPOTHESES

Participants sat on a table and swung their legs alternatingly (using swaying rhythm), or had to pull up their feet in parallel and push them down again (flexion and extension of foot ankle using biting rhythm, sometimes starting–stopping rhythm; this variation, however, was not important as long as it was a fighting rhythm) while they performed the evaluation task on a laptop. During the performance of the movement they had to push and hold down either a right or a left key to indicate the degree of sympathy of 60 neutral-expression stimulus faces (from −100 very unsympathetic to +100 very sympathetic). In addition to the motor congruency effect on affect, that is, that the smooth rhythm would again cause more positive affect, we expected two cognitive motor congruency effects: (a) higher sympathy ratings in the smooth rhythms group and (b) an increased recognition of the known faces where movement had been congruent to the valence of the initial evaluation. In the recognition task, they received 40 neural-expression facial stimuli: 10 known and 30 unknown. The 10 known were the ones they formerly had rated most extreme: their five most sympathetic and their five most unsympathetic. We computed an ANOVA using a 0.05 alpha-level with movement rhythm (swaying vs. biting/starting–stopping) as independent variable, and evaluations of faces, recognition of faces, and affect (MBAS) as the dependent variables. *Cronbach's Alpha* for the MBAS was 0.82.

RESULTS AND DISCUSSION

In line with our assumptions, findings were almost identical to study 1. We found no effects of indulgent vs. fighting rhythms on the cognitive-evaluative measure (neither online nor offline), but an effect on the affective measure $F(1,62) = 7.77$; $p = 0.007$; $\eta^2 = 0.12$. Again, the use of indulgent vs. fighting rhythms particularly affected the affective level in the hypothesized direction: when participants performed indulgent movement they felt more relaxed, joyful, etc.; when they performed fighting movement they felt more tense, aggressive, etc. Study 2 thus replicated the results of the first study. In sum, studies 1 and 2 demonstrate the initial validity of indulgent (smooth) vs. fighting (sharp) movement qualities as a meaningful basic dimension of movement and their link to the affect system as hypothesized by KMP-theory (Kestenberg, 1995). Cognition, also in the more evaluative operationalization, remained unaffected (see **Table 1**; **Figure 3**). Since the gist of these findings corresponded to the predictions of KMP-theory, and at the same time added the essential movement qualities to body

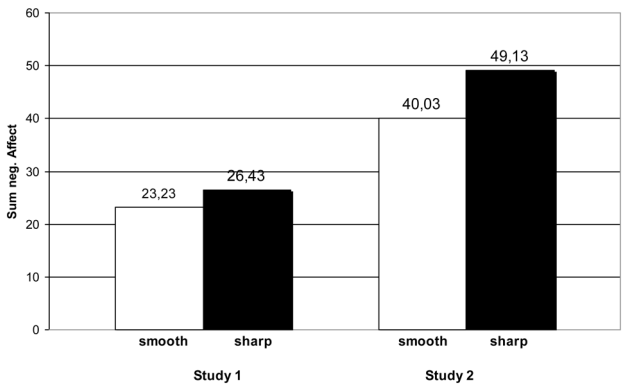

FIGURE 3 | Affect ratings (sum values) after indulgent vs. fighting movement in study 1 and 2. Results of studies 1 and 2: fighting rhythms caused higher negative affect (*tense, aggressive, nervous,* etc.), whereas indulgent rhythms caused higher positive affect (*relaxed, joyful, playful,* etc.); higher values indicate more negative affect.

feedback research, we felt encouraged to carry our studies further. On the basis of our results, we speculated that while fighting vs. indulgent movement may not have caused a main effect on our first evaluative measure selected, it may still affect other evaluative measures, maybe in conjunction with other embodiment effects on attitudes.

STUDY 3: DOES MOVEMENT QUALITY MODERATE APPROACH AND AVOIDANCE MOTOR EFFECTS?

In body feedback research, there is a well-known effect of arm flexion and extension causing more positive vs. more negative attitudes toward initially valence-free stimuli (Cacioppo et al., 1993). With a series of six experimental studies, Cacioppo et al. (1993) were among the first researchers to take the entire body plus a held directional force into account as an independent measure influencing attitude formation. They showed that non-facial and rudimentary dynamic motor manipulations can influence participants' attitudes toward initially valence-free stimuli (Chinese ideographs). Participants either performed an approach movement (i.e., arm flexion: they pressed their palms against the underside of a table, thereby mobilizing force upward and toward the body) or an avoidance movement (i.e., arm extension: they pressed their palms against the surface of a table, thereby mobilizing force downward and away from the body). While performing the movement, participants watched a series of 24 initially valence-free Chinese ideographs. When they later evaluated the ideographs, participants in the approach condition rated the ideographs significantly more positively than participants in the avoidance condition. These findings have been supplemented by empirical studies identifying moderators such as laterality (Cretenet and Dru, 2004; Dru and Cretenet, 2005), hemispheric processing asymmetries, and personality traits (Maxwell and Davidson, 2007), as well as the valence of the stimuli, and the relation to the effects' situated meaning (Centerbar and Clore, 2006). All of these studies have begun to take movement into account by inducing a basic movement direction, and by this means bringing rudiments of goal direction into the equation. Cacioppo et al. (1993) interpreted their findings as a direct effect of motor behavior on attitude. KMP-theory suggests that, because of their strong relation to affect, rhythms with smooth vs. sharp reversals should influence rudimentary attitudes in a similar fashion as approach vs. avoidance motor behavior; they may thus be components of, or contributors to, attitudes.

In this study, we aimed to replicate and extend the results from Cacioppo et al. (1993) that arm flexion and extension (as a manipulation of movement shape) has a differential effect on attitudes toward valence-free stimuli. Since we were interested in the effects of movement proper, rather than mere expense of held force, participants were instructed to move their arms rhythmically either toward the body or away from the body (palm direction oriented accordingly). We further wanted to find out whether movement qualities and movement shape are related to the evaluative system in a similar way and with similar effect sizes. On the basis of Cacioppo et al. (1993) and Kestenberg-Amighi et al. (1999), we hypothesized a main effect for movement shape (approach vs. avoidance) and a main effect for movement quality (smooth vs. sharp rhythms): smooth rhythms, just like approach movements, were assumed to cause more positive attitudes.

METHOD

SAMPLE AND DESIGN

Forty participants (21 women, 19 men; mean age 22.90, SD = 7.37) were tested in a 2 × 2 design: independent variables were movement rhythms (smooth vs. sharp rhythms) and movement shape (approach vs. avoidance movement). Dependent variables were the offline-evaluation of the Chinese ideographs from the original experiment by Cacioppo et al. (1993; attitude measure), and an affect scale, including the seven original items related to movement qualities, and five new items related to movement shape (**Figure 2**). Participants, mostly students, had been recruited in the local pedestrian zone and in the psychology department and received either course credits or sweets as a reward.

MOVEMENT MANIPULATION

In all four conditions participants were sitting, using both lower arms bilaterally (in parallel), which were moved in four (successive) steps rhythmically toward or away from the torso. Ten participants did an approach movement toward the body (palms also facing toward their body) combined with a smooth rhythm (round reversals, circular movement), 10 participants did an avoidance movement away from the body (palms facing away from their bodies) combined with the smooth rhythm. Ten participants performed an approach movement toward the body combined with a sharp rhythm (sharp reversals, angular movement), and 10 participants did an avoidance movement away from the body combined with a sharp rhythm.

MATERIALS AND SCALES

Chinese ideographs

We employed the Chinese ideographs from the original study Cacioppo et al. (1993). This material had been tested in many –

also international – contexts. We used 12 out of the 24 ideographs (the ones that had not been mirror imaged) and displayed them in a power point presentation at a rate of one ideograph every 10 s on a 2 m × 2 m screen at about 2 m distance from the observer. The entire duration of the presentation was 2 min. Departing from the original experiment, we did not use an initial evaluation during the first presentation of the ideographs.

Attitude scale

Participants had to rate the ideographs on a scale from 1 very negative to 6 very positive.

Affect scale

The affect scale used in the rhythms studies before was extended by five items related to change in movement shape (see **Figure 2**; Koch and Müller, 2007). The new items again were taken from the semantic interpretations of KMP-theory on the meaning of changes in movement shapes. Sample items were: *open* vs. *closed* (*offen* vs. *verschlossen*), *comfortable* vs. *uncomfortable* (*fühle mich wohl* vs. *fühle mich unwohl*), *inclined toward* vs. *disinclined* (*zugeneigt* vs. *abgeneigt*; see **Figure 2**; italicized items). *Cronbach's Alpha* was 0.89.

PROCEDURE

Participants met one of two experimenters (a man and a woman) and signed an informed consent sheet. Then they received the following information: "This is an experiment on the effects of arousal level on different dependent variables you are in the low arousal condition." Subsequently, their pulse was taken (base rate) followed by a short training of the movement by one of the experimenters. Thereafter, they were told that they would now see a series of Chinese ideographs that they should merely watch and let them sink in. In a second circulation, they watched the ideographs while performing one of the four movements described above. Afterward, their pulse was taken again. Then they were asked to do the movement for a few more times, before they received the affect scale where they indicated their affect after the movement on the bipolar adjective scales. In a third circulation, they saw the ideographs again and had to rate them on a 6-point scale from very negative to very positive. On the final sheet, they provided their demographic data, received their reward, and were debriefed by one of the experimenters.

DATA REDUCTION AND STATISTICAL ANALYSES

The sum scores of the affect items, and the means of the evaluations of the ideographs served as the basis for calculations. A MANOVA was computed with rhythm (smooth vs. sharp movement; sucking vs. biting) and shape (approach vs. avoidance movement; toward or away from one's own body) as independent variables, and attitudes (evaluation of ideographs) and affect (MBAS) as dependent variables.

RESULTS AND DISCUSSION

Results indicated that the movement condition had a systematic influence on attitudes and affect but not always in accordance with our expectations. While movement shape (approach vs. avoidance) had only a marginal influence on attitudes $F(1,40) = 3.94$; $p = 0.055$; $\eta^2 = 0.09$, it did have a significant influence on the affect measure $F(1,40) = 5.56$; $p = 0.024$; $\eta^2 = 0.13$: after the approach movement, participants felt significantly more relaxed, peaceful, etc.; after the avoidance movement, they felt significantly more tense, aggressive, etc. (no matter whether they had used indulgent or fighting rhythms). Movement rhythms unexpectedly had no influence on the affect measure (as we had seen in the two studies before), but significantly influenced the attitude measure: after using smooth rhythms, participants judged the initially valence-free ideographs more positively, than after using sharp rhythms $F(1,40) = 4.63$; $p = 0.038$; $\eta^2 = 0.11$. The interaction of movement rhythms and shapes was significant for the attitude measure $F(1,40) = 5.89$; $p = 0.020$; $\eta^2 = 0.14$ (see **Figure 4**).

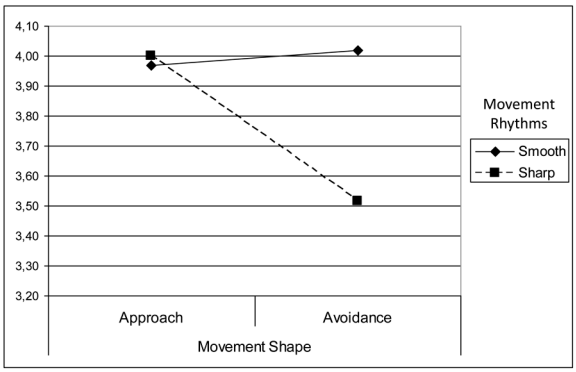

FIGURE 4 | Attitude ratings (*M*) in study 3: interaction of movement shape and movement quality (*N* = 40) for bilateral movement. Ratings on a 6-point scale from 1 very negative to 6 very positive; $*p < 0.05$.

The influence of rhythms on attitudes was a new finding. The influence of movement shape on affect is predicted by KMP-theory just the way it occurred in the experiment. An interesting finding is the interaction of movement rhythms and movement shape. It suggests that rhythm could be a moderator for shape in its effects on attitudes and potentially also on affect (**Table 2**). The effects were of comparable magnitude for movement quality and movement shape. In general, however, we only had a minimal sample size in study 3, leaving the power very low. Given the small effect sizes, results need replication.

GENERAL DISCUSSION

In this study, we investigated effects of dynamic body feedback, that is, effects from movement proper, on affect, attitudes and cognition. Based on KMP-theory, we introduced indulgent (smooth) and fighting (sharp) movement qualities as two basic principles from movement analysis (Kestenberg-Amighi et al., 1999). Movement qualities in general and movement rhythms with smooth vs. sharp reversals in particular were found to be important factors influencing affect and moderating effects of movement shape. Apart from the fact *which* movement is enacted (*shape*; here: approach vs. avoidance motor behavior), it seems equally important *how* the movement is enacted (*quality*). In sum, movement rhythms influenced the affect of participants and their attitudes toward initially valence-free stimuli, and moderated the influence of movement shape on attitude formation. Methodologically, the

Table 2 | Descriptives of study 3 ($N = 40$).

	Movement quality		*Movement shape*	
	Smooth rhythm ***M (SD)***	***Sharp rhythm*** ***M (SD)***	***Approach*** ***M (SD)***	***Avoidance*** ***M (SD)***
Affect (sum)	24.76 (8.21)	27.20 (8.07)	23.00 (6.09)	28.96 (8.94)
Attitude (*M*)	3.99 (0.29)	3.73 (0.45)	3.96 (0.31)	3.74 (0.44)

Affect (sum) = sum value of the affect scale; higher values indicate more negative affect; attitude (M) = mean evaluation of the 12 ideographs on 6-point scales. Movement shape had a significant influence on affect ($p < 0.05$); movement quality had a significant influence on attitude ($p < 0.05$); and the interaction of movement shape and movement quality was significant ($p < 0.05$).

affect and attitude scale may be seen as measuring two aspects of a basic evaluation variable: affect as operationalized here can be seen as the self-related component of a dependent evaluative measure whereas attitude can be seen as the object-related component.

Studies 1 and 2 established smooth and sharp rhythms as basic dimensions of movement with differential effects on affect but not on cognition. It did not matter what particular pair of rhythms we selected or whether there was parallel or alternating limb action, smooth rhythms generally caused more positive (relaxed, peaceful, etc.) affect than sharp rhythms. Other operationalizations of cognitive variables may bear more potential to detect causal relationships between rhythms and cognition than the ones employed here. Following KMP-theory, fighting qualities could for example help people differentiate better by putting them in a more analytic mode and indulging qualities could lead people to blend categories more by putting them in a more integrative and intuitive mode. Overall, our findings are conform with KMP-theory, since Kestenberg (1995) assumes that movement rhythms are foremost associated with needs and affect.

Study 3 showed that body rhythms also influenced attitudes. However, in study 3, affect was not influenced by movement rhythms but by movement shape. Moreover, movement qualities and movement shape interacted significantly in their effects on attitudes. The magnitude of the influence of both independent variables seemed to be comparable in this first joined test. In the study of Cacioppo et al. (1993), participants provided an initial evaluation of the ideographs while watching them for the first time – a condition that the researchers established as necessary for the occurrence of the effect. Since the effects in our study occurred without the initial evaluation of the ideographs, it may be possible that dynamic movement manipulations have stronger effects than statically held postures. Given this is correct, it may be due to the greater naturalness of dynamic movement as part of our everyday experience: the missing spatio-temporal and kinesthetic features in held postures could be exactly the ones that are decisive for the occurrence of the effect. However, because of the merely marginal significance of movement shape on attitudes ($p = 0.055$), and the small sample size, a replication of the same study with a larger sample is needed in order to analyze the complex influences of movement qualities and movement shape on attitudes and affect. As a next step, it may be useful to separate rhythms and shape manipulations within one design to find out more about potential hierarchies among the effects.

BEYOND STATIC BODY FEEDBACK

On a theoretical level, our results underline the importance of effects from movement shape (e.g., Neumann and Strack, 2000; Raab and Green, 2005; Friedman and Elliot, 2007) and complement the picture by adding movement qualities to the tradition of embodiment research. Movement qualities clearly modify the meaning of movements adding a second semantic dimension (cf. Suitner et al., 2012). Our studies are among the first to demonstrate an influence of dynamic movement quality in a body feedback context and the first using a differentiated theory background on how movement maps to semantics to derive its' predictions. The theory employed in this research and our empirical findings are compatible with other recent theoretical approaches in psychology and the neurosciences (e.g., Damasio, 1994; Barsalou, 1999; Gallese and Lakoff, 2005). All of these approaches assume action and action simulation in sensory-motor areas of the brain at the basis of affect, thinking and reasoning, while the mere duplication of information in abstract symbols, as postulated by amodal theories, is assumed to be implausible and uneconomic.

CLINICAL APPLICATIONS

Approach and avoidance motor behavior in interaction with movement qualities can take on different meaning in clinical contexts and psychopathology. To a borderline patient approach movements with sharp rhythm may cause more positive affect when he/she is in a state where self-harm is a goal or a means of relief. The obsessive-compulsive patient may benefit from smooth avoidance movements in order to overcome compulsive approach actions. In general, movement qualities employed in therapy can be assumed to cause changes in affect and attitudes. This assumption and its long term implications need to be explored in future clinical studies.

Approach and avoidance movements have self-related and interpersonal affective implications. Self-related implications have been described above, interactional implications have been described for example by Kafka (1950). Kafka dealt with the basic affects (*Uraffekte*) and assumed four of them, two approach- and two avoidance-related ones:

- *profusion*: "along with me to you" (love, affection);
- *ingestion*: "along with you to me" (desire, greed);

- *recession*: "away with me from you" (fear, disgust);
- *ejection*: "away with you from me" (anger, hatred).

These tendencies are picked up in the works of Shai and Belsky (2011), and Fuchs and Koch (2014; this issue) on embodied affectivity, both emphasizing the huge overlap between affect and motor action in general (see also Cipolletta, 2013), and the influence of intersubjective factors in particular. Such intersubjective factors are presently investigated in our research on movement rhythm and their communicative functions in handshakes and embraces (Koch, unpublished).

In psychopathology, patients often get stuck in one self-related or interpersonal way of being. One clinical goal would be to have chronically stuck patients expand their movement repertoire in order to extend their action and affective options, coping mechanisms, self-efficacy, and sense of agency. In dance movement therapy, changes in movement are assumed to produce global and specific changes in affect, attitudes and cognition, as differentially predicted by the KMP (Kestenberg, 1995) or Laban Movement Analysis (Laban, 1960); many of these assumptions still need empirical testing.

CONCLUSION

This research investigated the influence of movement on affect, attitudes and cognition, extending previous, more statically focused work on the effects of motor behavior. It extends Aronoff et al.'s (1992) and other researchers' findings on the basic smooth/sharp distinction with a body feedback approach. The general aim of the studies was to investigate the meaning of movement qualities, here in particular whether movement rhythms with smooth vs. sharp reversals are basic dimensions of movement with differential implications for affect, attitudes and cognition (as also evidenced from other lines of empirical studies such as Köhler, 1929; Aronoff et al., 1992; Bar and Neta, 2006). Merleau-Ponty (1965) assumed that each experience of a quality is in reality an experience of a certain way of movement. Is it possible that we have greatly overlooked the meaning of movement in clinical psychology? Could this be due to the fact that the dynamics of body movement cannot easily be investigated with classic experimental methods but in fact would be more appropriately modeled within a dynamic systems theory framework and methods? Our findings trace effects that start as movement rhythms in the body: in the alternation of muscle tension and relaxation and its smooth vs. sharp reversals dependent on our organisms' need to indulge or to separate. The results from our findings indicate that dynamic movement and movement qualities are an important research topic with potentially far reaching implications for clinical and health-related questions, but also for social cognition, interaction, *communication*, thinking, learning, memory, research methods, and in any case – as demonstrated here – for affect and attitudes as core themes of social embodiment research.

ACKNOWLEDGMENTS

Professor Dr. Sabine C. Koch, Department of Therapeutic Sciences, SRH University Heidelberg. I would like to thank Nancy Brechtel, Stefanie Glawe, Caroline Berude, Gloria Fischer, Marc Hörster and particularly Stephanie M. Müller for data collection, John Cacioppo for sharing the Chinese ideographs from the original studies, and Nancy Brechtel, Susan Loman, Janet Kestenberg Amighi, Michael Kimmel, Stephanie M. Müller, Mark Sossin, and Jörg Zumbach for helpful comments on the manuscript. Correspondence concerning this paper should be addressed to Professor Dr. Sabine C. Koch, SRH University Heidelberg, Maria-Probst-Straße 3, 69123 Heidelberg, Germany. email: sabine.koch@hochschule-heidelberg.de

REFERENCES

Aronoff, J., Woike, B. A., and Hyman, L. M. (1992). Which are the stimuli in facial displays of anger and happiness? Configural bases of emotion recognition. *J. Pers. Soc. Psychol.* 62, 1050–1066. doi: 10.1037/0022-3514.62.6.1050

Bar, M., and Neta, M. (2006). Humans prefer curved visual objects. *Psychol. Sci.* 17, 645–648. doi: 10.1111/j.1467-9280.2006.01759.x

Barsalou, L. W. (1999). Perceptual symbol systems. *Behav. Brain Sci.* 22, 577–609.

Bavelas, J. B., Black, A., Lemery, C. R., and Mullett, J. (1986). "I show you how I feel": motor mimicry as a communicative act. *J. Pers. Soc. Psychol.* 50, 322–329. doi: 10.1037/0022-3514.50.2.322

Buccino, G., Binkofski, F., Fink, G. R., Fadiga, L., Fogassi, L., Gallese, V., et al. (2001). Action observation activates premotor and parietal areas in a somatotopic manner: an fMRI study. *Eur. J. Neurosci.* 13, 400–404.

Buck, R. (1980). Nonverbal behavior and the theory of emotion: the facial feedback hypothe-sis. *J. Pers. Soc. Psychol.* 38, 811–824. doi: 10.1037/0022-3514.38.5.811

Cacioppo, J. T., Priester, J. R., and Berntson, G. (1993). Rudimentary determinants of attitudes II: arm flexion and extension have differential effects on attitudes. *J. Pers. Soc. Psychol.* 65, 5–17. doi: 10.1037/0022-3514.65.1.5

Centerbar, D. B., and Clore, G. L. (2006). Do approach-avoidance actions create attitudes? *Psychol. Sci.* 17, 22–29. doi: 10.1111/j.1467-9280.2005.01660.x

Chartrand, T. L., and Bargh, J. A. (1999). The chameleon effect: the perception-behavior link and social interaction. *J. Pers. Soc. Psychol.* 7, 893–910. doi: 10.1037/0022-3514.76.6.893

Cipolletta, S. (2013). Construing in action: experiencing embodiment. *J. Constr. Psychol.* 26, 293–305. doi: 10.1080/10720537.2013.812770

Cretenet, J., and Dru, V. (2004). The influence of unilateral and bilateral arm flexion versus extension on judgments: an exploratory case of motor congruence. *Emotion* 4, 282–294. doi: 10.1037/1528-3542.4.3.282

Cuddy, A. J. C., Wilmuth, C. A., and Carney, D. A. (2012). *Preparatory Power Posing Affects Performance and Outcomes in Social Evaluations.* Harvard Business School Working Paper, No. 13-027, September 2012, Boston, MA.

Damasio, A. R. (1994). *Descartes' Error: Emotion, Reason, and the Human Brain.* New York: Putnam.

Darwin, C. (1872/1965). *The Expression of Emotions in Men and Animals.* Chicago: University of Chicago Press.

Dru, V., and Cretenet, J. (2005). Influence of bilateral motor actions on judgements: additional evidence for the motor congruence hypothesis. *Laterality* 10, 389–398. doi: 10.1080/13576500500143314

Eberhard-Kaechele, M. (2007). "The regulation of interpersonal relationships by means of shape flow: a psychoeducational intervention for traumatised individuals," in *Movement Analysis - Bewegungsanalyse. The Legacy of Laban, Bartenieff, Lamb and Kestenberg*, eds S. C. Koch and S. Bender (Berlin: Logos), 203–212.

Erikson, E. H. (1950). *Childhood and Society.* New York: Norton.

Förster, J. (2004). How body feedback influences consumer's evaluation of products. *J. Consum. Psychol.* 14, 415–425. doi: 10.1207/s15327663jcp1404_10

Förster, J., and Strack, F. (1996). Influence of overt head movements on memory for valenced words: a case of conceptual-motor compatibility. *J. Pers. Soc. Psychol.* 71, 421–430. doi: 10.1037/0022-3514.71.3.421

Freud, A. (1965). *Normality and Pathology in Childhood: Assessments of Development*, Vol. 6. New York: International University Press.

Friedman, R., and Elliot, A. J. (2007). The effect of arm crossing on persistence and performance. *Eur. J. Soc. Psychol.* 38, 449–461. doi: 10.1002/ejsp.444

Fuchs, T., and Koch, S. C. (2014). Embodied affectivity: on moving and being moved. *Front. Psychol.* 5:508. doi: 10.3389/fpsyg.2014.00508

Gallese, V., and Lakoff, G. (2005). The brain's concepts: the role of the sensory-motor system in conceptual knowledge. *Cogn. Neuropsychol.* 22, 455–479. doi: 10.1080/02643290442000310

Gibbs, R. W. (2006). *Embodiment and Cognitive Science.* Cambridge: Cambridge University Press.

Grahn, J. A., and Brett, M. (2007). Rhythm and beat perception in motor areas of the brain. *J. Cogn. Neurosci.* 19, 893–906. doi: 10.1162/jocn.2007.19.5.893

Hatfield, E., Cacioppo, J. T., and Rapson, R. L. (1994). *Emotional Contagion.* Paris: Cambridge University Press.

Hatfield, E., Hsee, C. K., Costello, J., Weisman, M. S., and Denney, C. (1995). The impact of vocal feedback on emotional experience and expression. *J. Soc. Behav. Pers.* 10, 293–312.

Heider, F., and Simmel, M. (1944). An experimental study of apparent behavior. *Am. J. Psychol.* 57, 243–259. doi: 10.2307/1416950

Kafka, G. (1950). Über Uraffekte. *Acta Psychol.* 7, 257–278. doi: 10.1016/0001-6918(50)90018-7

Kestenberg-Amighi, J., Loman, S., Lewis, P., and Sossin, K. M. (1999). *The Meaning of Movement: Developmental and Clinical Perspectives of the Kestenberg Movement Profile.* New York: Routledge.

Kestenberg, J. S. (1995). *Sexuality, Body Movement and Rhythms of Development.* Northvale: Jason Aronson. (Originally published in 1975 under the title Parents and Children).

Kestenberg, J. S., and Sossin, K. M. (1973). *The Role of Movement Patterns in Development*, Vol. 1. New York: Dance Notation Bureau Press.

Kestenberg, J. S., and Sossin, K. M. (1979). *The Role of Movement Patterns in Development,* Vol. 2. New York: Dance Notation Bureau Press.

Koch, S. C. (2006). "Gender at work: differences in use of rhythms, efforts, and preefforts," in *Advances in Dance/Movement Therapy. Theoretical Perspectives and Empirical Findings*, eds S. C. Koch and I. Bräuninger (Berlin: Logos).

Koch, S. C., Caldwell, C., and Fuchs, T. (2013). On body memory and embodied therapies. *Body Mov. Dance Psychother.* 8, 82–94. doi: 10.1080/17432979.2013.775968

Koch, S. C., and Müller, S. M. (2007). "Assessments with the KMP questionnaire and the brief KMP-based affect scale," in *Movement Analysis. The Legacy of Laban, Bartenieff, Lamb and Kestenberg*, eds S. C. Koch and S. Bender (Berlin: Logos), 195–202.

Koch, S. C., and Sossin, K. M. (2013). "Kestenberg movement analysis," in *Handbook of Language, Communication and Gesture*, eds C. Mueller, E. Fricke, A. Cienki, and D. McNeill (Berlin: DeGruyter).

Köhler, W. (1929). *Gestalt Psychology.* New York: Liveright.

Laban, R. v. (1960). *The Mastery of Movement.* London: MacDonald & Evans.

LaFrance, M. (1985). Postural mirroring and intergroup relations. *Pers. Soc. Psychol. Bull.* 11, 207–217. doi: 10.1177/0146167285112008

Laird, J. D. (1984). The real role of facial response in the experience of emotion: a response to Tourangeau and Ellsworth, and others. *J. Pers. Soc. Psychol.* 47, 909–917. doi: 10.1037/0022-3514.47.4.909

Lamb, W. (1965). *Posture and Gesture.* London: Gerald Duckworth.

Levy, F. (2005). *Dance Movement Therapy: A Healing Art.* Reston, VA: National Dance Association.

Loman, S. (2007). "The KMP and pregnancy: developing early empathy through notating fetal movement," in *Movement analysis – Bewegungsanalyse: The legacy of Laban, Bartenieff, Lamb and Kestenberg*, eds S. C. Koch and S. Bender (Berlin: Logos).

Lotan, N., and Yirmiya, N. (2002). Body movement, presence of parents and the process of falling asleep in toddlers. *Int. J. Behav. Dev.* 26, 81–88. doi: 10.1080/01650250042000627

Maass, A., and Russo, A. (2003). Directional bias in the mental representation of spatial events: nature or culture? *Psychol. Sci.* 14, 296–301. doi: 10.1111/1467-9280.14421

Maurer, D., Pathman, T., and Mondloch, C. J. (2006). The shape of boubas: sound-shape correspondences in toddlers and adults. *Dev. Sci.* 9, 316–322. doi: 10.1111/j.1467-7687.2006.00495.x

Maxwell, J. S., and Davidson, R. J. (2007). Emotion as motion: asymmetries in approach and avoidant actions. *Psychol. Sci.* 18, 1113–1119. doi: 10.1111/j.1467-9280.2007.02033.x

Merleau-Ponty, M. (1965). *Die Phänomenologie der Wahrnehmung.* Berlin: DeGruyter.

Mussweiler, T. (2006). Doing is for thinking! Stereotype activation by stereotypic movements. *Psychol. Sci.* 17, 17–21. doi: 10.1111/j.1467-9280.2005.01659.x

Neumann, R., and Strack, F. (2000). Approach and avoidance: the influence of proprioceptive and exteroceptive cues on encoding of affective information. *J. Pers. Soc. Psychol.* 79, 39–48. doi: 10.1037/0022-3514.79.1.39

Niedenthal, P. M. (2007). Embodying emotion. *Science* 316, 1002–1005. doi: 10.1126/science.1136930

Niedenthal, P. M., Barsalou, L. W., Winkielman, P., Krauth-Gruber, S., and Ric, F. (2005). Embodiment in attitudes, social perception, and emotion. *Pers. Soc. Psychol. Rev.* 9, 194–211. doi: 10.1207/s15327957pspr0903_1

Raab, M., and Green, N. (2005). Motion as input: a functional explanation of movement effects on cognitive processes. *Percept. Mot. Skills* 100, 333–348. doi: 10.2466/pms.100.2.333-348

Ramsayer, F., and Tschacher, W. (2011). Nonverbal synchrony in psychotherapy: coordinated body-movement reflects relationship quality and outcome. *J. Consult. Clin. Psychol.* 79, 284–295. doi: 10.1037/a0023419

Riskind, J. H. (1984). They stoop to conquer: guiding and self-regulatory functions of physical posture after success and failure. *J. Pers. Soc. Psychol.* 47, 479–493. doi: 10.1037/0022-3514.47.3.479

Rizzolatti, G. (2013). The mirror mechanism: a mechanism for understanding the actions of others. *Paper Presentation at the TESIS-Workshop, September* 12th, 2013, Parma.

Rossberg-Gempton, I., and Poole, G. D. (1992). The relationship between body movement and affect: from historical and current perspectives. *Arts Psychother.* 19, 39–46. doi: 10.1016/0197-4556(92)90062-S

Schubert, T. W. (2004). The power in your hand: gender differences in bodily feedback from making a fist. *Pers. Soc. Psychol. Bull.* 30, 757–769. doi: 10.1177/0146167204263780

Shai, D., and Belsky, J. (2011). When words just won't do: introducing Parental Embodied Mentalizing. *Child Dev. Pers.* 5, 173–180. doi: 10.1111/j.1750-8606.2011.00181.x

Sheets-Johnstone, M. (1999). *The Primacy of Movement.* Philadelphia: John Benjamins. doi: 10.1075/aicr.14

Sossin, K. M. (1987). Reliability of the Kestenberg Movement Profile. *Movement Studies* 2, 23–28.

Smith, E. R., and Semin, G. R. (2004). "Socially situated cognition. Cognition in its social context," in *Advances in Experimental Social Psychology*, Vol. 36, ed. M. P. Zanna (Amsterdam: Elsevier), 53–117.

Stern, D. (1985). *The Interpersonal World of the Infant.* New York: Basic Books.

Strack, F., Martin, L. L., and Stepper, S. (1988). Inhibiting and facilitating conditions of the human smile: a nonobtrusive test of the facial feedback hypothesis. *J. Pers. Soc. Psychol.* 54, 768–777. doi: 10.1037/0022-3514.54.5.768

Suitner, C., Koch, S. C., Bachmeier, K., and Maass, A. (2012). "Dynamic embodiment and its functional role: a body feedback perspective," in *Body Memory, Metaphor and Movement*, eds S. C. Koch, T. Fuchs, M. Summa, and C. Müller (Philadelphia: John Benjamins).

Wallbott, H. G. (1990). *Mimik im Kontext. Die Bedeutung verschiedener Informationskomponen-ten für das Erkennen von Emotionen.* Göttingen: Hogrefe.

Wells, G. L., and Petty, R. E. (1980). The effects of head movement on persuasion: compatibility and incompatibility of responses. *Basic Appl. Soc. Psychol.* 1, 219–230. doi: 10.1207/s15324834basp0103_2

Wilson, M., and Knoblich, G. (2005). The case for motor involvement in perceiving conspecifics. *Psychol. Bull.* 131, 460–473. doi: 10.1037/0033-2909.131.3.460

Conflict of Interest Statement: The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Received: 09 March 2014; accepted: 14 May 2014; published online: 10 June 2014.
Citation: Koch SC (2014) Rhythm is it: effects of dynamic body feedback on affect and attitudes. Front. Psychol. ***5****:537. doi: 10.3389/fpsyg.2014.00537*
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology.

frontiers in
PSYCHOLOGY

ORIGINAL RESEARCH ARTICLE
published: 05 September 2014
doi: 10.3389/fpsyg.2014.00979

Nonverbal synchrony of head- and body-movement in psychotherapy: different signals have different associations with outcome

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Objective: The coordination of patient's and therapist's bodily movement – nonverbal synchrony – has been empirically shown to be associated with psychotherapy outcome. This finding was based on dynamic movement patterns of the whole body. The present paper is a new analysis of an existing dataset (Ramseyer and Tschacher, 2011), which extends previous findings by differentiating movements pertaining to head and upper-body regions.

Method: In a sample of 70 patients (37 female, 33 male) treated at an outpatient psychotherapy clinic, we quantified nonverbal synchrony with an automated objective video-analysis algorithm (motion energy analysis). Head- and body-synchrony was quantified during the initial 15 min of video-recorded therapy sessions. Micro-outcome was assessed with self-report post-session questionnaires provided by patients and their therapists. Macro-outcome was measured with questionnaires that quantified attainment of treatment goals and changes in experiencing and behavior at the end of therapy.

Results: The differentiation of head- and body-synchrony showed that these two facets of motor coordination were differentially associated with outcome. Head-synchrony predicted global outcome of therapy, while body-synchrony did not, and body-synchrony predicted session outcome, while head-synchrony did not.

Conclusion: The results pose an important amendment to previous findings, which showed that nonverbal synchrony embodied both outcome and interpersonal variables of psychotherapy dyads. The separation of head- and body-synchrony suggested that distinct mechanisms may operate in these two regions: Head-synchrony embodied phenomena with a long temporal extension (overall therapy success), while body-synchrony embodied phenomena of a more immediate nature (session-level success). More explorations with fine-grained analyses of synchronized phenomena in nonverbal behavior may shed additional light on the embodiment of psychotherapy process.

Keywords: nonverbal synchrony, embodiment, psychotherapy, motion energy analysis, head movement, body-movement, process-outcome research

> "Relationships are not created by the brain; rather, the brain was created to serve relationships."
>
> (Baumeister, 2012, p. 136)

INTRODUCTION

Social interaction is a core ingredient of human existence and people have a basic need to belong to other people (Baumeister and Leary, 1995; Baumeister, 2012). The motive for connection – called communion in interpersonal theory (Horowitz et al., 2006) – is observable in most forms of social exchange and interpersonal behavior. The mechanisms involved in this complex and dynamic interplay are manifold, and traditionally, a basic distinction between verbal and nonverbal communication channels has been made. For a long time, nonverbal behavior has been recognized as an important facet of social interaction (Knapp et al., 2013), and various efforts have been made to use this often overlooked source of information. These attempts have been most evident in truth verification (e.g., Ekman and Friesen, 1974; DePaulo and Rosenthal, 1979; Vrij and Semin, 1996; DePaulo et al., 2003; Duran et al., 2013). For instance, the Supreme Court of Canada has recently ruled that judges and jurors must view a witness to "adequately evaluate body language, facial expressions, and other indicators of credibility" (Porter et al., 2012).

Observable manifestations of nonverbal behavior are best described within the framework of embodiment (Oberzaucher and Grammer, 2008; Storch et al., 2010; Tschacher and Bergomi, 2011), and the association between emotion and motion is also well captured from the stance of embodied cognition (Niedenthal, 2007). In this paper, we will focus on phenomena of embodiment in psychotherapy dyads: a previous study on nonverbal behavior in psychotherapy (Ramseyer and Tschacher, 2011) has identified nonverbal synchrony – the coordination of patient's and therapist's body-movement – as an indicator of embodied

processes in the therapy dyad. Here, we aim to extend this finding by looking more closely at different regions of the body and how their coordination may relate to indices of success in therapy. We assume that the differentiation between body regions will provide additional insight into the dynamics of nonverbal exchange.

Traditionally, research in the domain of nonverbal communication has strongly focused on signals transmitted by the face (de Gelder, 2009). The human nervous system has specialized subsystems that are fine-tuned for such signals: certain regions of the brain are involved when analyzing facial features for the purpose of, e.g., face recognition (fusiform gyrus: Kanwisher et al., 1997), or decoding of emotional signals in facial displays (amygdala: Morris et al., 1998). Similarly, however, selective cortical areas for visual processing of the human body have been identified (extrastriate body area: Downing et al., 2001; Koningsbruggen et al., 2013). Recent neurophysiological evidence implies that face and body perception may rely on different neurocortical systems (Meeren et al., 2013; Van den Stock et al., 2014). The larger part of these processes occur outside conscious awareness (Whalen et al., 1998) both for the encoding as well as the decoding of actions (e.g., micro-expressions: Matsumoto and Willingham, 2006). There is a consensus in the popular literature on "body language" that body parts farther away from the head (e.g., a person's legs and feet) are progressively less under conscious control (e.g., Pease and Pease, 2006; Reiman, 2007; Goman, 2008), and would therefore betray a person's "hidden intentions." Yet such assertions – to our knowledge – have never been tested empirically.

Generally, nonverbal communication uses dynamical information, not only static features. Therefore, movement dynamics is a core facet in the nonverbal domain. For example, the accuracy of detecting facial emotion in movies (i.e., with visible movements of the face) is significantly higher than in still photographs (Brick et al., 2009). Accordingly, body motion detection and interpretation are crucial for social perception (Grèzes and de Gelder, 2009). Thus, the whole body (not just the face) may be viewed as the essential "signaling device" in emotional processing (de Gelder, 2006), and such signals are prime sources of social information.

From an evolutionary point of view (Boone and Buck, 2003), it is vitally important to accurately navigate in social surroundings, because "the basic discrimination of friend and foe likely was one of the earliest interpersonal judgments to evolve" (Williams and Mattingley, 2006). This implies that apart from the accurate detection and decoding of nonverbal information, relevant implications for the interpersonal consequences of an encounter should also be registered and incorporated into the behavioral and emotional responses of an individual. The association between emotional experience and nonverbal behavior is tightly linked (e.g., Niedenthal et al., 2010; Lausberg and Kryger, 2011; Dael et al., 2012). Grahe and Bernieri (1999, p. 265) stated that "rapport is primarily a physically manifested construct; it is a construct that is visible at the surface and readily apparent. (...) In other words, rapport simply may be visible." In neurobiological terms, sensorimotor loops and the mirror-neuron system are able to transform the primary perception of a partner's acts into an interpretation of the partner's emotions and intentions. Most of these processes occur very fast and outside of conscious awareness (Tamietto and de Gelder, 2010). This is also true for the domain of gross body-movement and locomotion detection (Blake and Shiffrar, 2007). The specificity of movement detection is evident early in life (Baldwin et al., 2001) and it is highly relevant for any kind of human social interaction (Burgoon, 1994). Findings from patients suffering from autism spectrum disorders highlight the social consequences of inaccurate, delayed, or missing nonverbal processing (Klin et al., 2009).

Research on the core ingredients of psychotherapy has pointed to a significant role of the therapeutic alliance: the relationship quality between therapist and patient is one of the best empirically supported predictors of therapy outcome (Horvath et al., 2011; Flückiger et al., 2012). The alliance is considered to have several components such as mutual sympathy, pursuing shared goals, and the overcoming of resistance to change. Psychotherapists in practice always regard their own and their patients' nonverbal behavior (Hall et al., 1995). Recently, however, this topic has almost disappeared from view in psychotherapy research, as evidenced by the lack of references to nonverbal behavior in the latest edition of the Handbook of Psychotherapy and Behavior Change (Lambert, 2013). At the same time, various new approaches for the analysis of nonverbal behavior have appeared in social and clinical psychology (Frey and von Cranach, 1973; Bänninger-Huber, 1992; Altorfer et al., 2000; Boker and Rotondo, 2002; Grammer et al., 2003; Brick and Boker, 2011; Lavelle et al., 2012). Work on mimicry/imitation focused mainly on directly observable and quantifiable (body) movement behaviors (e.g., foot shaking, face rubbing). Recent, highly sophisticated research has addressed head movement dynamics (Boker et al., 2009), showing that the dynamics was the relevant factor that influenced behavior in participants (Boker et al., 2011). This is also found in research on man-machine interfaces: avatars that mimic the head movements of an interaction partner are evaluated more favorably than avatars that do not display such imitative head movements (Bailenson et al., 2004, 2008; Reidsma et al., 2010). Along a similar line, body sway has been shown to become entrained in everyday face-to-face communication (Higo et al., 2012).

Thus, such advances in different fields suggest that disentangling of different body-movement regions may be a next step for research on nonverbal communication in the context of psychotherapy (Henry et al., 2012). We will base these new analyses on a database that was established by a previous study of psychotherapy dyads (Ramseyer and Tschacher, 2011). In the present article we will be focusing on nonverbal signals transmitted by the face (head movement) in contrast to nonverbal signals transmitted by the body (movement of the upper torso and hands) and how these signals relate to measures of success in psychotherapy. Our approach is mainly descriptive and exploratory – we report the extent of movement in the different body regions and the coordination (i.e., the nonverbal synchrony) of patients and therapists based on movement in these regions. Our expectation was that the nonverbal variables would differ in their associations with therapy outcome measures.

MATERIALS AND METHODS

SAMPLE

The present dataset is a subsample of previously published data (Ramseyer and Tschacher, 2011), which consisted of psychotherapy sessions that were randomly drawn from the entire video-recorded data ($N > 5000$ recordings) of the outpatient center of the University of Bern, Switzerland. We randomly selected one single session of each dyad of the previous sample. This resulted in a total of $N = 70$ sessions of psychotherapy from 37 female and 33 male same-sex dyads (mean age 36.5 years, SD = 10.2, all white Caucasian European ethnicity). The sample contained 33 sessions from the initial phase and 37 sessions from the final phase of the respective patient's therapy. Patients belonged to the following main diagnostic groups: 34% anxiety disorders, 29% affective disorders, 37% other diagnoses (11.4% adjustment disorders, 8.6% personality disorders, 17% other disorders). Comorbidity was predominantly found in anxiety disorders (58% comorbid patients) and affective disorders (24%). These percentages are closely representative of the complete database of the outpatient center of $N = 838$ cases, where 35.1% of patients were diagnosed with anxiety disorders, 24.8% affective disorders, 10.5% adjustment disorder, 4.3% eating disorders, and 15% with no axis-1 disorder. All clinical diagnoses were assessed before initiation of therapy using the Structured Clinical Interview (SCID; Wittchen et al., 1997) for the *Diagnostic and Statistical Manual of Mental Disorders* [DSM-IV; American Psychiatric Association (APA), 1994].

Mean psychotherapy duration per patient of the present sample was 38.1 sessions (SD = 22.1, range 8–126). Recording of therapy sessions was part of routinely ongoing research activity and quality assurance. Sessions were generally conducted once a week, each lasting 50 min on average. Patients and therapists sat in comfortable chairs facing each other with an angle of ∼110° at a distance of 1.5–2.5 m. Administration of psychotherapy and recording of sessions was independent of the research reported here, and took place before the formulation of research hypotheses, from 1998 to 2004. At the time of recording, patients and therapists were informed about further scientific use of their data and gave informed consent according to Swiss ethical regulation policies. For reasons of comparability and standardization, we analyzed only sessions from same-sex dyads, as was done in the previous analysis (Ramseyer and Tschacher, 2011). The limitation to same-sex dyads was based on research showing that mixed-gender dyads displayed lower nonverbal synchrony (Grammer et al., 1998). Only the first 15 min of any therapy session were chosen for our study. This limitation was put in place because we regarded only interaction sequences where dyads remained seated throughout, i.e., 15 min segments of psychotherapy where patients and therapists exclusively engaged in speaking/listening activity. Instances of, e.g., use of a flip chart or similar device, which implied leaving one's chair, were excluded from analyses.

MOTION ENERGY ANALYSIS

Motion energy analysis (MEA; Ramseyer, 2014) is a theory-free, objective, and fully automated computer program designed to quantify movement behavior in digital video recordings. Motion energy is defined as differences in gray-scale pixels between consecutive video-frames (frame-differencing: Grammer et al., 1997, 1999; Ramseyer and Tschacher, 2006; Nagaoka and Komori, 2008; Altmann, 2011; Paxton and Dale, 2013). Detection of frame-by-frame change allows an objective quantification of movement occurring in spatially pre-defined regions of interest (ROI's; see **Figure 1C**). MEA thus generates time-series of raw pixel-change within a ROI that were filtered and corrected prior to further analyses (see **Figure 1D**). Details of the processing of raw signals are described in Grammer et al. (1999), further information on MEA is provided in Ramseyer and Tschacher (2011) and may be accessed online (www.psync.ch).

NONVERBAL SYNCHRONY

Nonverbal synchrony was conceived as a dynamic quality capturing movement characteristics irrespective of the type of posture displayed in a ROI. Nonverbal synchrony thereby constitutes an objective quantification of the *dynamic* movement characteristics displayed by patient and therapist.

To compute synchrony, the time-series of motion energy (**Figure 1D**) were cross-correlated (Boker et al., 2002; Derrick and Thomas, 2004) in window segments of 1 min duration, thus taking into consideration the non-stationarity of movement behaviors. Movements were cross-correlated with time-lags up to ±5 s, in order to allow for exactly simultaneous synchronization (lag of 0 s) and delayed synchronization (lags up to ±5 s). Absolute values of cross-correlation were aggregated over the entire interval of 15 min in each session.

DIFFERENTIATION OF REGIONS OF INTEREST

Separate regions for head movement and upper-body movement were chosen (see **Figure 1**). Previous work in the psychotherapy setting indicated differences between head movement and body-movement (Fretz, 1966), which was confirmed in a more recent study with schizophrenia patients (Kupper et al., 2010). Two ROIs were defined per participant: the head region covered the head including the neck and thus contains all head and neck movements; the body region covered the upper-body from the chair's seating-base upward and the arms. Both ROIs are shown in **Figure 1C**. Boundaries of ROIs were defined such that a zone of non-contact resulted between head and body. This was done in order to minimize possible region-crossings, i.e., movement from one region being erroneously registered in the other region. The most frequent example of region-crossing is self-touch of the facial region by a hand. Spontaneous facial self-touch occurs frequently (Nicas and Best, 2008), and was found to serve emotion-regulative purposes (Grunwald et al., 2014), and to entail notable effects on social impression formation (Harrigan et al., 1987). In the present analysis, we were not specifically interested in self-touch to the facial region, but in overall movement of head- and body-regions. We addressed this possible confounding aspect by simply regarding facial-touch as an instance of head-movement. This simplification/generalization may be considered conservative, because it attenuates the differentiation between head- and body-movement. At the level of

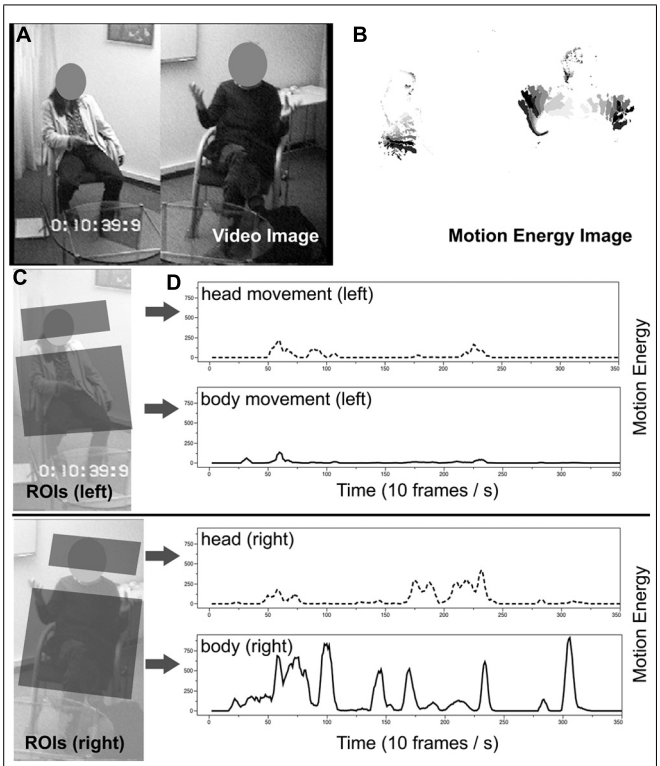

FIGURE 1 | (A) Original video recording; **(B)** Difference-image derived by motion energy analysis; **(C)** Definition of regions of interest; **(D)** Time-series (35 s shown) of raw movement for each defined region of interest.

statistical testing, we evaluated all synchrony-outcome associations either with or without partialling out the effect of the other region.

SYNCHRONY VERSUS PSEUDOSYNCHRONY

A final step in quantifying nonverbal synchrony is to rule out that the detected movement synchrony may be spurious. We therefore corrected for random contingencies between the two movement streams of patient and therapist. In early research on interactional synchrony, a debate addressed the genuineness of Condon and Ogston's (1966) findings (McDowall, 1978; Gatewood and Rosenwein, 1981). We acknowledge this critical consideration of synchrony findings by implementing a statistical mechanism that prevents false–positive detection of synchrony in psychotherapy sessions. To accomplish this, for each therapy session, we generated $N = 100$ surrogate datasets by shuffling the genuine data. In order to not destroy the microstructure of movement bursts, we shuffled each time-series windows-wise: the original structure inside one window remains intact, but due to shuffling of a window's position, it is paired with another window from a different time in the therapy. For example, the motion energy values of the therapist's behavior from the first minute may be aligned with the patient's movements from the ninth minute of the same session. The significance of observed movement synchrony in comparison with chance levels of synchrony is then determined by how much the genuine cross-correlation coefficients departed from the mean shuffled coefficients (Ramseyer and Tschacher, 2010).

MEASURES OF PSYCHOTHERAPY OUTCOME

Two types of outcome measures were used in this study. They captured change from different time-perspectives, which allowed both the quantification of session-level change – called micro-outcome – as well as overall therapy outcome – called macro-outcome (Ramseyer et al., 2014). The differentiation into micro- and macro-outcomes is not to be confounded with the level of evaluation used in, e.g., psychiatric assessments (Tomba and Bech, 2012), where the initial clinical judgment is called "macro-analysis" and a detailed analysis of symptoms is labeled "micro-analysis." The distinguishing feature of the outcome measures employed in the present study thus lies in their temporal extension: some events in the therapy process may extend to outcome at the session level, whereas other events may have an impact on the outcome of the whole treatment. Therefore, different temporal dynamics are captured by micro- and macro-outcome.

MICRO-OUTCOME

Post-session questionnaires were administered after the termination of each single therapy session as part of routine assessments. Patient (BPSR-P) and therapist (BPSR-T) versions of the *Bern Post-Session Report* (Flückiger et al., 2010) are self-report measures comprised of 22 (BPSR-P) and 27 (BPSR-T) items loading on five factors that were determined in previous factor analyses (Tschacher et al., 2007). Two factors captured the patient's view of core properties of therapy process: patient's alliance (exemplary item, "My therapist and I get along well") and patient's self-efficacy ("I feel more capable of solving my problems"). Other factors reflected the therapist's perspective on alliance (therapist's alliance: "Today, I felt comfortable with the patient") and on the interventions implemented by the therapist; the interventions factors were not considered in the present analysis. Internal consistency of BPSR scales ranged from 0.74 to 0.88 as reported by Flückiger et al. (2010). As an extension for the present analyses in this sample, we constructed an additional factor based on three BPSR-T items that captured the therapist's assessment of a patient's resistance ("I find this to be an interactionally difficult patient"; "Did the patient show signs of being observant and reactive?"; "Did you notice patient's resistance during conversation?"; Cronbach alpha = 0.82). These three items are part of the nine-item therapist alliance rating. We decided to also focus on this facet of problematic/oppositional behavior in the therapeutic relationship because we were interested in its association to head- and body-synchrony.

MACRO-OUTCOME

The overall success of therapies was estimated with direct measures of success: patient self-report questionnaires assessing the amount of change caused by psychotherapy were applied once, at termination of a therapy course. In addition to these direct (retrospective) measures of success, further self-report questionnaires administered before and after therapy had been used. Here we report only direct measures of success as indicators of the macro-outcome of treatment (Michalak et al., 2003; Flückiger et al., 2007).

Indirect pre-to-post outcome measures yielded lower associations with both head- and body-synchrony.

Goal attainment scaling

Goal attainment scaling (Cardillo and Smith, 1994) assesses to what extent the individual treatment goals explicitly defined at the beginning of therapies were reached. Assessments were performed by patients at the end of therapies. 7-point Likert scales are used, on which higher scores indicate greater goal attainment. The scores used here range from deterioration (−2: most unfavorable outcome thought likely) to no change (0: less than expected success with treatment) to various levels of improvement (4: best anticipated success with treatment). Cardillo and Smith (1994) reported inter-rater reliabilities of 0.87 and 0.71 for independent judges of GAS.

Changes in experiencing and behavior

The VEV [questionnaire to assess changes in experiencing and behavior (Veränderungsfragebogen des Erlebens und Verhaltens)] is a self-report measure used to assess the experienced changes and behavioral changes that are attributed to therapy. In Willutzki's (1999) version, patients indicate in 27 items using a 7-point Likert scale to what extent their life has changed compared to a time-point directly before therapy (e.g., "Compared with the time prior to initiation of therapy, I feel more relaxed/more tense"). The measure provides a global index of overall improvement. Zielke and Kopf-Mehnert (2001) reported an internal consistency of 0.98 and test–retest reliability of 0.61 over a 8 week period.

RESULTS

INDIVIDUAL-LEVEL CHARACTERISTICS: BASIC MOVEMENT PARAMETERS

We begin with findings pertaining to individual movement parameters. A consistent pattern of movement activity was found: the relative amount of movement was expressed as percentage of time with above-threshold movement. Head-movement (PAT = 28.84%; TH = 33.92%) was higher than body-movement (PAT = 15.60%; TH = 21.34%) both in patients [$t(69) = 15.79$; $p < 0.0001$; $d = 2.09$] and in therapists [$t(69) = 14.63$; $p < 0.0001$; $d = 1.60$]. Female and male patients showed significant differences in their basic movement characteristics: female patients moved their heads more than male patients [$F = 30.85\%$; $M = 26.56\%$; $t(69) = 2.89$; $p = 0.005$; $d = 0.70$], while body-movement was similar for patients of both sexes [$F = 16.09\%$; $M = 15.07\%$; $t(69) = 0.69$; $p = 0.508$; $d = 0.17$]. Therapists showed a similar pattern, however, differences between male and female therapists were lower (and insignificant) in comparison to patient differences, both in head regions [$F = 34.97\%$; $M = 32.84\%$; $t(69) = 1.24$; $p = 0.221$; $d = 0.30$] and in body regions [$F = 21.36\%$; $M = 21.32\%$; $t(69) = 0.02$; $p < 0.982$; $d = 0.01$]. The three diagnostic groups were not significantly different in their basic movement parameters (see **Table 1**).

DYAD-LEVEL CHARACTERISTICS: NONVERBAL SYNCHRONY

Significance of synchrony over pseudosynchrony was found for both ROIs and across all diagnostic groups. The amounts of nonverbal synchrony differed along the following lines: head-synchrony was higher than body-synchrony [0.089 versus 0.084; $t(69) = 2.51$; $p = 0.014$; $d = 0.33$]; no difference in terms of sex or diagnosis was found (all ps > 0.35). The comparison with pseudosynchrony indicated that the magnitude of the synchony-versus-pseudosynchrony difference was much higher in head-synchrony [$t(69) = 6.03$; $p < 0.0001$; $d = 0.74$; medium to high effect-size] than in body-synchrony [$t(69) = 2.17$; $p < 0.05$; $d = 0.20$; low effect-size].

Table 1 | Global movement parameters (mean percentage of movement) for head and body regions.

Diagnostic group	Female		Male		Both sexes	
	Head	Body	Head	Body	Head	Body
Affective disorders	31.65	17.40	25.42	14.50	28.68	16.02
Anxiety disorders	30.39	16.99	26.82	16.67	28.53	16.82
Other diagnoses	30.61	14.29	27.35	13.55	29.25	13.98

ASSOCIATIONS BETWEEN SYNCHRONY AND OUTCOME

Head-synchrony was strongly correlated with body-synchrony [$r(69) = 0.40$; $p < 0.001$], therefore associations between synchrony and outcomes were also calculated with the synchrony effect of the respective other ROI partialled out (see **Table 2**). The two sets of outcomes differ with respect to the time of assessment: micro-outcomes are obtained at the end of each session and relate to the current session only; macro-outcomes are assessed upon termination of therapy and relate to the whole course of treatment.

The synchrony-outcome associations indicated a differential pattern of relationships between head- versus body-synchrony and micro- versus macro-outcome: body-synchrony was associated with micro-outcome [$r(69) = 0.22$–0.45], whereas head-synchrony was to a lesser extent ($r = 0.05$–0.29). Head-synchrony was related to macro-outcome [$r(69) = 0.26$; 0.33], whereas body-synchrony was not [$r(69) = 0.14$; 0.15; see **Table 2** for details]. The most notable difference in associations between synchrony and micro-outcome was found in patient's alliance and body-synchrony [$r(69) = 0.45$; $p < 0.0001$] and patient's alliance and head-synchrony [$r(69) = 0.12$; $p =$ n.s.]. A reversed pattern showed up in the association between synchrony and macro-outcome: goal attainment was associated with head-synchrony [$r(69) = 0.33$; $p < 0.01$], but not with body-synchrony [$r(69) = 0.14$; $p =$ n.s.].

DISCUSSION

Nonverbal synchrony is a pervasive phenomenon found in many different situations of human interaction. Building on previous findings in the psychotherapy setting (Ramseyer and Tschacher, 2008, 2011), the present extended analysis addressed the frequencies of head- and body-movement of patients and therapists. Females moved more than male participants in therapeutic dyads, and patients more than therapists. The main goal was to explore the relative contributions of head- versus body-synchrony to the embodiment of session-level assessments (micro-outcome) and global therapy success (macro-outcome). Using the sample of our previous study, we replicated the result that synchrony existed

Table 2 | Associations (Pearson's *r*) between nonverbal synchrony and outcome.

Outcome variable	Head-synchrony	Body-synchrony	Head partial[1]	Body partial[1]	Head and body combined[2]
Micro-outcome (at end of session)					
Alliance (Patient)	0.124	0.454***	−0.071	0.445***	0.407***
Self-efficacy (Patient)	0.292*	0.383**	0.164	0.304*	0.388***
Alliance (Therapist)	0.045	0.223[t]	−0.050	0.224[t]	0.257*
Patient's resistance (Therapist)	0.007	−0.261*	0.126	−0.288*	−0.237*
Macro-outcome (at termination of therapy)					
Goal attainment (GAS)	0.333**	0.145	0.300*	0.012	0.214[t]
Changes in experiencing and behavior (VEV)	0.261*	0.141	0.221[t]	0.036	0.158

[t] *p < 0.10; *p < 0.05; **p < 0.01; ***p < 0.001.*
[1] *Correlation between synchrony and outcome with other synchrony partialled out.*
[2] *Both regions combined (sum), i.e., whole-body movement.*

at a level above chance in both head- and body-synchrony. The associations with outcome were at levels equivalent to those previously found. Yet the present analyses uncovered additional patterns of associations with outcome indicating differential aspects of embodied phenomena: synchronized head-movement was associated particularly with the macro-outcome of psychotherapies, whereas synchronized body-movement predicted short-term micro-outcome at the session-level.

The differential contribution of head- and body-synchrony suggests that distinct aspects of embodied cognition may be effective in psychotherapy: the associations of body-synchrony with alliance found at the session-level may be interpreted as evidence for nonverbal signals that operate completely outside of conscious awareness, and thus may be more strongly associated with immediate effects on relationship quality and emotions. Movements of the torso and the changing of seating positions are processes that require little or no conscious deliberation (Dittmann, 1987), which makes them more susceptible to being automatically triggered in resonating individuals. The implicit association of body-movement with emotional processes is a possible example for this purported link: in therapy phases with high emotional activation, an example for such an emotion-regulation strategy is the changing of posture (Scheflen, 1964; Mehrabian, 1969), and at the level of gestures, the use of so-called self-adaptors (Barroso et al., 1978; Ulrich and Harms, 1985; Lausberg and Kryger, 2011) – gestures that are present in times of heightened emotional stress. The same would be true for gestures that accompany speech, especially in the case of so-called beat gestures – gestures with little or no semantic content (Wagner et al., 2014). Gestures have been shown to be synchronized in dialog (Kimbara, 2008; Holler and Wilkin, 2011). From the perspective of embodied cognition (Tschacher and Bergomi, 2011), the associations with patient-rated alliance and therapist-rated resistance would thus reflect the observable nonverbal manifestation of this immediate expression of therapeutic alliance, and possibly resonance in emotion-regulation, between patient and therapist. Therefore, the patient's general impression of how helpful and how sympathetic the therapist has been in a session would thus be more closely reflected by the synchronized movements of the bodies, not the heads, of interacting persons.

The link with emotional, implicit content was less pronounced in head-movement synchrony: head movement is correlated with speech activity (Heylen et al., 2011) – e.g., nodding one's head in connection with affirmative verbalisations – which is a more consciously controlled activity. Hadar et al. (1983) found a high proportion of head-movement (89.9%) during speech activity. A patient likely exerts more deliberate control over her/his head movement compared to her/his body-movement. Movements located more toward the periphery of the body are generally assumed to elude conscious control (Pease and Pease, 2006; Reiman, 2007; Goman, 2008). Head-movement synchrony should thus be more closely associated with long-term aspects of the patient–therapist relationship. This would be the case in a session where the patient experienced a lower alliance with the therapist, but where the overall therapy quality was favorable in a way that the patient "stayed in sync" with the therapist in terms of head-synchrony. Thus the level of head-synchrony – as a potential indicator of (verbal and explicit) agreement on treatment goals and overall relationship quality – should be associated with the overall success of therapy, which was true in our sample.

Patients who manage to resonate with the movements of the therapist (or therapists that manage to get patients to adapt a more healthy movement pattern), could thus profit more from the stronger (more stable) bond emerging between them. This would then be reflected by a more successful reaching of therapy goals.

LIMITATIONS AND STRENGTHS

No set of specific *a priori* hypotheses had been generated, which implies that the present exploratory findings should be interpreted with caution. Nevertheless, they fit well with current knowledge on embodied processes in psychotherapy dyads and thus may serve as possible starting points for future research.

The data used in this study have the important advantage of having been monitored several years before the formulation or implementation of the nonverbal synchrony approach described

here. Neither therapists nor patients had any awareness of the concept of nonverbal synchrony and its potential assessment by MEA. All shown motor behavior was thus completely uninfluenced by the research questions presented here.

SUMMARY AND CONCLUSION

The present findings are in favor of fine-grained analyses of human movement. This analytic approach has been available for several years, yet its application was restricted to rather invasive procedures such as magnetic motion tracking or time-consuming rating techniques. Frame-differencing methods are increasingly available now, and we think that their ease of applicability and the potential for re-analyses of existing material clearly speak for a more wide-spread use. We hope that our present exploration encourages more research that would allow elaborating more and more differential methods that depict qualitatively distinct processes occurring in the domain of nonverbal movement. To cite Freud, we think that apart from the basic questions that may be answered with these tools, the results also offer promise for future use in clinical practice. "A path leads from identification by way of imitation to empathy, that is, to the comprehension of the mechanism by means of which we are enabled to take up an attitude at all toward another mental life" (Freud, 1955, p. 53).

REFERENCES

Altmann, U. (2011). "Investigation of movement synchrony using windowed cross-lagged regression," in *Lecture Notes in Computer Science*, eds A. Esposito, A. Vinciarelli, K. Vicsi, C. Pelachaud, and A. Nijholt (Heidelberg: Springer-Verlag), 335–345.

Altorfer, A., Jossen, S., Würmle, O., Käsermann, M. L., Foppa, K., and Zimmermann, H. (2000). Measurement and meaning of head movements in everyday face-to-face communicative interaction. *Behav. Res. Methods Instrum. Comput.* 32, 17–32. doi: 10.3758/BF03200785

American Psychiatric Association (APA). (1994). *DSM-IV: Diagnostic and Statistical Manual of Mental Disorders*. Washington, DC: Author.

Bailenson, J. N., Beall, A. C., Loomis, J., Blascovich, J., and Turk, M. (2004). Transformed social interaction: decoupling representation from behavior and form in collaborative virtual environments. *Presence* 13, 428–441. doi: 10.1162/1054746041944803

Bailenson, J. N., Yee, N., Patel, K., and Beall, A. C. (2008). Detecting digital chameleons. *Comput. Hum. Behav.* 24, 66–87. doi: 10.1016/j.chb.2007.01.015

Baldwin, D. A., Baird, J. A., Saylor, M. M., and Clark, M. A. (2001). Infants parse dynamic action. *Child Dev.* 72, 708–717. doi: 10.1111/1467-8624.00310

Bänninger-Huber, E. (1992). Prototypical affective microsequences in psychotherapeutic interaction. *Psychother. Res.* 2, 291–306. doi: 10.1080/10503309212331333044

Barroso, F., Freedman, N., Grand, S., and Van Meel, J. (1978). Evocation of two types of hand movements in information processing. *J. Exp. Psychol. Hum. Percept. Perform.* 4, 321–329. doi: 10.1037/0096-1523.4.2.321

Baumeister, R. F. (2012). "Need-to-belong theory," in *Handbook of Theories of Social Psychology*, Vol. 2, eds P. A. M. Van Lange, A. W. Kruglanski, and E. T. Higgins (London: Sage Publications), 121–141. doi: 10.4135/9781446249222.n32

Baumeister, R. F., and Leary, M. R. (1995). The need to belong: desire for interpersonal attachments as a fundamental human motivation. *Psychol. Bull.* 117, 497–529. doi: 10.1037/0033-2909.117.3.497

Blake, R., and Shiffrar, M. (2007). Perception of human motion. *Annu. Rev. Psychol.* 58, 47–73. doi: 10.1146/annurev.psych.57.102904.190152

Boker, S. M., Cohn, J. F., Theobald, B. J., Matthews, I., Brick, T. R., and Spies, J. R. (2009). Effects of damping head movement and facial expression in dyadic conversation using real-time facial expression tracking and synthesized avatars. *Philos. Trans. R. Soc. Lond. B Biol. Sci.* 364, 3485–3495 doi: 10.1098/rstb.2009.0152

Boker, S. M., Cohn, J. F., Theobald, B. J., Matthews, I., Mangini, M., Spies, J. R., et al. (2011). Something in the way we move: motion dynamics, not perceived sex, influence head movements in conversation. *J. Exp. Psychol. Hum. Percept. Perform.* 37, 874–891. doi: 10.1037/a0021928

Boker, S. M., and Rotondo, J. L. (2002). "Symmetry building and symmetry breaking in synchronized movement," in *Mirror Neurons and the Evolution of Brain and Language*, eds M. Stamenov and V. Gallese (Amsterdam: John Benjamins Publishing Company), 163–171. doi: 10.1075/aicr.42.14bok

Boker, S. M., Xu, M., Rotondo, J. L., and King, K. (2002). Windowed cross-correlation and peak picking for the analysis of variability in the association between behavioral time series. *Psychol. Methods* 7, 338–355. doi: 10.1037/1082-989X.7.3.338

Boone, R. T., and Buck, R. (2003). Emotional expressivity and trustworthiness: the role of nonverbal behavior in the evolution of cooperation. *J. Nonverbal Behav.* 27, 163–182. doi: 10.1023/A:1025341931128

Brick, T. R., and Boker, S. M. (2011). Correlational methods for analysis of dance movements. *Dance Res.* 29, 283–304. doi: 10.3366/drs.2011.0021

Brick, T. R., Hunter, M. D., and Cohn, J. F. (2009). "Get the FACS fast: automated FACS face analysis benefits from the addition of velocity," in *Proceedings of the Third International Conference on Affective Computing and Intelligent Interaction*, Geneva, 1–7. doi: 10.1109/ACII.009.5349600

Burgoon, J. K. (1994). "Nonverbal signals," in *Handbook of Interpersonal Communication*, eds M. Knapp and G. Miller (Thousand Oaks, CA: Sage Publications), 344–390.

Cardillo, J. E., and Smith, A. (1994). "Psychometric issues," in *Goal Attainment Scaling: Applications, Theory, and Measurement*, eds T. J. Kiresuk, A. Smith, and J. E. Cardillo (Mahwah, NJ: Lawrence Erlbaum), 173–212.

Condon, W. S., and Ogston, W. D. (1966). Sound film analysis of normal and pathological behavior patterns. *J. Nerv. Ment. Dis.* 143, 338–457. doi: 10.1097/00005053-196610000-00005

Dael, N., Mortillaro, M., and Scherer, K. R. (2012). Emotion expression in body action and posture. *Emotion* 12, 1085–1101. doi: 10.1037/a0025737

de Gelder, B. (2006). Towards the neurobiology of emotional body language. *Nat. Rev. Neurosci.* 7, 242–249. doi: 10.1038/nrn1872

de Gelder, B. (2009). Why bodies? Twelve reasons for including bodily expressions in affective neuroscience. *Philos. Trans. R. Soc. Lond. B Biol. Sci.* 364, 3475–3484. doi: 10.1098/rstb.2009.0190

DePaulo, B. M., Lindsay, J. J., Malone, B. E., Muhlenbruck, L., Charlton, K., and Cooper, H. (2003). Cues to deception. *Psychol. Bull.* 129, 74–118. doi: 10.1037/0033-2909.129.1.74

DePaulo, B. M., and Rosenthal, R. (1979). Telling lies. *J. Pers. Soc. Psychol.* 37, 1713–1722. doi: 10.1037/0022-3514.37.10.1713

Derrick, T. R., and Thomas, J. M. (2004). "Time series analysis: the cross-correlation function," in *Innovative Analyses of Human Movement*, ed. N. Stergiou (Champaign, IL: Human Kinetics), 189–205.

Dittmann, A. T. (1987). "The role of body movement in communication," in *Nonverbal Behavior and Communication*, 2nd Edn, eds A. W. Siegman and S. Feldstein (Hillsdale, NJ: Lawrence Erlbaum), 37–64.

Downing, P. E., Jiang, Y., Shuman, M., and Kanwisher, N. (2001). A cortical area selective for visual processing of the human body. *Science* 293, 2470–2473. doi: 10.1126/science.1063414

Duran, N. D., Dale, R., Kello, C. T., Street, C. N., and Richardson, D. C. (2013). Exploring the movement dynamics of deception. *Front. Psychol.* 4:140. doi: 10.3389/fpsyg.2013.00140

Ekman, P., and Friesen, W. V. (1974). Detecting deception from the body or face. *J. Pers. Soc. Psychol.* 29, 288–298. doi: 10.1037/h0036006

Flückiger, C., Del Re, A. C., Wampold, B. E., Symonds, D., and Horvath, A. O. (2012). How central is the alliance in psychotherapy? A multilevel longitudinal meta-analysis. *J. Couns. Psychol.* 59, 10–17. doi: 10.1037/a0025749

Flückiger, C., Regli, D., Grawe, K., and Lutz, W. (2007). Similarities and differences between retrospective and pre-post measurements of outcome. *Psychother. Res.* 17, 359–364. doi: 10.1080/10503300600830728

Flückiger, C., Regli, D., Zwahlen, D., Hostettler, S., and Caspar, F. (2010). Der Berner Patienten- und Therapeutenstundenbogen 2000. *Z. Klin. Psychol. Psychother.* 39, 71–79. doi: 10.1026/1616-3443/a000015

Fretz, B. R. (1966). Postural movements in a counseling dyad. *J. Couns. Psychol.* 13, 335–343. doi: 10.1037/h0023716

Freud, S. (1955). "Group psychology and the analysis of the ego," in *The Standard Edition of the Complete Psychological Works of Sigmund Freud*, Vol. 18, ed. J. Strachey. (London: Hogarth Press).

Frey, S., and von Cranach, M. (1973). "A method for the assessment of body movement variability," in *Social Communication and Movement*, eds M. von Cranach and I. Vine. (New York, NY: Academic), 389–418.

Gatewood, J. B., and Rosenwein, R. (1981). Interactional synchrony: genuine or spurious? A critique of recent research. *J. Nonverbal Behav.* 6, 12–29. doi: 10.1007/BF00987933

Goman, C. K. (2008). *The Nonverbal Advantage: Secrets and Science of Body Language at Work*. San Francisco, CA: Berrett-Koehler.

Grahe, J. E., and Bernieri, F. J. (1999). The importance of nonverbal cues in judging rapport. *J. Nonverbal Behav.* 23, 253–269. doi: 10.1023/A:1021698725361

Grammer, K., Filova, V., and Fieder, M. (1997). "The communication paradox and possible solutions," in *New Aspects of Human Ethology*, eds A. Schmitt, K. Atzwanger, K. Grammer, and K. Schaefer (London, New York: Plenum Press), 91–120. doi: 10.1007/978-0-585-34289-4/_6

Grammer, K., Honda, R., Schmitt, A., and Jütte, A. (1999). Fuzziness of nonverbal courtship communication unblurred by motion energy detection. *J. Pers. Soc. Psychol.* 77, 487–508. doi: 10.1037/0022-3514.77.3.487

Grammer, K., Keki, V., Striebel, B., Atzmüller, M., and Fink, B. (2003). "Bodies in motion: a window to the soul," in *Evolutionary Aesthetics*, eds E. Voland and K. Grammer (Heidelberg: Springer), 295–324.

Grammer, K., Kruck, K. B., and Magnusson, M. S. (1998). The courtship dance: patterns of nonverbal synchronization in opposite-sex encounters. *J. Nonverbal Behav.* 22, 3–29. doi: 10.1023/A:1022986608835

Grèzes, J., and de Gelder, B. (2009). "Social perception: understanding other people's intentions and emotions through their actions," in *Social Cognition: Development, Neuroscience, and Autism*, eds T. Striano and V. Reid. (Hoboken, NJ: Wiley-Blackwell), 67–78.

Grunwald, M., Weiss, T., Mueller, S., and Rall, L. (2014). EEG changes caused by spontaneous facial self-touch may represent emotion regulating processes and working memory maintenance. *Brain Res.* 1557, 111–126. doi: 10.1016/j.brainres.2014.02.002

Hadar, U., Steiner, T. J., Grant, E. C., and Rose, F. C. (1983). Kinematics of head movements accompanying speech during conversation. *Hum. Mov. Sci.* 2, 35–46. doi: 10.1016/0167-9457(83)90004-0

Hall, J. A., Harrigan, J. A., and Rosenthal, R. (1995). Nonverbal behavior in clinician-patient interaction. *Appl. Prev. Psychol.* 4, 21–37. doi: 10.1016/S0962-1849(05)80049-6

Harrigan, J. A., Kues, J. R., Steffen, J. J., and Rosenthal, R. (1987). Self-Touching and impressions of others. *Pers. Soc. Psychol. Bull.* 13, 497–512. doi: 10.1177/0146167287134007

Henry, S. G., Fuhrel-Forbis, A., Rogers, M. A., and Eggly, S. (2012). Association between nonverbal communication during clinical interactions and outcomes: a systematic review and meta-analysis. *Patient Educ. Couns.* 86, 297–315. doi: 10.1016/j.pec.2011.07.006

Heylen, D., Bevacqua, E., Pelachaud, C., Poggi, I., Gratch, J., and Schröder, M. (2011). "Generating listening behaviour," in *Emotion-Oriented Systems*, eds R. Cowie, C. Pelachaud, and P. Petta (Berlin: Springer), 321–347. doi: 10.1007/978-3-642-15184-2_17

Higo, N., Ogata, T., Ono, E., Nozawa, T., Ara, K., Yano, K., et al. (2012). "Interpersonal entrainment of body sway in everyday face-to-face communication," in *Proceedings of the 2012 IEEE/SICE International Symposium on System Integration (SII)*, (Fukuoka: IEEE), 906–911. doi: 10.1109/SII.2012.6427363

Holler, J., and Wilkin, K. (2011). Co-Speech gesture mimicry in the process of collaborative referring during face-to-face dialogue. *J. Nonverbal Behav.* 35, 133–153. doi: 10.1007/s10919-011-0105-6

Horowitz, L. M., Wilson, K. R., Turan, B., Zolotsev, P., Constantino, M. J., and Henderson, L. (2006). How interpersonal motives clarify the meaning of interpersonal behavior: a revised circumplex model. *Pers. Soc. Psychol. Rev.* 10, 67–86. doi: 10.1207/s15327957pspr1001_4

Horvath, A. O., Del Re, A. C., Flückiger, C., and Symonds, D. (2011). Alliance in individual psychotherapy. *Psychotherapy* 48, 9–16. doi: 10.1037/a0022186

Kanwisher, N., McDermott, J., and Chun, M. M. (1997). The fusiform face area: a module in human extrastriate cortex specialized for face perception. *J. Neurosci.* 17, 4302–4311.

Kimbara, I. (2008). Gesture form convergence in joint description. *J. Nonverbal Behav.* 32, 123–131. doi: 10.1007/s10919-007-0044-4

Klin, A., Lin, D. J., Gorrindo, P., Ramsay, G., and Jones, W. (2009). Two-year-olds with autism orient to non-social contingencies rather than biological motion. *Nature* 459, 257–261. doi: 10.1038/nature07868

Knapp, M. L., Hall, J. A., and Horgan, T. G. (2013). *Nonverbal Communication in Human Interaction*, 8th Edn. Boston, MA: Wadsworth.

Koningsbruggen, M. G. V., Peelen, M. V., and Downing, P. E. (2013). A causal role for the extrastriate body area in detecting people in real-world scenes. *J. Neurosci.* 33, 7003–7010. doi: 10.1523/JNEUROSCI.2853-12.2013

Kupper, Z., Ramseyer, F., Hoffmann, H., Kalbermatten, S., and Tschacher, W. (2010). Video-based quantification of body movement during social interaction indicates the severity of negative symptoms in patients with schizophrenia. *Schizophr. Res.* 121, 90–100. doi: 10.1016/j.schres.2010.03.032

Lambert, M. J. (2013). *Bergin and Garfield's Handbook of Psychotherapy and Behavior Change*, 6th Edn. New York, NY: Wiley.

Lausberg, H., and Kryger, M. (2011). *Gestisches Verhalten als Indikator therapeutischer Prozesse in der verbalen Psychotherapie: Zur Funktion der Selbstberührungen und zur Repräsentation von Objektbeziehungen in gestischen Darstellungen* [Gestural behavior as an indicator of therapeutic processes in verbal psychotherapy: on the function of self-adaptors and representations of object relations in gestural displays]. *Psychother. Wiss.* 1, 41–55.

Lavelle, M., Healey, P. G., and McCabe, R. (2012). Is nonverbal communication disrupted in interactions involving patients with schizophrenia? *Schizophr. Bull.* 39, 1150–1158. doi: 10.1093/schbul/sbs091

Matsumoto, D., and Willingham, B. (2006). The thrill of victory and the agony of defeat: spontaneous expressions of medal winners of the 2004 Athens Olympic Games. *J. Pers. Soc. Psychol.* 91, 568–581. doi: 10.1037/0022-3514.91.3.568

Meeren, H. K., de Gelder, B., Ahlfors, S. P., Hämäläinen, M. S., and Hadjikhani, N. (2013). Different cortical dynamics in face and body perception: an MEG study. *PLoS ONE* 8:e71408. doi: 10.1371/journal.pone.0071408

Mehrabian, A. (1969). Significance of posture and position in the communication of attitude and status relationships. *Psychol. Bull.* 71, 359–372. doi: 10.1037/h0027349

McDowall, J. J. (1978). Interactional synchrony: a reappraisal. *J. Pers. Soc. Psychol.* 36, 963–975. doi: 10.1037/0022-3514.36.9.963

Michalak, J., Kosfelder, J., Meyer, F., and Schulte, D. (2003). *Messung des Therapieerfolgs. Veränderungsmasse oder retrospektive Erfolgsbeurteilung* [Measuring therapy outcome – pre-post effect sizes and retrospective measurement]. *Z. Klin. Psychol. Psychother.* 32, 94–103. doi: 10.1026/1616-3443.32.2.94

Morris, J. S., Friston, K. J., Büchel, C., Frith, C. D., Young, A. W., Calder, A. J., et al. (1998). A neuromodulatory role for the human amygdala in processing emotional facial expressions. *Brain* 121, 47–57. doi: 10.1093/brain/121.1.47

Nagaoka, C., and Komori, M. (2008). Body movement synchrony in psychotherapeutic counseling: a study using the video-based quantification method. *IEICE Trans. Inf. Syst. E* 91-D, 1634–1640. doi: 10.1093/ietisy/e91-d.6.1634

Nicas, M., and Best, D. (2008). A study quantifying the hand-to-face contact rate and its potential application to predicting respiratory tract infection. *J. Occup. Environ. Hyg.* 5, 347–352. doi: 10.1080/15459620802003896

Niedenthal, P. M. (2007). Embodying emotion. *Science* 316, 1002–1005. doi: 10.1126/science.1136930

Niedenthal, P. M., Mermillod, M., Maringer, M., and Hess, U. (2010). The simulation of smiles (SIMS) model: embodied simulation and the meaning of facial expression. *Behav. Brain Sci.* 33, 417–433. doi: 10.1017/S0140525X10000865

Oberzaucher, E., and Grammer, K. (2008). "Everything is movement: on the nature of embodied communication," in *Embodied Communication in Humans and Machines*, eds I. Wachsmuth, M. Lenzen, and G. Knoblich (Oxford: Oxford University Press), 151–177.

Paxton, A., and Dale, R. (2013). Frame-differencing methods for measuring bodily synchrony in conversation. *Behav. Res. Methods* 45, 329–343. doi: 10.3758/s13428-012-0249-2

Pease, A., and Pease, B. (2006). *The Definitive Book of Body Language*. London: Orion Books.

Porter, S., ten Brinke, L., and Wallace, B. (2012). Secrets and lies: involuntary leakage in deceptive facial expressions as a function of emotional intensity. *J. Nonverbal Behav.* 36, 23–37. doi: 10.1007/s10919-011-0120-7

Ramseyer, F. (2014). MEA. Motion Energy Analysis: Objective Quantification of Nonverbal Behavior Dynamics [Software]. Available at: http://www.psync.ch (accessed February 14, 2014).

Ramseyer, F., Kupper, Z., Caspar, F., Znoj, H., and Tschacher, W. (2014). Time-series panel analysis (TSPA): multivariate modeling of temporal associations in psychotherapy process. *J. Consul. Clin. Psychol.* doi: 10.1037/a0037168 [Epub ahead of print].

Ramseyer, F., and Tschacher, W. (2006). Synchrony: a core concept for a constructivist approach to psychotherapy. *Construct. Hum. Sci.* 11, 150–171.

Ramseyer, F., and Tschacher, W. (2008). "Synchrony in dyadic psychotherapy sessions," in *Simultaneity: Temporal Structures and Observer Perspectives*, eds S. Vrobel, O. E. Rössler, and T. Marks-Tarlow (Singapore: World Scientific), 329–347.

Ramseyer, F., and Tschacher, W. (2010). "Nonverbal synchrony or random coincidence? How to tell the difference," in *Development of Multimodal Interfaces: Active Listening and Synchrony*, eds A. Esposito, N. Campbell, C. Vogel, A. Hussain, and A. Nijholt (Berlin: Springer), 182–196.

Ramseyer, F., and Tschacher, W. (2011). Nonverbal synchrony in psychotherapy: coordinated body-movement reflects relationship quality and outcome. *J. Consult. Clin. Psychol.* 79, 284–295. doi: 10.1037/a0023419

Reidsma, D., Nijholt, A., Tschacher, W., and Ramseyer, F. (2010). "Measuring multimodal synchrony for human-computer interaction," in *Proceedings of the 2010 International Conference on Cyberworlds*, ed. A. Sourin (Singapore: IEEE Computer Society Press), 67–71. doi: 10.1109/CW.2010.21

Reiman, T. (2007). *The Power of Body Language: How to Succeed in Every Business and Social Encounter.* New York, NY: Pocket Books.

Scheflen, A. E. (1964). The significance of posture in communication systems. *Psychiatry* 27, 316–331.

Storch, M., Cantieni, B., Hüther, G., and Tschacher, W. (2010). *Embodiment*. Bern: Hans Huber.

Tamietto, M., and de Gelder, B. (2010). Neural bases of the non-conscious perception of emotional signals. *Nat. Rev. Neurosci.* 11, 697–709. doi: 10.1038/nrn2889

Tomba, E., and Bech, P. (2012). Clinimetrics and clinical psychometrics: macro- and micro-analysis. *Psychother. Psychosom.* 81, 333–343. doi: 10.1159/000341757

Tschacher, W., and Bergomi, C. (2011). *The Implications of Embodiment: Cognition and Communication.* Exeter: Imprint Academic.

Tschacher, W., Ramseyer, F., and Grawe, K. (2007). *Der Ordnungseffekt im Psychotherapieprozess: Replikation einer systemtheoretischen Vorhersage und Zusammenhang mit dem Therapieerfolg* [The order effect in the psychotherapy process]. *Z. Klin. Psychol. Psychother.* 36, 18–25. doi: 10.1026/1616-3443.36.1.18

Ulrich, G., and Harms, K. (1985). A video analysis of the non-verbal behaviour of depressed patients before and after treatment. *J. Affect. Disord.* 9, 63–67. doi: 10.1016/0165-0327(85)90011-4

Van den Stock, J., Tamietto, M., Zhan, M., Heinecke, A., Hervais-Adelman, A., Legrand, L., et al. (2014). Neural correlates of body and face perception following bilateral destruction of the primary visual cortices. *Front. Behav. Neurosci.* 8:30. doi: 10.3389/fnbeh.2014.00030

Vrij, A., and Semin, G. R. (1996). Lie experts' beliefs about nonverbal indicators of deception. *J. Nonverbal Behav.* 20, 65–80. doi: 10.1007/BF02248715

Wagner, P., Malisz, Z., and Kopp, S. (2014). Gesture and speech in interaction: an overview. *Speech Commun.* 57, 209–232. doi: 10.1016/j.specom.2013.09.008

Whalen, P. J., Rauch, S. L., Etcoff, N. L., McInerney, S. C., Lee, M. B., and Jenike, M. A. (1998). Masked presentations of emotional facial expressions modulate amygdala activity without explicit knowledge. *J. Neurosci.* 18, 411–418.

Williams, M. A., and Mattingley, J. B. (2006). Do angry men get noticed? *Curr. Biol.* 16, R402–R404. doi: 10.1016/j.cub.2006.05.018

Willutzki, U. (1999). *VEV-VW. Neue Version des Veränderungsfragebogens des Erlebens und Verhaltens von Zielke* [VEV-VW. New Version of the Questionnaire to Assess Changes in Experiencing and Behavior]. Bochum: Institut für Psychologie der Ruhr-Universität.

Wittchen, H.-U., Zaudig, M., and Fydrich, T. (1997). *Strukturiertes klinisches Interview für DSM-IV (SKID)* [Structured clinical interview for DSM-IV]. Göttingen: Hogrefe.

Zielke, M., and Kopf-Mehnert, C. (2001). Der VEV-R-2001: Entwicklung und testtheoretische Reanalyse der revidierten Form des Veränderungsfragebogens des Erlebens und Verhaltens (VEV) [The VEV-R-2001: Questionnaire to Assess Changes in Experiencing and Behavior]. *Klin. Verhaltensmed. Rehabil.* 53, 7–19.

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Received: 16 May 2014; accepted: 19 August 2014; published online: 05 September 2014.

*Citation: Ramseyer F and Tschacher W (2014) Nonverbal synchrony of head- and body-movement in psychotherapy: different signals have different associations with outcome. Front. Psychol. **5**:979. doi: 10.3389/fpsyg.2014.00979*

This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology.

frontiers in PSYCHOLOGY

HYPOTHESIS AND THEORY ARTICLE
published: 12 January 2015
doi: 10.3389/fpsyg.2014.01424

Bodywork as systemic and inter-enactive competence: participatory process management in Feldenkrais® Method and Zen Shiatsu

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Feldenkrais and Shiatsu enable somatic learning through continuous tactile coupling, a real-time interpersonal dynamic unfolding in a safe dyadic sphere. The first part of our micro-ethnographic study draws on process vignettes and subjective theories to demonstrate how bodywork is infused with systemic sensitivities and awareness for non-linear process management. Expressed in dynamic systems parlance, both disciplines foster metastability, adaptivity, and self-organization in the client's somato-personal system by progressively reconfiguring systemic dispositions, i.e., an *attractor landscape*. Doing so requires a keen embodied apperception of hierarchies of somato-systemic order. Bodyworkers learn to explore these in their *eigen*function (joints, muscles, fascia), discriminate coordinative organization in small ensembles, and monitor large-scale dynamic interplay. The practitioner's "extended body" reaching forth into the client's through a resonance loop eventually becomes part of this. Within a bodywork session, practitioners modulate this hierarchical functional architecture. Their ability for sensorially staying apace of systemic emergence allows them to respond to minute changes and customize reactions in a zone of proximal development (*dynamic immediacy*). They stimulate the client's system with a mix of perturbing and stabilizing interventions that oscillate between *eigen*functions and their coordinative integration. Practical knowledge for "soft-assembling" non-linear synergies is crucial for this (cumulative local effects, high-level functions "slaving" the system, etc.). The paper's second part inventorizes the bodyworker's operative tool-box—micro-skills providing the wherewithal for context-intelligent intervention. Practitioners deploy "educated senses" and a repertoire of hands-on techniques (grips, stretches, etc.) against a backdrop of somatic habits (proper posture, muscle activation, gaze patterns, etc.). At this level, our study addresses a host of micro-skills through the lens of enactive cognitive science.

Keywords: bodywork, dynamic systems theory, systemic process management, synergies, embodied coregulation, enactive and extended cognition, expert skills

INTRODUCTION

Experts in dyadic bodywork configure a rich set of skills in real-time to stimulate a client's self-organization (Blackburn, 2003; Myers, 2004; Tarr, 2008; Heller, 2012; Fogel, 2013; Porcino et al., 2013; Stötter et al., 2013; Stuart, 2013). Our contribution showcases, through a micro-ethnographic lens, how expert practitioner's in the bodywork disciplines Shiatsu and Feldenkrais® Method advance somato-personal development in the client through a process of "mutual incorporation" and how they make this a substrate for systemic sensitivities.

AIMS AND OVERVIEW

The first claim we submit is that while acquiring the requisite technical and sensory skills bodyworkers must also develop competencies we call "intrinsically systemic." Practice constantly confronts them with the limitations of linear and mechanistic causality, forcing them to deal with dynamicity and complexity. Practitioners structure the interaction process and its dynamics in ways that are highly sensitive to how parts interrelate and dialectically interact with their embedding wholes, thus exhibiting a consistently holistic awareness. They are equally sensitive to the nature of non-linear synergies and take care to incrementally and gently nudge the client's dynamics rather than enforcing anything. These systemic sensitivities are partly explicated by metaphors, jargon, and conceptual frameworks of Shiatsu and Feldenkrais teachers, but partly remain pre-reflexive.

Our second aim is to demonstrate that a particular kind of situated embodied interaction with a profound interpersonal connection is affine to the systemic approach. We shall show how practitioners respond continuously to embodied emergence and hereby stay in a micro-zone of proximal development with the client.

The present work emerges from a cognitive micro-ethnography of interaction skills done with interviews and

practitioner diaries. During this project the impression grew in us that the experts' perception of processes in our vignettes reflect what dynamic system theorists speak of. We discovered that Feldenkrais theorists like Carl Ginsburg and Marc Reese were greatly inspired by theories of dynamic self-organization and autopoiesis, including joint work with Esther Thelen, the renowned developmental systems researcher (Spencer et al., 2006). The first generation of Feldenkrais textbooks even took up key terms from cybernetics. Others such as Herfel and collaborators emphasize that Shiatsu theory itself contains essential aspects of dynamic systems thinking. We then found out that Günther Schiepek, Wolfgang Tschacher and others had developed a dynamic systems framework for describing non-linear processes in psychotherapy. All this inspired us to explore systemic skills in our context, which is "as embodied as it gets." We also felt that merging this with tools from enactive cognitive science, motor control theory, and ecological psychology provides flesh and blood to the concrete implementation of the process.

Our qualitatively rich micro-genetic descriptions of bodywork sessions brought to the fore embodied micro-repertoires and situated strategies which proved to reflect process management with a holistic and systemic logic to it, thus converging with the dynamic-cum-systemic key ideas manifest in bodyworkers' descriptions of their trade. To explicate bodywork skills from a comparative distance we presently adopt the terminology of dynamic systems theory (DST), without relying on its mathematical tools. In keeping with clinical applications to human psychology (Tschacher and Dauwalder, 2003; Strunk and Schiepek, 2006) we aim at a DST and *synergetics* based metatheory for ordering processes and process management (Haken and Schiepek, 2010; Schiepek et al., 2013). Although several of our claims necessarily remain hypotheses we wish to contribute to the nascent dialog with practitioners who employ DST parlance by investigating "how changes at the micro-level of relationships between the system's constituents give rise to new patterns of behavior at macro-levels" and how "constituents of a system act together to constrain the multiple actions of other constituents" (Lavelli et al., 2008, p. 45). The specific kind of viewpoint we shall develop here follows Fogel's qualitative model, which is based on informational dynamics and which he contrasts with quantifying, measurement based viewpoints (2006: 26):

> "Qualitative dynamic systems research is ideal for translational applications. Models that are expressed in terms of statistical interactions between quantitative variables are probabilistic and often far removed from the everyday process of meaning making as a social system. New models and interventions that rely on an understanding of the informational dynamics of the change process could be immediately applied to the work of practitioners and participants because these models are expressed in terms of the meanings that are already present in the system."

Practically speaking, qualitative DST parlance is a crystallizing core for the comparative study of bodywork skills that future researchers may find useful. In our view, this essentially 3rd person process theory can connect to 1st person correlates, i.e., practitioner's strategies of a highly sensorially "grounded" nature. What follows is a plea for groundwork on the micro-interactions underlying the systemic process, i.e., for exploring how systemic thought in the abstract is implemented in concrete somatic interaction.

DISCIPLINARY BACKGROUND AND GOALS

Founded by the physicist and judo teacher Moshé Feldenkrais (1904-1984) after the 1940s, the Feldenkrais Method® views itself as a somatic educational system for enhancing the body image, heightening awareness and expanding one's movement repertoire (Feldenkrais, 1993, 2005; Russell, 2004; Ginsburg, 2010). Two different styles may be contrasted. Awareness through movement (ATM) lessons are presented verbally. The practitioner guides several participants through a series of movements. The participants are invited to discover effortless and pleasurable exertion, while increasing their musculoskeletal awareness and spatial orientation (cf. Connors et al., 2010). The aim is to help them realize new proprioceptive and kinesthetic possibilities. In Functional Integration (FI)—our present focus—the practitioner manually guides a single client's movement. Feldenkrais himself characterized this tactile communication process as "two nervous systems dancing together." Feldenkrais practitioners work through a skeletal and neuromuscular interface—while certainly not narrowing the intended outcomes to this. In terms of techniques FI includes a variety of small repetitive mobilizations, left-right mirroring, as well as differentiation and integration of movement patterns. Sensorimotor differentiation is thought to arise through minimal stimulus differences and thereby tunes the nervous system (Rywerant, 2003: *cybernetic-kinesthetic model*).

Shiatsu, here with a focus on Zen Shiatsu after Shizuto Masunaga, employs manual techniques and attentive touch to harmonize the client's *Ki*-system[1] . *Ki* (Japanese for *Qi*) is conceptualized as an encompassing "lifeforce" that sustains and coordinates various functions of the body-mind whole. Shiatsu practitioners report that they develop a "sense" for *Ki* in their practical training, thus making "energetic" states amenable to modulation. This scientifically scarcely theorized medium (Oschman, 2000) is phenomenologically acutely real, while appearing more elusive to the layperson than musculoskeletal categories. The *Ki*-system is deemed an energy supplying resource, an informational vehicle, and a regulatory mechanism surpassing the central nervous system. Within this system, Eastern Traditional Medicine discerns *Functional circuits* that cut-across various dimensions of the body-mind whole. This *Circuit* model incorporates centuries of systematically observed correlations between *Ki*-patterns on the one hand and physical, cognitive and psychological conditions on the other (Masunaga, 1987; Beresford-Cooke, 2011; Reder, 2013). This model only partly corresponds to Western biomedical and psychological concepts. It constitutes a framework to interpret collected indicators (via anamnesis, observation and palpation) and deduce from these which *Functional circuits* are presently dominant or diminished in the overall *Ki* distribution. Shiatsu practitioners aim to foster the free circulation and even distribution of *Ki* that guarantees

[1]Capitalized italics refer to concepts from subjective theories or models used by bodyworkers. All other italic expressions are used for highlighting analytic concepts when first introduced.

musculoskeletal mobility, metabolic activity, nourishment of tissue, and mental and emotional balance. After diagnosing the client's momentary *Ki* distribution practitioners apply impulses for stimulating, collecting or scattering *Ki*, e.g., by stimulation of acupressure points (*Tsubos*) and *Meridians*[2] . All manual techniques affecting musculoskeletal mobility, fascial stress release, etc. additionally benefit unrestricted *Ki* circulation.

When we juxtapose the two practices, the manual techniques and indeed the dominant "medium" differ: One skill focuses on movement, the other on subtle energy. However, FI and Shiatsu have many operative structures and the goal of *somatic-sensory pedagogy* in common:

- Both obey the systemic metaphor of homeostatic "dynamic balance" (i.e., *metastability*).
- Both furnish springboards for the client's self-regulating capabilities. Practitioners awaken existing resources in the client or jointly exploit new ones.
- Both purport to widen the action repertoire, advance adaptability, and strengthen resilience in a process of sensitization. This happens by de-habitualizing familiar locomotory, muscular, and energy management patterns.
- For many clients the aims reach beyond ailments, into the affective, mental, psychic (Hanna, 1988, 2003; Posadzki et al., 2010), and even *ecosomatic* realms (Burns, 2012). A transformation of life habits and the personality is at issue.
- The embodied dialog works via a somatic interface, occasionally supplemented by speech.

Both disciplines summon wide expanses of expertise, with profound mastery being reached after a decade or more. Apprenticeship in Feldenkrais and Shiatsu shapes a "knowing body" (Section "Embodied Skills"): It transforms the hands, eyes, and other senses to yield extraordinary somato-cognitive resources. In the moment-to-moment interaction this enables the practitioner to draw on a variety of enactive micro-skills such as "smart" perception, dynamic sensory disambiguation, basic motor routines ("grips" for mobilizing joints, etc.) and task-conducive imagery, all against a backdrop of postural and sensory pre-calibrations.

SOMATIC COREGULATION

FI and Shiatsu cultivate "the art of encounter" between a trained giver and a layperson client. High quality personal coupling and mindfulness is essential (Blackburn and Price, 2007; Nolan, 2014). Rapport is both a means and a goal, for it engenders trust, a cooperative attitude and, hence, compliance. A well constituted "dyadic bubble" establishes resonance loops for perception and action that allow a very fine dynamic attunement between the two bodies.

Generally, bodywork exemplifies *participatory sense-making* (Fuchs and De Jaegher, 2009). The two bodies are "mutually dynamically entangled" (Froese and Fuchs, 2012) in a bi-directional feedback loop and respond to each other continuously. Irrespective of the client's superficial inactivity, subtle somatic signals make for active engagement. A genuinely two-way street with ceaseless reciprocal causation arises, a condition variously dubbed *coregulation* (Fogel, 1993, 2006) and *inter-enaction* (Torrance and Froese, 2011). Froese and Fuchs (2012, p. 212) specify that both individuals' intra-bodily resonance loops (affective feedback, sensation, etc.) are embedded in an interpersonal resonance loop and an inter-affective system[3]. This "union of two nervous systems" (Stuart, 2013) goes with a subjective feel of strong rapport and genuine *interbeing*. Thus, practitioners report a salient perceptual shift when two individual systems become a genuine dyad, which is frequently described as boundaries to the client becoming fluid. A quote from Moshé Feldenkrais expresses this idea:

> "Through touch, two persons, the toucher and the touched, can become a new ensemble: two bodies when connected by two arms and hands are a new entity. These hands sense at the same time as they direct. Both the touched and the toucher feel what they sense through the connecting hands, even if they do not understand and do not know what is being done" (Ginsburg, 2010, p. 267).

From a 3rd person viewpoint, coregulation manifests a superindividual dynamic with a degree of its own autonomy. We can thus seek "to understand how the patterning of the collective is related to the coregulation between the constituents" (Fogel, 2006, p. 8). This opens the interesting possibility of studying the coordinative process dynamics (cf. Haken and Schiepek, 2010) and, from our angle, invites asking how bodywork practitioners, who experience coregulative process signatures, learn to expertly read and shape these[4].

In terms of enskilment for coregulation two things bodyworkers need to master are (a) attuning with the client to establish resonance and (b) reading signals of the other body and acting on them in real-time. Accordingly, bodyworkers train capacities for tactile sensing and subtle stimulation. The ability to take up the client's "offerings," i.e., *affordances* (Gibson, 1979), at each moment is paramount. Action guidance comes from tactile, kinesthetic, and visual information from the other body. Practitioners in return offer opportunities to the client.

Another skill to learn is to literally extend into the other body to widen control beyond the tactile interface. Remote body

[2] *Meridians* are conceptualized as pathways along which *Ki* circulates through the whole body. They provide practitioners with a close access to *Ki* since it tends to accumulate there more tangibly than in other structures. (According to Eastern Medicine all living tissue is permeated with *Ki*.) Each of the 12 *Main meridians* is assigned to a *Functional circuit* and its respective tasks.

[3] Embodied "dialogs" have been investigated in infant development (Murray and Trevarthen, 1985; Stern, 1985; Fogel, 2006; Rączaszek-Leonardi et al., 2013) and adult communication (Fusaroli et al., 2014; Fusaroli and Tylén, 2015), as well as in minimal social behavior experiments (Auvray et al., 2009) and evolutionary robotics (Froese and Di Paolo, 2011). These approaches shed light on the dynamics of dyadic self-organization.

[4] Compare studies of we-intentionality (Schweikhard and Schmid, 2009), intercorporeity (Merleau-Ponty, 1964), super-individual *somatic modes of attention* (Csordas, 1993), the *embedded/extended body* (Clark, 2008), and embodied intersubjectivity more generally (Morganti et al., 2008; Semin and Cacioppo, 2008; Tomasello, 2008; Zlatev et al., 2008).

parts can not only be sensed, but guided through the resonance loop. An untouched part like the client's head can be targeted by mobilizing a leg. Frequently, the resulting remote feedback allows fine-tuned incremental control as the client's signals are passed on into the giver's sensorimotor control system. For this kind of remote control, practitioners create dyadic structures extending through both bodies such as a joint musculoskeletal chain, or a *Ki* resonance loop (body *extensions*, Clark, 2008; Froese and Fuchs, 2012).

Finally, while each bodywork encounter is unique, it is not that emergence in the client just "comes to pass." Expertise means being able to continuously tweak and guide the process through strategies at different levels. The micro-genetic perspective embraced in the next two sections shall deal with systemic strategies (Section "Bodywork as Systemic Competence") and their concrete embodied implementation (Section "Embodied Skills").

BODYWORK AS SYSTEMIC COMPETENCE

Shiatsu and FI furnish prime examples for *process management in (superindividual) systems* and for how systemic thinking translates into practice. Practitioners assist the client's somato-personal development. In this endeavor, the practitioners' acute awareness of complex systemic wholes and the frequently non-linear synergies between the parts is a precondition for managing somatic emergence. They routinely deal with structural signatures of dynamic systems, including *attractors*, *emergence, dynamic stability*, *non-linearity, circular causality, multi-causality, etc*. A typical practitioner thinks and acts systemically, at least implicitly. Accordingly, Feldenkrais practice sees complaints like psychosomatic pain as a non-linear dynamic involving perceptual, biomechanical, neural, emotional and other elements (Russell, 2003; Ginsburg, 2010). Shiatsu even has its own process theory, the *Driving and Damping Cycles* of the *Five Phases* model (Herfel et al., 2007).

GENERAL AIMS AND STRUCTURE OF SYNERGETIC PROCESS MANAGEMENT

The clients' resilience and process competence depends on a dynamically stable, harmonious interplay of systemic functions and elements. Bodywork fosters a heightened sense of somatic self-efficacy by sensitizing the client at multiple levels, including intrapersonal, interpersonal, and ecological ones. Expressed in DST parlance, the systemic configuration and *intrinsic dynamics* is reconfigured: from relative disorder to order (cf. Tschacher and Grawe, 1996; Tschacher et al., 2007), from rigidity to greater adaptability, or from dysfunctional order to a salutary alternative when clients' systems are caught in a stable, yet dysfunctional *attractor regime* (Section "A Meta-Theoretical Description").

Let us first survey how bodyworkers deal with complexity through *synergetic* management principles. They emphasize that emergence must be respected and immediacy is of paramount importance. Therefore, they frequently seek optima among flexibly activated principles and *soft-assemble* the process via a situated coordination of elements (Thelen and Smith, 1994; Kelso, 1995; Kello and Van Orden, 2009), rather than using hard-and-fast routines. Bodyworkers regularly intersperse improvised phases and adapt best practices dynamically, even if some (sketchy) strategic planning may occur. Any such plans are persistently modulated or re-evaluated in accordance with momentary feedback from the client.

Throughout the whole process, bodyworkers respect general maxims of systemic intervention that Haken and Schiepek (2010) call *generic principles*. These transversally infuse the process:

- Practitioners know that sustainable somatic learning depends on stable conditions. Destabilization in a context of stability is crucial (ibid.: 437).
- Practitioners configure a safe space of trust through a non-judgmental, accepting atmosphere as well as attentive support.
- An attitude of "requesting" and "making suggestions and offers," verbally as well as in tactile intent, engages the clients in a co-equal process instead of making them passively "handled" recipients. Practitioners present changes as painlessly and pleasurably as possible. These precepts foster receptivity, motivation and self-responsibility on the part of the client.
- In order to heighten the client's motivation and self-efficacy, stimulation must be meaningful and timely (*kairos* principle). Systems can only permanently assimilate order which is somatically meaningful. Reorganization needs to be coherent with the self-image, needs, and extant capacities.
- All inputs are suggested in a sensitive, yet precise way to convey a maximum of information. The idea is to "advertise" favorable patterns via their sensory effect. Although clients may temporarily relapse into their habitual patterns, order reached earlier—especially of gratifying states—is somatically remembered and can be re-triggered (ibid.: 245). For similar reasons, system history is always factored into the treatment.

Interacting without synergetic sensitivities has significant disadvantages: "Pre-fabricated" recipes not only preclude adapting to a person's unique dynamics or unexpected changes, but can altogether overlook the client's priorities. A non-systemic view can lead to a merely symptom-oriented treatment bypassing the clients' deeper needs or making them swing back to a detrimental attractor if the wider systemic disposition has not changed.

In its global structure, a typical bodywork session lasts 45–70 min. Each stage consists of multiple local interventions that are embedded in a wider strategy tailored to the client's needs. A degree of *fractality* meets the eye here. For example, practitioners create stable conditions and run an evaluation both at the beginning of the session and when starting a new sub-routine. **Figure 1** depicts this sort of phase structure with micro-loops embedded in the intervention phase.

The following FI vignette (**Figure 2**) illustrates how the practitioner evaluates the somatic system, tailors a sketchy treatment strategy, fleshes it out it with responsiveness to situated affordances, and helps the client integrate new patterns in a familiar task-context.

- **Tuning-in/anamnesis.** The client who complains of stress-related neck pains would like to sit more effortlessly during computer work. Starting from this, the practitioner visually gauges how differentiated the interplay of the client's body

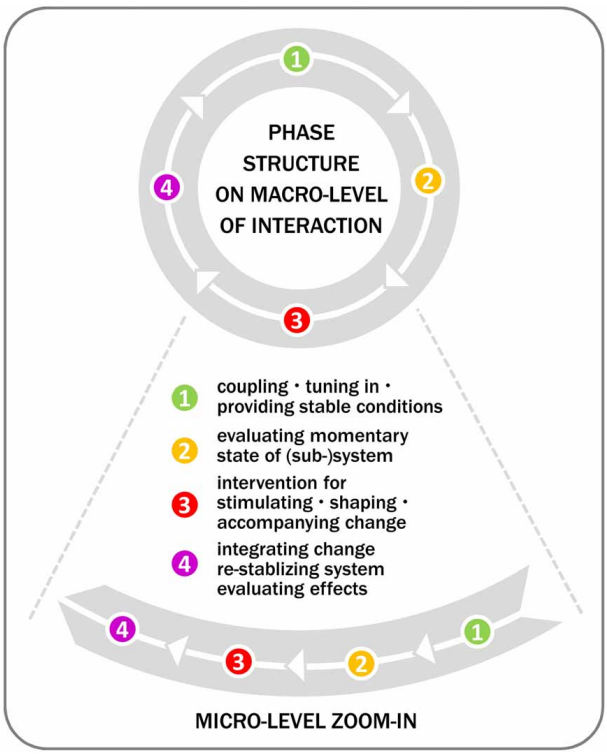

FIGURE 1 | Phase structure. As the intervention phase indicates, multiple micro-level sequences may be nested in the global process and fractally replicate the macroscopic in the microscopic structure. In certain cases, these phases are condensed or may even temporally coincide, e.g., when intervention simultaneously creates stable conditions, elicits information, and provides impulses.

regions is during walking, standing or sitting (**2a**). The trunk moving en bloc, particularly in the ribcage and shoulder girdle, suggests undifferentiatedness. Pelvis and head movements confirm this impression. Next, the practitioner establishes tactile contact and attunes with how the client's muscle tone is distributed. The purpose is to probe habitualized "attractors" (Section "A Meta-Theoretical Description"), to identify relevant sub-systems and their patterns of interplay. For a more specific exploration, the client comfortably lies supine on the Feldenkrais table with bent knees and feet flat. The practitioner applies a finely adapted thrust on the ischial tuberosity with the index finger enclosing the thumb. The resulting sense of direct bony contact allows him to probe into and thus address the whole skeletal configuration. He now sends gentle force impulses via the pelvis toward the head, while monitoring how well these proliferate along the spine. The force appears noticeably blocked, smothered, or diverted in the lower thoracic spine. This confirms the original impression of local non-differentiation and further directs attention to the lower ribcage area.

- **Strategy choice.** An FI lesson for *sitting and standing functions* in a pain-reduced side-lying position is selected, featuring the leitmotifs of *side-bending* and *differentiation of shoulder, ribcage and head*. The guiding notion is that distributing the excessive tone in the neck's wider surroundings will foster systemic balance in keeping with the client's needs. This sketchy plan remains to be fleshed out in detail along the way.
- **Intervention.** Exploratory variations are introduced with the client lying in a stable lateral recumbent position (knees bent and head resting on a pad). The practitioner applies various manipulations (**2b–g**) to explore the potential degrees of freedom while repeatedly contrasting directions. Movement queries initiated from the head, shoulder, pelvis or leg ("preferred tendency of movement?"; "any alternative possibilities?") release local inhibitions. The intensity of the movement queries is subtle but just strong enough to further stimulate the client's motor system. The idea is that her system will learn through supported self-agency (Reese, 1999). Many of these manipulations connect parts on this side of the body into a complex organic ensemble, as indicated by responsive and permeable functional chains ("Does the motion of single vertebrae involve the whole spine, sacrum, pelvis and head?"). The practitioner explores the synergetic interplay from various vantage points ("Does this element have to cope alone or can another one help? What if I inhibit the helper?") and may intermittently spot-check if degrees of freedom in previously explored parts have changed. Finally, the client is rested again in supine position and is asked to inwardly observe recent changes. Then, for involving greater ranges of the body into the lateral interplay, similar interventions are repeated with the client lying on the other side. Lastly, the reference movement from the evaluation phase is taken up to test anew force transmission through the spine, its connectedness.
- **Integration.** The practitioner now integrates the movement pattern into a task simulating real-life situations such as sitting in front of a computer or comfortably grabbing something overhead to see, e.g., if side-bending can be recruited with ease and minimal impulses (**2h**). A miniaturized walking motion with the sit bones on the FI-table also fits this context. This is done with lengthened arms and then with arms dangling on the side. In closing, probing routines in standing and walking confirm the newly acquired range and quality of motion. These integrative techniques at the end of the session consolidate the gains before releasing the client into autonomy.

As a general point, this vignette highlights the constant switch of focus between global and local, of holistic sensorimotor patterns and their sub-functions. The somatic system is stimulated repeatedly from different angles to implicate an increasing number of functions. In FI, widening the possibility space through variations is believed to foster sensorimotor learning and flexibility.

A META-THEORETICAL DESCRIPTION

We may now, for our purposes of theoretical bridge-building, relate bodyworkers' process management competencies to DST concepts before we demonstrate their subjective, sensory correlates. Basically, practitioners perceive the client's body as a complex system with nested levels of ordered functional sub-systems. The DST notion of *order parameters*, i.e., collective variables of somatic organization, manifests in musculoskeletal and energetic

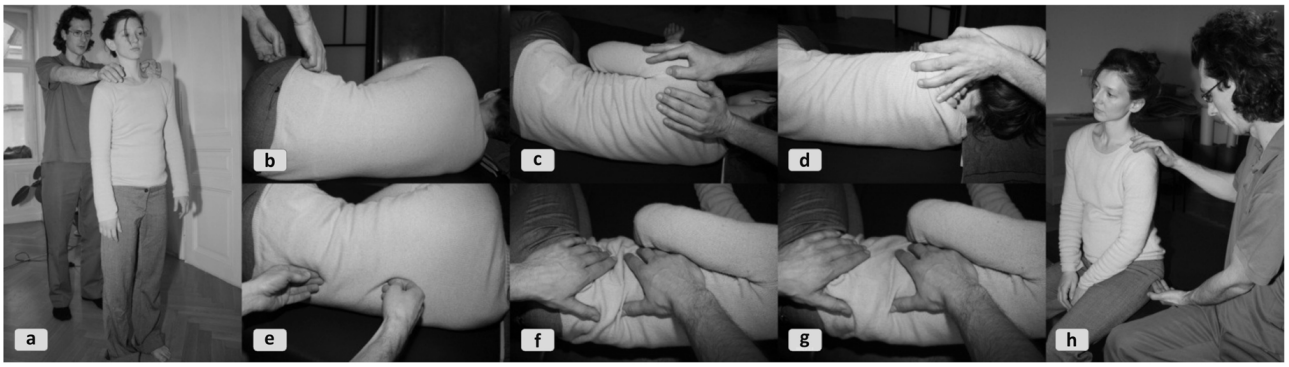

FIGURE 2 | Selected snapshots from an FI session. (2a) Visual and tactile anamnesis of body part interplay. **(2b)** The responsiveness of the pelvis in relation to the upper body is explored ("cardinal directions of the pelvis"). **(2c)** The shoulder is differentially moved in relation to the chest ("cardinal directions of the shoulder"). **(2d)** Jointly moving head and shoulder, with their distance kept stable through fixation, in relation to the lower chest and spine to stimulate responses in the latter. **(2e)** Tactile probing allows the practitioner to test the vertebrae's *eigen*-tendency in the lower thoracic spine. Two points are touched to stimulate tiny side-bending motions of the vertebral joints. The attentional focus lies on releasing the erector spinae muscles and on establishing pelvis-chest communication via the spine ("elongating the spine"). Next, starting from the neighboring vertebrae, the proximal synergetic interplay is explored. **(2f+2g)** A gentle combined stimulation of the pelvis and the chest alternates between approaching, receding and random movements ("harmonica-like oscillations") and widens both the diaphragm and the lower belly for deeper breathing. **(2h)** In the integration phase the full task is simulated in sitting position.

phenomena "that matter" to the disciplinary logic[5] . Specifically, the client's system is stimulated based on its conceptualization as hierarchically nested levels of order that cooperate, compete, or co-exist (**Figure 3**). In keeping with DST, embodied transformations of order occur via greater or lesser *phase shifts* (Thelen and Smith, 1994; cf. Buchanan and Ulrich, 2001), often in sudden leaps. Also, when multi-component systems shift to a new state, changes in the components may suspend higher-level patterns until a stable re-adaptation emerges. Changes are thought to run through a progression from rigidity, via acquaintance with novel organization, to full familiarity (Bernstein, 1967).

The order hierarchy, at any given point in time, concretizes as an *attractor landscape* (Haken and Schiepek, 2010, p. 340) representing states and routines into which the client easily "slips." Bodywork is about effecting a gestalt change in this landscape by transforming its valleys and peaks. Some landscapes are more resilient and prone to adaptive self-organization than others. Experienced practitioners must therefore possess a refined sensitivity for both, dysfunctional and functional attractors. They recognize tipping points and input-prone moments and know how to channel extant dynamics, when to confirm, reduce, change, dynamize, or otherwise modulate them, when to take the lead and when to pace along. Practitioners thus *manage* transformations of the landscape by a stream of modulations that target either individual attractors or their relationship. Depending on the context, interventions can aim to:

- flatten out a particular attractor trough,
- confirm or deepen the attractor,
- calm excessive fluctuations,
- shift toward a more beneficial attractor to re-stabilize there.

To avoid deepening a dysfunctional attractor one can lead away from it or strengthen neighboring ones. Sometimes, jointly exploring tipping points suffices to boost the client's self-confidence with and grasp of the zone. Practitioners aim at conditions for risk-reduced phase shifts to new attractors or attractor regimes (i.e., by shifting the weights among attractors). Within the zone of "beneficial patterns" a diverse attractor landscape is advantageous, e.g., having multiple options of movement control or *Ki*-organization. When practitioners introduce new options to experience this lessens the likelihood of a few "domineering" attractors and thus of stereotypical responses (Haken and Schiepek, 2010, p. 426). On the other hand, systems displaying dysfunctional hyperflexibility or overburdening parallel tasks may stabilize by flattening some attractors and elevating others.

This intervention process is highly non-linear and cumulative. Over a treatment, bodyworkers will invariably mix (a) stabilizing with (b) perturbing stimuli. "Adjustment screws" on three dimensions are used to introduce and accompany the change process:

- *novelty:* new vs. familiar patterns (variation vs. redundancy and cyclic repetition).
- *diversity:* homogeneous vs. heterogeneous process gestalts (slowness / continuity / similarity vs. vacillation / accentuation / surprise).

[5]In distilling order hierarchies from the data (Strunk, 2004), we restrict ourselves to the client's system, leaving order descriptions of the dyadic coupling for future study. In principle the inter-body coordination dynamics can be equally expressed through collective variables of synchronization, relative force, etc. (Oullier and Kelso, 2009; Schmidt et al., 2011; Dale et al., 2013). Examples include multi-agent synergies in sports (Passos et al., 2006; Bourbousson et al., 2010; Vilar et al., 2013), horseback riding (Peham et al., 2004; Lagarde et al., 2005), and teams (Gorman et al., 2010; Stevens and Gorman, 2011).

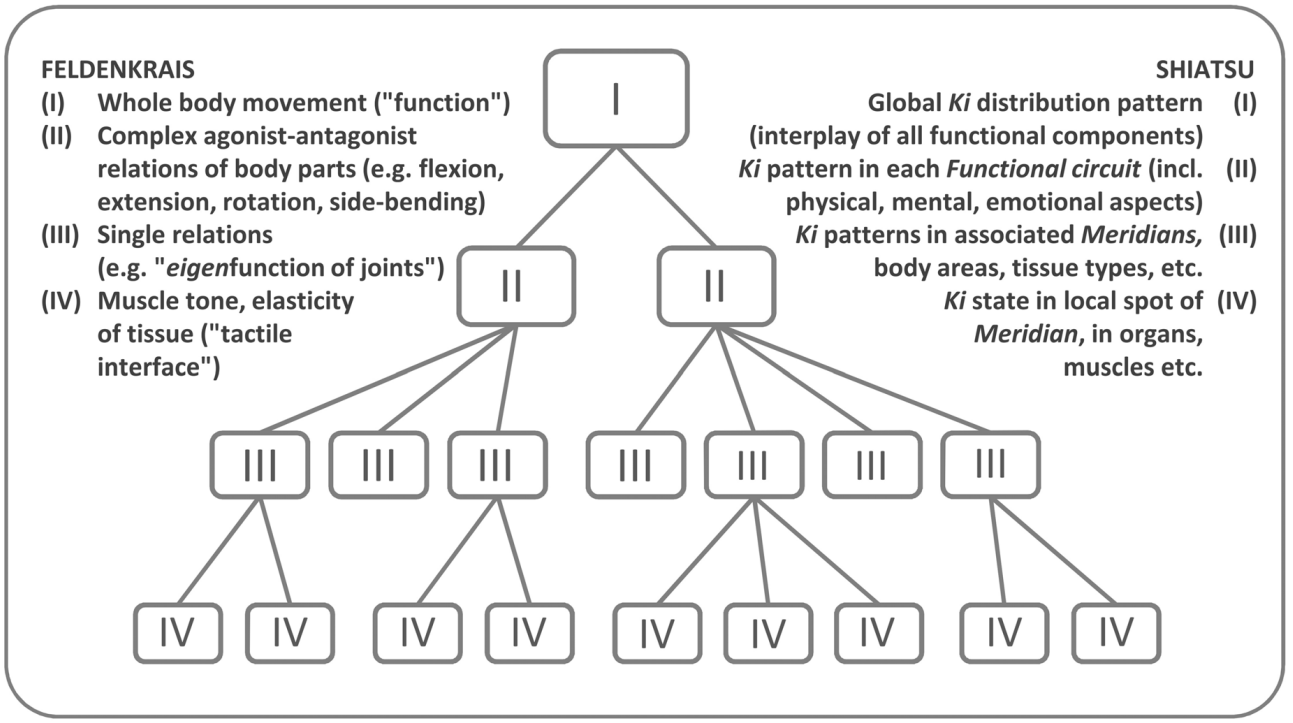

FIGURE 3 | The client's systemic order—a nested hierarchy from minimal- to highest-level functions and synergies. Leaving the various situated system dynamics for later we illustrate here the *generic* architecture practitioners operate within. To take an FI example (see Shiatsu counterpart in the legend), the highest level corresponds to a complex body function like standing or walking. The second level contributes more restricted sub-functions or sub-circuits, typically of body segments like arms, legs, or spine. Such sub-functions in turn arise from synergies of yet lower-level components like joints and muscle groups. The third or fourth levels, respectively, constitute the lowest meaningful layers and define the maximum degree of resolution (Schiepek et al., 1992, p. 241). More subordinate synergies down to the molecular level lie out of scope.

- *dynamicity:* high vs. low impulse density, intensity, tempo, rhythmicity, accentuation, in-phase vs. anti-phase.

What makes an appropriate action strategy, however, is context dependent. A stabilizer in one context can become a perturber in another[6] . Practitioners need contextual awareness of whether an adjustment confirms, complements, or counteracts the client's ongoing dynamic. They carefully weigh in which states of order or transition to initiate action and how to combine stabilizing with perturbing stimuli.

PROBING THE ATTRACTOR LANDSCAPE

A tangible, sensorial apperception of the client's hierarchic system architecture is crucial for bodyworkers. The reported complaint/request and the manifest somatic signals are diagnostically connected. By gradually probing the client's attractor landscape (i.e., the beaten paths vs. non-preferred states) practitioners (a) identify functional complexes presently relevant to self-organization and (b) determine parameters providing leverage. Despite differences in the somatic focus of Shiatsu and FI, the overarching heuristic principle is similar: Over- or under-represented elements indicate systemic imbalances (triggered either by *eigen*function disorders or lacking cooperation between parts). Both imbalances and balances have precise sensory correlates.

Coordination of components

In adaptive systems elements show a functional meso- and macroscopic interplay. This can be sensorially gauged by exploring how degrees of freedom in various loci co-vary when stimulated. Diagnosis seeks to spot over- or under-represented aspects and non-integrated subsystems in the holistic configuration. In FI motor functionality is tested, e.g., will a three-dimensional pelvis motion translate to neck motility? In Shiatsu a well-coordinated *Ki* distribution and smooth interplay of all *Functional circuits* is decisive.

Eigenvalue of local states

Adaptive order in a limb, joint, or *Meridian* should exhibit continuous responsiveness when addressed. Conversely, non-adaptive order will summon resistance, inertness, or deflection, e.g., when a force meeting a barrier perpendicularly veers off or "slips around" a particular area on the trajectory. FI

[6]To take a familiar experience, if we talk to someone in a frenzy in a markedly calm way (low intensity, deceleration), patting her arm while whispering (low intensity) to take it easy (redundancy) that person may well get more worked up. To be soothing we deployed every trick in the book—resulting in failure to pick up our friend from where she was! The overabundance of canonically "stabilizing" features unwittingly created an exaggerated contrast and amplified the disorder.

practitioners check how unencumbered movements are and if they possess their full degrees of freedom. Adaptive movements are perceived as minutely responsive, "organic" and "mono-motivated" for the present task. Furthermore, a healthy system easily assumes a "neutral" state of action-readiness (*metastability*). In Shiatsu balanced *Ki*-activity correlates with effortlessly coordinated motion, well-nourished, elastic tissue and unrestricted *Ki*-flow. (Practitioners match this against the recognizable *Ki*-signatures of different *Functional circuits* as well as against the specific character of *Ki* in varying tissues, i.e., muscles, bones, ligaments, fasciae, etc.). The school of Zen Shiatsu, specifically, offers practitioners the following concepts for attractor recognition. Two dysfunctional types of sensory signatures are differentiated: states very high (*Jitsu)* and states very low (*Kyo*) in the local degree of (a) activity and (b) saturation of *Ki*.

Functionally isolated regions

In both disciplines local restrictions in breathing movement indicate isolated regions. FI hints include compromised erectness, lateral asymmetries in walking or in a resting position, body parts that smother or divert an impetus, and "blind spots" with so-called *sensorimotor amnesia* and disconnectedness. Analogously, in Shiatsu persistent *Kyo* areas lack energy or "forget" about their cooperative function. They may show signs of reduced metabolism and blood flow, lessened tone of tissue or loss of flexibility. They look pale and caved in, feel cooler, less animated or even stiff and brittle. *Kyos* react to touch with great neediness or—after drifting into stagnation—hesitantly, indifferently, with rigid resistance or nagging pain, and will even repel *Ki* channeled there and thus progressively exacerbate the lack. Complementarily, overactive *Jitsu* areas arise. They may display a reddish hue, heightened tone of tissue (bulging, overly firm, yet elastic) and respond to touch instantly with a resistant, definite, at times fierce feel. They may cause sharp pain especially when stagnant, a condition in which the *Jitsu* arrests *Ki*. Local *Ki* excess, painful tension, inflammations, and substance accumulation may follow suit.

Compensatory patterns

Basic compensation patterns are frequently recognized in diagnosis, but may also arise mid-way. In FI, when say the shoulder girdle is hypermobile a functionally connected part like the chest typically overcompensates with rigidity. In Shiatsu the abovementioned *Kyo-Jitsu* complementariness epitomizes this: When areas or functions lack *Ki* others compensate with over-activation or are worn down by trying to provide support. Even the entire system can resist change (to maintain a familiar pattern) when one sub-system is dynamized and another sub-system buffers this by way of reciprocal compensation.

Emergent process gestalts (Tschacher, 1997; Stern, 2010)

Bodyworkers also remain especially alert to self-organization in progress. They know the characteristic feel of continuous "response flow" of an adaptive system. Signal discontinuities can hint at fluctuations typical of transitory moments (*critical* instabilities),[7] e.g., when muscle tone, heart- or breath rate vacillate. Instabilities will not alarm a practitioner as long as the risk of tilting to the detrimental side of two attractors can be counteracted (*symmetry breaking* toward the preferred side). In addition to fluctuations experts monitor critical values of strain, stiffness, hyperflexibility etc. in the client's system to mitigate detrimental dynamics.

INTERVENTION STRATEGIES

Bodyworkers often work on two or three tactile interfaces simultaneously by using hands, knees, elbows, and feet plus resistance from the support. Effects can extend considerably further into the functional complexes to which these interfaces provide access: Bodyworkers address effector spaces across the whole body. Thus, frequently stimulation generates remote effects, e.g., an FI practitioner can induce a full-body pattern like rotating the whole spine via a soft twist of the heel bone and thus "have the whole skeleton in his hand." By using different depths and qualities of touch bodyworkers address different functional structures in a single area (e.g., fascial, skeletal, muscular, *Meridians*). Within the interface-effector space distinction stimulations can be more or less inclusive than the aimed at somatic order.

In terms of relating spatial logic to systemic logic, three types of strategies can be discerned. In one recurrent strategy bodyworkers temporarily single out a functional component and optimize its *eigen*function, ultimately to improve its interplay with other functions, but with a local focus. A sub-synergy in the systemic whole is attentionally highlighted or even temporarily disconnected from other "players," e.g., by fixation (**Figures 4** and **5a,b**). In Shiatsu the *Ki*-states of acupressure points (*Tsubos*) along a *Meridian* may be individually tuned and dis-inhibited to later allow for free *Ki*-flow through the entire pathway. In FI practitioners may mobilize single vertebrae, which later benefits equal worksharing among vertebrae. A variation is to address *eigen*functions remotely, as shown in **Figure 4b**.

The second possibility is to dynamize the relation between local functions through co-stimulation of two or more interfaces.

FIGURE 4 | Local vs. remote cueing. Mobilization of the wrist joint can be effectuated **(4a)** locally by mobilizing the joint itself (i.e., *interface = effector space*) or **(4b)** remotely by inducing motion from the finger's base joints. While both interventions address the wrist's *eigen*function, they do so through different actuation pathways. The FI-principle of "proximal-distal-reversal" is applied here to let the client experience slight differences in the joint's and muscles' organization depending on where the movement is started from.

[7] Anticipatory assessments are required to estimate which critical fluctuations partake of a sound developmental trajectory and which ones put the system's integrity at risk.

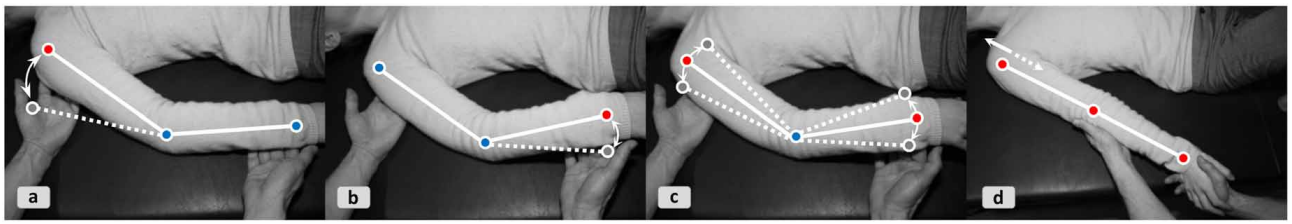

FIGURE 5 | Transforming the functional interplay in a limb. (Red points signify motion and blue ones immobility relative to the surrounding space). The practitioner first addresses the subfunctions of the shoulder-elbow interplay **(5a)** and the elbow-wrist-interplay **(5b)** independently before introducing more complex arm flexion patterns though a co-mobilization of upper and lower arm **(5c)**. Differentiating variations are introduced, e.g., gentle to-and-fro movements in a see-saw fashion, starting with lifting the shoulder first and letting it sink when the wrist is lifted (and vice versa); bringing up shoulder and wrist simultaneously; synchronous mobilization with varying emphasis on both interfaces. In **(5d)** the whole ensemble is moved to simulate a pattern of the client's movement organization that requires the cooperation of all functional shoulder-arm components, as the pushing function addressed here.

This indirectly clarifies the *eigen*functions, while triggering the re-organization of the superordinate function(s). This optimizes the local functions' interplay, as shown in **Figure 5c** for an arm-flexion. The coordinative relations highlighted can either connect sub-synergies from the same hierarchical level to the higher-level patterns they partake of or cross-cut aspects across several hierarchical levels in the client's somatic order.

A third possibility is to directly stimulate a *complex* coordinative context. This higher-level functional ensemble is expected to impel embedded sub-synergies to re-adjust themselves, as illustrated in **Figure 5d**. In another FI example, practitioners simulate walking patterns with the client's leg ("artificial floor" exercise) to optimize the movement organization of the ankle joint and how the foot cooperates with the leg, pelvis, and upper body in locomotion.

Depending on context, bodyworkers will combine these three strategies differently. A frequent procedure in both disciplines is to treat a complex coordinative pattern in its holistic context, then disentangle it to transform selected aspects and finally reassemble it. This procedure can apply across the hierarchical order in a fractal fashion (i.e., practitioners may zoom into synergies at various nested levels). **Figure 5** illustrates the stepwise integration of a local sub-synergy into increasingly complex patterns in the shoulder-arm system during an FI session.

SYNERGETIC PROCESS MANAGEMENT

The discussed strategies require a profound understanding of coordinative functions and causal interdependencies in somatic systems. Practitioners recognize—and sensorially monitor—the make-up and genesis of *synergies*, i.e., coordinative structures realized in "functional groupings of structural elements (e.g., neurons, muscles, joints) that are temporarily constrained to act as a single coherent unit" (Kelso, 2009, p. 1537, cf. Latash et al., 2007; Turvey, 2007). To monitor this dynamic interplay, awareness of specific trade-offs and complementariness between local body states is crucial. A supportive practitioner must know how specific synergies become summarily constituted, including mutual neutralization, unidirectional damping, multiplication, or reciprocal compensation, and must consequently possess knowledge about the levels and nature of synergetic ordering (cf. Tschacher and Brunner, 1997).

We shall analyze the following Shiatsu vignette reported by an experienced practitioner to showcase a complex synergetic strategy: By strategically probing and mapping the information on a conceptual backdrop (Section "Abstract Inferences") the practitioner generates a complex systemic gestalt, which is progressively updated, drawn upon as a constraining backdrop, and later used for evaluating the outcome[8]. The practitioner chooses fitting interventions by and by, a cascade which brings forth synergies of increasing power for reshaping the attractor landscape. The example involves a client who is acutely overworked and suffers from painful tension between the shoulder blades. The practitioner seeks to release physical and psychological stress by working on anatomical structures and *Meridians* with largely extemporized, affordance-driven interventions—which are, however, fit into the earlier noted general structure of attunement, evaluation, intervention, integration, and final check (**Figure 6**). First, the practitioner applies empathetic, non-demanding touch (**6a**) to focalize the client's proprioception and encourage a relaxed parasympathetic mode (known to be favorable to self-organization). In return tactile feedback provides a first impression of the client's general *Ki*-state, which appears "vibrant but strained." The standard *Hara* test (**6b**) provides a closer evaluation by localizing *Functional circuits* with excessive and lacking *Ki* activity. The specific check of the *Hara* zones indicates:

(A) excessive *Gallbladder Ki* (*Jitsu*);
(B) depleted *Spleen Ki* (*Kyo*);
(C) unstable and "flickering" *Ki*-quality in the *Bladder* zone (vacillating between *Jitsu* and *Kyo* indicators).

The practitioner now maps this sensorial input to Shiatsu concepts to infer the full picture (Section "Abstract Inferences"). To evaluate the current systemic status she must interpret the

[8]The gestalt-building procedure is reminiscent of idiographic models in psychotherapy research (Strunk and Schiepek, 2006, p. 176ff; Haken and Schiepek, 2010, p. 432).

Attunement: The practitioner establishes rapport with the client while one hand rests quietly, but attentively on his *Hara* (abdomen). She gradually lets her hand sink into the *Hara*, while synchronizing with the client's breathing rhythm (**6a**).
Evaluation: To gauge the client's attractor landscape, i.e. to identify the most and least active aspects in the relative *Ki* distribution, the practitioner palpates the *Hara's* diagnostic zones (**6b**). The latter microscopically represent all *Functional circuits*.
Preparatory routines are employed to release strain in the autonomous back muscles and tone *Ki* in the *Bladder meridian*: Areal stretches on the back are applied (**6c**), followed by two-handed pressing techniques on both sides of the thoracic spine all the way from neck to pelvis (**6d**), where the practitioner puts her weight on the sacrum to release a potential *Ki* "bottleneck" (**6e**).
Intervention phase (A) aims to scatter *Ki* in the overexerted shoulder area: The practitioner stimulates *Ki* in both the muscles and the *Gallbladder meridian* on the scapula edge (**6f**) with a single grip.
Intervention phase (B) aims to harmonize *Ki* flow along the *Bladder meridian*: The practitioner applies thumb pressure on reflex points (*Tsubos*) on the *Meridian*; she lets the pressure sink in on each until a noticeable change of *Ki* quality is discernable. This treatment runs down from the neck to the sacrum (**6g**) before continuing on the leg section of the *Bladder meridian w*here we focus on two key situations: A *Ki*-collecting technique on a *Kyo tsubo* situated on the lower leg is initiated with the other hand resting on the sacrum, thus co-stimulating an "access-point" to the entire *Bladder circuit* (**6h**). Due to the *Kyo* state's persistence, the same *Tsubo* is then co-stimulated with a *Jitsu-Tsubo* on the thigh-section of the *Bladder meridian* (**6i**).
Intervention phase (C) aims to strenghten the *Spleen circuit*: Initially, a stretch for "opening" the *Spleen meridian* is done (**6j**). To replenish this *meridian's Ki* a number of *Tsubos* are gently and patiently stimulated by thumb pressure, while the other hand co-stimulates the *Spleen* zone of the *Hara*, as shown in (**6k**).
Integration phase: At the end of the session, toning techniques on the *Hara* are applied (**6l**). Finally, the overall *Ki*-distribution is once more evaluated by palpating the *Hara's* diagnostic zones (as in **6b**).

FIGURE 6 | A cascade of Shiatsu interventions.

gathered sensorial data through the lens of the conceptual-diagnostic model in which manifest symptoms correlate with particular imbalanced *Ki*-patterns. Only after having mapped the troublemakers to *Ki*-logic can physical grips and techniques be selected that afford "navigating" the medium of *Ki*.

A sketchily defined procedure suggests itself from the default strategy of strengthening the weakest link of the *Ki*-system. Empowering the most underrepresented *Kyo* is assumed to result in a redistribution of *Ki*, which the client's system previously invested in the corresponding *Jitsu's* effort to compensate for the *Kyo's* deficiency. The practitioner also reckons that preparatory routines may be needed to open the *Kyo* for *Ki*-intake or to "detach" the excessive *Ki* from the corresponding *Jitsu* area if the latter cannot release it straight away. Implementing this weakest link strategy specifically suggests strengthening the depleted *Spleen's Ki*, which is in charge of mental labor, physical vigor, and psychological stability. Convergently, the *Gallbladder circuit's* strain has to be downtuned sufficiently to release the *Ki* "held hostage" there. Also, as the *Bladder Ki* is known to be crucial for systemic stress release and *Ki*-supply, the practitioner decides to balance out this subsystem as a further mediating factor for *Kyo-Jitsu* equalization. Therefore, the *Bladder meridian* is already factored into the preparatory routines for calming the nervous system and releasing tension (**6c**–**e**).

We may now analyze the cumulative synergy build-up in systemic parlance. Each of the following intervention blocks is dedicated to one of the abovementioned strategic aims, with the means being selected in a more perceptually driven fashion from the repertoire while the process is underway. The bullet points with Roman numerals shall be illustrated in **Figure 7**, excluding step II (as the strategy remains without effect).

Aim A: Setting free stagnant *Ki* in shoulder girdle and *Gallbladder meridian*

- **(I) "Local dis-inhibition and horizontal synergy for weakening dysfunctional attractor"**
  Strategy: The idea is to scatter the stagnant *Ki* in the muscles and *Meridian* structures of the shoulder area. Since they are not only functionally connected by their relation to the *Gallbladder circuit* but also topologically coextensive, the bodyworker can address them with a single grip (**6f**). It is immaterial which of the structures unblocks first, since the effect will usually spill over to the other aspect either way (horizontal synergy). This local dis-inhibition is expected to benefit the dissolution of the *Jitsu* in the entire *Gallbladder circuit*.
  Effect: The *Jitsu* is tangibly toned down and the strain between the shoulder blades thus reduced enough to release the client's tension. The preconditions are now in place to balance the *Bladder meridian's Ki* which should thereupon unleash its mediating power for the overall *Ki*-balance.

Aim B: Equalizing vacillating *Bladder-Ki*

- **(II) "Relating isolated sub-synergy to superordinate level"**
  Strategy: While treating the *Meridian* the practitioner notices an acupressure point (*Tsubo*) with a conspicuous *Kyo* signature (dysfunctional attractor). To reintegrate the isolated *Tsubo* into its functional context the practitioner co-stimulates it with the sacrum (**6h**), a key access point to the *Bladder circuit*.
  Effect: No effect observable. Since the local *Kyo* attractor persistently resists adaptation and coordinated interplay an alternative strategy for optimizing *Ki*-flow in the *Bladder meridian* is selected opportunistically, as follows.
- **(III) "Optimizing component interplay to resolve dysfunctional attractor"**
  Strategy: The stagnant *Kyo* is co-stimulated with a *Jitsu* spot (**6i**) that was identified in passing as potentially corresponding to the former. The practitioner's assumption is that both local attractors might be part of a compensatory pattern inhibiting free *Ki* flow along the *Meridian*, as is confirmed next.
  ***Effect*:** After some moments of stasis, *Ki* begins to move along the "connective bridge" and dissolves the *Kyo* and *Jitsu* attractors simultaneously. After a certain point of equalization in the local *Ki*-distribution a tangible flush of *Ki* unfolds along the entire section of the *Meridian* (a phase shift in the local system). A moment later the effect dissipates through the whole system, thus entraining other sub-systems.
- **(IV) "Emergent higher-level synergy entraining subsynergies"**
  The client shows multiple signs of deeper relaxation, ostensibly due to the equalized *Bladder Ki's* calming effect on the autonomic nervous system, which reduces muscle tone throughout. The strong effect suggests that the changes in the *Bladder* and *Gallbladder circuits* have begun to transform the system. These changes in the global *Ki*-distribution now afford strengthening the system's weakest link of the *Spleen circuit* (i.e., the dominant *Kyo*), the session's main goal.

Aim C: Balancing whole system by strengthening weakest link (*Spleen-circuit*)

- **(V) "Elevating beneficial attractor by cumulative local effects"**
  Strategy: By stretching the *Meridian* (**6j**) the practitioner first seeks to make the "atrophied" leg section of the *Spleen meridian* amenable to *Ki* accumulation, which apparently lost a healthy capability to hold *Ki*. Then she applies *Ki*-collecting techniques to a number of *Tsubos* along the *Meridian* (**6k**). The practitioner finishes by toning the *Hara* (**6l**), a body area closely connected to the *Spleen circuit*, to further boost the *Circuit's Ki*-activity. Apart from this, the *Hara* technique was chosen for two surplus virtues in the given context: The *Hara* is a body zone connecting with all *Functional circuits*, which makes it inherently conducive to integrating the whole *Ki*-system, and the *Hara* focus redirects the client's attention from legs to torso, which in turn fosters centered somatic awareness.
  Effect: The improved *eigen*function and interplay of the *Tsubos* reinforces the *Ki*-activity in the whole *Meridian* and thereby benefits the entire *Functional circuit*. Together with the *Hara* techniques this cumulatively builds a beneficial attractor. A final test of the *Hara* zones shows the following advantageous changes of the global *Ki*-pattern.
- **(VI) "New equilibrium dissipates through system"**
  The *Bladder circuit* has been noticeably replenished and stabilized, resulting in a more equalized *Ki*-signature. The *Kyo* in the *Spleen* and the *Jitsu* in the *Gallbladder circuit* are still traceable, but reduced to an uncritical level. The system can be left to its self-regulatory devices from now on. The achieved local dis-inhibition and redistribution of *Ki* has apparently dissipated to all high-level *Circuits* and now downward propagates to all subordinate systems.

The stream of activation in the client's system, stimulated by the cascade of systemic intervention strategies, can be interpreted as gradual systemic activation spread (**Figure 7**). The vignette thus combines several strategic types afforded by a somato-systemic logic according to our earlier model. However, the client's system does not always respond to impulses as envisaged. Strategy II from the vignette illustrates this (which also explains why it is left out in the figure). When this occurs, the practitioner selects a new ad hoc route for synergy build-up. Thus, not only the ground-level operative tools, but even the mediating synergetic strategies are dynamically adjusted to the inevitably emergent nature of the interaction.

We may now wrap this up, both to add a few further items from the tool-box of synergetic process management and to clarify how important DST concepts relate to our discussion.

Modulating complex synergies

Frequently, bodyworkers inhibit or bracket out some co-synergetes to de-complexify the synergetic interplay. In FI practitioners may suppress reciprocal compensation or other trade-offs, e.g., by fixating other body parts. Alternatively, practitioners may facilitate a synergy with all its co-synergetes

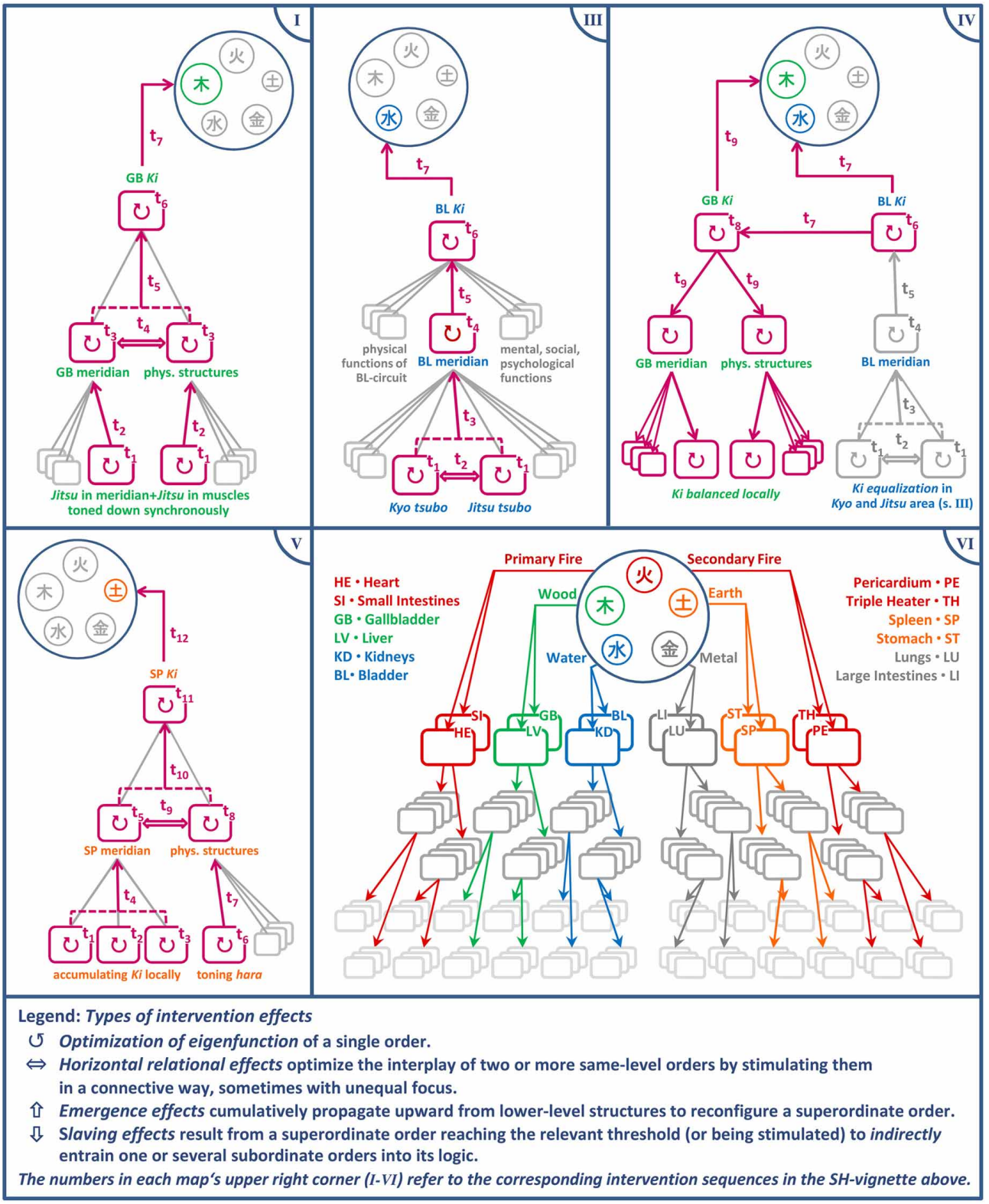

FIGURE 7 | Spreading activation: increasing upward propagation in the hierarchy and subsequent slaving downward. The stepwise synergy build-up in the Shiatsu treatment (excluding the failed attempt II) illustrates several basic types of systemic effects. In each panel, the currently activated functions at the relevant point in time are displayed as highlighted sub-structures. The uppermost level depicts how the various *Functional circuits* feed into the compressing model of the *Five Phases*, which encapsulates the global *Ki* configuration (see panel VI and, for further details about the conceptual mapping the practitioner performs, Section "Abstract Inferences").

through specific aids. Reducing strength requirements is an example: Support against gravity shapes whether a nascent ability will manifest (cf. Thelen and Smith, 1994's work with treadmills for toddlers). Or, repositioning a person in the field of gravity induces a different experience of weight. In lying certain muscles will be relieved and liberate other resources. Conversely, in still other situations degrees of freedom may be deliberately opened, e.g., through labile supports, and the task's difficulty is progressively increased to trigger reorganization.

Stepwise synergy integration

In one basic transformational scheme an effect spreads out bottom-up. E.g., a newly established organization of the arm-shoulder movement propagates to the whole shoulder-girdle, ribcage, and spine. Practitioners frequently use intermediary states of relative order as springboards from which clients can make territorial gains. Frequently, functional semi-saturation suffices. The practitioner moves on before a local synergy is fully constituted. She is confident that with partial stimulation in multiple spots a connective synergy will emerge, as affine incipient pattern formations reach out toward each other and jointly amplify the local alterations. In the special case of *hierarchical synergies*, cumulative effects require respecting a particular sequential order. Elements simply need to be implemented with a key sub-synergy first to entrain the ensemble into further self-organization. The most elementary degrees of freedom must be sufficiently configured for others to join in an organized way. To illustrate, Feldenkrais practitioners commonly start with proximal foci before wandering outwards on the body: Basic movements of the spine/head (rotation, flexion, extension, torsion, side-bending) come first, followed by pelvic/shoulder girdle movements, etc.

Utilizing "slaving"

Another way of exploiting self-organization is to foster downward spreading activation. One route goes up and then down—as in the vignette—by working on lower levels for a while until an effect manifests in the macroscopic order. When the latter stabilizes it begins to downward propagate to the substrate and pull further aspects into its orbit (*circular causality*). As soon as elementary synergies connect, say, shoulders, ribcage, and cervical spine, previously unaffected elements will spontaneously join in, say, the head. In another scenario variant practitioners immediately target a higher-level order, e.g., in Shiatsu the action chosen at first contact may aim to trigger a parasympathetic reaction. Much as a chemical system exhibits greater reactiveness with rising temperature, inducing a mode of relaxation influences various sub-systems: more regular breathing and heart-rate, lower muscle tone and facial tension, greater receptiveness and attentiveness, *Ki* accessibility, etc. Such overarching levers come closest to a *control parameter*, i.e., a variable "to which the collective behavior of the system is sensitive and that moves the system through different collective states" (Thelen and Smith, 1994, p. 62) and which modulates the trade-off between elements by activating or dis-inhibiting resources (Haken and Schiepek, 2010, p. 438). However, such interventions must be thought of as non-deterministic, as each is assimilated, refracted, and transformed by the system before an effect unfolds (Strunk and Schiepek, 2006, p. 187).

Autopoiesis "kicks"

Oftentimes, brief stimulating or perturbing impulses induce self-organization. For example, particular Shiatsu acupressure points, e.g., *Gallbladder 21* or *Kidney 1*, foster self-regulatory dissipation of *Ki*. The mechanism here can be slaving, but also work via any of the other vertical or horizontal routes. Thus, in situations when a system is receptive an entire multi-step chain of spreading activation can be triggered through a single intervention, provided channels have previously been "lubricated."

HOW IS SYSTEMIC PROCESS MANAGEMENT EMBODIED?

We argued that bodyworkers are intrinsically systems thinkers. They possess an (implicit) understanding of the somato-systemic architecture and synergies unfolding within this framework. They frequently envision dynamic images of a (self-)organizing process, of how the elements interact to generate non-linear outcomes. Such images shape sketch planning and, as the session progresses, the evaluation of ongoing percepts and actions in terms of their effect on the client's system. Apparently, to keep track both of sensory occurrences in the here-and-now and their likely relevance in the bigger processual picture, many practitioners index the stream of embodied evaluations to a systemic framework. We might speak of mappings from experience to a conceptual "sketchpad." Another possibility we cannot discount is that systemic skills implicitly arise without such conceptual mappings, simply by applying situated principles that add up to a good systemic effect. Thus, acting with systemic awareness minimally needs a collection of local strategies, but not necessarily an explicit ideology.

A distinctive feature of closely coupled embodied interaction as a means of process management is its *dynamic immediacy*. The process is kept hovering at a micro-zone of proximal development. Bodyworkers stay apace of every smallest dynamic increment and continuously respond to emergence with micro-actions by (a) amplifying input or modulating its quality, (b) changing the means when needed, (c) repairing problems, e.g., by boosting dwindling affordances, (d) buffering overshooting reactions and (e) optimizing boundary conditions underway. Whenever unexpected occurrences arise practitioners can immediately fine-tune and customize the ongoing process by virtue of their full embodied presence.

Dynamic immediacy is a prime precept for somatic learning, as it continuously challenges the client's proprioception and differential sensibility. Raising awareness for fine variations of actuation diversifies the client's potentials. Through constant perturbation and stabilization the client is kept hovering around the perceptual *limen*. This just-noticeable difference is sensitized (cf. Seitz and Watanabe, 2005). Dynamic immediacy is thus ideal for striking the important, but tenuous balance between blending in with the client's dynamics and cultivating a difference to it, e.g., by returning to familiar homebases and progressively exploring new things from there (Eilam and Golani, 1989).

Beyond the micro-dynamics, a further key to bodywork lies in how practitioners strategically re-allocate their attention over

larger stretches of time. Their focus oscillates between parts and wholes with their various levels of interplay. A recursive to-and-fro movement follows logically from the non-mechanistic ethos of bodywork, which demands constant contextualization of local states. They accordingly allocate action in zoom-in/zoom-out fashion and entrain clients into this oscillation. An optimal systemic integration of micro-processes is hereby provided. Somatic learning thrives on the coequal stimulation of elementary *eigen*functions and their interrelations. Particulars become integrated in holons, the rationale being that components recursively confronted with coordinative functions optimally self-organize. Process management of this sort respects the multi-level nature of functional system architectures. In other words, emergence is addressed at multiple levels.

EMBODIED SKILLS

We now aim to ground the foregoing reflections, largely cast in systemic abstractions, in distinct embodied capabilities: Systemic sensitivities are implemented through a flexible tool-box of enactive micro-skills, many of which one might find in manuals or training curricula. During apprenticeship bodyworkers educate their senses to actively explore and elicit relevant perceptual information, but also to provide concrete interaction guidance, using modulatory feedback control, imagery, and related resources.

DYNAMIC SOLUTIONS

Many of our reflections fall squarely within enactive cognitive science (Di Paolo, 2005; Thompson, 2007; Froese and Gallagher, 2012), which claims that perception is active and that dynamic solutions are found by exploiting a continuous sensorimotor loop (instead of discrete "ready-mades"). How can one, by just blending into and tweaking an emergent dynamic succeed with a goal? Firstly, tasks may be openly specified, such that the means and sub-steps remain flexible. By analogy, scoring a soccer goal can not only be achieved in multiple ways, a forward is also free to abort the intention of scoring himself and to pass the ball. The same flexibility of intentions and means-goal relationship applies here. As one goes along intermediate goals and new means take on shape.

Secondly, in view of continuous interaction solutions need never be of a one-shot nature; in fact experts make the dynamic itself their confederate. Solutions are incremental and distributed over an extended time-course. We must think of them as an *arc* even if they last only seconds. In this arc, the expert's "closed loop interaction with the outside world" (Kirsh and Maglio, 1994, p. 542) incorporates attention-focusing, information gathering, generative, and full-out actions in various mixes. The micro-dynamic of bodywork mirrors the eye-tracking study by Ballard et al. (1997) who had experimental subjects recreate a pattern of building blocks from a template. The authors discovered that, while finding the solution, the gaze constantly flips to-and-fro between the template, the work-space, and the resource box. Many so-called epistemic actions are performed to yield further information, make the task manageable, and help think up matches (cf. Kirsh and Maglio, 1994). Tentative activity produces input and further dynamic adaptation. In bodywork, too, subjects refer back to the world itself multiple times to complete an action, rather than deciding at a single moment. Within this kind of enactive strategy the world becomes "its own best model" (Brooks, 1991; cf. Beer, 2003).

Thirdly, bodywork exploits genuinely higher-level properties of dynamic engagement (Auvray et al., 2009). That is, inter-enaction itself generates options unavailable to two passive bodies. The client's responses, however subtle, in conjunction with the practitioner's actions provide emergent affordances. An emergent self-stabilizing dynamic of mutual co-adjustments thus becomes the source of further options. E.g., the client's active breathing into a painful area while the practitioner mobilizes it typically generates a mutual pattern that clarifies percepts and presents new affordances.

ENACTIVE PERCEPTION

Bodyworkers actively bring forth information (Noë, 2004). Sensing invariably requires (subtle) activity. E.g., resistance can only be probed by feeding impulses into the client's system. Bodyworkers thus *enact* percepts by *dynamic touch* (Turvey and Carello, 2011) or exploratory visual activity (O'Regan and Noë, 2001). They learn appropriate epistemic actions to gather and, by extension, stimulate information with, while also monitoring feedback from their pragmatic (overt) actions on the client. When actively inquiring into somatic responses, one particular trick is to subtly dynamize the client and thereby generate differentiated feedback. A refined *pacing* skill is associated with docking one's hands on the client's body in a way clear enough to feel and accompany movements, yet softly enough not to influence them. In fact, a desired sensation can be induced through "as if" interaction which aligns with the client's response anticipatorily (see *emulation*, Grush, 2004). In terms of resonance, applying this tactile quality "seduces" the client's system into providing clearer feedback. Emulation finely primes their perceptual apparatus to maximize chances of sensorially "clicking" with even minute traces of an activity pattern—which practitioners can amplify after having attuned with it. For example, they imagine putative micro-movements of the extremely subtle motility of inner organs like the liver or of small joints enveloped by muscles.

Frequently, bodyworkers simultaneously invest themselves with multiple epistemic strategies. To illustrate a typical cooperation pattern, the "*Mother hand*" in Shiatsu ensures a stable dyadic contact, provides a stabilizing context for change and keeps the global state in focus, while the "*Child hand*" works locally. In FI one hand often senses for effects at a distance of what the other does, so the two effector spaces are attentionally coupled and relationally interpreted.

Filters

Frequently, enactive pre-calibrations of the sensory apparatus are crucial. Depending on the situation, the senses are primed for a narrower or broader stimulus range. This creates perceptual filters of two sorts: Either one pre-configures the "hardware" of the sensory apparatus itself for a task, e.g., through a particular softness of touch or a particular gaze. Or, one pre-configures the attentional "software" by screening out irrelevant perceptual dimensions. Such calibrations can be very subtle. Expert practitioners can tune ostensibly identical acts of dynamic touch to

selectively capture joint positions, muscle tone, tissue elasticity, or *Ki* flow. They do so by guiding their attentional focus to an (inner-)bodily target region or by attuning to qualitative dimensions like elasticity, *Ki*-permeability, temperature, vitality, or rigidity. Sensory filters may be pre-set for a whole task or they may dynamically change.

Sensory alertness

Experts equally know when to relax filters or active sensory exploration as such, i.e., when to just broadly register information with minimal activity of the sensorium. Even while momentarily using a filter the expert's senses have to be able to register contingencies in the background. Unexpected emergence requires multi-dimensional sensory alertness. To exemplify this, the attentional technique of "soft eyes" adopts a blurry focus for the widest possible angle of view and no visual fixations. Or, suppose a Shiatsu practitioner is exerting deep pressure on an acupressure point and suddenly the client's fascia shows an autonomic somatic reaction of "unwinding." This calls for an instant switch by re-attuning the hands to a rather superficial, mainly lateral fascia movement and using decreasing pressure of the full palm ("*Butterfly touch*").

"Smart" perception

Another way in which the educated senses of bodyworkers surpass ordinary capabilities is by employing "high-level perceptual functions" (Gobet, 1997; Gauthier et al., 2010; Goldstone et al., 2010). A major source of efficiency is smart perception where

> "[t]he pickup function itself, rather than the subsequent processing, is the designated locus of perceptual sophistication" (Runeson et al., 2000, p. 533).

The gaze or hands are attuned to complex variables capturable with robust perceptual routines involving no inferential synthesis. The dynamic act of information pickup immediately compresses the perceptual field to "what counts," frequently in terms of complex relational properties. In a typical example, FI experts attune their eyes to a walker's locomotory "wave patterns" wandering through the spine. They focus on the idealized body axis in walking and standing. A second example (**Figure 8**) for a smart exploratory technique in FI explicitly highlights the relational integration of inputs. The practitioner's gaze perceptually integrates an outward leg rotation (gestalt 1) and a head position with shorter ear-shoulder distance on the left side (gestalt 2). Both indicate a tendency toward leftward rotation in the spine. The gaze probes several spots, perceiving their relationship as a higher-level gestalt. Hence, smart perception task-specifically organizes the perceptual field. Setting "marking" anchors can bestow further smart organization to this perceptual field, as can using the appropriate patterns of dynamic attention management at the right time, e.g., figure/ground or perspectival operations such as zoom-in/zoom-out.

Dynamic specification

Perceptual exploration is temporally extended and structured even within a few seconds or less. Finely feedback-triggered micro-actions in response to a stream of micro-affordances lend relevant sub-structure to the smallest routines. To give

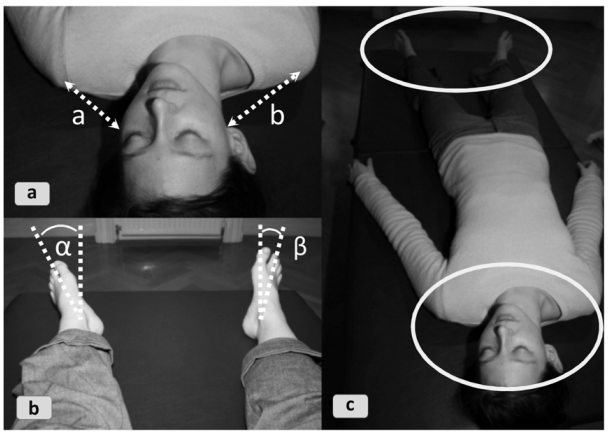

FIGURE 8 | Smart perception: two local perceptual gestalts inform a higher-level gestalt. The practitioner picks from the perceptual field the local gestalt of the shoulder-ear relation **(8a)** as well as the local gestalt of the leg rotation **(8b)**. The geometric frame between the two loci is then perceived as meaningful integral relation **(8c)**. In skilled practitioners this can virtually happen at a single glance, but even if two glances are needed perceptual integration to a higher-level gestalt can ensue.

Gibson's theory of affordances an appropriately dynamic format, we need to envision how practitioners realize integral actions such as tactile palpation techniques as a suite of many microscopic perception-action cycles. This process can unfold in two ways: In openly specified actions *sequential affordances* (Gaver, 1991) reveal themselves only step-by-step. Attention begins non-specifically attuned and the perceptual focus narrows while moving along. In many such situations experts simply trust that their epistemic and pragmatic micro-actions will produce enough further information to narrow down the possibility space by and by. This enactive strategy disambiguates means, strategies, and possibly even the proximal action goal itself in a *sensory funnel*, which progressively adds structural specifications while the task is underway. The problem solving exploits a to-and-fro motion between an incomplete action and proximal responses. To start the process, heuristics for exploratory sensory activity may be used, e.g., "probe the cardinal directions of a joint" and respond to micro-affordances by "start(ing) off with the easiest motion pathway" in FI (**Figure 9**).

Alternatively, routine techniques (Section "Action Skills") may also possess phasic structure with internal causal and temporal dependencies. To respect these, experts rely on familiar *micro-affordance* sets (Kimmel, 2012). Thus, when initiating a multi-phasic technique, active perceptual exploration first allows the practitioner to anticipatorily "sense for" micro-affordances specifying the relevant onset threshold and later micro-affordances for continuation and micro-timing. Micro-affordances comprise specific feedback signatures—a particular elasticity, resistance, force, etc.—that trigger the action's next phase or allow modulating the movement direction or intensity underway. Notably, micro-affordances provide the appropriate coregulative sensitivity whenever the client's system responds gradually to the initial stimulus. Suppose a practitioner should intensify the impetus of a pressing technique only the moment the

tissue softens or maximum elasticity is reached. In all situations when fluidity and quickness is of essence, bodywork experts anticipatorily prime their attention for such trigger signatures and the motor system for the incremental micro-action associated with each trigger.

Emergence is made a virtue of by incorporating dynamic feedback. Consider a Shiatsu technique for unblocking *Ki* flow by gradually increasing ribcage elasticity. Here the action is sketchily pre-specified, while fine-tuning and timing remain open. Muscular resistance determines how much pressure to apply and when to exert it. (Increasing the pressure in sync with the client's exhalation phase heightens the effect and makes it more agreeable for the client). Another point this illustrates is that micro-affordances may, when "go" signals remain absent, suggest a midway switch to alternative courses of action. E.g., a ribcage remaining rigid may suggest changing from vertical to a laterally swinging pressure. If this equally fails, the superordinate aim of unblocking *Ki* can be realized through totally different means like *Meridian* manipulation. Thus, whenever the desired feedback remains absent practitioners may intensify or change the stimulus, or even switch techniques.

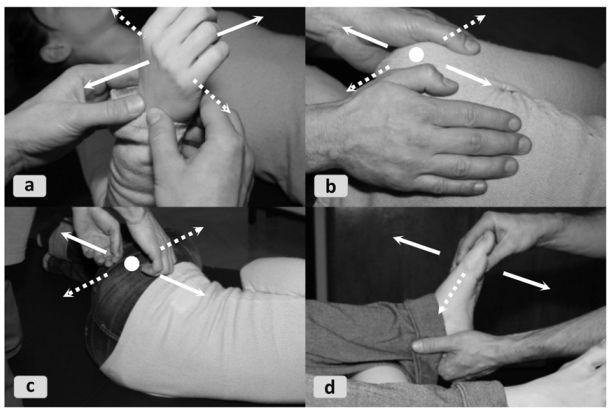

FIGURE 9 | Stepwise sensory discrimination by probing "cardinal directions" (FI). Gentle initial movements determine which micro-action patterns the area is amenable to and which it resists or finds unfamiliar. The dotted lines represent resistant directions and the solid lines yielding ones. Similar 3D movement patterns emerge around different parts of the body: **(9a)** wrist, **(9b)** shoulder blade, **(9c)** pelvis, **(9d)** ankle.

ACTION SKILLS

In addition to *epistemic* actions bodyworker practitioners obviously need a repertoire of full-out *pragmatic* actions (Kirsh and Maglio, 1994). A set of basic micro-routines provides goal-directed motor programs for manual grips, stretches, presses, mobilizations, and so forth, i.e., "action-oriented representations" (Clark, 1997). Bodyworkers internalize this assemblage of micro-routines as ideomotor modules (Prinz, 1997; Koch et al., 2004; Shin et al., 2010) (**Figure 10**).

Action concepts

The term *basic action concept* refers to structured increments within complex and multiphasic ideomotor representations, as might be evident in the phases of a volleyball spike or ski jump that a sports expert represents (Schack, 2010). The Feldenkrais theorist Rywerant (2003) coins the term *manipulon* for such a modular action concept. Each short action, even at the temporal level of a single grip is, in the minds of experts, multiphasic and contains fine-grained sub-structure represented as a string of minuscule *sequencing points* (Kimmel, 2012). Both the sequencing points and the motor gestalt they create—the whole "mini-clip"—are represented in terms of ideomotor imagery. Action concepts thus comprise hierarchically structured ideomotor gestalts, many of which may be stored as prototypes and can be further adapted for context-sensitive action variation (**Figure 11**).

Feedback control

While basic ideomotor units are first acquired independently of the client's or other real-time reactions it was suggested that bodyworkers combined these routines with feedback signatures for precise timing and fine-tuning of all sorts (*micro-affordances*).

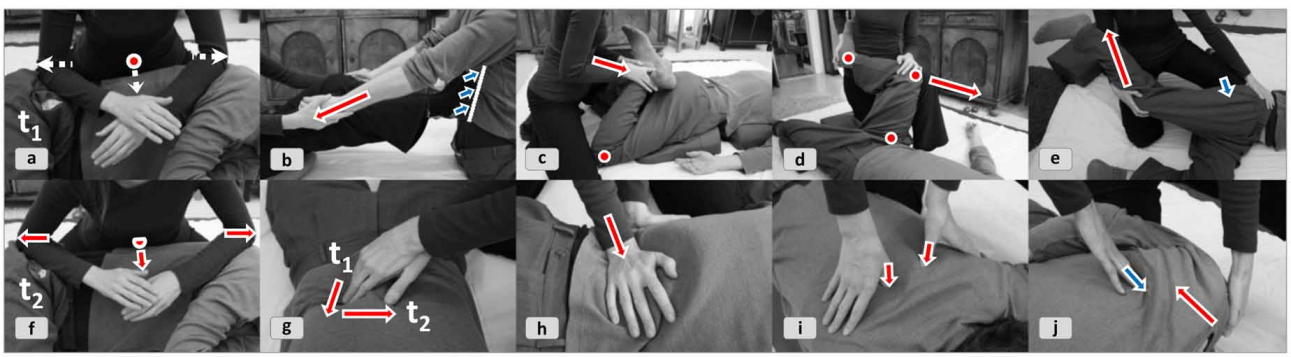

FIGURE 10 | Modular action concepts in Shiatsu. The red vectors stand for the direction of pressure or pull, the blue vectors for simultaneously applied counterforce, and the dotted lines for preparatory actions in anticipation of the next moment. Various examples from practitioner's "toolbox" are illustrated. **(10a+f)** Transfer of body weight via elbows for an areal stretch. **(10b)** The feet provide a fulcrum for a shoulder stretch. **(10c+d)** Stretches of *Meridians*, muscles, tendons etc. combined with mobilization of joints. **(10e)** A large-scale *Meridian* stretch combined with acupressure through the knee. **(10g–i)** Attentive pressure, exerted by thumbs, fingertips, and palms, is intermittently combined with horizontal pull. **(10j)** Mobilization and pressure combined in rhythmic counter-motion for simultaneously moving *Ki* in the muscles and *Meridians* of the focal area.

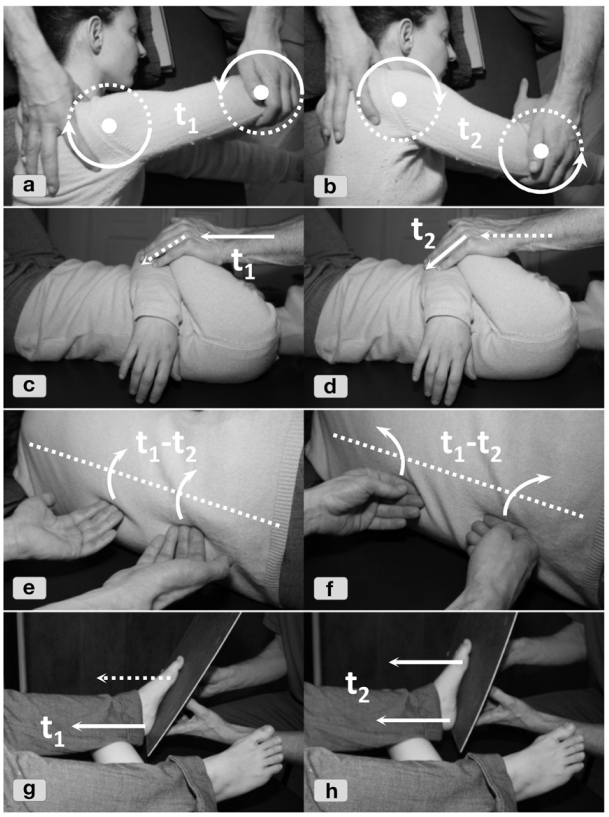

FIGURE 11 | Basic action concepts and multi-phasic gestalts in FI. These can be thought of as modular interaction elements that can be repeatedly deployed with the appropriate contextual calibration. **(11a+b)** Figure-eight shaped curve gestalt in rotating the shoulder around the clavicle in relation to the elbow. **(11c+d)** In t_1 the shoulder is addressed to initiate and deepen chest flection in t_2. **(11e)** Touching the spine for rotation. **(11f)** Touching the spine for rotation & side-bending. **(11g+h)** "Artificial floor" simulation of walking pattern in supine position.

Instead of execution in "blind-flight" practitioners dynamically modulate micro-actions underway. By comparing actual to expected feedback they monitor and hereby correct against deviations the intensity, extension, direction, speed, phrasing, or accentuation of the ongoing activity (*forward models*, Wolpert et al., 2003, 2011; Pacherie, 2006). Further evidence suggests that experts use what we would call *enhanced* action concepts. These combine a spatio-temporal action image, the initializing motor commands, and expectations about accompanying tactile, visual, and proprioceptive feedback. Enhanced action concepts provide an integrative understanding of all sources of interaction control.

Imagery

In addition to full ideomotor commands of single-body techniques and small interaction scenarios, bodyworkers report using numerous types of schematic imagery: (a) *Global process gestalts* or *vitality contours* (Stern, 2010) help to envisage tempo, rhythm, and energy deployment over time, e.g., suddenness vs. gradualness, crescendo, ostinato. (b) *Image-schematic and force dynamic gestalts* (Johnson, 1987) include force attraction and repulsion, blockage, going with the force or against it, imagining a trajectory end-point, moving in intervals or a direct transition; countervectors such as a "rubber band" for stretches between two points, spiraling into a tissue, circling, vibrating into a point, snipping/snatching away energy, compression and torsion, stroking, "pushing a wave," "see-saws"; complex trajectories like eights or 3-D shapes. (c) *Causal ("if-then") imagery* of anatomical or physical principles like mechanic levers (Franklin, 1996) can be used to support action planning or to detect underlying principles while observing the client's body. (d) *Summarizing imagery aids*: Advanced experts project into space virtual points, vectors, axes, or shapes like a sphere representing the joint gravitational center. Such virtual gauges (cf. Hutchins, 1995) sum up the system's state for them while implicitly blending sensory data from multiple interfaces into an emergent organizing image. (e) *Node points*: When improvising, configurational images of "homebases," i.e., junctures from which several continuations are known, provide usable end- and transition-points for the ongoing action and subserve a fluid connection (Kimmel, 2015). In sum, imagery is a crucial didactic asset and frequently couched in metaphors and key concepts (Kimmel, 2012). By being "introjected" (Kimmel, 2008, 2013) it organizes the body into the right synergies and activates the right effectors and sensors.

Control laws

Building on feedback control mechanisms, *control laws* robustly link specific perceptual values to specific action responses (Warren, 2006, cf. *sensorimotor contingencies*, Noë, 2004). They are frequently expressed verbally in principles like "as long as tissue response is elastic you can go deeper" or "pursue the kinetic vector of least resistance." When applying a control law bodyworkers monitor feedback in a particular dimension such as interpersonal distance, angle, balance, or pressure and gradually scale up their degree of action response after hitting a task-relevant onset threshold. Within the task, the applied control law specifies the relevant sensory dimension and *optimal* and *critical values* (Warren, 1984). The task can now be regulated in real-time via dynamic feedback. Deviations from the optimal value are corrected on-the-fly: the suboptimal parameter setting at time$_{(n)}$ is adapted to conform with the optimal value at time$_{(n+1)}$. Examples of this abound in bodywork: In passive mobilizations, which are used to familiarize FI clients with a new movement, it is all-important to support their incipient movements without losing the minimal cooperation of their motor system (for effective sensory pedagogy)[9]. For striking the proper balance, a control law specifies that the client's limb is just self-impelled enough when it remains in a closely defined range of tactile resistance. "Smooth" response continuity is felt as confirmatory feedback. Another example: Shiatsu givers will direct their

[9]The FI related quote by Rywerant (2003, p. 82) fits this idea: "While exploring the range of movement the teacher first makes sure that the habitual sector of that range is established as well-known and familiar. This middle-part of the range of movement is usually somewhere around the neutral point of least effort. Only with the acknowledgement of this neutral area as safe can one address oneself to the pupil's upper level of control."

Hara and thus the center of gravity directly at the region under treatment. The ideal direction will generate a feel of ease and non-deflected force. This feel progressively diminishes as one moves out into the "cone" surrounding the ideal vector, up to a threshold where it is lost (**Figure 12**).

To supply a last example, the quality of dyadic coupling can be monitored and shaped concerning the dynamic micro-interplay of forces. Practitioners report the optimal dyadic control state to involve another agency not hampering one's own and a sensory continuum with precise gradual scaling and without response delays or gaps. The loss of response continuity when a critical threshold is reached feels like a "barrier" or like something turning "rigid," "dumb," and "indifferent." The perceived feedback signature (resistance, elasticity, etc.) begins to change qualitatively.

Further aspects of anticipation

Mentally and motorically simulating outcomes in advance can be important for further reasons. In multi-phasic actions, anticipatory simulations allow an optimal build-up of the desired end-state, e.g., to maximize end-position comfort. A practitioner might start a grip technique with an awkward crossed arms position to get to the other side of the body in a continuous flow (**Figure 13**).

Anticipatory combined with enactive abilities allow practitioners to strategically exploit the structured temporal dynamics of coregulation. Thus, they can—actively or by waiting—bring about usable configurations at a remove ("I do X for the client to respond with Y, which lets me do Z") and strategically generate affordances. Practitioners might, e.g., apply pressure for a muscle's release and hereby enable further diagnostic exploration of a ligament underneath. Knowing that—and how—one can adjust to the temporal dynamics expands the interaction possibilities (Section "Dynamic Solutions"). E.g., when pushing into the client's abdomen (*Hara*) Shiatsu experts can perform astonishingly deep stimulations because (a) they are alert to indicators of the client's pain threshold and possess salvaging strategies they dynamically apply before anything goes awry and (b) they fine-tune the action quality so it can be assimilated.

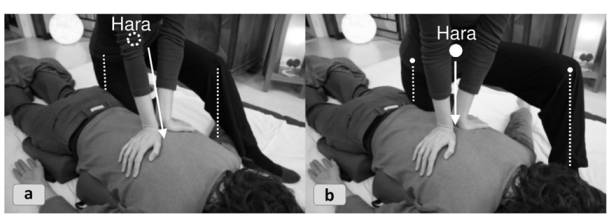

FIGURE 12 | Vector emerging from the *Hara* directed at the focal interface zone. For illustrative purposes, we contrast a novice's rather ineffective approach to using the body weight **(12a)** with a proper vector emerging from the *Hara* **(12b)**. The proper technique directs the full center of gravity in the practitioner's lower belly onto the focal spot on the client. The practitioner is thus able to use compact force without exerting a lot of muscular pressure, while ensuring a maximum of inter-body rapport.

PRECALIBRATIONS

Bodywork apprenticeship instills general somatic dispositions that become a second nature in experts. Practitioners must employ comparatively unchanging bodily organizing principles to enable and sustain coregulation. They cultivate good somatic dispositions both of a task-specific and of a generally enabling sort (i.e., a permanent backdrop that guarantees fluid interaction as such).

At the session's outset the practitioner "slips into" a *habitus* which specifies permanent "dos" and "don'ts," i.e., habits of posture, kinetic efficiency, motion range, attentional focus, muscle tension, and breathing. Thus, Feldenkrais and Shiatsu experts habitually initiate their own movements from their body centers, strive to continuously remain neutrally poised for action, etc. Habitus may become "naturalized" and, as Dreyfus and Dreyfus (1999) say, partly "hidden in the body."

Habitualized action principles also furnish an efficient inter-body configuration: Shiatsu givers always direct power from their *Hara*. One image of this is to create a vector from the lower belly that is aligned with the focal zone of manual activity (**Figure 12**). Furthermore, bodyworkers in general refine their sensorimotor apparatus so as to become a good feedback environment for the client. They provide a "mirror," "resonator," and "amplifier" for the client's self-oscillation. Simultaneously, they contribute to the "unity of nervous systems" and create a backdrop of *we-intentionality*. These principles guarantee the rapport and constant information flow requisite for the build-up of all further dyadic synergies.

An accompanying *somatic mode of attention* (Csordas, 1993) specifies a host of epistemic strategies like using "soft eyes," a defocused gaze. Active relaxation, a sense of balance, and minute proprioceptive awareness of breath, heart-rate and attentional states helps attune with the client. Organized "mental" interaction attitudes like being non-judgmental, unbiased, or contact ready reinforce this.

Overall, only educated bodies with properly constrained degrees of freedom can realize all the specific micro-skills we have discussed. We may think of this as intelligent presettings of muscle elasticity, joint radii, and so forth, which provide efficiency for specific techniques, but more fundamentally also enable interaction. With this, task management is partly offloaded to—albeit temporarily created—body structure (cf. Pfeifer and Bongard, 2007).

CONCEPTUAL BACKDROPS

Finally, we encounter hybrids of embodied-enactive and inferential skills in bodywork. Beyond their sensory and ideomotor routines practitioners throw genuinely representational skills into the mix (*contra* Hutto and Myin, 2012).

FUNCTIONAL ANATOMY

One kind of representation in both disciplines is percept-near (*simulative, imaginative*): Functional anatomy models guide attention, as particular regions of the client's body are highlighted for exploration. Anatomical imagination also allows perception to become augmented through properties hidden beneath the skin into a rich multi-modal "image-percept." Functional anatomy

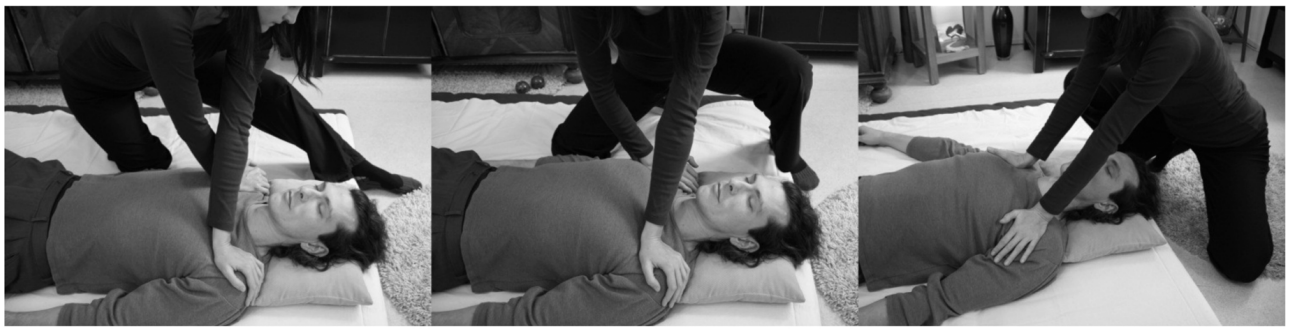

FIGURE 13 | End-position comfort through initial arm crossing (Shiatsu technique). As the practitioner moves around the client's body she aims at uninterrupted touch on the two shoulder interfaces. To ensure this, she begins in a rather awkward position she would not usually employ. As she rotates further, however, this guarantees an end-position where she comfortably can linger without having to lift the hands away for repositioning.

models can be thought of as dynamized text-book like images that simulate a limb in action. They are loaded with causal knowledge of the sort "when the shoulder blade is lifted the pull of the *Levator scapulae* muscle on the cervical spine is released." Causality is based on observed perceptual covariance, which experienced practitioners can simulate off-line. Such models encapsulate biomechanical concepts like myofascial *tensegrity* (Ingber, 2008) or kinetic laws concerning levers, force transfer and deflection, etc. (Franklin, 1996). Thus, bodyworkers utilize precise images of functional body-part interrelations to actuate minute motion. Such simulative imagery defines afforded actions, maximal ranges of motion, etc., hence model-based perceptual inferences. Consequently, functional anatomy models enrich the interaction process via a kind of real-time embodied problem solving. The adduced information from functional anatomy is immediately merged into the sensory interaction dynamics for supporting diagnosis and action choice.

Since functional anatomy suggests causal contingencies between parts and wholes it inherently predisposes toward a systemic view of embodiment. Moreover, models are implemented in an inherently relational and holistic fashion. The way anatomy is taught to bodyworkers discourages a localistic and mechanistic course of action (as one might well see in more traditional biomedical quarters). This point further reinforces our claim that systemic relationality is inherent to bodywork (Section "How is Systemic Process Management Embodied?").

ABSTRACT INFERENCES

Beyond percept-near inferences, truly abstract representations are utilized in Zen Shiatsu. A sense of how complex these can be may be gleaned from the previously mentioned *Functional circuits* and *Five Phases* network models (Sections "Disciplinary Background and Goals" and "Synergetic Process Management"). For the treatment to begin, a perceptual gestalt is re-interpreted in theoretical terms (*Ki*-related concepts) and further disambiguated to suggest a course of action (**Figure 14**, top). The perception-action loop thus takes a "detour" by intermittently drawing on inferential processes.

- In a first step, information is integrated, including verbal reports, tactile indicators such as tight back muscles, and *Ki*-signatures perceived via palpation. This perceptual input now becomes enmeshed with corresponding concepts of *Kyo/Jitsu*—opposing attributions of *Ki* activity and saturation (Section "Probing the Attractor Landscape"). Sometimes working with regional *Kyo/Jitsu* profiles is enough for the practitioner to act. However, Zen Shiatsu also provides special procedures dedicated to synthesizing a global *Kyo-Jitsu* profile of *Ki* distribution across all *Functional circuits*. E.g., *Hara* diagnosis allows the practitioner to integratively map the verbal feedback and perceptual feedback gathered in respective diagnostic zones to the conceptualized logic of *Kyo/Jitsu* and *Functional circuits* (**Figure 14**, center and bottom).
- In sophisticated cases further concept-concept mappings may be added, such as mappings to the *Five Phases* model (**Figure 14**, bottom), a higher-level conceptual layer that summarizes how all twelve *Functional circuits* work together. This mapping serves complexity reduction. A dynamized version of the *Five Phases* model, the so-called *Driving and Damping Cycles*, encapsulates the functional interplay and possible transformations between *Functional circuits*. (Re-interpreting the basic conceptual model in terms of this processual rendering provides helpful inferences about the client's long-term system history, which we cannot explain here for space reasons.) Bear in mind, however, that not all of these resources need to be used at all times.
- At the stage of action planning, general praxeological principles need to be found that fit the diagnostic conceptual model. This type of inference either yields simple strategic routes of intervention such as "strengthen dominant *Kyo* and downtune compensatory *Jitsu*" or suggests multi-step strategies of synergy build-up. The Shiatsu vignette has illustrated this for three *Functional circuits*.
- For a final concretization of these strategies operative tools are selected (action concepts, control laws, sequence schemes, best practices). This happens with situated flexibility to optimally tailor the selected means, usually from a rich pool of options, to the client's emergent process dynamic.

To recap, inferences are utilized to link percepts and concepts, different levels of conceptual compression amongst each other, and the derived intervention strategies to the concrete action tool-box.

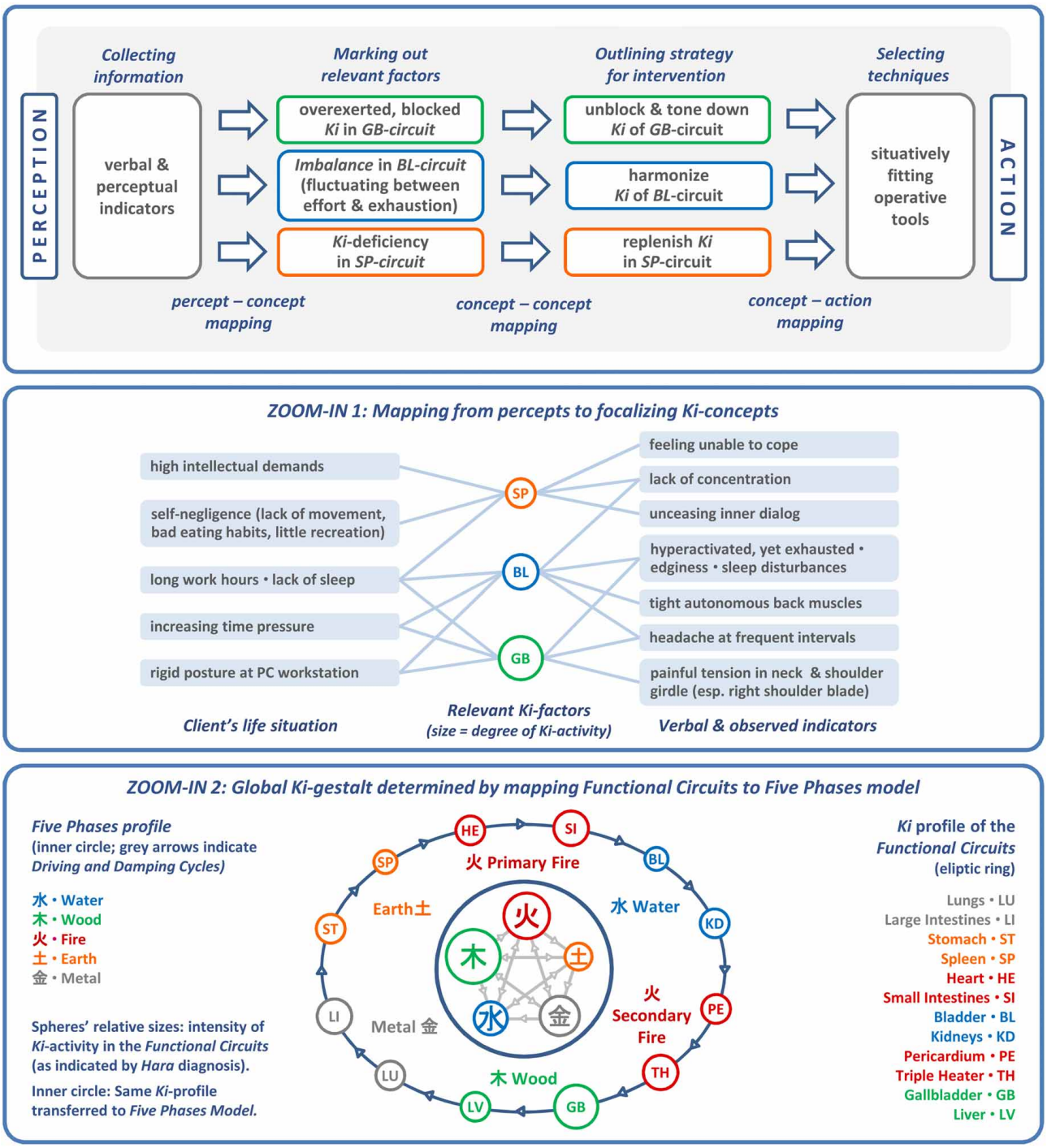

FIGURE 14 | Conceptual inferences within the perception-action loop. The initially diagnosed state of the client's system shows a global imbalance of *Ki*. The practitioner singles out for treatment the three most disproportional aspects in the *Gallbladder* (GB), *Bladder* (BL), and *Spleen* (SP) *circuits*. The top panel encapsulates the idea that the diagnostic process runs via "hidden layers" at which conceptual mappings supervene in the practitioner's mind from diagnosis, via interpretation and strategy building to selecting operative tools. The center panel specifies the various informational sources brought to bear in the diagnostic phase, a mapping from many percepts to three focalizing concepts. The bottom panel goes into the details of the concept-to-concept mapping that is used to connect and further compress the global diagnostic gestalt from the twelve *Functional circuits* to the processual model of the *Five Phases*.

We claim that various interdependent layers have to be coordinated in a complex parallel process that necessitates supplying inferences at the appropriate junctures while staying in touch with the client.

CONCLUSION

Bodywork can be defined as continuous process management for somato-personal learning that respects moment-by-moment emergence. It is implemented via a tactile or otherwise sensory interface and follows a holistic philosophy of accompanying change in the client's systemic order. Under the master metaphor of achieving dynamic homeostatic balance, clients receive stimulations at multiple levels of their body system within the larger system of the stabilizing dyad. This triggers adaptive self-organization. The underlying idea, as in kindred systemic approaches, is to transform the attractor landscape for resilience in the longer run. Our aim has been to illustrate the types of process management strategies used:

- Bodyworkers combine perturbing and stabilizing stimuli to stimulate the client's system in a zone of proximal development.
- Through cumulative, at times recursive interventions a step-by-step reconfiguration of attractors takes hold in the client's system.
- The transformation process can be thought of as spreading activation in the somato-systemic architecture constituted by nested synergies and where the most encompassing level is a whole-body function.
- Bodyworkers ostensively operate within a more or less explicit image of this (hierarchical) architecture.

Our close analysis of vignettes illustrated that, as a basis for initiating action, practitioners probe the client's system to understand its order, especially imbalances. They (optionally) sketch-plan a macro-strategy for synergy build-up with greater or lesser projective reach, which is subsequently implemented through soft-assembly of synergies in response to the client's real-time feedback. While monitoring how synergies develop, practitioners can at every point customize strategies, switch from one operative tool to a better fitting one, or even take a different strategic route. The fact that systems are forever in flux and that this emergence must be respected necessitates systemic sensitivities, and these in turn require a flexible tool-box: Systemic constraints are involved in dynamically selecting and adapting operative tools—which are embedded in equally dynamic tactics and strategies.

Bodywork is unmistakably a "multi-skill." A general mode of mind-body presence and a constant relational attentiveness need to be integrated in real-time with systemic awareness. These overarching factors need to be made co-extensive with the substrate of enactive micro-skills, which we have analyzed in detail (action repertoire, imagery, smart and dynamic perception, habitus, etc.). Although presence and attentive embodied rapport already accomplish a lot, bodywork is much more than benevolent touch: The numerous embodied micro-skills allow tailoring the intervention to each specific embodied dialogue's quality and dynamics. Hence, the way systemic awareness is augmented through embodied micro-skills commends bodywork in no small way. For therapeutic practice a hypothesis suggests itself: All other things being equal, skills gain leverage the greater their inter-enactive situatedness is (as indexed by continuity of monitoring and constancy of full-body presence). Situatedness in enactive terms cashes out as *dynamic immediacy* whereby the practitioner can respond with customized micro-interventions. To summarize, the "art of encounter" in bodywork consists in orchestrating multiple skill components, some at a more framing and some at a more situated level.

Understanding how the relatively abstract principles of DST are moored in the embodied-perceptual realm benefits greatly from the 1st person viewpoint of practitioners. Practical knowledge alone elucidates how systemic and embodied skills converge. Systems thinking left to its abstract devices will find it difficult to fully understand the micro-dynamics of bodywork. Micro-ethnographic analysis grounded in embodied, enactive, extended, and embedded cognitive science sheds light on these finer layers of the process. In summary, we hope that our case studies encourage *somatics* and therapy related areas to continue along these lines and further develop the interface between DST, embodiment theory, and their implementation in real-time interaction.

ACKNOWLEDGMENTS

We wish to thank the Austrian Science Fund for supporting our research (FWF grant P-23067) as well as for subsidizing the publication, Gina Battistich for the Feldenkrais photo sessions, and the many learners and experts who have participated in our study.

REFERENCES

Auvray, M., Lenay, C., and Stewart, J. (2009). Perceptual interactions in a minimalist virtual environment. *New Ideas Psychol.* 27, 32–47. doi: 10.1016/j.newideapsych.2007.12.002

Ballard, D. H., Hayhoe, M. M., Pook, P. K., and Rao, R. P. N. (1997). Deictic codes for the embodiment of cognition. *Behav. Brain Sci.* 20, 723–742.

Beer, R. D. (2003). The dynamics of active categorical perception in an evolved model agent. *Adaptive Behavior.* 11, 209–243. doi: 10.1177/1059712303114001

Beresford-Cooke, C. (2011). *Shiatsu: Theory and Practice.* Edinburgh: Churchill Livingstone.

Bernstein, N. A. (1967). *The Coordination and Regulation of Movements.* London: Pergamon.

Blackburn, J. (2003). Trager® psychophysical integration—an overview. *J. Bodyw. Mov. Ther.* 7, 233–239. doi: 10.1016/S1360-8592(03)00042-1

Blackburn, J., and Price, C. (2007). Implications of presence in manual therapy. *J. Bodyw. Mov. Ther.* 11, 68–77. doi: 10.1016/j.jbmt.2006.05.002

Bourbousson, J., Sève, C., and Mc Garry, T. (2010). Space-time coordination dynamics in basketball: part 2. The interaction between the two teams. *J. Sports Sci.* 28, 349–358. doi: 10.1080/02640410903503640

Brooks, R. A. (1991). Intelligence without representation. *Art. Intell.* 47, 139–159.

Buchanan, P., and Ulrich, B. (2001). The Feldenkrais Method®: a dynamic approach to changing motor behavior. *Res. Q. Exerc. Sports* 72, 315–323. doi: 10.1080/02701367.2001.10608968

Burns, C. A. (2012). Embodiment and embedment: integrating dance/movement therapy, body psychotherapy, and ecopsychology. *Body Mov. Dance Psychother. Int. J. Theory Res. Pract.* 7, 39–54. doi: 10.1080/17432979.2011.618513

Clark, A. (1997). *Being There: Putting Brain, Body, and World Together Again.* Cambridge, MA: MIT Press.

Clark, A. (2008). *Supersizing the Mind. Embodiment, Action, and Cognitive Extension.* Oxford: Oxford University Press.

Connors, K. A., Galea, M. P., Said, C. M., and Remedios, L. J. (2010). Feldenkrais Method balance classes are based on principles of motor learning and postural

control regaining: a qualitative research study. *Physiotherapy* 96, 324–336. doi: 10.1016/j.physio.2010.01.004

Csordas, T. J. (1993). Somatic modes of attention. *Cult. Anthropol.* 8, 135–156. doi: 10.1525/can.1993.8.2.02a00010

Dale, R., Fusaroli, R., Duran, N. D., and Richardson, D. C. (2013). The self-organization of human interaction. *Psychol. Learn. Motiv.* 59, 43–95. doi: 10.1016/B978-0-12-407187-2.00002-2

Di Paolo, E. A. (2005). Autopoiesis, adaptivity, teleology, agency. *Phenomenol. Cogn. Sci.* 4, 429–452. doi: 10.1007/s11097-005-9002-y

Dreyfus, H. L., and Dreyfus, S. E. (1999). "The challenge of merleau Ponty's phenomenology of embodiment for cognitive science," in *Perspectives on Embodiment: The Intersections of Nature and Culture*, eds G. Weiss and H. F. Haber (London: Routledge), 103–20.

Eilam, D., and Golani., I. (1989). Home base behavior of rats (Rattus Norvegicus) exploring a novel environment. *Behav. Brain Res.* 34, 199–211.

Feldenkrais, M. (1993). *Body Awareness as Healing Therapy: The Case of Nora.* Berkeley, CA: Frog Books.

Feldenkrais, M. (2005). *Body and Mature Behaviour. A Study of Anxiety, Sex, Gravitation, and Learning*. Berkeley, CA: North Atlantic Books.

Fogel, A. (1993). *Developing Through Relationships: Origins of Communication, Self and Culture*. Chicago, IL: The University of Chicago Press.

Fogel, A. (2006). Dynamic systems research on interindividual communication: the transformation of meaning-making. *J. Dev. Proc.* 1, 7–30.

Fogel, A. (2013). Better or worse: a study of day-to-day changes over five months of rosen method bodywork treatment for chronic low back pain. *Int. J. Ther. Massage Bodywork* 6, 14–24.

Franklin, E. (1996). *Dynamic Alignment through Imagery.* Champaign, IL: Human Kinetics.

Froese, T., and Di Paolo, E. A. (2011). "Toward minimally social behavior: social psychology meets evolutionary robotics," in *Advances in Artificial Life*, eds G. Kampis, I. Karsai, and E. Szathmáry (Heidelberg: Springer), 426–33.

Froese, T., and Fuchs, T. (2012). The extended body: a case study in the neurophenomenology of social interaction. *Phenomenol. Cogn. Sci.* 11, 205–235. doi: 10.1007/s11097-012-9254-2

Froese, T., and Gallagher, S. (2012). Getting Interaction Theory (IT) together: integrating developmental, phenomenological, enactive, and dynamical approaches to social interaction. *Interact. Stud.* 13, 436–468. doi: 10.1075/is.13.3.06fro

Fuchs, T., and De Jaegher, H. (2009). Enactive intersubjectivity: participatory sense-making and mutual incorporation. *Phenomenol. Cogn. Sci.* 8, 465–486. doi: 10.1007/s11097-009-9136-4

Fusaroli, R., Rączaszek-Leonardi, J., and Tylén, K. (2014). Dialog as interpersonal synergy. *New Ideas Psychol.* 32, 147–157. doi: 10.1016/j.newideapsych.2013.03.005

Fusaroli, R., and Tylén, K. (2015). Investigating conversational dynamics: interactive alignment, interpersonal synergy, and collective task performance. *Cogn. Sci.*

Gauthier, I., Tarr, M. J., and Bub, D. (eds.). (2010). *Perceptual Expertise. Bridging Brain and Behaviour*. Oxford: Oxford University Press.

Gaver, W. (1991). "Technology affordances," in *Proceedings of the ACM CHI 91 Human Factors in Computing Systems Conference,* eds S. P. Robertson, G. M. Olson, and J. S. Olson (New Orleans: ACM Press), 79–84.

Gibson, J. J. (1979). *The Ecological Approach to Visual Perception*. Boston, MA: Houghton Mifflin.

Ginsburg, C. (2010). *The Intelligence of Moving Bodies: A Somatic View of Life and Its Consequences*. Santa Fe: AWAREing Press.

Gobet, F. (1997). A pattern-recognition theory of search in expert problem solving. *Thinking Reason.* 3, 291–313. doi: 10.1080/135467897394301

Goldstone, R. L., Landy, D. H., and Son, J. Y. (2010). The education of perception. *Top. Cogn. Sci.* 2, 265–284. doi: 10.1111/j.1756-8765.2009.01055.x

Gorman, J. C., Amazeen, P. G., and Cooke, N. J. (2010). Team coordination dynamics. *Nonlin. Dyn. Psychol. Life Sci.* 14, 265–289.

Grush, R. (2004). The emulation theory of representation: motor control, imagery, and perception. *Behav. Brain Sci.* 27, 377–396. doi: 10.1017/S0140525X04000093

Haken, H., and Schiepek, G. (2010). *Synergetik in der Psychologie: Selbstorganisation Verstehen und Gestalten*. Göttingen: Hogrefe.

Hanna, T. (1988). *Somatics: Reawakening the Mind's Control of Movement, Flexibility, and Health*. Cambridge: Da Capo Press.

Hanna, T. (2003). *Das Geheimnis Gesunder Bewegung: Wesen und Wirken Funktionaler Integration*. Paderborn: Junfermann.

Heller, M. C. (2012). *Body Psychotherapy: History, Concepts, and Methods*. New York, NY: Norton.

Herfel, W., Rodrigues, D., and Gao, Y. (2007). Chinese medicine and the dynamic conceptions of health and disease. *J. Chin. Philos.* 34, 57–80. doi: 10.1111/j.1540-6253.2007.00453.x

Hutchins, E. (1995). *Cognition in the Wild*. Cambridge: MIT Press.

Hutto, D., and Myin, E. (2012). *Radicalizing Enactivism: Basic Minds without Content.* Cambridge: MIT Press.

Ingber, D. E. (2008). Tensegrity and mechanotransduction. *J. Bodywork Mov. Ther.* 12, 198–200. doi: 10.1016/j.jbmt.2008.04.038

Johnson, M. (1987). *The Body in the Mind: The Bodily Basis of Meaning, Imagination, and Reason*. Chicago, IL: University of Chicago Press.

Kello, C. T., and Van Orden, G. V. (2009). Soft-assembly of sensorimotor function. *Nonlin. Dyn. Psychol. Life Sci.* 13, 57–78.

Kelso, S. J. A. (1995). *Dynamic Patterns.* Cambridge, MA: MIT Press.

Kelso, S. J. A. (2009). "Coordination dynamics," in *Encyclopedia of Complexity and Systems Sciences*, ed R. A. Meyers (Berlin: Springer), 1537–1564.

Kimmel, M. (2008). "Properties of cultural embodiment: lessons from the anthropology of the body," in *Body, Language and Mind, Vol II. Interrelations between Biology, Linguistics and Culture*, eds R. Dirven, R. Frank, T. Ziemke, and J. Zlatev (Berlin: de Gruyter), 77–108.

Kimmel, M. (2012). Intersubjectivity at close quarters: how dancers of Tango Argentino use imagery for interaction and improvisation. *J. Cogn. Semiotics.* 4, 76–124. doi: 10.1515/cogsem.2009.4.1.76

Kimmel, M. (2013). The arc from the body to culture: how affect, proprioception, kinesthesia, and perceptual imagery shape cultural knowledge (and vice versa). *Int. Rev.* 9, 300–348.

Kimmel, M. (2015). "A cognitive theory of joint improvisation: the case of tango argentino," in *Oxford Handbook of Dance Improvisation*, ed V. Midgelow (Oxford: UP).

Kirsh, D., and Maglio, P. (1994). On distinguishing epistemic from pragmatic actions. *Cogn. Sci.* 18, 513–549.

Koch, I., Keller, P., and Prinz, W. (2004). The ideomotor approach to action control: implications for skilled performance. *Int. J. Sport Exerc. Psychol.* 2, 362–375. doi: 10.1080/1612197X.2004.9671751

Lagarde, J., Peham, C., Licka, T., and Kelso, S. J. A. (2005). Coordination dynamics of the horse-rider system. *J. Mot. Behav.* 37, 418–424. doi: 10.3200/JMBR.37.6.418-424

Latash, M. L., Scholz, J. P., and Schöner, G. (2007). Toward a new theory of motor synergies. *Mot. Control* 11, 276–308.

Lavelli, M., Pantoja, A. P. F., Hsu, H., Messinger, D., and Fogel, A. (2008). "Using microgenetic designs to study change processes," in *Handbook of Research Methods in Developmental Science*, ed D. M. Teti (Oxford: Blackwell), 40–65.

Masunaga, S. (1987). *ZEN Imagery Exercises: Meridian Exercices for Wholesome Living.* Tokyo; New York, NY: Japan Publications.

Merleau-Ponty, M. (1964). *The Primacy of Perception, and Other Essays on Phenomenological Psychology and the Philosophy of Art, History and Politics*. Evanston: Northwestern University Press.

Morganti, F., Carassa, A., and Riva, G.(eds.). (2008). *Enacting Intersubjectivity: A Cognitive and Social Perspective on the Study of Interactions*. Amsterdam: Ios Press.

Murray, L., and Trevarthen, C. (1985). "Emotional regulation of interaction between two-month-olds and their mothers," in *Social Perception in Infants*, eds T. M. Field and N. A. Fox (Norwood: Ablex), 101–25.

Myers, T. W. (2004). Structural integration: developments in Ida Rolf's 'Recipe'. *J. Bodywork Mov. Ther.* 8, 131–142. doi: 10.1016/S1360-8592(03)00088-3

Noë, A. (2004). *Action in Perception*. Cambridge: MIT Press.

Nolan, P. (2014). The relational field of body psychotherapy. *Body Mov. Dance Psychother. Int. J. Theory Res. Pract.* 9, 29–40. doi: 10.1080/17432979.2013.866598

O'Regan, J. K., and Noë, A. (2001). A sensorimotor account of vision and visual consciousness. *Behav. Brain Sci.* 24, 939–973. doi: 10.1017/S0140525X01000115

Oschman, J. L. (2000). *Energy Medicine: The Scientific Basis.* Edinburgh: Churchill Livingstone.

Oullier, O., and Kelso, S. J. A. (2009). "Social coordination from the perspective of coordination dynamics," in *Encyclopedia of Complexity and Systems Sciences*, ed R. A. Meyers (New York, NY: Springer), 8198–8212.

Pacherie, E. (2006). "Towards a dynamic theory of intentions," in *Does Consciousness Cause Behavior? An Investigation of the Nature of Volition,* eds S. Pockett, W. P. Banks, and S. Gallagher (Cambridge: MIT Press), 145–67.

Passos, P., Araújo, D., Gouveia, L., and Serpa, S. (2006). Interpersonal dynamics in sport: the role of artificial neural networks and 3-D analysis. *Behav. Res. Methods* 38, 683–691. doi: 10.3758/BF03193901

Peham, C., Licka, T., Schobesberger, H., and Meschan, E. (2004). Influence of the rider on the variability of the equine gait. *Hum. Mov. Sci.* 23, 663–671. doi: 10.1016/j.humov.2004.10.006

Pfeifer, R., and Bongard, J. (2007). *How the Body Shapes the Way We Think: A New View of Intelligence.* Cambridge, MA: MIT Press.

Porcino, A. J., Boon, H. S., Page, S. A., and Verhoef, M. J. (2013). Exploring the nature of therapeutic massage bodywork practice. *Int. J. Ther. Massage Bodywork* 6, 15–24.

Posadzki, P., Stöckl, A., and Mucha, D. (2010). Qi Gong exercises and Feldenkrais method from the perspective of Gestalt concept and humanistic psychology. *J. Bodywork Mov. Ther.* 14, 227–233. doi: 10.1016/j.jbmt.2008.12.001

Prinz, W. (1997). Perception and action planning. *Eur. J. Cogn. Psychol.* 9, 129–154. doi: 10.1080/713752551

Rączaszek-Leonardi, J., Nomikou, I., and Rohlfing, K. J. (2013). Young Children's dialogical actions: the beginnings of purposeful intersubjectivity. *IEEE Trans. Auton. Ment. Dev*. 5, 210–221. doi: 10.1109/TAMD.2013.2273258

Reder, C. (2013). *Die 12 Meridiane nach Masunaga.* Wien: Verlag grenzen erzaehlen.

Reese, M. (1999). *The Feldenkrais Method and Dynamic System Principles*. Available online at: http://feldenkraissoutherncalifornia.com/html/dynamic_systems.html [accessed 03.09.2014]

Runeson, S., Juslin, P., and Olsson, H. (2000). Visual perception of dynamic properties: cue heuristics versus direct-perceptual competence. *Psychol. Rev.* 107, 525–555. doi: 10.1037/0033-295X.107.3.525

Russell, R. (2003). *Dem Schmerz den Rücken kehren.* Paderborn: Junfermann.

Russell, R. (ed.). (2004). *Feldenkrais im Überblick: über den Lernprozeßder Feldenkrais-Methode*. Paderborn: Junfermann.

Rywerant, Y. (2003). *The Feldenkrais Method: Teaching by Handling.* North Bergen: Basic Health.

Schack, T. (2010). "Building blocks and architecture of dance," in *The Neurocognition of Dance*, eds B. Bläsing, M. Puttke, and T. Schack (London: Psychology Press), 11–40.

Schiepek, G., Eckert, H., and Kravanja, B. (2013). *Grundlagen Systemischer Therapie und Beratung: Psychotherapie als Förderung von Selbstorganisationsprozessen*. Göttingen: Hogrefe.

Schiepek, G., Fricke, B., and Kaimer, P. (1992). "Synergetics of psychotherapy," in *Self-Organization and Clinical Psychology: Empirical Approaches to Synergetics in Psychology*, eds W. Tschacher, G. Schiepek, and E. J. Brunner (Berlin: Springer), 239–67.

Schmidt, R. C., Fitzpatrick, P., Caron, R., and Mergeche, J. (2011). Understanding social motor coordination. *Hum. Mov. Sci.* 30, 834–845. doi: 10.1016/j.humov.2010.05.014

Schweikhard, D. P., and Schmid, B. (eds.). (2009). *Kollektive Intentionalität: eine Debatte über die Grundlagen des Sozialen*. Frankfurt a. Main: Suhrkamp.

Seitz, A., and Watanabe, T. (2005). A unified model for perceptual learning. *Trends Cogn. Sci.* 9, 329–334. doi: 10.1016/j.tics.2005.05.010

Semin, G. R., and Cacioppo, J. T. (2008). "Grounding social cognition: synchronization, coordination, and co-regulation," in *Embodied Grounding. Social, Cognitive, Affective, and Neuroscientific Approaches*, eds G. R. Semin and E. R. Smith (Cambridge: Cambridge University Press), 119–47.

Shin, Y. K., Proctor, R. W., and Capaldi, E. J. (2010). A review of contemporary ideomotor theory. *Psychol. Bull.* 136, 943–974. doi: 10.1037/a0020541

Spencer, J. P., Clearfield, M., Corbetta, D., Ulrich, B., Buchanan, P., and Schöner, G. (2006). Moving toward a grand theory of development: in memory of esther thelen. *Child Dev.* 77, 1521–1538. doi: 10.1111/j.1467-8624.2006.00955.x

Stern, D. (1985). *The Interpersonal World of the Infant: A View from Psychoanalysis and Developmental Psychology*. New York, NY: Basic Books.

Stern, D. (2010). *Forms of Vitality. Exploring Dynamic Experience in Psychology, the Arts, Psychotherapy, and Development*. Oxford: Oxford University Press.

Stevens, R. H., and Gorman, J. C. (2011). "Mapping cognitive attractors onto the dynamic landscapes of teamwork," in *Foundations of Augmented Cognition. Directing the Future of Adaptive Systems,* eds D. D. Schmorrow and C. M. Fidopiastis (Berlin: Springer), 366–375.

Stötter, A., Mitsche, M., Endler, P. C., Kamenschek, D., Mosgoeller, W., and Haring, C. (2013). Mindfulness-based touch therapy and mindfulness practice in persons with moderate depression. *Body Mov. Dance Psychother. Int. J. Theory Res. Pract.* 8, 183–198. doi: 10.1080/17432979.2013.803154

Strunk, G. (2004). *Organisierte Komplexität. Mikroprozess-Analysen der Interaktionsdynamik zweier Psychotherapien mit den Methoden der nichtlinearen Zeitreihenanalyse.* Bamberg: Otto-Friedrich-Universität Bamberg. (published dissertation).

Strunk, G., and Schiepek, G. (2006). *Systemische Psychologie. Einführung in die komplexen Grundlagen menschlichen Verhaltens*. Heidelberg: Spektrum.

Stuart, S. A. J. (2013). The union of two nervous systems: neurophenomenology, enkinaesthesia, and the Alexander Technique. *Construct. Found.* 8, 314–323.

Tarr, J. (2008). Habit and conscious control: ethnography and embodiment in the Alexander Technique. *Ethnography* 9, 477–497. doi: 10.1177/1466138108096988

Thelen, E., and Smith, L. B. (1994). *A Dynamic Systems Approach to the Development of Cognition and Action*. Cambridge: MIT Press.

Thompson, E. (2007). *Mind in Life. Biology, Phenomenology, and the Sciences of Mind*. Cambridge: Belknap Press.

Tomasello, M. (2008). *Origins of Human Communication*. Cambridge: MIT Press.

Torrance, S., and Froese, T. (2011). An inter-enactive approach to agency: participatory sense-making, dynamics, and sociality. *Hum. Mente.* 15, 21–53.

Tschacher, W. (1997). *Prozessgestalten. Die Anwendung der Selbstorganisationstheorie und der Theorie dynamischer Systeme auf Probleme der Psychologie*. Göttingen: Hogrefe.

Tschacher, W., and Brunner, E. J. (1997). "Theorie der Selbstorganisation und systemische Sicht der Psychotherapie," in *Von der Familientherapie zur Systemischen Perspektive*, eds L. Reiter, E. J. Brunner, and S. Reiter-Theil (Berlin: Springer), 81–102.

Tschacher, W., and Dauwalder, J.-P.(eds.). (2003). *The Dynamical Systems Approach to Cognition*. Singapore: World Scientific.

Tschacher, W., and Grawe, K. (1996). Selbstorganisation in therapieprozessen. die hypothese und empirische Prüfung der "Reduktion von Freiheitsgraden" bei der Entstehung von Therapiesystemen. *Z. Klin. Psychol.* 25, 55–60.

Tschacher, W., Ramseyer, F., and Grawe, K. (2007). Der ordnungseffekt im psychotherapieprozess. *Z. Klin. Psychol. Psychother.* 36, 18–25. doi: 10.1026/1616-3443.36.1.18

Turvey, M. T. (2007). Action and perception at the level of synergies. *Hum. Mov. Sci.* 26, 657–697. doi: 10.1016/j.humov.2007.04.002

Turvey, M. T., and Carello, C. (2011). Obtaining information by dynamic (effortful) touching. *Philos. Trans. R. Soc.* 366, 3123–3132. doi: 10.1098/rstb.2011.0159

Vilar, L., Araújo, D., Davids, K., Correia, V., and Esteves, P. T. (2013). Spatial-temporal constraints on decision-making during shooting performance in the team sport of futsal. *J. Sports Sci.* 31, 840–846. doi: 10.1080/02640414.2012.753155

Warren, W. H. (1984). Perceiving affordances: the visual guidance of stair climbing. *J. Exp. Psychol. Hum. Percept. Perform.* 10, 683–703. doi: 10.1037/0096-1523.10.5.683

Warren, W. H. (2006). The dynamics of perception and action. *Psychol. Rev.* 113, 358–389. doi: 10.1037/0033-295X.113.2.358

Wolpert, D. M., Diedrichsen, J., and Flanagan, J. R. (2011). Principles of sensorimotor learning. *Nat. Rev.* 12, 739–751. doi: 10.1038/nrn3112

Wolpert, D. M., Doya, K., and Kawato, M. (2003). A unifying computational framework for motor control and social interaction. *Philos. Trans. R. Soc.* 358, 593–602. doi: 10.1098/rstb.2002.1238

Zlatev, J., Racine, T. P., Sinha, C., and Itkonen, E. (2008). *The Shared Mind: Perspectives on Intersubjectivity*. Amsterdam: John Benjamins.

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Received: 02 May 2014; paper pending published: 14 July 2014; accepted: 21 November 2014; published online: 12 January 2015.

*Citation: Kimmel M, Irran C and Luger MA (2015) Bodywork as systemic and inter-enactive competence: participatory process management in Feldenkrais® Method and Zen Shiatsu. Front. Psychol. **5**:1424. doi: 10.3389/fpsyg.2014.01424*

This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology.

frontiers in PSYCHOLOGY

HYPOTHESIS AND THEORY ARTICLE
published: 29 April 2014
doi: 10.3389/fpsyg.2014.00349

Patterns of empathy as embodied practice in clinical conversation—a musical dimension

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Cognitive linguistics and conversation analysis (a) converge in the analysis of category bound activities and (b) in viewing thinking and talking as embodied activities. The first aim of this paper is to outline these powerful theories as useful tools for the analysis of enacting empathy. The second aim is to outline these theories as useful tools for the analysis of how empathy is co-enacted in clinical conversation documented in transcripts. Cognitive Linguistics and Conversation Analysis converge in detecting patterns of I-You-relationships with roots in early preverbal embodied protoconversation continuing to more symbolic conversational level. The paper proposes to describe this continuity of empathic conversation in *musical* metaphors like balance, rhythm and resonance. In a first section transcripts from therapeutic sessions are presented. In a second section linguistic and other research data are presented in order to bring empirical data to this new conception of how empathy can be understood, how it is done and how two participants cooperate to enact empathy. Ideas for further research are outlined.

Keywords: empathy, embodiment, conversation analysis, psychotherapy, cognitive linguistics, alterocentrism, transcripts

INTRODUCTION

All therapists with a clinical background share some of the following experiences: talking to a depressive patient you suddenly realize how your voice changes. You speak in a calm and soothing manner, you turn your voice down to a gentle mode. It is not that your voice changes into this depressive-response mode gradually. It is there right from the start. You see your patient for the first time, you see her or his eyes and you "know" how to respond. But this is not (static) "knowledge" you have from a handbook, it cannot be written down in teachable and learnable sentences. It just happens, it is a process of "knowing," less from "knowledge." You adopt yourself to something you sense and often it takes a long time to realize that you did.

The phenomenon is far-reaching. Being married to another therapist, I have very often witnessed the fact that by listening to one's partner responding to the client's first phone call, the bystanding partner can make a kind of diagnostic proposal just from listening to the voice of the partner answering the phone. More often than not this diagnostic assessment turns out to be correct. Therapists have a different way of talking with anxious clients from that with obsessive compulsive ones, they change pitch, volume and speech rhythm when they talk to a client with a personality disorder in a different manner to when engaging with someone who is depressive. Very often this adaptation in *resonance* remains beyond conscious awareness.

Galatzer-Levy (2009) reports another experience. He had a patient who never responded after his therapist had said something. He simply was silent for half a minute or so and when speaking he would change topic. So the therapist was never informed via a feed-back loop whether he had said something correct or not, nor whether he had even been heard! Sometimes the therapist even got to feeling uncertain whether he had actually spoken or not. After having endured this derealiziation mode for a certain time he made up his mind to address the pattern directly. And what did the patient say? "I admit and go on." Perplexed, the therapist responded with something like "You admit and go on" and quickly the patient now answered "Yes, I admit and go on." This little exchange of the same phrase had a *rhythm*, spoken with groove and swing—both suddenly felt compelled to laugh. So in a difficult dialog format suddenly a sort of warm cheerfulness emerged, bringing this therapy into a new mode. Not the meaning of the words, it was the bodily dance-like rhythm that moved the therapeutic pair to a new level.

Elizabeth Nutt Williams (2008, p. 140) reports that one evening she wanted to review a video-taped session that she remembered as vivid, full of quick verbal exchange. "I was stunned to see a low-key, slow, and fairly quiet one instead. I was struck by the vast difference between my experience and the recorded tape." How can this *imbalance* be accounted for?

When in June 2013 at a research-conference at "International Psychoanalytic University" (IPU) in Berlin, Germany, I presented a CA (Schegloff, 2007a,b) of a psychoanalytic first interview exchange I discovered a rhythmic element in it. The experienced therapist gave an impulse by asking a confrontational question—and when the patient answered the therapist did not come up with the next question, but withdrew with a conversational continuer like "hm:h" which pragmatically means something like "go ahead." So on the transcript one could see a certain kind of rhythm: one hard beat (the impulse of a question) followed by 3–4 soft beats like "hm:h," calmly spoken. This way of beginning an initiative left room for the patient's own initiatives. One could not say that this pattern was planned, it emerged from the situation. It was a kind of *musical* rhythm that made the burden of being interviewed a little lighter. It was one of those

impressive interviews, wherein a skilled therapist manages to talk with a patient never seen before about deep involvement in certain sexual topics without being either intrusive or seductive.

This kind of experience can best be described by *musical* metaphors like resonance, rhythm or balance. Since Freud it is well known that psychic experience cannot be conceptualized but in metaphors. But is it necessary to hold on to metaphors of "inner" mental (or cognitive) life and "outer" real world as so many contemporary theorists like to do? Potter and Edwards (2013) analyze the consequences of such a distinction. These metaphors guide many quarrels about "cognition" vs. "social cause" of traumatic experience, they stem from a Cartesian tradition of separating body from mind. Using new metaphors as guide may contribute to get a deeper understanding of embodied simulation, of conversation and of helpful interactions. This gradually growing conviction inspired me to look for the *musical* structure of talk-in-interaction (Malloch and Trevarthen, 2010 were inspiring reading), especially psychotherapy, and to explore if there are some deeper layers contributing to empathy and the experience of being understood which is so elementary in psychotherapy.

My proposal is to combine CA and a special part of embodiment theory taken from CL (Johnson, 1987; Lakoff, 1987). Lakoff's subtitle (1987) was "What categories reveal about the mind." Huge parts of this influential book refer to cognitive theory and experimental psychology, especially to prototype theory of Eleanor Rosch (Rosch and Lloyd, 1978) and her followers (Varela et al., 1993). In CL metaphors are no longer viewed as part of "texts" but as part of cognitive operations. They organize one's understanding of the world and of oneself-being-in-the-world. Metaphors have the potential to generate surprising kinds of category type and content (Glucksberg, 2008). In preverbal children's play the creation of metaphors can be detected (Tomasello, 2008). Metaphors become an element of thinking and not only of speaking.

In CA there is a deep interest in categorizing. CA is not only about "turn-taking," repair activities etc., but also about "doing categorizing" (Sacks, 1980; Lepper, 2000; Schegloff, 2007a,b). However, interestingly enough, there is no mentioning neither of "categorizing" nor "metaphor" in the topic index of "The handbook of conversation analysis" (Sidnell and Stivers, 2013).

However, both influential traditions, CA and CL, deal with categorizing activity as part of human cognition and conversation. Embodiment is a useful thread to combine both with the aim to come closer to a solution of the riddle how cognition is influenced by conversation. This means (a) to better understand what "understanding" means in clinical practice, (b) how it is done, (c) how empathy is co-organized by two embodied participants. Empathy is a practice of "doing empathy," not a magical or mystical equipment, it is no one-way endeavor. However, both participants indispensably use categories and they use conversation in order to match the difference. The *musical* dimension operates in leveling differences bearable. Sometimes, there is "groove" in good therapy sessions. However, this should not lead one to overlook many *musical* dimensions of conversationally "doing empathy." Empathy can be studied as embodied practice in clinical contexts.

In CL it is assumed that all categories used to organize one's experience can be derived from bodily sensory experience. Thus, the Cartesian assumption of a mind in the body can be reverted to that there is a body in the mind (Johnson, 1987). For example, the prelanguage bodily experience of "balance" can be shown to apply to mathematical equations (Lakoff and Nunez, 2000; Nunez, 2008, 2011) and high levels of abstract mathematical thinking. Combining CA and CL might 1 day arrive at a subtle understanding how (therapeutic) conversation can influence the cognitive "apparatus" of clients enmeshed in seemingly unresolvable difficulties. In a CA+CL-approach categories care for "order at every point" as talk-in-interaction does. The ambivalent question (Heritage, 1984) like "Why don't you come and see me sometimes?" can be heard as friendly invitation or as reproach. The answer will inform the questioner about how the second speaker categorized. The change of category is an important aspect of therapeutic change—often achieved by therapist's using reformulations (Antaki, 2008). The client metaphorically speaks about somebody about whom he "exploded like a volcano," the therapist may ask: "What made you so indignant?"—Using another metaphor with the effect that the emotional event appears in a new frame. These examples may suffice here. Categories operate in a multidimensional way. One cannot do without. How can this approach be applied in the analysis of clinical conversations?

It was Harvey Sacks (1992, p. 117) who reminded us that to understand another person you must use the distinction between "observables" and "communication." First, you look at another's bodily clothing and behavior, gesture, mimic display in her face, you are struck by a gaze and listen to her voice. Then, you conclude something from these observables, you categorize these observations as indices of social status, gender, race etc. *and* of an internal state like (generally) intentionality or joy, pleasure, shame or the like. Third, you begin to speak following the rules of a (local) culture. Fourth, while observing and categorizing you realize that the same happens to you. Fifth, a cycle of mutual observing and reasoning is created within a few moments and within this cycle, sixth, the therapeutic task is to generate conversational contributions smoothly urging the other person to "doing opening," which means to give that kind of knowledge that makes a common production of "empathy" possible. In any case, there are embodied persons mutually observing, categorizing, producing utterances by bodily voices for bodily ears. (Cf. Reich, 2010). Doing conversation by embodied persons solves the old philosophical problem of how people often "do understand each other" although they cannot look into another's mind.

The CA+CL-approach has been theoretically detailed and empirically validated by an extended qualitative study of a 4-year group therapy with sexual offenders in prison (Buchholz et al., 2008; Mörtl et al., 2010). We studied a huge corpus of transcribed group therapy sessions. The CA+CL-approach proved useful to gain a better understanding of how these people talk. While overtly confessing what they had done they secretly allude with certain indices to arouse listeners in the group, they use and share askew metaphors and they skillfully exploit a therapist's authenticity to blind his understanding. Their cognitive apparatus uses a high level of empathy in a very instrumental way. It seemed useful to combine CA and CL in order to make these phenomena

hearable and visible for our analyses. And in order to understand how two very skillful therapists managed to overcome these difficulties and to bring these men in a deeper examination of what they did which brought some of them into a serious suicidal crisis. If this crisis was passed we could observe that they had changed the use of metaphors, their way of talking and categorizing things.

This paper starts with CA and its utility for the analysis of studying empathy as embodied practice in psychotherapy. Embodiment concepts of CL and CA will be integrated. Transcribed examples will be analyzed. The second part reviews some findings from infant research, psychotherapy process research and conversation analysis in order to mine neighboring fields in the expectation to find some treasures for embodiment theory, gaining new kinds of data or methodological progress. This might contribute to gaining a clearer, empirically-based definition of what we mean by empathy—two embodied persons engaged in producing mutual understanding. The paper concludes with some ideas about further research.

A COMBINATION OF CONVERSATION ANALYSIS AND COGNITIVE LINGUISTICS: USEFUL IN STUDYING EMPATHY AS EMBODIED PRACTICE

The therapeutic relationship is seen as the most influential factor in psychotherapy. Several dimensions have been differentiated. Since Freud's distinction between a "decent" and "transferential" relationship dimension, most modern researchers and clinical therapists see the importance of a "working alliance" (WA). Several instruments have been developed to measure the degree of working alliance since Bordin (1979) inaugurated a tripolar theory differentiating a working alliance into "aims," "tasks," and the entire "bond." This conception integrates the (disembodied) rational means-end-orientation (MEO) of psychotherapy with the emotional side of the relationship (ESR). Ruptures of working alliances typically show up in the MEO—patients do not comply with arrangements, dates, appear too late to a session or forget what they had agreed to—but most often have their origins in the ESR: a sensitive domain of their experience has been addressed in too rough a fashion, they feel criticized by the therapist or devalued. The contributions of the therapist to alliance ruptures cannot be ignored either, e.g., the therapist might try too intensively to explore negative feelings or was not "licensed" to do so. Colli and Lingiardi (2009, p. 721) propose to differentiate therapist's failure into relational (empathy, attunement, warmth) and technical (type or focus of intervention) failure. Thus, as Safran and Muran (2000, p. 165) have pointed out, alliance is not a static variable based on mutual agreement only (MEO), but emerges from *resonances* in ESR. Scales have been constructed to measure the collaborative interaction of the WA (Colli and Lingiardi, 2009) or how the alliance is (re-)negotiated after ruptures (Doran et al., 2012).

The details of verbal exchange are so meaningful that serious doubts arose whether therapeutic talk can be analyzed by pre-established codings (Stiles, 1988, 1995; Stiles and Shapiro, 1989). However, CA is a micro-analytic method with a fine-grained methodological view for saving elusive data against a too strong theory. CA has its origins in Ethnomethodology and social linguistics and since has proved an enormous potential to discover new phenomena (Martinez et al., 2012). It can be combined with similar approaches like analysis of metaphor (Buchholz, 1996/2003; Cameron and Maslen, 2010). CL (Lakoff, 1987) has shown that metaphors are rooted in embodied experience. Metaphor is understood as a mapping from bodily experience into more abstract domains. In CL bodily experience is conceived of by a number of bodily schemata as *container, path, balance, force.* They are understood as organizers of bodily experience that map this experience into more abstract domains. One of the first proponents of this view was Johnson (1987) in a very influential attempt to overcome philosophical cartesianism. This line of reasoning was followed by publications viewing the body as the prominent organizer of human experience (Gallagher, 2005; Hari, 2007), even in therapeutic theory (e.g., Lombardi, 2008). Johnson (1987) conceptualized a "metaphorical projection" according to which bodily experiences of "containing" were "projected" in abstract domains as in sentences like "Let's go into this topic now"—the topic itself is formatted as a container and the proposal is to enter this container. Other sentences like "my future lies before me" project the bodily experience of moving in a physical space onto the construction of a "time as a path"-metaphor. The viewing of a relationship as "balanced" is directly taken from the toddler's experience of balancing one's body when standing up and learning to walk. A special part of Lakoff's theory of metaphor (Lakoff, 2008) details this mapping from neural theory via experienced embodiment into abstract thinking. Thus, a new theory of metaphor has emerged based in embodied experience (Glucksberg, 2008). This is paralleled by quite similar developments in CA.

This has consequences for the conception of empathy. Empathy over a long time has been thought as something an "empathizer" applies to the one "empathized." Neisser (1980) wondered why so much experimentation and theorizing considered participants as "passive onlookers" (p. 603) interested in science-like theory-testing. Schlicht (2013) criticizes the methodological individualism of this thinking and, in parts, experimentation. In real-life it is important for me to understand the other person correctly and not only "test" my theory about the other's "theory."

The rationalistic bias of MEO is to be overcome as it is two bodies talking-in-interaction. Neither cognition nor empathy is an individualistic endeavor. And conversation is not "verbal behavior" transmitting coded messages to a decoding receiver. This outdated terminology led research to technical MEO-orientations. What was overlooked is that there are bodies thinking, talking and constructing opportunities for empathy (and blocking).

CA is not only interested in a semantic dimension of talk, but more in the organizational level. When we follow this line of reasoning that "turn-taking" is the cradle of meaning (Schegloff, 1999) we can track the continuity from deeply embodied early infant proto-conversations to adult discourse on high levels of symbolic encounter. Sequencing, repair-activities, synchrony of gestures and a lot of other features is as present in adult as in mother-infant conversation (Braten, 2009). Embodiment-theory talks of "emergence" (Brinich, 1982; Varela, 1990; Colunga and Smith, 2003; Tschacher and Bergomi, 2011).

How do people manage not to interrupt each other all the time? How do they deal with "trouble" (if someone does not reciprocate greetings or does not answer questions)? How do they know what can be said and what not (e.g., telling a dirty joke, Sacks, 1978)? The overall assumption is "order-at-every-point" which means that talk entails orderliness which participants produce *and* use to make sense of their interaction continuously. To hesitate in responding, to accompany the other party's talk with "confirmation utterances" or information receipt tokens (hm, hm), to withdraw your gaze, or raising your voice for a moment become significant events in order to produce meaning of the interaction itself—by the participants. Astonishingly, voice as the embodied producer of meaning *per se* is seldom paid attention to neither in clinical nor in research papers in psychotherapy (see Weiste and Peräkylä, 2013, for an exception).

Talk-in-interaction is hardly imaginable without embodied voice. It is one of the most surprising things that all therapists' unavoidably most used tool, talking-using-voice, has hardly found any research interest in the therapeutic sphere. Conversation analysts (Streeck, 2011) observe in finegrained detail how bodily movements of hand, gaze and body posture in everyday conversation contributes to the organization of talking and understanding. To speak of "mindful hands" as Jürgen Streeck (2011) does, could in therapeutic contexts become complemented by an observation of "mindful voice"—clinicians know how a voice can calm and sooth, attack and heal, prepare a carpet of empathy in a dialog or make everything said unacceptable. The analysis of multimodal metaphor has begun to include bodily gestures and the analysis of voice (Forceville and Urios-Aparisi, 2009; Cienki and Müller, 2010) and this converges with more recent studies in CA. Here is an enormous potential for future studies.

Production *and* usage of orderliness is compatible with "construing in action" as we have learned since Daniel Stern's classic "Interpersonal world of the infant" and his following excursions into the moments of meeting between adults (Stern, 1985, 2004; Leitner, 2007; Cipolletta, 2013). I will comment more extensively on what baby observation and conversation analysts have in common.

CA approaches can best be understood by demonstrating how it is done. Up to now CA has hardly been applied to a huge amount of verbal data for statistical analysis. CA demonstrates results by extensively presenting verbal data in transcribed form and showing how these data can be analyzed when participants try to make sense of their interaction.

Thus, CA will be used here in order to analyze psychotherapeutic talk-in-interaction. It has been applied to a lot of areas (e.g., medical communication, conversation in court, laughter, repair activities, emotion talk etc.) and is now shown to reveal undiscovered aspects of psychotherapeutic activity (Peräkylä et al., 2008). Sidnell and Stivers (2013) provide an extensive introduction to the method (for a short look see my review of this volume, Buchholz, 2013). What we don't have is a full precise description of psychotherapy on a conversational level, although this task is begun (Peräkylä et al., 2008). Here the dynamic system aspect comes into view. My first example will show the ups and downs of a wave-like interactional exchange.

EXAMPLES

EXAMPLE 1: WAVES OF DIVERGENCE AND CONVERGENCE

I take as a first approach a transcribed example from Thomä and Kächele (1994, chap. 4.1) where the patient Nora comes 5 min late to a session, something which is not normal for her. The emotional situation between her and the analyst is clearly described:

> "When she finally arrived, I was surprised to see her smiling and beaming with happiness; upon entering the room, she looked at me longer than customary and in an inquisitive manner. Her happiness and my displeasure created a very discordant contrast."

Then the dialog is transcribed[1] as follows:

P: Well, what's actually preoccupying me, I think, was the last comment I made before I left, about paying, which was also the topic of the previous hour, and I just thought it was rather telling that precisely that same topic was the last point in the conversation I just had with my boyfriend, although initially we had talked about something entirely different.

We are informed that she quarreled with her boyfriend in a restaurant about paying for the coffee, a quarrel which she described as "a back-and-forth like in a ball game *(Hin und Her wie ein Ballspiel)*." Using this metaphor of a *ball game* she uses an embodied activity as the source of imagination and this becomes a metaphor for this therapeutic discourse.

She remarks that still something is going on. She wonders whether she might be happily smiling either because she had left her therapist waiting or because of the situation in the restaurant. The question of who pays for what, she muses, had been a topic in the last therapy session, too. So several contexts of "paying" are brought together here. The transcript continues:

P: Now today…I'll play it where it's about speaking my thoughts, holding them back, then with the bills and…I'm wondering whether there is a connection with my being late.
A: Hum, I'd think so.
P: You'd think so. Ok, so I take away time. It's just, I actually also divide it up differently, and so my boyfriend and I were together a little longer.
A: We recently spoke about you wanting to give a good whopping to your boyfriend, and today it's my turn.
P: Yeah, I enjoy it.
A: And that's why you were beaming at me like that when you came in.

The focus of attention shifts to an expansion of the metaphor of game and play affected with a waving air of amusement and fun. She then connects this with interactional scenes, but she does not yet take full responsibility as she speaks in a non-actor mode: "my

[1] Timo Buchholz (based on the English-Version of Thomä and Kächele vol. II) retranslated the transcript-parts from German into English.

being late" instead of "I came late"[2]. The analyst reacts in a diffuse manner, and his utterance is hedged by an alignment token: "hum," he aligns with the patient's pleasure in the game.

Then, this game successfully rearranges itself in the interaction, the patient responds with "You'd think so" in a playful manner. Now she moves on in an actor's responsibility mode: "I take away time," pre-announced by the compliance token "Ok." To take time away is a cultural metaphor, as if time were a thing that can be taken away. Again, the source of this metaphor is an embodied experience ("take something away"). Regarding this, the therapist responds: "today it's my turn." He responds within the metaphorically created domain of a ball game.

Here now the pleasure ("I enjoy it") of "taking away something" appears on the scene. In the German original version the therapist uses a strong metaphor in a humorous way in response to the cheerful tone of the patient, namely "*überbraten,*" evoking the image of being whacked over the head with a frying pan, in order to describe what it is she seems to be taking pleasure in when interacting both with him and her boyfriend—a new self-description (instead of ball game) of what happens in this conversation appears taken from another embodied source.

What we find is a very complex move in order to empathize with the patient consisting of several steps: we see the embodied patterns of observing and being observed (see my introduction) when the therapist describes the study of the patient's face. Here we can focus on the ebb-and-flow waves of the conversation when these observations become part of the conversation. We see a) an alignment of the therapist; b) enrichment by other interactional scenes having the effect of a "go-ahead!" directed at the therapist; c) the therapist's response with another enrichment ("we recently spoke about…"); d) return to the initial observation when the patient came in; now this observation becomes a common object of conversation.

Although the therapist (emotionally) disaffiliates with the patient's being late he (conversationally) aligns with an expansion of metaphor and with "hum." By the steps described a new way is paved toward a new shared conversational space. It is not only a new object ("being late"), but a new level of consideration for each others' concerns is co-established (i.e., the meaning of being late). In everyday conversation being late is expected to be a subject to reproach. Obviously, the therapist feels an inclination to this as we are informed in extra-conversational comments. But in his utterances during the conversation he manages to affiliate *and* to initiate a new level of conversational consideration.

The therapist then comments on his own participation:

> "I [the therapist] shared my impression with the patient to make it clear to her how much she enjoyed coming late and how much pleasure she had acting out aggressive impulses."

The therapist's initial anger at being left waiting (reported in the comments only) seems to be overruled by the patient's fun in this game. The patient finds a new metaphor for her pleasure letting the therapist wait. The transcript continues:

P: [Laughing] Honestly—and I think that's where the expression is coming from—this gives me a feeling of devilish pleasure.

The German phrase "diebisches Vergnügen" (lit. "thievish pleasure") here should be understood as "fiendish (or devilish) pleasure." Affect and behavior are now linked in this illicit-fiendish or forbidden pleasure; the patient's repelled aggression was expressed both in her pleasure and in the fact that her behavior for the moment had been at the expense of the relationship to the therapist.

A: Yes, that's clear, and you let yourself have this pleasure. But I'm not very sure whether you also see the consequences of your pleasure.
P: Yes, well, the question of "What do I get out of it?" I haven't so far asked myself yet. But when I raise it now, then I do think that acting this way I gain your attention, because you might think "What's keeping her?" or something of the sort, and then I also realize how I react if someone else is late. It actually annoys me a good bit.
A: Hum, you seem sure of that.
P: That it annoys me. But that it annoys others, I don't want to know too much about that.
A: Isn't just that the source of your pleasure, that you can get people quite upset in a seemingly innocent manner.

What we have here is the emergence of *equifinal meaning* (Donnellon, 1996). Two speakers starting from different points for "moments of meeting" (Stern, 2004) arrive at a plateau of consensual understanding that is quickly left again. This I call the *convergence of meaning*. In everyday talk most people assume that convergence of meaning is the ultimate goal of conversation. This is, obviously, one side of the communicative coin only. If meaning converges, conversation ends. Convergence of meaning cannot last long. It is achieved when patient and analyst agree that to let someone wait is an enjoyable pleasure.

Now a contrary maneuver starts. The therapist disturbs the convergence of meaning by *diverging* conversation; he says that today it is his turn. He is the one made upset as the patient violated the rules of the "ball game." Ball games are ruled by mutuality, and who violates the rules is stopped, the other player can restart the game. This is embodied interaction although, on the level of verbal exchange, nothing seems to happen but talking. The rules of embodied interaction are absorbed into the more abstract domain of verbal exchange—and both speakers follow these embodied rules (see **Figure 1**).

This is the part the patient did not want to see ("I don't want to know too much about that"). Is there another interpretation possible that the patient is simply not concerned about her behavior's effects on others?[3] I would object that the patient's

[2]This distinction is not meant as a linguistic one; in German the difference is stronger than in English. In any case it is the responding analyst treating this difference as relevant.

[3]As an unknown reviewer helpfully asked.

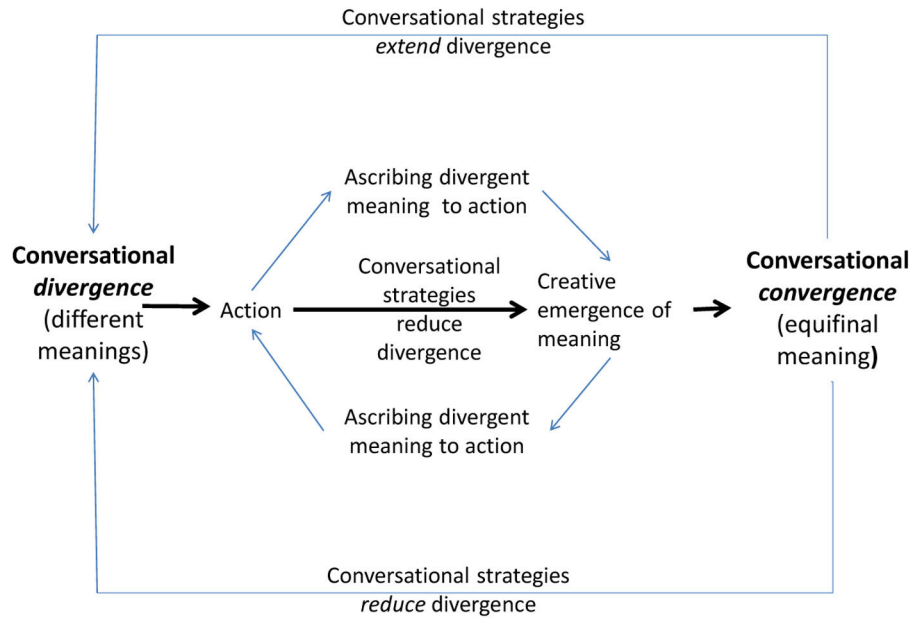

FIGURE 1 | Course of a conversational wave dance.

overall readiness to debate the whole topic speaks against such a view. This readiness is communicated to the therapist and he can refer to it by diverging, which adds a new meaning to the conversation.

The conversational strategies used to produce equifinal meaning can be described as follows:

(a) Metaphors (e.g., game and play, "überbraten") are used here in order to reconcile diverging opinions.
(b) Logical arguments: premise and conclusion are here used as rhetorical figures in order to mutually promote the other person's agreement.
(c) Modulation of affect: a sequence where one speaker starts with the expression of affect which is then either expanded upon or constrained by the next speaker.
(d) Linguistic indirectness: some use of passive constructions indicating some denial of agency, mitigators ("Hum, I think so," "perhaps"), imprecise articulations which prove as helpful to continue conversation.

The conversation here begins with an affective discordant experience, conversation diverges: the therapist has no pleasure while he is waiting for his patient. The patient comes with a smile on her face—a maximum of divergence. Being late and the mutually recognized affect is the "action" that has to be debated. Convergence begins at this level of being prepared to commonly debate this divergence. Hereby certain conversational strategies reduce the affective disalignment.

Both participants use the conversational strategies described and add diverging semantic and, more importantly, affective meaning to how the "action" is to be understood. They finally achieve equifinal meaning, they converge[4]—and in the next move they start again to diverge from this point in order to begin a run through the same complex conversational pattern again. Convergence is just a momentary plateau of rest which is immediately given up in order to continue conversation.

This pattern cannot be reduced to properties of one of the participants or to a method "applied" by one participant to the next. One might say that a skillful therapist imagines this kind of experience as a kind of advanced organizer and strives to accomplish something like it, but the therapist cannot "make" it happen. What is needed is the special kind of empathic cooperation that can be described easily by *musical* metaphors: there is a wave-like rhythm of convergence and divergence between the two speakers, there are phases of affective resonance (differentiated in themselves between consonance and dissonance) and there is the aim to keep the relationship as a whole in balance, so that the cooperative work of meaning making can be continued. This constitutes a conceptual difference to what is called "alliance ruptures" because we can see here how the cooperative structure in general is maintained despite the divergence of meanings. The conversation as a whole is more a kind of play than an "exchange of information," one can sense affective resonance even in the transcribed version.

There is a methodological difference between what psychotherapists *think* they do and what can be observed when they open their doors for scientific observation via audio or video recordings. Even in psychoanalysis it is becoming clear that

[4]My terms of convergence and divergence have something in common with the more general terms of affiliation and disaffiliation (Muntigl et al., 2013). These terms set the accent to the emotional experience, my terms to the conversational exchange making visible the wave movement of conversation here (Thanks to an unknown reviewer for this hint).

self-description of professional work can only be one side of the coin (Canestri, 2011). The other side is "doing." In interaction and conversation one cannot predict which "effect" an "intervention" will have, since this prediction, even if made silently, very quickly becomes part of the conversation and interaction and is responded to. There is no simple way "from cognition in one mind to conversation between two minds" (Potter, 1998; Coulter, 2005; Goodwin, 2007; Holt and Clift, 2007; Spurrett and Crowley, 2010; Deppermann, 2012). The methodological view used here originates from CA. As Harvey Sacks (1992, part I, p. 11) put it:

> "When people start to analyze social phenomena, if it looks like things occur with the sort of immediacy we find in some of these exchanges, then, if you have to make an elaborate analysis of it—that is to say, show that they did something as involved as some of the things I have proposed—then you figure that they couldn't have thought that fast. I want to suggest that you have to forget that completely. Don't worry about how fast they're thinking. First of all, don't worry about whether they're thinking. Just try to come to terms with how it is that the thing comes off. Because you'll find that they can do these things."

Surprisingly, one can find empirical evidence supporting this position. Similar to what conversation analyst Heritage (2002) described, in a study on "the pull of hostility" in therapeutic discourse (von der Lippe et al., 2008) a new design was created in order not to ascribe "hostility" to either the therapist or the patient. From a pool of 373 fully transcribed therapies 28 were selected. 14 Therapies were successful and 14 not. These cases had been treated by 14 therapists. From each therapist, one case with a successful outcome and one non-successful one were analyzed. In this way, neither positive nor negative outcome could be reduced to personal properties of the therapist. The transcribed sessions were analyzed with the "Structural Analysis of Social Behavior" (SASB, Benjamin, 1974, 1996, 2010) and the authors find

> "that in successful therapy therapist and client follow each other, as in a dance (i.e., the overall balance of positive and negative affiliation can be predicted for one by knowing the other), while this harmony decreases over time in treatment failures" (p. 429)

There follows an important observation:

> "It seemed to be in the dialogue itself that the constructive or unconstructive therapeutic climate was created."

This is a helpful remark to bear in mind when looking at my next examples.

EXAMPLE 2: AN INTERPLAY OF RESONANCE

Sometimes in therapeutic conversation therapists formulate their utterances with pre-announcements like "You think that…" Linguistic observers of therapeutic discourse (Scarvaglieri, 2011a,b) found that many therapeutic utterances start with incomplete half-sentences in the format of "…that you felt loved" or "…that you thought this was an attack." Therapeutic discourse here makes use of a strategy that can be observed in everyday contexts, too. But therapists seem to speak in this elliptic mode more often. Completing the other's utterance seems to be a means to achieve various aims: (a) to move oneself into resonance; (b) to propel conversation forward; and (c) to help the client to overcome assumed obstacles. Clients often react with signs of relief when they hear another speaker articulating thoughts they never dared to utter. The therapeutic relationship then is in resonance. The experience of being understood in most cases is felt to be helpful; sometimes it is also what clients fear.

What if this kind of intervention fails? I want to compare two different examples treated by different therapists. In the second example I will show how a skillful therapist managed to be allowed to articulate what he felt in resonance with his client in a first interview, as the therapist's utterances with pre-announcements like "You think…" were eagerly accepted and followed by the client's responses.

Here I show how a therapist[5] completes the utterances of the client in a seemingly skillful way, but the whole conversation quickly deteriorates into a turn-taking fight. I want to find out if therapists can be given hints how to discern such moments and react differently.

P: und das hat mir auch jetzt=im=nachhinein (.) sehr leid getan daßi:ch das
and also now in retrospect (.) I felt very sorry that I
nicht (.) äh geschafft *hab=die* Zeit dort (..) sinnvoll für mich zu gestalten
didn't (.) uh manage to use my time over there (..) in a meaningful way for me
oder (.) sprich ich mein (−) ich kannte ja da meine Freundin schon und
or (.) say I mean (−) at that time I already knew my girlfriend and
vorher hatte ich eine andere (lacht etwas) Freundin, so daßich also immer
before I had another (laughs a little) girlfriend, so that actually I always
(..) da über's Wochenende heimgefahren bin? und au:ch, mit dem Ziel?
went home there over the weekend? and also with the aim?
°unter der Woche sehr viel° gelernt? oder sprich eben die Arbeit versucht
°studied a lot during the week?° or let's say well tried to
hab zu erledigen di::e (.) so=sein=muß=
finish the work that (.) should be done
⟶ T: = um=dann=a:m Samstag=[Sonntag,
in order to then Saturday [Sunday,
P: [=genau.
[exactly.

[5]Many thanks to Horst Kächele, Berlin, for the audio record I used for transcription. Pauses are indicated by (.) for a length of less than 0.2 seconds; (..) is a pause of 0.2–0.4 s and (−) is a pause of 0.5–0.9 s length; numbers in brackets, e.g. (2) indicate a pause of 2 s. Quiet speaking phases are marked by °…°. Latching is indicated by = which means that no discernible silence between two turns could be detected. Lengthened syllables are indicated by a colon:. Overlaps are indicate by [.
This is a very reduced version of transcription rules normally used in CA-papers. For a full description of the CA approach to transcription see Hepburn and Bolden (2013).

T: = heimfahren zu können=um [da:nn
be able to drive home, in order to [then
P: [ja
[yes
T: nicht arbeiten zu müssen,=
not to have to work
P: =ja genau! und das war irgendwo ein Stück wei::t ein Fehler? Wenn ich
yes exactly! and that was somehow a mistake to a degree? If I
je:tzt=zurück[schau
now look [back
⟶T: [und Sie denken jetzt (..) das Heimfahren haben Sie
[and you're thinking now (..) going home you
gemacht um nicht allein sein zu müssen.
did that so you wouldn't to have to be alone.
P: ja! bestimmt mit auch.
yes! definitely also that.
T: in *2. (Ortsname)
*in *2 (place name)*
P: bestimmt mit auch. obwohl ich eigentlich ziemlich schnell Kontakt
definitely also that. even though I was actually pretty fast
gefunden hab gell,
in making contact wasn't I,
T: ja,
yes,

The student who came for therapeutic help because of some obsessive compulsive disturbance here talks about how he suffered from not being able to use his time meaningfully. He had a girlfriend at the time—but he still had to study and do his chores. Here it can be easily seen how therapist and client complement each other's utterances. They talk like one mouth speaking—probably another aspect of embodied talk-in-interaction not too often observed in everyday interactions. This goes so far that the therapist can say "and you're thinking now," and the client accepts and agrees succinctly. CA (Schegloff, 2007a,b) has developed a way of describing turn-taking mechanisms according to which interruptions and overlaps are handled by participants as a kind of "trouble" demanding repair activities to restore the order of turn-taking. Remarkable, that these repair activities are not practiced here. In this first interview there are many passages in which therapist and client seem to be in this kind of affective resonance so that a new order of conversation emerges and the therapist can complement the client's utterances and vice versa. To be engrossed at the conversational surface makes the phenomenon of resonance appear. The following important aspect should be pointed out: at the point where this interplay of resonance takes place, the therapist takes himself back with the final "yes"—he moves back into the position of a listener, not of a participant with directing initiative.

EXAMPLE 3: FAILED RESONANCE

My third example is from another therapy conducted by a female therapist with a male patient. I want to contrast these two examples in order to highlight some differences.

P: ja. (--) das hat sie ähm (--) aber das ich konnte ihr das irgendwie nicht (--)
yes (- -) that she did um (- -) but that to her I somehow couldn't (-)
das war schon berechtigt also das war jetzt nicht übertrieben oder so und
that was actually justified well it wasn't excessive or so and
sie hat auch nicht (--) sie hats mir verboten wie es Frauen verbieten
she didn't either (- -) she forbade me to do it like women forbid things
((lacht)) das tut mir weh ich möcht das nicht ((lacht)) also ähm
((laughs)) that hurts I don't want that ((laughs)) so um
⟶ (15.0)
T: also die hat Angst dass sie sie verlieren könnte,
so she's afraid that she might lose you,
⟶P: ja, (3.0) das äh (9.0) doch es ist irgendwie schon ja das hat sie
yes, (3.0) that uh (9.0) yeah somehow actually yes she is
(27.0)

For readers it will be difficult to understand what's the subject matter here. However, that is less important than the organizing turn taking activity: the client closes his first remark with a token indicating that *he wants to continue*. But the pause of 15 s disturbs the turn taking routine. On the semantic level the client's message did not come to a natural transitionally relevant point. On the performative level of turn taking the client indicates that *the next speaker might take the turn*. Thus, the client exposes the therapist to an interesting form of contradictory behavior. Should the therapist take the turn or not?

The therapist now starts his utterance with the same word the client ended and continues with what (the therapist thinks) the client might have intended to say. The client continues with an agreement token followed by a long pause (3 s), restarts to take the turn, pauses again (9 sec) and does not finish his sentence. Another example from the same session reveals that this is an interactional pattern between the two participants:

P: ja, das kann sein also das ist jetzt glaub ich noch zu kurz (---) um das
yes, that could be well I think that's still a little too short (- -) to
sagen zu können aber
be able to say that but
(6.0)
T: aber trotzdem könnte diese (---) war eben so mein Gedanke ob das nicht
but nonetheless this could (- - -) I just had the thought if this isn't
äh bei Anke ein bisschen ich will nicht sagen Angst macht aber doch
uh for Anke a little I don't wanna say frightening but yes
nicht nur nicht nur ähm Freude macht.
not only not only uh: enjoyable.

Again the patients ends his contribution with a semantically open clause and a performative "long" pause of 6 s. This makes it

unclear to the therapist whether this is a transitionally relevant point for turn taking or not. And, just as in the previous part, the therapist starts by taking over the client's last word. This pattern occurs several times during this session so that, 2 min later, we see the following escalation of "trouble" and turn-taking disorganization:

P: also ich versuche da keinerlei Rivalität rein zu bringen aber (---) äh ich
so well I try not to bring any rivalry into it but (- -) uh I
nehme das schon wahr wenn das von ihm so zum Beispiel mal ein
do notice it if for example occasionally from his side
bisschen kommt also (---) ich hab glaube ich das letzte mal erzählt von
he does it a bit so (- - -) I think the last time I talked about
vor zehn Tagen das Wochenende (---) da wo die beiden sehr stark
the weekend from ten days ago (- - -) when the two of them very much
ausgerastet sind so (---) äh
threw a tantrum so (---) uh
(4.0)

da (--) hab ich schon so ein bisschen gedacht er will schon wissen was
at that moment (- -) I did actually think a little like he does want to know what
los ist oder er will irgendwie (6.0) ja gestern sind wir mit dem (--)
is going on or he wants to somehow (6.0) yeah yesterday with the (-)
gestern, vorgestern? gestern sind wir mit dem Auto äh zum Hockey
yesterday, the day before? yesterday we drove to the hockey training by car
gefahren weil die beiden jetzt auch mal gucken wollten und sind da mit

because the two of them eventually wanted to have a look too and drove gefahren und (--) äh da hab ich saßich vorne und hab den Arm um *
*with me and (- -) uh I did I sat in the front and put my arm around **
(---) ähm Sitz gemacht und da kam von hinten so ein kleiner Klopfer also
(- - -) um seat and then from behind a little knock came so
⟶ [()]
⟶T: [()]
⟶P: [()]
T: [()] gehn Sie weg von
get away from
meiner Frau
my wife

P: nja, (2.0) äh also von ihm her sicherlich nicht bewusst sondern es war so
hum (2.0) uh well surely not consciously on his part but it was like
von ihm her so ne Art spielen () das
on his part a kind of playing () that
(3.0)
T: hm=hm,
hm=hm,

This is an example where something does "not work," obviously; the therapist tries to complete the patient's utterances and overrides the rules of turn-taking. Two observations serve to be mentioned: (a) after this happened several times during the session a kind of disorganization in turn taking makes repair activities relevant; (b) it is interesting that the patient announces this event in a metaphorical fashion before it happens ("I try not to bring any rivalry into it").

The arrows mark the escalation of a "rivalry fight" for the right to take the turn. It was impossible to transcribe more precisely as there are simply sounds of starts and interrupting but not a single understandable word. Instead of continuing the other's thought as in Example 2, here we see an escalation of rivalry. This is a *term presented by the patient* itself. From an embodiment point of view one might reason that he sensed the rivalry in turn-taking in the paragraphs presented before. Turn-taking is the cradle of meaning. It is an embodied activity, using breath, a common focus of attention for an orderly sequence of interaction and energizing the body for the preparation of an interruption, when one wants to take the turn not only at transition relevant points. This bodily experience he termed "rivalry," using a bodily experience of fighting. The embodied source domain again is projected into the more abstract domains.

In the first example one could see how the therapist manages to emotionally affiliate and conversationally align with the patient followed by the emergence of a new level of commonly focused attention. Here, in Example 3, the establishment of a new conversational level is not achieved. Emotional resonance is put out of use, turn taking is unbalanced and the rhythm of the talk is disorganized.

By further contrasting these examples we find the following results. Such processes cannot be considered to be therapeutic "failures" in the sense that a therapist does not want to help. The client disorganizes the transitionally relevant point in a characteristic manner: semantic non-continuation and long pauses effect a disturbance in the therapist's reactivity. How to respond? It is the best intentions of the therapist, namely to intervene helpfully, that contribute here to the unintended effect of disorganizing the talk. The transitionally relevant point is semantically unmarked but pragmatically offered—and so the therapist either by taking the turn or not, has a good chance of failing. Whichever way the therapist behaves, it could be considered as false. Often clients complain after such conversational episodes that the therapist has interrupted—but a close inspection of the record reveals that at one level at least turn taking was offered.

There is a third option for the therapist in order to escape this pragmatic paradox of false responding or false non-responding: to consider silence as a response. If after a while the client might complain about the silent therapist, one might describe one's

own silence as politeness, waiting for the client to complete the sentence. And one could then ask what the client had in mind during the long pauses. Ruptures are a co-production of both sides, therapist and client alike (Safran and Muran, 2000; Lepper and Mergenthaler, 2007). The study of detailed transcriptions might help to identify and understand how to repair such ruptures. To pay attention to such turn-taking organization might become a part of training therapists.

EXAMPLE 4: REPAIR AND MIND READING

My next example stems from an everyday talk observed and analyzed by Paul Drew (2005, p. 170). Conversation analysts have observed and widely demonstrated that conversation has a consensus preference. It is for example easy to accept an invitation for lunch but it is complicated to decline. "No" is an option that forces the participant with conditional relevance to provide a justification, an explanation, some kind of account why "not." The *format* (put in square brackets) for an invitation refusal can be described by three conversation moves:

[Appreciation] + [(mitigated) Declination] + [Account]

When invited, a speaker will first respond with an appreciative remark, will then decline (more or less embedded in "softeners") and will subsequently provide an account as to why it is impossible to accept the invitation. Here is an interesting example by Drew (2005, p. 170):

(1) Emma: Wanna c'm do:wn 'av [a bah:ta] lunch w]ith me?=
(2) Nancy: [°It's js] ()°]
(3) Emma: =Ah gut s'm beer'n stu:ff,
(4) (0.3)
(5) Nancy: Wul yer ril sweet hon: uh:m
(6) (.)
(7) Emma: [Or d'y]ou'av] sup'n [else ° ()°
(8) Nancy: [L e t] I:] hu. [n:No: I haf to: uh call Roul's mother, h I told'er I:'d call'er this morning...

Emma invites Nancy to come down "and have lunch with me" and while talking Nancy does not interrupt her. There is an overlap (indicated by the brackets [and]): she is immediately starting her (mitigated) refusal (line 2) calmly (indicated by °) but very early, too. The calm voice is an embodied aspect of conversation here; it indicates Nancy's very early awareness of the whole format and more, that her declination might hurt Emma and be followed by a change of state of her relationship.

Emma quickly (indicated by =) adds an attractive offer that she has "got some beer and stuff" (line 3) followed by a delay (line 4). Then follows Nancy's "appreciation" (line 5) addressed not to the invitation but to the person of her friend Emma. Then we have a short pause at a transition relevant point. Emma takes the turn offering "or do you have something else" (line 7).

This is the interesting point here. Emma offers an alternative account for Nancy's refusal and Drew here makes an important comment:

> "This is a 'cognitive moment,' in a double sense: in order to make that move, before Nancy makes explicit her declination, Emma has to have *realized* that Nancy might be going to decline her invitation; she thereby *reads Nancy's mind*, attributing that *intention* to her." (Drew, 2005, p. 170)

Drew wants to point out here that "intention" is not only a philosophical term but a practice performed by conversational participants in order to ascribe motivation[6]. In order to understand the process of mind-reading addressed here it is, of course, not necessary to assume telepathic abilities. Their voices have indicated declination and some repair activities. This observation can be extended to the assumption that both participants have an unconscious knowledge of the standard format how to refuse invitations among friends. This format is instantiated when Nancy in line 2 calmly begins to speak, followed by Emma's offer of "beer'n stuff." This must not be viewed as an intentional pressure on Nancy to come. It is an alternative account for the refusal Emma has sensed embodied with Nancy starting to speak in line 2. There is a common format steering this conversation and, of course, this format is determined by a shared culture not by cognition-in-one-mind (Cerulo, 2002; Miller, 2006). Part of these cultural practices is to organize conversation and talk around eating. It is this cultural habit that allows Emma to anticipate Nancy's declination and try to get ahead by offering something better for the body. Several aspects of embodiment (calm voice, attractive dinner and eating) and the use of distributed conversation formats functionally operate together.

This example has something in common with my next one. In the Emma-Nancy interaction, Nancy's offer in line 5 can be seen as a "third move." The first one is the invitation, the second one is the positive or negative response. The refusal, as Drew's analysis shows, is anticipated by Nancy's remark in line 2 and so Emma can insert the offer of line 5 in order to gain more acceptance for her invitation. Following a first (calmly spoken) resonance, Emma adjusts her invitation and this adjustment is influenced by Nancy's calm utterance. As Peräkylä (2010) has been able to show, this immediate correction procedure is just what happens in psychoanalytic therapy.

Braten (2009) shows how repair activities begin in preverbal mother child interaction. Some of these repairs anticipate the other's (negative) state (a mother feeling that her baby's body feels pain when handled in a certain way) and react to events that can, but must not happen. This feeling-the-other's-body is an embodied precursor of later conversational repair activities. There is "doing empathy" in conversational repairs.

It is very inspiring to read how conversation analysts (Corrin, 2010) observe very similar patterns in early child talk with their mothers. Helping and being-helped, asking and receiving an answer, greeting and being greeted, smiling and smiling back are examples for complete interactive patterns children acquire in early childhood. These patterns are expanded with the advent of language acquisition, then, they form expectations of how others should behave. And this continues in everyday conversation

[6] Potter and Edwards (2013) refer to this example in order to convincingly demonstrate that "intention" must be considered a mundane term; "intention" is not something to explain conversational practice. It is used by participants themselves as "account."

between adults. Perhaps this might be, what Gregory Bateson (1961) thought of in his notion of the "pattern connecting" diverging minds.

EXAMPLE 5: THE "THIRD MOVE" AFTER AN INTERPRETATION

Annsi Peräkylä is professor for microsociology in Helsinki and in addition a well-trained psychoanalyst. He has begun to publish a series of papers (Peräkylä, 2004, 2005, 2008, 2011, 2013) on how psychoanalytic talk is being conducted beyond theoretical self-descriptions of psychoanalytic colleagues.

Peräkylä (2010) used a corpus of 58 audio-recorded psychoanalytic sessions involving two experienced psychoanalysts and 3 patients. Here is one of his examples. The female patient has a partner who is seriously ill, the patient takes care of him and talks about her experiences and feelings:

(1) P: As I had a dream that I had been (0.6) quite
(2) insane for a few days.
(3) (0.8)
(4) T: Yea[h.
(5) P: [so as one (0.4) as as one probably wants to
(6) (1.8) empathize the (1.6) patient in his (1.1)
(7) condition and his situation and and one wants to go
(8) along with it, (0.4) then (2.9) one goes too far.
(9) (6.2)
(10) T: Probably in the same time you also repress the.hhh the
(11) immense grief that [(arises) from that]
(12) P: [Yeah. then it is is] is ((clears throat))
(13) hh impossible.hhhh ((coughs)) to erm deal (0.2)
(14) really with (0.6) that grief because (.) one has to act
(15) all the time.
(16) (0.4)
(17) P: Or to be rational and to do dusting and to
(18) order (0.5) things from pharmacy and (0.8) and this and that.
(19) (2.2)
(20) T: And on the other hand (0.6) you can also avoid the grief
(21) through this very action.
(22) (1.5)
(23) T: So that it works b- [both ways]
(24) P: [Yes, but as there is the]
(25) responsibility so it erm some [kind of act] ion has to be
(26) T: [yes]
(27) P: acc[omplished.]
(27) T: [It] has to be done necessarily.

The patient actively connects her being insane in her dream with her partner's insanity, proposing that this kind of excessive identification might reflect some kind of insanity on her behalf, too (line 9: "one goes too far," which is a metaphor using an embodied experience). This prepares the way for the analyst's activity—Empathy cannot be thought as an "intervention" by an especially gifted empathizing person "into" a less able person; empathy here is clearly co-produced by both participants.

Obviously the body is present here, when the patient clears throat after her grief has been addressed by the therapist. And she uses bodily activities to (dusting) to avoid feeling sad.

The analyst addresses her active repression of grief when so intensely identifying with her partner. While first agreeing with "yeah" (line 12), the patient "then hastily moves into elaboration" (lines 12 ff.). But there is a difference. While the patient actively repressed her grief and tears, she talks about having "to act all the time" (lines 14 and 15). Again, she uses her bodily activities in order not to feel what the therapist tries to address. This is followed by a transitionally relevant point (line 16), where the analyst could have taken the turn, but keeps silent and so the patient continues talking about dusting etc. (lines 17 ff.). From line 20 onwards the analyst makes another interpretive turn. Peräyklä thinks, the therapist proposes

> "a new perspective by pointing out that focusing on practicalities can also be a means for avoiding the grief. So, while 'not grieving' appeared in the patient's elaboration as something imposed upon the patient by the imperatives of the situation, in the analyst's third interpretative turn, avoidance of grief appears as the patient's own accomplishment, and the practicalities appear as instrumental in realizing this choice. By emphasizing the patient's agency or choice in 'not grieving,' the analyst also returns to an aspect of his initial interpretation where he suggested that the patient represses her grief." (p. 1378)

By starting with "on the other hand," the analyst combines both accepting the patient's perspective and adding a new one.

> "The combination of the acceptance of the patient's elaboration and the explicit perspective shift is also embodied in the way in which the analyst, after the initial non-response by patient (line 22), pursues his suggestion in line 23. By pointing out that 'so that it works both ways,' the analyst suggests that both are true: that the patient is unable to grieve due to her responsibilities (perspective in the patient's elaboration) and that the patient uses her responsibilities to avoid grieving (perspective in the analyst's third interpretative turn)." (Peräkylä, 2010, p. 1378)

The artful operation of changing somebody's perspective is here skillfully handled by the turn-initial phrase "on the other hand"—again an embodied metaphor. Therapists of every kind use similar phrases without ever paying special attention as to how to initiate such an operation. But they do it successfully—by using implicit cultural knowledge of how to respect their client's view, unconsciously referring to formats like in example 4 and 5, and sometimes these operations open up a conversation to deep levels of common empathizing (Example 2), while at other times they fail, as in Example 3. Therapeutic conversation might be based on formats of that kind—more than ever thought. Therapeutic empathic skillfulness seems to be based in embodied knowledge of how to use common cultural formats with respect to a patient's topics and at the same time they hurt the patient's expectations, they violate rules of conduct, don't show respect for practicing avoiding feelings and then there is a skillful readjustment and fine attunement as repair activity of one's own utterances. This skillful handling of repair activities should be studied with greater attention. I assume it is based in early experiences of embodied

repair activities during infant proto-conversation. There is continuity form proto-conversation to higher levels of conversation in using repairs.

In what follows I will turn to some evidence that could be used in psychotherapy process research. This evidence is presented here in the format of outlining some interdisciplinary lines of research especially between infant observers and conversation analysts.

"EMPATHY IS BACK"

Examples 1, 3, and 5 might give an impression as to how easily these complex therapeutic operations might fall apart. Ruptures in emotional resonance might give birth to violent escalations. Resonance, rhythm and balance should be considered relevant dimensions of empathic interaction in psychotherapy. In psychotherapy process research, the stage of understanding therapeutic "interventions" as technological procedures to be applied independent of the therapist-as-person should be overcome. In their influential work Orlinsky and Ronnestad(2005, p. 5) observed:

> "As a rule, the study of psychotherapies has been favored over the study of psychotherapists—as if therapists, when properly trained, are more or less interchangeable."

They see this attentive paucity as founded in a modernistic MEO-bias which led to the assumption that not the person of the therapist but the standards of method, procedure and technique are responsible for success or failure of the psychotherapeutic endeavor—this is an example of disembodied thinking viewed as a failure of research orientation. These assumptions fall in line with scientific standards of rationality and objectivity. What was termed *personal equation* from early astronomy (when astronomers looked through telescopes their observations deviated a little bit from one another) should be ruled out as a source of error which was to be controlled by experimental design. This disembodied kind of scientific understanding led to an elimination of the personal experience on the therapist's side, and one may wonder how this dimension should be brought back into the process by a therapist trained in this kind of reasoning only. Huge amounts of money were spent to research therapies—as if they could be conducted independent of the therapist. The NIMH study on depression conducted sophisticated statistical analyses to decide this question, and it looks so far as if the "therapist effects" had made the race (Elkin et al., 2006, 2007; Wampold and Bolt, 2006, 2007; for an overview of this debate see Buchholz and Gödde, 2012). It seems as if we meet a kind of paradox here: within the statistical area of objective science its counterpart, the embodied therapist's personal element and subjectivity, reappears. Since the publication of these results, many researchers have turned their attention to the therapist.

This development is accompanied by a reappearance of empathy in other areas than neurological research of mirror neurons. I leave out this topic as so many others have written about it with greater competence than I have. However, there are parallels in philosophy (Batson, 2011). Karsten Stueber (2006), a German philosopher teaching in the United States for many years, is well informed about the debates in German philosophy at the beginning of the 20th century. Prominent names are Theodore Lipps, who was highly respected by Freud; Max Scheler, who gave "Einfühlung" a central position in his philosophy; Friedrich Theodor Vischer, who saw empathic qualities as a presupposition for moral reasoning with respect to the different world views of others. Their opponents, such as the founders of the Vienna Circle, in those days were representatives of a more rationalistic philosophy in many variants. Stueber accomplishes a heroic task. He considers all the debates taking place at the time, brings the opposing positions of the prominent philosophers into a dialog and manages to cite a lot of empirical research. Prominent here is, of course, research on mirror neurons, the debate between simulation theory and theory-of-mind-theory, the role of folk psychology and cultural contextuality as opposed to explanatory approaches. In Stueber's analysis, MEO-conceptions of empathy tend to misunderstand empathy as a kind of theoretical enterprise, the body is missed in his analysis, too. Philosophers from the Wittgensteinian and hermeneutic tradition agree that empathy cannot be conceptualized as an analog of theory. So they replace the concept of empathy by "understanding" and this is mostly fixed to a textual level (Stueber, 2006, p. 195).

Stueber comes to define the limits of empathy (see also Breyer, 2013) not by rationality; in his view it is folk-theoretical conceptions that cannot sufficiently differentiate between correct empathic perceptions and prejudicial forms of understanding. Thus, certain constraints are to be acknowledged as in the case of different cultures. Here, further cognitive strategies are to be supplemented. But without empathic utterances everyday social interaction would break down in seconds. This holds even more for therapeutic conversation. Conversation, as I hope my examples have demonstrated, is more than just the exchange of propositions or mutual information about states in the world. Conversation includes the body.

KNOWING AND FEELING (OF THE OTHER'S KNOWING)

The earlier opposition of *naturalistic* experimentation as the "hard" version and *hermeneutic* understanding as the "soft" version of practicing science is outdated. As philosopher Wolfgang Detel (2011) states, in the current situation, perhaps surprisingly, strong impulses for a mutual rapprochement come from recent experimental evidence. I will give a line of experimental examples relevant for the topic of embodiment here.

What follows is some linguistic experiments that aim at exploring the psychological environment of certainty or uncertainty that a speaker has when responding to a knowledge question. These epistemic shades of gray envelop the content of the answer and help the hearer decide how certain or uncertain the speaker is with his answer. This look into the other's mind is a link to empathy. The disjunction between empathy and propositions is here bridged as researchers take into account that what is important is not only the information given, but the *embodied person* making the utterance, or respectively the *relationship of propositional knowledge (information) and personal certainty or uncertainty*.

Speakers indicate the degree of epistemic certainty of a proposition with hedges, e.g., by introducing their utterance with phrases like "I mean" or "as far as I know," using adverbs "anyhow," "probably," employing modality (instead of saying: "this is

so and so" they say "It might be that…"), and through changes in prosody (e.g., intonation, rhythm, and quality of voice). Not only knowing exists, but a "feeling of knowing" (FOK), as Hart (1965) termed it.

The assessment of the (un)certainty of an utterance can follow a procedure of counting the linguistic indicators here mentioned in a question-answer design (Smith and Clark, 1993). This design was expanded upon when the researcher's interest turned to "feeling of another's knowing" (FOAK), as in Brennan and Williams (1995). These authors found that listeners use a lot of resources to approximately assess a speaker's (un)certainty: (a) use of one's own embodied knowledge as a measure; (b) the assessed degree of question difficulty for the speaker as a tool to judge confidence; (c) the degree of mutual knowledge; (d) how the speaker is known or said to have performed in other environments previously; and (e) linguistic surface features, such as (f) latency to respond, (g) intonation, (h) forms of avoiding an answer etc. We find voice, hesitation, avoiding as embodied measures perceived by the listener with sensitive ears. Krahmer and Swerts (2005) turned to childrens' ability to detect (un)certainty in videos. While adults care a lot about uncertainty and, when uncertain, will increase frequency of pause production, display a higher pitch of voice, change intonation, lift their eyebrows and display an increase in smiling responses (embodied responses), children don't appear to care too much about uncertainty. Self-presentation, these authors conclude, is a less important thing for children than for adults.

Dral et al. (2011) used textual markers vs. prosodic markers to assess (un)certainty. They were looking for the possibility to automatically detect (un)certainty by prosodic markers. As for textual markers they differentiate hedges into different types such as "shields" and "approximators." "Shields" obviously are designed to prevent failures and approximators are used as a politeness strategy in the flow of conversation. This is context-dependent, participants differentiate between these two. Embodied variables of prosody such as intonation, latency of response, intensity of voice and speed of talking were also put under scrutiny. They conducted several statistical analyses on a dataset of 552 audio files and in comparing the transcripts became optimistic that "(un)certainty in spoken dialogs can be assessed automatically." The authors display a certain degree of optimism here. They find that to approximate (un)certainty "the textual features obviously score best" (p. 76). To a (unexpectedly) high degree, uncertainty comes in the guise of assessment or suggestion.

These empirical and experimental results can be taken as cues for the increasing attention given to the relevance of embodiment-dimensions in linguistics, in psychotherapy process research and in conversation analysis, too. New empathy-related questions appear: not only what is spoken about (informational content), but also who is speaking (the speaker's "identity," see Antaki and Widdicombe, 1998), to what (recognized) contexts a speaker responds ("situatedness"), to whom someone is talking (recipient design, see Hepburn and Potter, 2011; Hitzler, 2013) and the positioning of the body in the physical room and dimension and the personal positioning in metaphorical descriptions for interaction (e.g., ball game) seem to me to be relevant dimensions for studying empathy.

As empathy like love can hardly be defined propositionally it is advisable to follow the strategy of conversation analysts here. These researchers don't use pre-defined concepts to be applied onto empirical data. They look for naturalistic data (Mondada, 2013) and study the various *practices* of empathy. The research question is not ontologically directed to what empathy "is" but to how empathy is "made" by participants in talk-in-interaction. Empathy emerges as a co-production. Heritage (2011, 2012) and Heritage and Lindström (2012), analyzing transcripts of everyday interactions found that articulation formats of empathy can be described. Following Goffman (1978) they analyzed "response cries" like "Oh!" and "Ah:h!" by which people embodied the expression of surprise, silent participation or follow the emotional paths of up- and downgrading excitements. Response cries (Hepburn and Potter, 2012) of that kind are articulated when you hear something you know: how a tooth was extracted, the first kiss or that somebody died.

Other conversational activities can be assigned to a "spectrum" (Heritage, 2011, p. 164) of empathic responses. "Ancillary questions" are uttered when another empathic response to a story told could be expected and the recipient of a story utters a kind of related question expressing some affiliative engagement with the teller. Ancillary questions have the power to refocus the matter in a way the teller could not have expected. The recipient thus opens a way to escape further conversational obligations in a single move. Often a teller cannot decide from ancillary questions how empathically engaged the recipient is.

This is different with "parallel assessments." Respondents "can focus on focal elements of the experience described by the teller, by describing a similar, but particularized, experience or preference" (Heritage, 2011, p. 168). Someone praises the asparagus pie prepared by Jeff and the respondent utters something like "I love it. °Yeah I love tha:t." He takes a "my side"-response in Heritage's term. There is a dilemma emerging in this kind of empathic affiliation with others:

> "On the one hand, the recipient has not had direct first-hand experience of the event reported, and a parallel 'my side' response risks being heard as flat, pallid or pro forma. On the other hand, a parallel assessment that is too florid, extended or enriched in detail … risks being heard as competitive with the very report that it is designed to affiliate with." (Heritage, 2011, p. 169)

Parallel assessment is a term to express the experience of "I know how this feels" or "I felt like you." Heritage's goes beyond this and shows what a risky stuff lies in this kind of responding. Responding that way might be perceived as a contest about who might enjoy the privilege to continue telling. In therapeutic contexts the most conventional form of parallel assessments might be utterances like "I know that, too," "yes, I do understand that" or the compliance token "hm:hm."

On a higher level of empathic responses he finds what he terms as "subjunctive assessment."

> "With the term *subjunctive assessments,* I mean to introduce efforts at empathic affiliation which suggest that if the recipient were to experience the things described they would feel the same way." (p. 169)

Think of someone telling of a wonderful meal and then changing the receipt in a certain respect and the recipient responds with "Oh yeah! This would be fantastic!" He never has eaten the meal prepared in this way but he answers in advance as if he would have; thus, presenting an evaluation of this experience in the conditional. Both use their body (mouth) to simulate an experience they have not yet had—and affiliate on that. The subjunctive mode expresses a time mode of futurum II, something that has not yet happened is treated as if it happened and can be evaluated as something in the past. In therapeutic contexts subjunctive assessments might appear when talking about a clients wish-fulfillents and future aims.

Heritage offers a further level:

> "By 'observer responses,' I mean to indicate responses in which recipients claim imaginary access to the events and experiences described, but position themselves as observers, or would-be observers, to the event." (P. 171)

With this format a listener takes the position of an imaginary or belated witness. In therapeutic contexts this might often happen when treating traumatized patients who suffer from having experiences nobody saw or listened to and thus are threatened by derealiziation of their experience.

Applying this schema of empathic response spectrum Kächele and Buchholz (2013) showed that in an emergency SMS-therapy different empathic reactions could be differentiated in their effects to the client. But it would be a serious error to assume that such formats of empathic responses could be deliberately "applied" in order to achieve certain effects in the other person. This is misunderstanding of the whole thinking and approach. No, what researchers find is the opposite of deliberate application. It "just happens" that people react that way. They have a feeling for what reactions and answers fit into the situation and in contexts. This feeling is a resonance evoked by such situations and contexts and only après coup this can be analyzed by a scientific observer. Being in resonance, Heritage finds in his further contributions is complemented by a balance of knowledge between participants. Someone mentioning a name never used before will immediately recognize if the person referred to is not known to the listener. He has a "knowledge surplus" (K+), the listener lacks this person reference (K-). Heritage (2012) speculates that to equalize this epistemic difference is a mighty impetus why people are in interaction. So the first speaker who realizes that "Peter" is unknown to the listener will immediately add the relevant knowledge ("Peter, my neighbor at the left side") and knowledge difference is equalized. Balance is one of the embodied schemata Johnson (1987) and Lakoff (1987) have proposed as a source domain for so many target domains—this conception is applied here when Heritage describes how the knowledge difference is restored. Balancing is part of the universal cooperative structure of conversation (Grice, 1975; Tomasello, 2008). Affiliation is increased on both sides by such inobtrusive means.

Interestingly, this small conversational operation cannot be repeated. If someone in the same conversation were to add a second "Peter, my neighbor at the left side" this would show that here, too, is the potential for risky stuff. The same conversational operation is never the same. This contributes to the conviction that conversational contributions cannot be thought of as applicables. In the FOK and FOAK-terminology one could say this would hurt the balance of knowing and feeling between, at least, two participants. This reasoning makes plausible that balancing is a genuine embodied source domain that cannot be replaced easily.

TOWARD A DEFINITION OF EMPATHY

The most surprising result seems to be that people employ all these dimensions, react via different channels (textual or prosodic, eye gaze or affective facial displays) and integrate them at high speed. In most instances of everyday experience this suffices to achieve sufficiently reliable conclusions about trustworthiness of conversational partners. This type of research results supports a view that transcends neurological and information processing approaches, where it does not suffice to correlate experience and the activity of the brain. Correlational thinking would simply accentuate the gap between what a neurologist and what a psychologist studies. *Empathy is the vehicle by which human beings, with their basically embodied enormous capacity for coordination, integration and organized movement, can create their own environment with respect to the other's state, context and situatedness.* The single organism's helplessness can be overcome by these abilities. From this evolutionary moment empathy alters environmental morphostasis to environmental morphogenesis which we perceive as cultural plasticity. Culture never is a single individual's product alone. To quote Whitehead (1929, p. 1):

> "Culture is activity of thought, and receptiveness to beauty and humane feelings. Scraps of information have nothing to do with it."

Culture has more to do with "feelings of knowing" and "feelings of the other's knowing" than with knowing/information alone. Infant researcher Colwyn Trevarthen (2003, p. 76) stresses this difference with great emphasis and points to a perceived error of research activity emerging from ignorance of this difference:

> "In Edinburgh our Computational Linguists seem to have lost all interest in communication. The study of grammar cannot progress that way. It just gets more and more complex. But, as soon as you start to relate grammar to these spontaneous rhythmic characteristics of mother and baby communicating, then grammatical syntax gains a new meaning, a vitality and usefulness. What we are studying is dynamic emotional syntax; phrases and narrative sequences of feeling that are certainly foundational for the structure of verbal sentences, and their messages."

Endowed with *dynamic emotional syntax* (DES), human beings, designed for culture, *must* be experts in empathy. This conclusion seems less disturbing when I add the constraints: as long as friendliness and a lack of serious conflict prevails. Conflict, trouble, quarrel, animosity and finally violence either let empathy disappear or instrumentalize it differently: in order to find out where the enemy can be struck the most harmful blow. In infancy, DES is constituted of rhythms of those "motives and emotions for actions that sustain *human intersubjectivity*" (Trevarthen, 2011,

p. 121). Rhythm here means moving one's body in rhythmic synchrony with the baby's body. From rhythmic forms of shared emotionality, the ability to mutually read intentions emerges as well as the "flow of emerging self-awareness" (Trevarthen, 2011, p. 121). "To live as an animal, or as an infant . . . is to move with *good purpose;* that is, to want to act in ways that will be felt to be beneficial to the whole individual." (p. 122).

THE TURN TO ALTEROCENTRISM: CONCORDANT AND COMPLEMENTARY FORMS OF EMPATHY

What we generalize as "human relatedness" can be understood as a rich system of various patterns with an I-pole and a You-pole organized by rhythm, balance and resonance based in evolutionary view on mirror neurons (Ferrari and Gallese, 2007) and then advancing to conversational and symbolic organization. The whole system is built bottom-up, but if once established it operates more and more top-down. There are two dimensions in this conception: (a) a methodological problem of separating and integrating channels of empathy; (b) a developmental/evolutionary dimension. What follows are these two points of view.

To do empirical research in "empathy" seems to become a paradoxical endeavor. Empathy "happens," it cannot be "applied," it cannot be elicited by command and sometimes you have it, sometimes not. All researchers know this very well. So they cannot but try to establish an experimental copy of real world empathy. Battles and Berman (2012) direct their attention to what they call "conversational acknowledgers" presenting a list of 30 exemplars. This is very similar to what Heritage described as a spectrum from response cries to observer response. Such acknowledgers can be actualized on a verbal and nonverbal level (e.g., "hmhm" and "nodding"). Four experienced and licensed therapists of an eclectic orientation produced videos with pseudo clients. The hypothesis was that an increase of acknowledgers would increase the perceived empathy of therapists. The videos were produced in different fashion: some with verbal and nonverbal acknowledgers in a high degree, some with both low and some videos with a mixture. The videos were rated by 320 participants. The results show an unexpected consistency effect for both types of acknowledgers: if the rate of acknowledgers is equal (both low or both high) than empathy was rated high; if the video observers found an inconsistency than empathy-ratings decreased.

> "Inconsistency in levels of verbal acknowledgers and nodding leads to miscommunication and perceptions of deception and sarcasm." (p. 6)

is the author's best explanation. So what the 320 video observers observed was not only the sensory-embodied information: viewing with eyes frequency of nodding or hearing with ears the frequency of verbal acknowledgers. What they observed is a difference, an imbalance (again: balance as an embodied schema) between the two types of acknowledgers and their empathy assessment was dependent on this difference. *Observers go beyond sensory information*, they immediately conclude from "observables" to "invisibles"—a "difference" cannot be observed. In empathy assessment they use sensory information for immediate integration onto a higher level of meta-information concerning the integrity of the person emitting the sensory information. This is the way a top-down strategy begins to operate in the whole system.

The study group of Regenbogen et al. (2012) highlighted this topic by a complicated experimental design. They produced videos, too. They directed their research interest to the question which influence single channels of information have when observers attribute empathy to a story heard and seen in the video. Three channels were varied: facial expression of a story teller, the prosody of the voice telling and the content of the narrative told. The self-related stories, presented by well-trained actors, presented disgusted, fearful, happy, sad, or neutral narrative content. Four experimental conditions were varied. The same emotional expressions on the prosodic or facial expression level were added so that one could hear a story with neutral content, but with a sad voice and happy facial expressions. Or in the "neutral condition" all channels were equal. A complex variation of channel combination led to the production of 64 short video clips which were to assessed by 40 healthy persons. They had to rate the emotions seen on the video and the emotions observed in themselves while attending to the video. Some other measures such as Galvanic skin reaction were taken, too. The statistical analysis of this complex design again and again presents "a significant main effect of Communication" (p. 1002, p. 1003, p. 1004, p. 1005). This phrase was repeated again and again; it refers to the match of self and target emotion, to the matching of self and other, to perceived naturalness, to intensity levels, to a comparison of non-empathic and neutral responses etc.

Another important result was that once a channel was neutralized, the number of empathic responses decreased. Speech content was particularly involved for assessing the participants' own emotion.

> "Based on these findings, we attribute a specific role to speech content, contrary to several findings previously suggested. . . During the appraisal of several-channel information, neutralized speech might represent a context in which the bimodal emotional information cannot be integrated. In other words, the neutral speech content did not give a rational explanation of the emotional visual-auditory perception and subsequently might have inhibited an emotional perspective change, which is a prerequisite for empathy." (p. 1009)

And the authors make this point very clear:

> "Summarised, the present findings suggest that in human communication, behavioural empathy relies on consistent information from several sources; facial expressions, prosody, and speech content. Omitting one channel generally results in decreased empathy judgements, lower intensities and fewer psychophysiological reactions. The requirements for empathy are differently affected by different communication channels. While missing emotional information in the face decreases a person's ability to recognise someone else's emotional expression displayed by other channels, omitting emotional information in the speech content causes the largest drop in performance rates of adequate emotional reactions." (p. 1011)

Cautiously, we can assume this to be experimental evidence for the influence of the conversational dimension including sensory-embodied perception which gradually increases in development and allows for a top-down influence in empathic perception.

Now I want to turn to the developmental dimension. It is interesting to observe that some prominent experimental researchers also do not hesitate to quote some of those authors philosopher Stueber quoted. Frans de Waal (2007) contributes a "Russian doll-model" of empathy in an evolutionary perspective. De Waal turns against cognitive conceptions of empathy. Empathy and theory of mind (ToM) cannot be set equal. Autism in children cannot be explained by a ToM deficit because autism can be found before the age of 4 years. But what are the antecedents of ToM? The answer is in de Waal's view that "at the core of the empathic capacity is a relatively simple mechanism that provides an observer (the 'subject') with access to the subjective state of another (the 'object') through the subject's own neural and bodily representations. When the subject attends to the object's state, the subject's neural representations of similar states are automatically activated. The closer and more similar subject and object, the more perceiving the object will activate matching peripheral motor and autonomic responses in the subject (e.g., changes in heart rate, skin conductance, facial expression, body posture). This activation allows the subject to get 'under the skin' of the object, sharing its feelings and needs, which in turn foster sympathy, compassion, and helping." (de Waal, 2007, p. 59).

This automatic embodied response is called the "Perception-Action Mechanism" (PAM), a description that fits well with other authors', such as Damasio's hypothesis of emotions (2010). What is important here is not only the close match between contemporary authors' theorizing. Going further, de Waal hints at Lipps who, long before modern neuropsychological research, pointed out that what he called *Einfühlung* meant something like "feeling into" by which he meant something like inner mimicry. Empathy is a bodily re-construction of the object's state of mind, feelings and other inner states. "Accounts of empathy as a higher cognitive process neglect such gut-level reactions, which are far too rapid to be under conscious control," de Waal (p. 59) adds.

There is a neural basis of empathy as matching the other's state, leading to emotional contagion. This process is based on PAM using motor mimicry and matching the actions of others, as in the case of yawning or imitating other people's gestures. This provides the base for higher levels of cooperation and shared intentions leading to cognitive empathy and understanding the other's need for help. At a third level the other is actively imitated and his/her state is emulated, thus attributing certain emotions and mental states and generating a difference between "my" and "your" perspective. This difference reiterates the process of individuation while empathy creates bonds. So empathy is a phenomenon which "covers a wide range of emotional linkage patterns, from the very simple and automatic to the very sophisticated" (de Waal, 2007, p. 62).

Here I would like to suggest a differentiation between concordant and complementary empathy.

If a chimpanzee mother sees her baby unable to come down from a tree, she will reach out her hand to give just that kind of support and help the baby needs. If a human mother sees her baby fighting with a woolen blanket that is too warm, she will remove it with a gesture and talk soothingly to her baby. This is complementary empathy: both figures involved, the baby and the mother, have a different stance. One can offer the kind of help or support the other needs and is willing to grant it. Different qualities and different perspectives complement each other to form a circle of helping-helped-relationship. Concordant empathy can be differentiated from that: if you hear a poem that moves your heart you react in concordance, re-constructing automatically the same state within yourself as (you think) the poet expressed in the poem. Here, not difference but equality of emotion is the main factor.

Both forms of empathy are guided by what Tronick (2007) termed a "dyadic state of consciousness." Tronick aims to conceptualize the experience of being included in a "higher" level of functioning if together with someone else and if both are attuned at the same wavelength. There is no sender-receiver-relationship, this is rather included in a part-whole-relationship constituting new forms of experience, personal identity and emotional quality.

> "This dyadic state organization has more components—the infant and the mother—than the infant's (or mother's) own self-organized state. Thus, this dyadic System contains more information and is more complex and coherent than either the infant's (or the mother's) endogenous State of consciousness alone. When infant and mother mutually create this dyadic state—when they become components of a dyadic system—both fulfill the first principle of systems theory of gaining greater complexity and coherence. The gesturing mother-held-infant performs an action—gesturing—that is an emergent property of the dyadic System that would not and could not occur unless the infant and mother were related to each other as components of a single dyadic system." (Tronick, 2007, p. 407)

Tronicks thinks that entry into this kind of dyadic state of consciousness is an indispensable precondition for psychotherapeutic help. A client must have a feeling that the therapist knows in his own body what kind of pain the client feels and that the therapist's actions are guided by this "feeling into" the client's emergency—and this embodied base of empathy must be communicated. The feeling of being in this state of good care prepares the client to endure the stress and strains that are bound to come up during the course of psychotherapy. Empathy can be considered a means to achieve this indispensable *dyadic state of consciousness*.

This state is indispensable not only during infancy. An adult suffering from toothache will endure the necessary surgery much easier when feeling that the doctor is in resonance with him/her and will conduct the treatment with care and compassion. A child at school age who failed in an exam may accept help with studying only when she experiences some form of emotional resonance from her teacher. Someone with a broken leg from an accident lying on the ground will accept the risk of painful transportation only if he can feel that the emergency assistant does what must be done with a sensibility for what might cause the patient harm or pain. A psychotic on a psychiatric ward who is in a fit of rage because of a feeling of being treated with injustice will calm down when someone tells him convincingly that he is understood in his claims. Resonance is an indispensable experience.

CONCLUSION

In the first section I presented conversational data with the intention to point out some embodied phenomena of empathy. I have tried to bring together CL and CA by using the theory of embodied schemata Lakoff (1987) proposed. Although these areas are still somewhat strange to each other as reflected in their positioning to "cognition" (Potter, 1998; Deppermann, 2012; Potter and Edwards, 2013) they seem to converge with respect to embodiment. From embodied schemata there is a direct path to categorization which is object of study in CA and CL. Thus, certain aspects of embodiment concepts can help to bring theories of cognition and conversation closer together. To include the body as an interactional resource of meaning generation is of highest relevance for studying therapeutic process and for therapeutic listening as an embodied practice. The way of analysis proposed here followed this convergence into the domain of therapeutic "talk-in-interaction." To include the body does not necessarily involve video-recording only. The body is present in talk—and this can be made "hearable" in audio-recording and transcripts following the convergence of CL and CA as outlined here. Of course, a lot of empirical research has to be done in the future.

My analysis showed repeating waves of divergence and convergence in a therapeutic dialog, a second and third example showed the quality of mind reading evolving in one and failing in the other conversation, the fourth example compared this with an everyday practice of anticipating the other's next move and the fifth example from a psychoanalytic session showed how the analyst adjusted his interpretative activity following the patient's response to a first interpretation. The embodiment aspects have been outlined in all these examples. In these examples one can see how sensitive conversation is based in being aware of the of the other's body (voice, moves to prevent being hurt, repair activities), how it operates in talking and how this sensitivity is done, practiced by analyzable moves, turn taking units, anticipations. People think, respond and react to thinking people and they know that these people are thinking how they themselves think about what's going on while things go on. Empathy should no longer be conceptualized as a special "tool" gifted persons (therapists) use; empathy should be conceptualized as a coproduction of both embodied participants using embodied mindful voices. New research questions arise: what activities are brought into conversation to prepare the cooperative coproduction of empathy? How is cooperation in this special domain prepared and organized? The answers might be found in the direction of moving waves between convergence and divergence, of making use of metaphors, of speaking rhythms, prosody and the like—aspects that can be understood more easily when abstaining from disembodied concepts of mind and conversation.

In the second section I tried to organize a theoretical tour d'horizon along some recent linguistic, philosophical and conversational studies available when one studies empathy. Philosophers turn to empathy again and they refer to neuroscientific studies reporting results which in part have been well formulated in former years by philosophers without having neuroscientific evidence at hand. There is astonishing evidence between these areas of research and new formulated theories from infant research. Further research of empathy should include the continuity of conversation from embodied early childhood proto-conversation to high levels of abstract communication, the overall cooperative organization of conversation which in early years can be described by *musical* metaphors but which are not lost when high levels of communication are achieved. Balance, rhythm and resonance (Buchholz and Gödde, 2013) on high levels play their embodied role in order to make empathic understanding possible from embodied proto-conversation stages of development onwards. Further psychotherapy process research should more thoroughly consider this musical dimension of embodied conversation. Process research can make use of detailed transcripts in order to detect these dimensions.

Finally, some remarks about how empathy ruptures might risk giving birth to conversational forms of violence. Conversational violence has been shown in a qualitative interview study with 90 participants (Buchholz and von Kleist, 1997) as a consequence of failed empathy. False empathic understanding has serious consequences for the "empathizer," too. If co-embodied empathy operates it creates a sense of being-in-contact fulfilling a deep human desire. Yet, increasing numbers of ruptures of the empathic bond are responded with some kind of withdrawal, aggression or, at least, verbal violence. This is felt in a certain place: in the therapist's body.

REFERENCES

Antaki, C. (2008). "Formulations in psychotherapy," in *Conversation Analysis and Psychotherapy*, eds A. Peräkylä, C. Antaki, S. Vehviläinen, and I. Leudar (Cambridge; New York, NY: Cambridge University Press), 26–43.

Antaki, C., and Widdicombe, S. (eds.). (1998). *Identities in Talk*. Los Angeles; London: Sage Publications.

Bateson, G. (1961). "The biosocial integration of behavior in the schizophrenic family," in *Exploring the Base for Family Therapy*, eds N. W. Ackerman, F. L. Beatman, and S. N. Sherman (New York, NY: Family Service Association of America), 9–45.

Batson, C. D. (2011). *Altruism in Humans*. New York, NY: Oxford University Press.

Battles, M. B., and Berman, J. S. (2012). The impact of conversational acknowledgers on perceptions of psychotherapists. *Psychother. Res.* 22, 648–655. doi: 10.1080/10503307.2012.699476

Benjamin, L. S. (1974). Structural analysis of social behavior (SASB). *Psychol. Rev.* 81, 392–425. doi: 10.1037/h0037024

Benjamin, L. S. (1996). *Interpersonal Diagnosis and Treatment of Personality Disorders*. New York, NY: The Guilford Press.

Benjamin, L. S. (2010). "Interpersonal assessment and treatment of personality disorders," in *Social Psychological Foundations of Clinical Psychology*, eds J. E. Maddux and J. P. Tangney (New York, NY: Guilford Press), 349–374.

Bordin, E. S. (1979). The generalizability of the psychoanalytic concept of the working alliance. *Psychotherapy* 16, 252–260. doi: 10.1037/h0085885

Braten, S. (2009). *The Intersubjective Mirror in Infant Learning and Evolution of Speech* (*Advances in Consciousness Research*, Vol. 76). Amsterdam; Philadelphia: John Benjamins Pub.

Brennan, S., and Williams, M. (1995). The feeling of another's knowing: prosody and filled pauses as clues to listeners about the metacognitive states of speakers. *J. Mem. Lang.* 34, 383–398. doi: 10.1006/jmla.1995.1017

Breyer, T. (ed.). (2013). *Grenzen der Empathie. Philosophische, Psychologische und Anthropologische Perspektiven* (Limits of Empathy. Philosophical, Psychological and Anthropological Perspectives). Paderborn: Wilhelm Fink.

Brinich, P. M. (1982). Rituals and meanings: the emergence of mother-child communication. *Psychoanal. Study Child* 37, 3–15.

Buchholz, M. B. (1996/2003). *Metaphern der 'Kur.' Qualitative Studien zum Therapeutischen Prozeß(2. Auflage 2003) (Metaphors of Cure. Qualitative Studies of the Therapeutic Process)*. Giessen: Psychosozial-Verlag.

Buchholz, M. B. (2013). Book review - "The Handbook of Conversation Analysis" and "Emotion in Interaction". *Lang. Psychoanal.* 2, 50–55. doi: 10.7565/landp.2013.0003

Buchholz, M. B., and Gödde, G. (2012). "Person versus Methode—Eine zentrale Frage für Therapeutik und Therapieforschung (Person or Method? A central question for therapy and therapy research)," in *Der Besen, mit dem die Hexe fliegt. Wissenschaft und Therapeutik des Unbewussten. Band 2: Konversation und Resonanz in der Psychotherapie*, eds G. Gödde and M. B. Buchholz (Giessen: Psychosozial-Verlag), 641–675.

Buchholz, M. B., and Gödde, G. (2013). Balance, Rhythmus, Resonanz: Auf dem Weg zu einer Komplementarität zwischen "vertikaler" und "resonanter" Dimension des Unbewussten (Balance, Rhythm resonance. Towards a complementarity between vertical and resonant dimension of the Unconscious). *Psyche* 67, 1–36.

Buchholz, M. B., Lamott, F., and Mörtl, K. (2008). *Tat-Sachen. Narrative von Sexualstraftätern. ("Facts Done. Narratives of sexual offenders").* Giessen: Psychosozial-Verlag.

Buchholz, M. B., and von Kleist, C. (1997). *Szenarien des Kontakts—Eine metaphernanalytische Untersuchung in der stationären Psychotherapie* (*Scenarios of Contact—a Study of Metaphors in Psychotherapy*). Gießen: Psychosozial-Verlag.

Cameron, L., and Maslen, R. (eds.). (2010). *Metaphor Analysis. Research Practice in Applied Linguistics, Social Sciences and the Humanities*. Oakville: Equinox Pub.

Canestri, J. (ed.). (2011). *Putting Theory to Work. How are Theories Actually Used in Practice*? London: Karnac Books.

Cerulo, K. A. (ed.). (2002). *Culture in Mind. Toward a Sociology of Culture and Cognition*. New York; London: Routledge.

Cienki, A., and Müller, C. (eds.). (2010). *Gesture Studies:* Vol. 3. *Metaphor and Gesture* (*Paperback)*. Amsterdam: Benjamins.

Cipolletta, S. (2013). Construing in action: experiencing embodiment. *J. Constr. Psychol.* 26, 293–305. doi: 10.1080/10720537.2013.812770

Colli, A., and Lingiardi, V. (2009). The Collaborative Interactions Scale: a new transcript-based method for the assessment of therapeutic alliance ruptures and reesolutions in psychotherapy. *Psychother. Res.* 19, 718–734. doi: 10.1080/10503300903121098

Colunga, E., and Smith, L. B. (2003). The emergence of abstract ideas: evidence from networks and babies. *Philos. Trans. Biol. Sci.* 358, 1205–1214. doi: 10.1098/rstb.2003.1306

Corrin, J. (2010). "Hm? What? Maternal repair and early child talk," in *Analysing Interactions in Childhood. Insights from Conversation Analysis*, eds H. Gardner and M. A. Forrester (Chichester: Wiley-Blackwell), 23–42.

Coulter, J. (2005). "Language without mind," in *Conversation and Cognition*, eds H. T. Molder and J. Potter (Cambridge; New York: Cambridge University Press), 79–92.

Damasio, A. R. (2010). *Self Comes to Mind. Constructing the Conscious Brain.* New York, NY: Pantheon Books.

Deppermann, A. (2012). How does 'cognition' matter to the analysis of talk-in-interaction? *Lang. Sci.* 34, 746–747. doi: 10.1016/j.langsci.2012.04.013

Detel, W. (2011). *Geist und Verstehen. Historische Grundlagen einer modernen Hermeneutik* (*Mind and Understanding. Historical Foundations of a Modern Hermeneutic*). Frankfurt am Main: Vittorio Klostermann.

de Waal, F. (2007). "The 'Russian Doll' model of empathy and imitation," in *On Being Moved. From Mirror Neurons to Empathy (Advances in Consciousness Research,* Vol. 68), ed S. Braten (Amsterdam; Philadelphia: John Benjamins Pub), 49–73.

Donnellon, A. (1996). *Team Talk. Listening Between the Lines to Improve Team Performance*. Boston: Harvard Business School Press.

Doran, J. M., Safran, J. D., Waizmann, V., Bolger, K., and Muran, J. C. (2012). The Alliance Negotiation Scale: psychometric construction and preliminary reliability and validity analysis. *Psychother. Res.* 22, 710–719. doi: 10.1080/10503307.2012.709326

Dral, J., Heylen, D., and Akker, R. O. D. (2011). "Detecting uncertainty in spoken dialogues: an exploratory research for the automatic detection of speaker uncertainty by using prosodic markers," in *Affective Computing and Sentiment Analysis. Emotion, Metaphor and Terminology (Text, Speech and Language Technology*, Vol. 45), ed K. Ahmad (Dordrecht; New York: Springer), 67–78.

Drew, P. (2005). "Is confusion a state of mind?" in *Conversation and Cognition*, eds H. te Molder and J. Potter (Cambridge; New York: Cambridge University Press), 161–183.

Elkin, I., Falconnier, L., and Martinovich, Z. (2007). Misrepresentations in Wampold and Bolt's critique of Elkin, Falconnier, Martinovich, and Mahoney's study of therapist effects. *Psychother. Res.* 17, 253–256.

Elkin, I., Falconnier, L., Martinovich, Z., and Mahoney, C. (2006). Therapist effects in the National Institute of Mental Health Treatment of Depression Collaborative Research Programm. *Psychother. Res.* 16, 144–160. doi: 10.1080/10503300500268540

Ferrari, P. F., and Gallese, V. (2007). "Mirror neurons and intersubjectivity," in *On Being Moved. From Mirror Neurons to Empathy (Advances in Consciousness Research*, Vol. 68), ed S. Braten (Amsterdam; Philadelphia: John Benjamins Pub), 73–89.

Forceville, C. J., and Urios-Aparisi, E. (eds.). (2009). *Multimodal Metaphor*. Berlin; New York: Mouton de Gruyter.

Galatzer-Levy, R. M. (2009). Good vibrations: analytic process as coupled oscillations. *Int. J. Psychoanal.* 90, 983–1007. doi: 10.1111/j.1745-8315.2009.00188.x

Gallagher, S. (2005). *How the Body Shapes the Mind*. Oxford; New York: Clarendon Press.

Glucksberg, S. (2008). "How metaphors create categories—quickly," in *The Cambridge Handbook of Metaphor and Thought*, ed R. W. Gibbs, Jr (Cambridge; New York: Cambridge University Press), 67–83.

Goffman, E. (1978). Response cries. *Language* 54, 787–815. doi: 10.2307/413235

Goodwin, C. (2007). "Interactive footing," in *Reporting Talk. Reported Speech in Interaction*, eds E. Holt and R. Clift (Cambridge; New York: Cambridge University Press), 16–45.

Grice, P. (1975). "Logic and conversation," in *Syntax and Semantics III: Speech Acts*, eds P. Cole and J. L. Moran (New York, NY: Academic Press), 41–58.

Hari, R. (2007). "Human mirror systems: on assessing mind by reading brain and body during social interaction," in *Advances in Consciousness Research: V. 68. On Being Moved. From Mirror Neurons to Empathy*, ed S. Braten (Amsterdam; Philadelphia, PA: John Benjamins Pub.), 89–101.

Hart, J. (1965). Memory and the feeling-of-knowing experience. *J. Educ. Psychol.* 56, 208–216. doi: 10.1037/h0022263

Hepburn, A., and Bolden, G. B. (2013). "The conversation analytic approach to transcription," in *The Handbook of Conversation Analysis*, eds J. Sidnell and T. Stivers (Chichester, West Sussex: Wiley-Blackwell), 57–77.

Hepburn, A., and Potter, J. (2011). Designing the recipient: managing advice resistance in institutional settings. *Soc. Psychol. Q.* 74, 216–241. doi: 10.1177/0190272511408055

Hepburn, A., and Potter, J. (2012). "Crying and crying responses," in *Emotion in Interaction*, eds A. Peräkylä and M.-L. Sorjonen (New York, NY: Oxford University Press), 195–211.

Heritage, J. C. (1984). "A change-of-state token and aspects of its sequential placement," in *Structures of Social Action*, eds J. M. Atkinson und John C. Heritage (New York, NY: Cambridge University Press) (Auflage von 1992), 299–346.

Heritage, J. (2002). The limits of questioning: negative interrogatives and hostile questions content. *J. Pragmat.* 34, 1427–1446. doi: 10.1016/S0378-2166(02)00072-3

Heritage, J. C. (2011). "Territories of knowledge, territories of experience: empathic moments in interaction," in *The Morality of Knowledge in Conversation*, eds T. Stivers, L. Mondada, and J. Steensig (Cambridge; New York: Cambridge University Press), 159–183.

Heritage, J. C. (2012). Epistemics in action: action formation and territories of knowledge. *Res. Lang. Soc. Interact.* 45, 1–29. doi: 10.1080/08351813.2012.646684

Heritage, J. C., and Lindström, A. (2012). "Knowledge, empathy, and emotion in a medical encounter," in *Emotion in Interaction*, eds A. Peräkylä and M.-L. Sorjonen (New York, NY: Oxford University Press), 256–273.

Hitzler, S. (2013). Recipient design in institutioneller Mehrparteieninteraktion. *Gesprächsforschung* 14, 110–132.

Holt, E., and Clift, R. (eds.). (2007). *Reporting Talk. Reported Speech in Interaction.* Cambridge; New York: Cambridge University Press.

Johnson, M. (1987). *The Body in the Mind: The Bodily Basis of Meaning, Imagination and Reason*. Chicago: University of Chicago Press.

Kächele, H., and Buchholz, M. B. (2013). Eine Notfall-SMS-Intervention bei chronischer Suizidalität—Wie die Konversationsanalyse klinische Beobachtungen bereichert (An emergency SMS-Intervention with a chronic suicidal patient. How conversation analysis enriches clinical observation). *ZPPM Zeitschrift für Psychotraumatologie, Psychotherapiewissenschaft, Psychologische Medizin* 11, 49–62.

Krahmer, E., and Swerts, M. (2005). How children and adults signal and detect uncertainty in audiovisual speech. *Lang. Speech* 48, 29–54. doi: 10.1177/00238309050480010201

Lakoff, G. (1987). *Women, Fire, and Dangerous Things. What Categories Reveal about the Mind*. Chicago; London: The University of Chicago Press.

Lakoff, G. (2008). "The neural theory of metaphor," in *The Cambridge Handbook of Metaphor and Thought*, ed R. W. Gibbs, Jr (Cambridge; New York: Cambridge University Press), 17–38.

Lakoff, G., and Nunez, R. E. (2000). *Where Mathematics Comes From. How the Embodied Mind Brings Mathematics into Being.* New York, NY: Basic Books.

Leitner, L. M. (2007). Theory, technique and person: technical integration in experiential constructivist psychotherapy. *J. Psychother. Integr.* 17, 33–49. doi: 10.1037/1053-0479.17.1.33

Lepper, G. (2000). *Categories in Text and Talk. A Practical Introduction to Categorization Analysis*. London; Thousand Oaks; New Delhi: Sage Publications.

Lepper, G., and Mergenthaler, E. (2007). Therapeutic collaboration: how does it work? *Psychother. Res.* 17, 576–588. doi: 10.1080/10503300601140002

Lombardi, R. (2008). The body in the analytic session: focusing on the body-mind link. *Int. J. Psychoanal.* 89, 89–110. doi: 10.1111/j.1745-8315.2007.00008.x

Malloch, S., and Trevarthen, C. (eds.). (2010). *Communicative Musicality. Exploring the Basis of Human Companionship*. Oxford: Oxford University Press.

Martinez, C., Tomicic, A., and Medina, L. (2012). Dialogical discourse analysis of psychotherapeutic dialogue: microanalysis of relevant psychotherapeutic eipisodes. *Int. J. Dialog. Sci.* 6, 99–121.

Miller, S. (2006). *Conversation. A History of a Declining Art.* New Haven: Yale University Press.

Mondada, L. (2013). "The conversation analytic approach to data collection," in *The Handbook of Conversation Analysis*, eds J. Sidnell and T. Stivers (Chichester, West Sussex: Wiley-Blackwell), 32–57.

Mörtl, K., Buchholz, M. B., and Lamott, F. (2010). Gender constructions of male sex offenders in germany: narrative analysis of group psychotherapy. *Arch. Sex Behav.* 39, 203–212. doi: 10.1007/s10508-009-9588-1

Muntigl, P., Knight, N., Watkins, A., Horvath, A. O., and Angus, L. E. (2013). Active retreating: person-centered practices to repair disaffiliation in therapy. *J. Pragmat.* 53, 1–20. doi: 10.1016/j.pragma.2013.03.019

Neisser, U. (1980). On "social knowing." *Pers. Soc. Psychol. Bull.* 6, 601–605. doi: 10.1177/014616728064012

Nunez, R. (2008). "Conceptual metaphor, human cognition, and the nature of mathematics," in *The Cambridge Handbook of Metaphor and Thought*, ed R. W. Gibbs, Jr (Cambridge; New York: Cambridge University Press), 339–362.

Nunez, R. E. (2011). "Enacting infinity: bringing transfinite cardinals into being," in *Enaction. Toward a New Paradigm for Cognitive Science*, eds J. R. Stewart, O. Gapenne, and E. A. Di Paolo (Cambridge, MA: MIT Press), 307–335.

Orlinsky, D. E., and Ronnestad, M. H. (2005). *How Psychotherapists Develop. A Study of Therapeutic Work and Professional Growth.* Washington, DC: American Psychological Association.

Peräkylä, A. (2004). Making links in psychoanalytic interpretations: a conversation analytical perspective. *Psychother. Res.* 14, 289–307. doi: 10.1093/ptr/kph026

Peräkylä, A. (2005). Patients' responses to interpretations: a dialogue between conversation analysis and psychoanalytic theory. *Commun. Med.* 2, 163–176. doi: 10.1515/come.2005.2.2.163

Peräkylä, A. (2008). "Conversation analysis and psychoanalysis: interpretation, affect, and intersubjectivity," in *Conversation Analysis and Psychotherapy*, eds A. Peräkylä, C. Antaki, S. Vehviläinen, and I. Leudar (Cambridge; New York: Cambridge University Press), 100–120.

Peräkylä, A. (2010). Shifting the perspective after the patient's response to an interpretation. *Int. J. Psychoanal.* 91, 1363–1384. doi: 10.1111/j.1745-8315.2010.00323.x

Peräkylä, A. (2011). After interpretation. Third position utterances in psychoanalysis. *Res. Lang. Soc. Interact.* 44, 288–316.

Peräkylä, A. (2013). "Conversation analysis in psychotherapy," in *The Handbook of Conversation Analysis*, eds J. Sidnell and T. Stivers (Chichester, West Sussex: Wiley-Blackwell), 551–575.

Peräkylä, A., Antaki, C., Vehviläinen, S., and Leudar, I. (eds.). (2008). *Conversation Analysis and Psychotherapy*. Cambridge; New York: Cambridge University Press.

Potter, J. (1998). Cognition as context (whose cognition?). *Res. Lang. Soc. Interact.* 31, 29–44. doi: 10.1207/s15327973rlsi3101_2

Potter, J., and Edwards, D. (2013). "Conversation analysis and psychology," in *The Handbook of Conversation Analysis*, eds J. Sidnell and T. Stivers (Chichester, West Sussex: Wiley-Blackwell), 701–726.

Regenbogen, C., Schneider, D. A., Finkelmeyer, A., Kohn, N., Derntl, B., Kellermann, T. et al. (2012). The differential contribution of facial expressions, prosody, and speech content to empathy. *Cogn. Emot.* 26, 995–1014. doi: 10.1080/02699931.2011.631296

Reich, W. (2010). Three problems of intersubjectivity - and one solution. *Sociol. Theory* 28, 40–63. doi: 10.1111/j.1467-9558.2009.01364.x

Rosch, E., and Lloyd, B. B. (1978). *Cognition and Categorization*. Hillsdale, NJ: Lawrence Earlbaum Ass.

Sacks, H. (1978). "Some technical considerations of a dirty joke," in *Studies in the Organization of Conversational Interaction*, ed J. Schenkein (New York, NY; San Francisco, CA; London: Academic Press), 249–270.

Sacks, H. (1980). Button button who's got the button. *Sociol. Inq.* 50, 318–327. doi: 10.1111/j.1475-682X.1980.tb00025.x

Sacks, H. (1992). *Lectures on Conversation. Edited by Gail Jefferson, with an introduction by Emanuel A. Schegloff.* Oxford: Basil Blackwell.

Safran, J. D., and Muran, J. C. (2000). *Negotiating the Therapeutic Alliance—A Relational Treatment Guide*. New York, NY: The Guilford Press.

Scarvaglieri, C. (2011a). *"Nichts anderes als ein Austausch von Worten …" Empirische Untersuchungen zum sprachlichen Handeln in der Psychotherapie ("Nothing but an Exchange of Words…" Empirical Studies of verbal action in psychotherapy)*. Dissertation Univ. Hamburg. Dissertation. Hamburg.

Scarvaglieri, C. (2011b). Sprache als Symptom, Sprache als Arznei. Die linguistische Erforschung von Psychotherapie (Language as Symptom, Language as Medicine). *Psychother. Soz.* 13, 37–58.

Schegloff, E. A. (1999). What next? Language and social interaction study at the century's turn. *Res. Lang. Soc. Interact.* 32, 141–148. doi: 10.1080/08351813.1999.9683617

Schegloff, E. A. (2007a). A tutorial on membership categorization. *J. Pragmat.* 39, 462–482. doi: 10.1016/j.pragma.2006.07.007

Schegloff, E. A. (2007b). *Sequence Organization in Interaction. A Primer in Conversation Analysis.* Cambridge: Cambridge University Press.

Schlicht, T. (2013). "Mittendrin statt nur dabei: wie funktioniert Kognition? (Right in th middle instead of only accompagnying. How cognition works)" in *Übergänge:* Vol. 63. *Grenzen der Empathie. Philosophische, Psychologische und Anthropologische Perspektiven*, ed T. Breyer (München: Wilhelm Fink Verlag), 45–92.

Sidnell, J., and Stivers, T. (Eds.). (2013). *The Handbook of Conversation Analysis*. Chichester, West Sussex: Wiley-Blackwell.

Smith, V., and Clark, H. (1993). On the course of answering questions. *J. Mem. Lang.* 32, 25–38. doi: 10.1006/jmla.1993.1002

Spurrett, D., and Crowley, S. (2010). "The extended infant: utterance-activity and distributed cognition," in *The Extended Mind (Life and Mind)*, ed R. Menary (Cambridge, MA: MIT Press), 295–324.

Stern, D. N. (1985). *The Interpersonal World of the Infant. A View from Psychoanalysis and Developmental Psychology*. New York, NY: Basic Books.

Stern, D. N. (2004). *The Present Moment in Psychotherapy and Everyday Life*. New York; London: W.W. Norton and Company.

Stiles, W. B. (1988). Psychotherapy process-outcome correlations may be misleading. *Psychotherapy* 25, 27–35. doi: 10.1037/h0085320

Stiles, W. B. (1995). Stories, tacit knowledge, and psychotherapy research. *Psychother. Res.* 5, 125–127. doi: 10.1080/10503309512331331236

Stiles, W. B., and Shapiro, D. A. (1989). Abuse of the drug metaphor in psychotherapy process-outcome research. *Clin. Psychol. Rev.* 9, 521–543. doi: 10.1016/0272-7358(89)90007-X

Streeck, J. (2011). "The changing meaning of things: found objects and inscriptions in social interaction," in *Learning in Doing: Social, Cognitive and Computational Perspectives. Embodied Interaction. Language and Body in the Material World*, eds J. Streeck, C. Goodwin, and C. D. LeBaron (New York, NY: Cambridge University Press), 67–78.

Stueber, K. R. (2006). *Rediscovering Empathy. Agency, Folk Psychology, and the Human Sciences*. Cambridge; London: MIT Press.

Thomä, H., and Kächele, H. (1994). *Psychoanalytic Practice,* Vol. 2 *Clinical Studies*. New-York, NY: Jason Aronson.

Tomasello, M. (2008). *Origins of Human Communication*. Cambridge; London: MIT-Press.

Trevarthen, C. (2003). "Neuroscience and intrinsic psychodynamics: current knowledge and potential for therapy," in *Revolutionary Connections. Psychotherapy and Neuroscience*, eds J. Corrigal and H. Wilkinson (London; New York: Karnac), 53–78.

Trevarthen, C. (2011). What is it like to be a person who knows nothing? Defining the active intersubjective mind of a newborn human being. *Inf. Child Dev.* 20, 119–135. doi: 10.1002/icd.689

Tronick, E. (2007). *The Neurobehavioral and Social-Emotional Development of Infants and Children*. New York; London: W.W. Norton.

Tschacher, W., and Bergomi, C. (eds.). (2011). *The Implications of Embodiment: Cognition and Communication*. Exeter; Charlottesville: Imprint Academic.

von der Lippe, A. L., Monsen, J. T., Ronnestad, M. H., and Eilertsein, E. (2008). Treatment failure in psychotherapy: the pull of hostility. *Psychother. Res.* 18, 420–432. doi: 10.1080/10503300701810793

Varela, F. (1990). "On the conceptual skeleton of current cognitive science," in *Beobachter: Konvergenz der Erkenntnistheorien?* eds N. Luhmann, H. Maturana, M. Namiki, V. Redder und F. Varela (München: Wilhelm Fink), 13–24.

Varela, F., Thompson, E., and Rosch, E. (1993). *The Embodied Mind. Cognitive Science and Human Experience.* Cambridge; London: MIT-Press.

Wampold, B. E., and Bolt, D. M. (2006). Therapist effects: clever ways to make them (and everything else) disappear. *Psychother. Res.* 16, 184–187. doi: 10.1080/10503300500265181

Wampold, B. E., and Bolt, D. M. (2007). Appropriate estimation of therapist effects: one more time. *Psychother. Res.* 17, 256–258.

Weiste, E., and Peräkylä, A. (2013). A comparative conversation analytic study of formulations in psychoanalysis and cognitive psychotherapy. *Res. Lang. Soc. Inter.* 46, 299–321. doi: 10.1080/08351813.2013.839093

Whitehead, A. N. (1929). *The Aims of Education and Other Essays*. New York, NY: Macmillan.

Williams, E. N. (2008). A psychotherapy researcher's perspective on therapist self-awareness and self-focused attention after a decade of research. *Psychother. Res.* 18, 139–147. doi: 10.1080/10503300701691656

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Received: 06 September 2013; accepted: 02 April 2014; published online: 29 April 2014.
Citation: Buchholz MB (2014) Patterns of empathy as embodied practice in clinical conversation—a musical dimension. Front. Psychol. ***5****:349. doi: 10.3389/fpsyg.2014.00349*
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology.