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The grand challenge for psychology: integrate and fire!

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Is psychology a scientific discipline of its own? Or is it the case, as Scott (1991) upheld, that "Psychology lacks a clear identity"? The latter is certainly the impression one gets reading Ludin (1979), who, in his opus titled "Theories and Systems of Psychology", describes the emergence of psychology over the 20th century with retrospectively comical words that would perhaps best be used to describe how hunter-gatherers got together to form tribes:

> "As psychology has evolved during the present century, different groups of people who called themselves psychologists have banded together to put forth communities of ideas and efforts designed to direct the way psychology should go. When a particular group shared similar ideas and opposed others, a "school" of psychology was formed". (p. 1)

The balkanization of psychology in separate subfields that Scott laments is nothing new. Already in 1949, for instance, on the occasion of the creation of the Belgian Society for Psychology, its main incipient, the famous Michotte, wrote that

> "it seems to me that it would be of interest to better know each other and to coordinate our efforts by creating opportunities for regular contact, which would make it possible for us to discuss either theoretical problems or professional questions, and, in a more general way, of anything that is relevant to professional psychologists" (Michotte, 1954, p. 1).

There is undoubtedly a bewildering diversity of approaches to the old and respectable problem of how the mind works. This comes as no surprise, given the complexity of exploring not only the intricacies of our mental life, but, more to the point, how the mind relates to the body, and in particular to the brain. The brain is itself so complex that a neuroscientist can spend his entire career working on a single type of neuron. But this is not all, for neither body nor mind ever stand still. The brain changes when we grow up, and as we age. Further, as agents, we are in continuous interaction with the world and with other agents, and to such an extent that one may reasonably claim that it is meaningless to study psychological mechanisms without considering how they are modulated by the environment and by social factors.

Psychology is thus, by nature, a "hub" discipline, for its object of study is quite literally spread over several levels of description that span the entire spectrum of reality – from molecules to ecstasy. As Freud (1949) presciently noted,

> "We know two kinds of things about what we callour psyche (or mental life): firstly, its bodily organ and scene of action, the brain (or nervous system) and, on the other hand, our acts of consciousness, which are immediate data and cannot be further explained by any sort of description. Everything that lies in between is unknown to us, and the data do not include any direct relation between these two terminal points of our knowledge. If it existed, it would at most afford an exact localization of the processes of consciousness and would give us no help towards understanding them".

By some accounts at least, we have come a long way since then, and indeed both consciousness (as a singular problem), and brain imaging (as the best technology to bridge the gap between neural activity and mental life) now stand tall in the study of mind. And thus we have integrated methods and ideas from a number of related disciplines, from the neurosciences to philosophy, from economics to psychiatry, from biology to artificial intelligence, so spawning interconnected fields that all have human beings as their core object of interest.

More often than not unfortunately, this multiplicity of approaches has proven detrimental to the psychological sciences, not only because their object is constantly under threat of appropriation by other disciplines, but also because of a lack of cogent dialogue within our own community. "Things appear to be changing in Psychological Science, however", as Cacciopo (2007), then president of the Association of Psychological Science, remarked in an *Observer* article. And indeed they are. For someone who has been active in our field for just about 25 years now, it is truly remarkable to witness the emergence of entirely new fields such as social neuroscience, experimental psychopathology, or neuropsychoanalysis. Some such specialties bear monickers that clearly reflect the ambition to be integrative, such as "developmental social cognitive neuroscience". Almost all carry either a "neuro -" prefix or a "science" postfix, thus reflecting both enthusiasm in the face of the increased availability of entirely new tools to study the mind and perhaps also some preoccupation with granting the new subfields better status by describing them as "science" rather than as mere "psychology". Make no mistake however: The mind is a messy affair, and it is not in virtue of the fact that we now have considerably better methods available to probe it that it will suddenly unwrap itself for inspection in newfound simplicity…

Cacciopo (2007) in his *Observer* piece, showed an interesting little graph delineating and structuring psychology through which he distinguished between "levels of organization" on the one hand, and "cross-cutting perspectives" on the other, so carving up our science in subfields characterized both by their object of interest and by the method through which it was approached.

Here is my own take at this attempt (**Figure 1**), not *Frontiers*' tiered pyramid, but a Rubik's cube of subfields defined by crossing three dimensions: *Levels of organization* (Biology, Individuals, Groups), *Methods* (Observation and Population Studies, Experimentation and Modeling, Intervention), and *Perspectives* (Normality, Change and Differences, Pathology). The first dimension – Levels of Organization – is self-explanatory and simply refers to whether the research is focused on understanding the mind by focusing on its neural correlates, on the mental representations and on the behaviour of individuals, or on the processes that take place when such individuals interact with other people. The second dimension – Methods – is an attempt to capture the

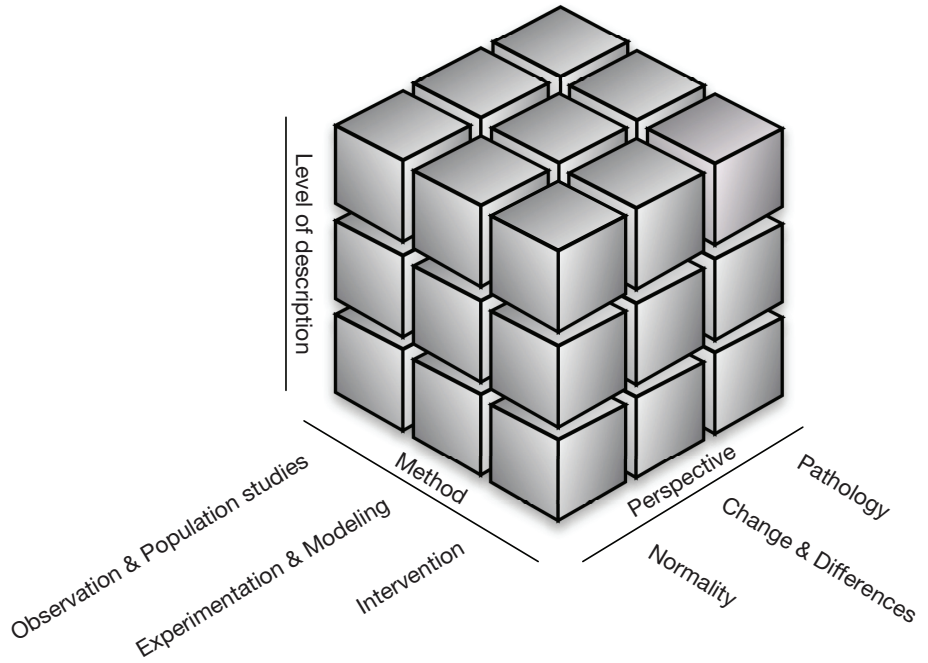

FIGURE 1 | Carving up psychology at its joints results in a Rubik's Cube of 27 subfields.

astounding diversity of approaches to psychological phenomena that characterizes the field. Observation is grouped with Population Studies to the extent that both involve some form of data-mining and descriptive statistics. Experimentation and Modeling (in particular computational modeling) are the mainstay of psychological research and instantiate methods where one attempts to manipulate specific factors in such a way as explore their effects on the variables of interest and hence develop an understanding of the mechanisms involved. Intervention methods refer to an altogether different approach perhaps more typical of Clinical, Educational, and Neuro-Psychology whereby researchers actively act upon the participants so as to improve their condition or to promote the occurrence of specific behaviours. Finally, the third dimension – Perspectives – describes the overall focus of the research – normal or pathological functioning on the one hand, change through evolution, development, maturation and learning as well as differences between individuals or species on the other. Of course, one may always quibble with specific choices in carving up a domain as complex as Psychology in such a manner. Thus, it should be clear that "Experimentation and Modeling" includes brain imaging methods, and that fields such as Animal Psychology are subsumed in the "Change and Differences" perspective whenever the main concern is to understand the human mind by comparing it with other minds. Finally, while this analysis depicts psychology as fragmented in neat little subdomains, it is obvious that the proposed dimensions define each other and are thus very much co-dependent, both at their junctures and over their own levels.

But you get the idea… and the resulting cube, which contains 27 subfields, satisfyingly produces many of the expected specialties. For instance, crossing "Individuals" with "Experimentation and Modeling" and "Pathology" gives us "*Frontiers in Psychopathology*". Crossing "Groups" with "Observation and Population Studies" and "Normality" gives us "*Frontiers in quantitative psychology and measurement*". Not all specialties can be confined to one little cube. Rather, some can span several because of their own interdisciplinary nature. Thus for instance, "*Frontiers in Evolutionary Psychology*", while squarely focused on Change and Differences as its central perspective, can clearly interest different levels of organization. Likewise, "*Frontiers in Theoretical and Philosophical Psychology*" is perhaps best seen as forming the background against which our cube is depicted inasmuch as the questions the specialty will address could potentially concern any domain, any perspective, or any method that has something to do with the discipline as a whole.

The singular "Grand Challenge" for the Psychological Sciences, as they blossom in the 21st century, is thus clearly integration – a stance that prominent colleagues such as Mischel (2004) have long been promoting. Not only is it high time that we start speaking to each other, but it may also be the case that doing so is absolutely essential for psychology to thrive as a discipline of its own in the future. Everybody else, indeed, feels like a psychologist today. Even physicists sometimes feel they have better answers than we do to particularly hard problems such as consciousness. But it takes considerable wits to design interesting psychology experiments, and this is not something that comes cheap. As one famous pioneer in neuroimaging methods once confessed to me, "The most interesting part of any neuroimaging study is the behavioral paradigm". Designing such experiments is what psychologists do best, and I am convinced that excellence in experimental design and behavioural methods will remain the greatest strength of psychology in the future.

Thus, the Rubik's cube of Psychology depicted in **Figure 1** needs to be set right! But perhaps not in the way a real Rubik's cube is set right, that is, by attempting to obtain uniformly colored surfaces, but instead by twisting and turning it in such a way that each face contains as many different colors as possible, so fostering fecund conjunctions where the colors blend into each other at the seams… For indeed this appears to be the only forward in psychology, as much as it is true that it makes little sense to speak of pathological states in the face of disagreement about what is normal; as much as it is true that the inductive reasoning fostered by observation should be followed by the deductive reasoning made possible by experimentation; as much as it is true that cognition can only be understood in the social context in which information processing takes place.

Now is thus the time to expand our thinking and cast our conceptual nets in a way that is relevant to psychology as a whole. Instead of having each of us retreat to his or her own little space of our collective cube, we should instead strive to expand our reach so as to make psychology fully assume its role as a modern "hub" discipline, a discipline through which Man can be understood in his full complexity, from individual differences to social trends, from neurons to emotions. This is no simple task; it is indeed a "grand challenge"; one that I am confident *Frontiers in Psychology* will help address.

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