



RETRACTED: Increasing interpersonal trust through divergent thinking

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Interpersonal trust is an essential ingredient of many social relationships but how stable is it actually, and how is it controlled? There is evidence that the degree of trust into others might be rather volatile and can be affected by manipulations like drawing attention to personal interdependence or independence. Here we investigated whether the degree of interpersonal trust can be biased by inducing either a more integrative or a more focused/exclusive cognitive control mode by means of a creativity task requiring divergent or convergent thinking, respectively. Participants then performed the trust game, which provides an index of interpersonal trust by assessing the money units one participant (the trustor) transfers to another (the trustee). As expected, trustors transferred significantly more money to trustees after engaging in divergent thinking as compared to convergent thinking. This observation provides support for the idea that interpersonal trust is controlled by domain-general (i.e., not socially dedicated) cognitive states.

Keywords: control-state, interpersonal trust, divergent thinking, convergent thinking

INTRODUCTION

Increasing evidence suggests that the degree to which people trust others can vary. First, evidence for inter-individual variability comes from intercultural and religious studies, which revealed that interpersonal trust is stronger in collectivistic cultures than in individualistic cultures that emphasize the independence of self and other (for an overview see Buchan et al., 2002). Second, the degree of interpersonal trust is sensitive to situational factors, such as self-construal tendencies. For example, drawing participants' attention to either personal interdependence (e.g., by instructing them to circle all relational pronouns in a text, such as "we," "our," and "us") or independence (by having them to circle pronouns such as "I," "my," and "me") has been demonstrated to modulate the degree of interpersonal trust (Maddux and Brewer, 2005), increasing and decreasing the effect, respectively. Third, positive mood and the neuropeptide oxytocin seem to boost the degree to which people trust others (Capra, 2004; Kosfeld et al., 2005). Interestingly, recent studies have shown that the effects of oxytocin in the social domain are confined by features of situations and characteristics of individuals (Bartz et al., 2011). For instance, Tops et al. (2013) reported trust scores to increase with salivary oxytocin levels under conditions of social novelty but to decrease with such levels under conditions of social familiarity. Finally, Colzato et al. (2013a) demonstrated that interpersonal trust can be enhanced by administering the food supplement L-tryptophan, the biochemical precursor of serotonin.

Taken together, these results indicate that interpersonal trust is a rather volatile, dynamic state that adjusts to the situation at hand. In other words, the degree to which one individual trusts another does not seem to reflect just a trait or some overlearned cultural bias but, rather, a particular state (or set of states) of the cognitive system. If so, it must be possible to control one's degree of interpersonal trust—be it directly

(by means of an explicit decision) or indirectly (by engaging in some mental activity that is associated with a cognitive state affecting trust, as in the study of Maddux and Brewer, 2005). In the present study, we focused on the latter, more indirect kind of control by inducing particular (non-social) cognitive control states¹ or control styles by means of creativity tasks.

As we have demonstrated elsewhere, tasks tapping into convergent thinking are associated with (i.e., are likely to induce) a sort of "exclusive" thinking while tasks tapping into divergent thinking are associated with a more "inclusive/integrative" thinking style (Fischer and Hommel, 2012; Hommel, 2012). Interestingly for our purposes, adopting such thinking styles affects the processing of social information in systematic ways. As reported by Colzato et al. (2013b), people are more likely to relate their own actions to that of a co-actor in the context of a divergent thinking task than in the context of a convergent thinking task. This suggests that divergent thinking requires or tends to establish a cognitive control state that promotes self-other integration. Also of interest, the same effect (i.e., more self-other integration) can be achieved by drawing participants' attention to personal interdependence by having them to circle relational pronouns in a text (Colzato et al., 2012a). The observation that this latter manipulation also increases mutual trust (Maddux and Brewer, 2005) suggests that divergent thinking and attending to personal interdependence tend to induce the same cognitive control state, which again would predict that engaging in divergent thinking should promote interpersonal trust. To be more specific, interpersonal trust should be more pronounced after

¹Cognitive control is commonly defined as the ability to regulate one's attention, thought, and behavior (e.g., Monsell, 1996). Along these lines, we define cognitive control states as cognitive or neural states that, once established or activated, regulate attention, thought, and behavior in particular ways.

engaging in divergent thinking than after engaging in convergent thinking².

We tested this prediction by having participants perform a behavioral trust game (Camerer and Weigelt, 1988), a task widely used in behavioral economics to measure interpersonal trust, after having them perform either a convergent thinking task or a divergent thinking task. Like Fischer and Hommel (2012), we used Mednick's (1962) Remote Associates Task (RAT) to induce convergent thinking and Guilford's (1967) Alternate Uses Task (AUT) to induce divergent thinking. Convergent thinking is considered to occur "when cognition is used to identify one correct or conventional answer" (Kozbelt et al., 2010, p. 32). Accordingly, the RAT confronts participants with three unrelated words in each trial, such as "night," "wrist," and "stop," and requires them to report the one common associate ("watch")³. In contrast, divergent thinking is considered a process triggering many new ideas in a context where more than one solution is correct, such as with brainstorming (Guilford, 1950, 1967). Accordingly, in the AUT participants are presented with a particular object, such as a bottle, and then asked to generate as many likely uses of this object as possible. If the RAT induces a more exclusive control state while the AUT induces a more integrative state, interpersonal trust should be more pronounced after performing the AUT than after performing the RAT.

Given that our experimental manipulation is targeting an unobservable state, we were interested in measures that might be diagnostic about the degree to which our manipulation actually worked. Interestingly, engaging in convergent thinking induces more negative mood and less pleasure than performing a brainstorming task (Akbari Chermahini and Hommel, 2012). We would thus expect participants to experience less pleasure after the convergent thinking task than after the divergent thinking task. To check for that, we also assessed pleasure and arousal of our participants, and we did so before and after the creativity task, and at the end of the experimental session.

MATERIALS AND METHODS

PARTICIPANTS

Forty healthy young adults, with a mean age of 20.0 years (SD = 2.0, range 18–25; 4 males, 36 females), participated for partial fulfillment of course credit or a financial reward. Written informed consent was obtained from all participants after a

²One might consider it useful to include a neutral control condition with no particular control state. However, this is difficult to achieve for both theoretical and practical reasons. Theoretically, it is difficult to see how humans can be prevented from adopting a particular control state, or to experimentally induce a state that is neither integrative nor exclusive. Practically, students being tested in an academic setting are very likely to be biased toward convergent thinking—the thinking style they are taught to adopt and practice on a daily basis—which is likely to account for the frequent finding that divergent thinking interventions have stronger effects than convergent thinking interventions (e.g., Colzato et al., 2012b).

³Note that there is no task that might be considered to provide a pure measure of convergent or divergent thinking, so that each of the two tasks we were using has convergent and divergent aspects to it. Nevertheless, it seems clear that the RAT relies more on convergent than on divergent thinking, while the opposite is true for the AUT. Moreover, performance in these two tasks is commonly uncorrelated and differentially affected by further manipulations (Akbari Chermahini and Hommel, 2010), suggesting that the processing overlap is not substantial.

detailed explanation of the study procedures. The protocol was approved by the local ethical committee (Faculty of Social and Behavioral Sciences, Leiden University).

APPARATUS AND STIMULI

Remote Association Task (convergent thinking)

In this task, which we adopted from Colzato et al. (2012b), participants were presented with three words (such as cottage, swiss, and cake) and were asked to find a common associate (cheese). Our Dutch version comprised of 15 items (Akbari Chermahini et al., 2012), which were to be responded to within 10 min.

Alternate Uses Task (divergent thinking)

In this task, which we also adopted from Colzato et al. (2012b), participants were asked to list as many possible uses for two common household items (pen, bottle) within 10 min. The results can be scored in several ways with flexibility, the number of different categories used, often being the most consistent and reliable one (Akbari Chermahini and Hommel, 2010).

Trust Game

The task assesses the extent to which one person (the trustor) trusts another person (the trustee), as indicated by the number of money units transferred from trustor to trustee (Camerer and Weigelt, 1988). Participants were invited in (unacquainted) pairs to emphasize the social-game aspect. After having been introduced to each other by the experimenter, members of each pair were seated in two separate cubicles and led to believe that one of them would play the role of trustor and the other the role of trustee (in reality, both of them were trustors). Trustors were endowed with €5 and could decide how much of this amount to transfer to the trustee. Transferred money would be multiplied by three, after which the trustee could reciprocate by giving part of this tripled amount back to the trustor. Thus, by transferring eurocents to the trustee, the trustor could gain extra endowments, but only if the trustee would give enough money back—which makes the amount transferred by the trustor an indicator of interpersonal trust (Meijnders et al., 2009).

PROCEDURE AND DESIGN

Convergent and divergent conditions were created by presenting participants with one of the two paper and pencil creativity tasks (a convergent thinking task and a divergent thinking task). Upon arrival, participants were individually asked to rate their mood on a 9 × 9 Pleasure × Arousal grid (Russell et al., 1989) with values ranging from -4 to 4. Next, 20 participants were asked to perform the RAT (based on Mednick, 1962, and translated into Dutch) for 10 min to induce convergent thinking before rating again their mood and completing the trust game. The other 20 participants carried out the AUT (Guilford, 1967) for 10 min to induce divergent thinking before performing the trust game. After having completed the trust game participants rated their mood for the third time. Participants were told that the study was about decision-making, but all of them were unaware of the more specific purposes of the study and the hypothesis being tested.

STATISTICAL ANALYSIS

The data from all participants were considered in the analyses and a significance level of $p < 0.05$ was adopted for all tests. A *t*-test for independent groups was performed to assess differences between the two groups (Convergent vs. Divergent) in the amount of money transferred. Pleasure and arousal were analyzed separately by means of two repeated-measures analyses of variances (ANOVAs) with effect of time (first vs. second vs. third measurement) as within-subjects factor and group (Convergent vs. Divergent) as between-participants factor.

RESULTS

CREATIVITY TASKS

Performance was good and comparable to performance in similar studies (e.g., Akbari Chermahini and Hommel, 2010). Participants produced about five correct responses on average in the RAT ($M = 4.9$ and $SD = 2.3$) and used about six different categories in the AUT ($M = 6.4$ and $SD = 2.4$).

TRUST GAME

As hypothesized, participants transferred significantly more euros to the trustee (the other participant of the couple) in the divergent (3.47, $SD = 1.33$) than in the convergent group (2.60, $SD = 1.31$), $t(38) = 2.08$, $p < 0.05$, $d = 0.67$.

MOOD

An ANOVA performed on the scores from the arousal scale revealed no significant main effect, $F(2,76) = 1.28$, $p > 0.28$, or interaction between group and time, $F(2,76) = 2.54$, $p > 0.08$. Arousal levels were thus comparable across group and time (−0.35 vs. 0.30 vs. 0.55 for participants in the convergent group and 1.05 vs. 0.75 vs. 0.95 for participants in the divergent group).

An ANOVA performed on the scores from pleasure scale showed a significant main effect of group, $F(1,38) = 7.03$, $p = 0.01$, $\eta_p^2 = 0.16$, reflecting higher pleasure in the divergent group (1.43) than in the convergent group (0.43). Both the main effect of time, $F(2,76) = 4.08$, $p = 0.02$, $\eta_p^2 = 0.10$, and the interaction, $F(2,76) = 3.96$, $p = 0.02$, $\eta_p^2 = 0.09$, were also significant. *Post hoc* (Newman-Keuls) analyses showed that pleasure levels were constant across the three measurements in the divergent group (1.35 vs. 1.45 vs. 1.50, $ps \geq 0.70$) but dropped significantly from the first (0.60) to the second measurement (−0.15; $p = 0.006$), and significantly increased again in the third measurement (0.85; $p = 0.0009$) in the convergent group (the difference between first and third measurement was not significant, $p = 0.34$). The interaction was thus driven by particularly bad mood (i.e., lower pleasure) after having performed the divergent thinking task, which replicates the findings of Akbari Chermahini and Hommel (2012) and was further confirmed by the fact that the two groups differed at the second measurement only ($p = 0.004$).

To rule out the possible influence of pleasure levels in mediating the observed relationship between the degree of interpersonal trust and the induced cognitive control state, Pearson correlation coefficients were computed between the amount of money transferred and the levels of pleasure at the second measurement and the change in pleasure between the first and second measurement,

separately for the two groups. No significant correlation was found, $ps \geq 0.17$.

DISCUSSION

As expected, interpersonal trust was more pronounced in the Divergent than in the Convergent group. This suggests that the two creativity tasks established different control states, which again had a different impact on the degree to which participants trusted others. These findings provide support for the idea that interpersonal trust is a volatile state that is under some degree of cognitive control. Even though there is no reason to assume that our participants exerted intentional control of the degree of trust they executed, the control states that we managed to establish by means of the creativity priming tasks turned out to be effective for the participants' degree of interpersonal trust. These observations are in line with studies showing that interpersonal trust is sensitive to various situational and environmental factors (Buchan et al., 2002; Capra, 2004; Maddux and Brewer, 2005; Colzato et al., 2013a).

The fact that we were able to modify interpersonal trust through a logically unrelated task suggests that the degree of trusting each other is controlled the same way as other cognitive operations are. As we did not include a neutral condition (as this would be difficult to conceptualize²), we are unable to determine whether the impact of the two creativity tasks was symmetrical and comparable in size. However, based on previous creativity studies (e.g., Colzato et al., 2012b) we suspect that having tested students in an academic environment (which emphasizes convergent thinking) might have rendered the divergent manipulation more effective. In any case, however, the type of thinking seems to have a systematic impact on interpersonal trust. Although our sample was not balanced with respect to gender, this cannot account for the effect of divergent thinking on trust, because the four male participants were evenly distributed across conditions. Nevertheless, future follow-up studies should include a more balanced sample.

As expected, we observed that convergent thinking had a negative impact on mood. This replicates the previous observations of Akbari Chermahini and Hommel (2012) and provides converging evidence for our assumption that the two creativity tasks created different cognitive states. One might be tempted to consider mood an alternative factor that was responsible for the observed trust effect. However, although such an explanation would fit with previous observations that trust can change as a function of mood (Capra, 2004), it seems unlikely to apply to our data, as suggested by the absence of any correlation between pleasure levels and amount of money transferred.

One may wonder whether the trust game solely measures interpersonal trust. After all, one may argue that the trustor simply has a desire to increase his/her own gains, and – by transferring money to the trustee – may be willing to take the risk to achieve this (see e.g., Sapienza et al., 2007; Fehr, 2009). According to this reasoning, the trust game may not (or not only) measure interpersonal trust, but (also) the trustor's risk attitude. However, Houser et al. (2010) showed that people's risk attitudes did predict behavior in individual investment decisions, but not in the trust game. As Houser et al. (2010) point out, these results favor the "trust" interpretation of decisions in the trust game over the "risk-taking" interpretation.

Even though our study did not include neurophysiological measures, and thus cannot directly inform about the neural underpinnings of our effects, we would like to conclude by considering theoretical connections to two recent neuroscientific approaches. For one, Hecht (2014) has suggested that the right cortical hemisphere has a relative advantage in mediating pro-social attitudes and behaviors. Given the available evidence that the right hemisphere is also specialized in holistic, integrated perception and representation (Hellige, 1996; Christie et al., 2012), integrative processing and the processing of trust-related information might thus share cortical circuits—which again might account for mutual priming effects of the sort suggested by our findings. For another, there is a connection to the *predictive and reactive control systems* theory (PARCS) suggested by Tucker et al. (1995) and Tops's (2014; see also Tops et al., 2014) recent application of this theory to the formation of social attachment and interpersonal trust. According to Tops, oxytocin and serotonin facilitate the process of shifting between different control states. Interestingly, one of the postulated control states is considered to be more reactive and assumed to promote local and convergent processing, while another is more active/predictive and assumed to promote global and divergent processing. Given that PARCS suggests associations between trust to strangers and divergent thinking on the one hand and between trust to in-group members and convergent thinking on the other (cf., Tops, 2014), this conception would fit with our idea that convergent thinking and divergent thinking establish two different cognitive control states and that the state associated with divergent thinking promotes trust to unfamiliar others.

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