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The role of Theory of Mind in assessing cooperative intentions

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ABSTRACT

Folk wisdom indicates that people vary in the extent to which they can assess others' cooperative intentions. In two studies we investigated whether Theory of Mind (ToM), the ability to represent mental states of others, is related to accuracy in the recognition of cooperativeness. Participants completed a ToM task and were asked to assess either video clips of people playing a variation of a Prisoner's Dilemma (PD) game (Study 1, $N = 88$), or photographs of people playing PD taken at the very moment when they were expressing a decision to cooperate or to defect (Study 2, $N = 99$). We found relationships between ToM and cooperative intention recognition only in Study 1, when participants were exposed to long versions of the video clips. In contrast to previous reports, participants in our samples did not score higher than chance in cooperativeness assessment except for Study 1 in the condition with short video clips. Our results question human expertise at identifying defectors and cooperators and do not provide clear support for an association between ToM and cooperativeness assessment. The findings are discussed from the perspective of an evolutionary arms race between interpreting and masking cooperative intentions.

1. Introduction

Large scale cooperation towards unrelated individuals has been identified as a potential driving force behind the evolution of human-specific cognitive machinery (Dunbar, 2003; Hill, Barton, & Hurtado, 2009; Moll & Tomasello, 2007). According to Dunbar (2003), increased group size and, in consequence, more complex social interactions often involving encounters with strangers, put pressure on human cognitive capacities. Not being able to directly observe other individuals' actions creates a problem of how to keep track of free-riders. Free-riders undermine the stability of social systems by reaping the benefits without incurring the costs in cooperative interactions. The need to detect free-riders and maintain high levels of cooperation could explain the existence of language (Dunbar, 1996), some of the pro-social emotions (Price, Cosmides, & Tooby, 2002), and socially oriented reasoning (Cosmides & Tooby, 1992).

When meeting strangers, the means to assess someone's cooperative intentions may include reading subtle cues from a face or interpreting non-verbal body language. Evolutionary research shows that faces reveal important information about potential mates and social partners (e.g. Rhodes, 2006; Stirrat & Perrett, 2010). Decisions about who to trust are affected by stable facial features, e.g. attractiveness, similarity to kin or facial width (for a summary see Stirrat & Perrett, 2010). People also use others' facial expressions to determine cooperative intentions and, as reported by Verplaetse and colleagues (2007), after viewing photographs of individuals playing a Prisoner's Dilemma game, can correctly identify cooperators and defectors with a probability higher than chance.

Theoretically, there could be two opposing evolutionary pressures acting on human cognition: one promoting cooperative intention recognition and another one favouring masking uncooperative intentions (see Hanley, Orbell, & Morikawa, 2003). In fact, signals of cooperation might evolve to be deceptive in a similar way as it occurs in the mating context in animals, e.g. some male crickets instead of a nutritionally valuable nuptial gift may offer a female an empty silken balloon (Maynard Smith & Harper, 2003). The co-evolution of cooperative intention detection and disguising uncooperative intentions would result in an overall low ability to predict cooperativeness (Dawkins & Krebs, 1979). Results from lie-detection research indicate that on average, people are poor judges of dishonesty (see Bond & DePaulo, 2006, for a review). Nevertheless, there are some individuals who appear to be able to reliably detect lies (O'Sullivan & Ekman, 2004). Unlike lie-detection, a number of recent studies suggest that people perform better than chance when assessing others' cooperativeness, but there is also a considerable individual variation in this ability (e.g. Brown, Palameta, & Moore, 2003; Fetchenhauer, Groothuis, & Pradel, 2010; Frank, Gilovich, & Regan, 1993; Oda, Naganawa,

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Yamauchi, Yamagata, & Matsumoto-Oda, 2009; Oda, Yamagata, Yabiku, & Matsumoto-Oda, 2009; Verplaetse, Vanneste, & Braeckman, 2007). Could this variation be explained by between-individual differences in the Theory of Mind (ToM)?

ToM is one of the dimensions of social intelligence and refers to the ability of reading others' minds, i.e. understanding and interpreting mental states of others. It consists of at least two components subserved by different neural mechanisms (Sabbagh, 2004). The social-perceptual component involves reading facial or body cues and from them representing others' thoughts and desires. In the classic task testing this skill participants have to visually assess an individual's mental state from a photograph of their eye region (Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001). The social-cognitive component, on the other hand, describes the capacity to infer about the reasoning of others, e.g. ''I suppose he thinks...''. Social-cognitive ToM can be represented hierarchically by using different levels of social embeddedness, e.g. ''I understand that you want me to believe that he thinks...''. The classic task measuring the social-cognitive component involves reading or listening to stories about characters socially interacting with each other. Participants are then asked to answer questions about the characters' beliefs containing different levels of embeddedness (Stiller & Dunbar, 2007).

Are there any grounds for expecting a positive relationship between ToM and the ability to assess cooperative intentions? A person with high ToM skills, by definition, should be able to infer about others' mental states pertaining to cooperative behaviour. The Eyes Task, used to measure the social-perceptual component of ToM, relies on attributing a belief or an intention to a person (Baron-Cohen et al., 2001). People scoring high on this task should also excel at recognising cooperative or uncooperative plans of others. Cooperation and defection invoke certain emotions such as gratitude, liking, nervousness, shame or anger. Hence, the ability to recognise such emotions correctly might help in determining someone's cooperative intentions. People can inhibit the expression of true emotions, however, true emotions will usually manifest themselves as microexpressions lasting for 1/25–1/5 of a second (Ekman & Friesen, 1969) or slightly longer expressions that do not match the intended or declared expressions (Porter & Brinke, 2008). Proficiency in recognising emotions in general may translate to spotting any false or inconsistent emotions and in consequence, the willingness to behave uncooperatively. Alternatively, another cue of cooperativeness could be emotional expressiveness itself: cooperative individuals display more both positive and negative emotions (Boone & Buck, 2003; Schug, Matsumoto, Horita, Yamagishi, & Bonnet, 2010). Predicting others' cooperative behaviour could also be related to the social-cognitive component of ToM. In this case, however, it is more likely that individuals of high ToM skills would make more accurate assessments of cooperative intentions based on third-party information (gossip) rather than on facial cues.

This research examines the possible role of social intelligence in cooperative intention assessment. In order to determine whether cooperativeness recognition could be linked to ToM skills we conducted two studies. In Study 1, participants completed the ToM task measuring the social-perceptual component, and were asked to assess the cooperativeness of contestants in a TV game show "Golden Balls". We investigated the ability to predict cooperativeness under both short and long exposures to the stimuli. Our rationale for varying the length of the stimuli is that there is evidence for more than one cooperative intention recognition mechanism. People can form accurate impressions of others very quickly (Bar, Neta, & Linz, 2006). However, analysing speech content also aids in detecting lies (Vrij & Mann, 2004), and long clips provide much more verbal information than short ones. To explore these putative recognition methods, we used two classes of stimuli, in the hopes of capturing these differences. In Study 2, we used photographs of people who cooperated or defected in a Prisoners' Dilemma game. We administered both the social-perceptual and the social-cognitive ToM measures and examined participants' ability to guess the cooperative decisions of the photographed people. For both studies we predicted that social-perceptual ToM would be positively associated with cooperative intentions recognition. Based on research highlighting human sophistication in guessing cooperative intentions, we expected that participants would be able to correctly assign cooperative intentions with a probability higher than chance.

2. Study 1 – Method

2.1. Participants

72 females and 16 males (mean age = 24.10, SD = 10.27) were recruited from the student and general population in the North West of England. The study was approved by the psychology ethics committee at Liverpool Hope University.

2.2. Materials

2.2.1. Reading the mind in the Eyes test (Baron-Cohen et al., 2001)

This test consists of 36 pictures of pairs of eyes. Each picture is surrounded by four words depicting complex emotions. Participants are required to match the eyes with the correct emotion. Participants are provided with instructions, including a glossary for the terms used to describe the emotions. Each correct response scores a point. The test has been used as a measurement of affective Theory of Mind capacity in both clinical and non-clinical populations.

2.2.2. "Golden Balls" video clips

This test consist of 20 short video-clips (length varies between approximately 2 min and 5 s) recorded from the ITV game show "Golden Balls". In the show, contestants compete for sometimes large sums (up to £100,000) of money in a Prisoner's Dilemma-type of situation. At the end of each show, two of the remaining contestants try to convince each other about their intentions to share the money. In the case of mutual cooperation, the players split the money. In mutual defection, neither of the players receives the reward. If one of the players defects while the other cooperates, the defector receives all of the money while the cooperator loses everything.

In the present experiment, clips from 20 episodes are shown (six cooperator–cooperator pairs, five defector–defector pairs, and nine cooperator–defector pairs). Altogether, participants evaluated clips of 19 (12 females) defectors and 21 (14 females) cooperators. Half ($N = 44$) of the participants watched long versions (1–2 min) of the clips, where the game show contestants were verbally convincing each other about their intentions to share the money. The other half were shown short clips (1–5 s) at the time of the decision making, where the game show contestants had stopped talking, and were just about to reveal their decisions. Each correct guess scored a point. The clips were presented in a balanced order, alternating between different types of pairs (e.g. a clip of a cooperator–cooperator pair was always followed by clip of a different type, e.g. cooperator–defector pair). One of the pre-requisites for participation in the study was that participants had not seen the "Golden Balls" series before.

2.4. Procedure

Participants were tested either in their workplace, or in a quiet seminar room in University. The experiment consisted of completing the Eyes test, watching the "Golden Balls" video clips and guessing whether each contestant would "split" or "steal" the money. Additionally, for exploratory purposes we collected various measures of participants' tendency to cooperate, which are not reported in this paper. The testing sessions lasted approximately 45–60 min.

3. Study 1 – Results

All of the scaled data were normally distributed (see Table 1 for descriptive statistics). We first investigated whether participants could assesses the cooperativeness of "Golden Balls" players with a probability higher than chance, and then, we conducted an omnibus ANOVA to explore the reasons for variation in cooperativeness assessment.

A one-sample *t* test comparing participants' performance to chance level indicated that, in general, participants were not able to guess the cooperativeness of "Golden Balls" players with a probability higher than chance ($M = 20.42$, $SD = 3.23$, $t(87) = 1.22$, $p = 0.225$). However, participants in the short-clip condition did perform better than chance ($M = 21.04$, $SD = 3.29$, $t(43) = 2.11$, $p = 0.04$). In the long-clip condition the accuracy did not reach the above chance level ($M = 19.79$, $SD = 3.07$, $t(43) = -.44$, $p = 0.661$).

Next, we ran an omnibus ANCOVA with the cooperation status of the assessed person as a within-subject variable, the length of the stimulus as the between-subjects variable, the ToM score as the covariate and the proportion of correctly assessed "Golden Balls" players as the dependent variable. There was a significant main effect of the cooperation status ($F(1,85) = 4.899$, $p = 0.03$). Participants correctly assessed a higher proportion of cooperators ($M = 0.54$, $SD = 0.15$) than defectors ($M = 0.48$, $SD = 0.14$). We also found an interaction between the cooperation status and the length of the stimuli ($F(1,85) = 19.185$, $p < 0.001$). This interaction was driven by a difference in accuracy when judging defectors in short vs. long clips (see Fig. 1). Participants viewing short clips ($M = 0.54$, $SD = 0.11$) correctly identified a higher proportion of defectors than those viewing long clips ($M = 0.41$, $SD = 0.13$; $t(86) = 4.934$, $p < 0.001$).

There was also a significant interaction between the cooperation status of the assessed person and the participant's performance on the ToM test ($F(1,85) = 6.968$, $p = 0.01$). Because of the variation in performance in short vs. long clips, we investigated this interaction separately for each condition. In the short-clip condition there was no correlation between either the performance in ToM and the accuracy in judging cooperators ($r(44) = -0.076$, $p = 0.673$) or defectors ($r(44) = -0.231$, $p = 0.132$). However, in the long-clip condition, we found a positive correlation between ToM performance and identification of cooperators ($r(44) = 0.352$, $p = 0.019$). There was also a negative correlation between ToM performance and identifying defectors ($r(44) = -0.316$, $p = 0.036$). Additional analysis on the possible gender bias in assessing male and female faces can be found in the Supplementary material.

Table 1
Mean scores (*M*) with standard deviations (SD) for the tasks used in Study 1.

Task	*M* (SD)	Observed range	Maximum possible score
The Eyes test	26.20 (3.92)	16–34	36
"Golden Balls" clips (short)	21.04 (3.29)	16–30	40
"Golden Balls" clips (long)	19.79 (3.08)	14–27	40

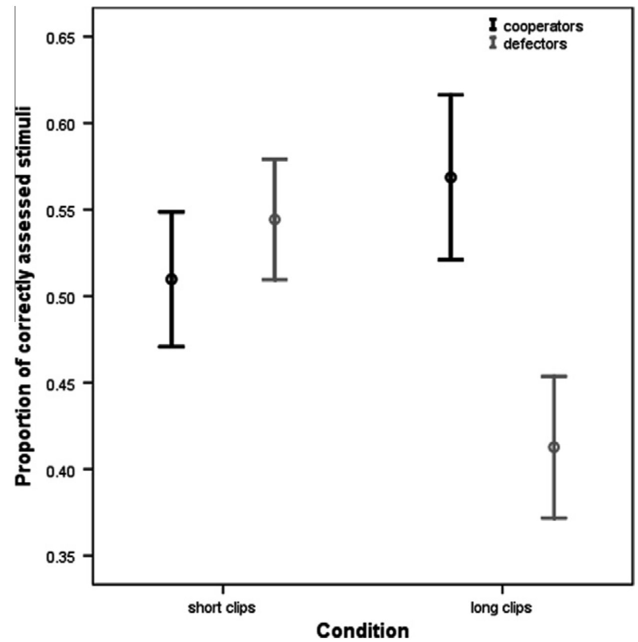

Fig. 1. Differences in the proportions of correctly identified cooperators and defectors in short and long clips. Data points are the mean proportions, with 95% confidence intervals.

4. Study 2 – Method

4.1. Participants

We collected data from 100 participants, 15 males and 84 females (mean age = 20.0, SD = 2.76). The sex and age of one participant was unknown. In the analysis only data from English native speakers or non-native speakers who spent at least 1 year in the UK were used (99 participants). Students were asked to do the study in a computer cluster after they finished their class in research methods. The tasks, presented in a random order using Qualtrics survey software, took approximately 40 min to complete and the students were rewarded for their time with course credits. The study was approved by Newcastle University Psychology Ethics Committee.

4.2. Materials

4.2.1. Social-cognitive ToM task – an updated version of the one used by Stiller and Dunbar (2007)

Participants were asked to listen to a set of five short stories describing social situations (e.g. about a woman trying to receive a wage increase from her boss) and answer ten memory questions (true or false) after each story was presented. Five questions referring to different levels of ToM were mixed with five questions about the factual content of the story. ToM questions involved between two (e.g. 'Emma wanted more money.') and six (e.g. 'Emma believed that Jenny hoped that her boss, the greengrocer, would believe Emma's claim about the chemist wanting to offer her a job.') levels of embedding. The questions pertaining to factual events also involved different levels of complexity and were included in order to control for the participant's understanding of complex sentences. The stories were recorded by a professional actor (D.N.) using high-tech equipment. For analysis we calculated the number of correctly answered intentionality and factual questions in all stories.

4.2.2. Assessing cooperativeness of faces (Verplaetse et al., 2007)

Participants were presented with a set of 26 photographs used as stimuli in a previous study (Verplaetse et al., 2007). The photographs depicted faces and torsos of Belgian students who had played a Prisoner's Dilemma (PD) game. The photographs were taken at the very moment when the students were expressing a decision to cooperate or defect. Participants were first familiarised with the PD game and had to pass a comprehension test in order to proceed. Then, the photographs of 13 cooperative (four females) and 13 defecting (six females) faces were presented to them in a random order, each accompanied with a question of whether the photographed person cooperated or defected.

4.2.3. Reading the mind in the Eyes test (Baron-Cohen et al., 2001) described in Section 2

5. Study 2 – Results

In order to satisfy the assumption of normal distribution scores for cooperative intentions assessment were square rooted and scores for the Eyes test were cubed. Table 2 presents descriptive statistics for the measures used in the study. Scores for cooperative intentions assessment differed from chance but in an unexpected direction: participants accurately identified cooperative intentions with a probability lower than chance (one-sample t test comparing the square rooted chance level of 13 to participants' performance, $M = 12.66$, $SD = 0.34$ ($t(98) = -2.01$, $p = 0.05$).

Next, we ran a similar ANCOVA analysis to that in Study 1. We used cooperation status as the within-subject factor, two covariates: social-cognitive and social-perceptual ToM scores, and the proportion of correctly assessed faces as the dependent variable. There was no effect of cooperation status ($F(1,98) = 0.481$, $p = 0.49$). Also, none of the interactions with the within-subject variable were significant. We then ran correlations which confirmed that there was no relationship between either the social-cognitive or the social-perceptual ToM score and the ability to assess cooperative intentions ($r(97) = .039$, $p = 0.701$ and $r(97) = -.036$, $p = 0.721$, respectively). Using a power calculator, we estimated that with our sample size and the anticipated medium effect size (0.15) the probability of rejecting a false null hypothesis was over 90%.

6. General discussion

A number of recent reports stress human ability to predict others' cooperative behaviour from immediately available facial and bodily cues (e.g. Fetchenhauer et al., 2010; Oda, Yamagata, et al., 2009; Verplaetse et al., 2007). Our results raise questions about the notion that people can, on average, assess cooperative intentions with a probability higher than chance. Overall, participants in our studies did not show proficiency in identifying cooperators and defectors. Only in Study 1 when viewing short clips did participants guess cooperative intentions with a probability higher than chance, but this effect was weak. One possible explanation might be that, in the long clips, verbal communication and contestants' efforts to appear cooperative hindered the assessment of cooperativeness. Also in the "Golden Balls" TV show itself, people did make many mistakes when judging others' intentions. Data from 281 episodes of the "Golden Balls" game demonstrate that in 44.1% of episodes one player decided to cooperate while the other one defected (Van den Assem, Van Dolder, & Thaler, 2010). Clearly, cooperators in those pairs failed to guess what their partner would do and misinterpreted cues of defection. In general, in Study 1 cooperators were easier to recognise than defectors. "Golden Balls" players, who did not intend to defect, could act naturally and were probably not sending conflicting information. However, when we consider the short-clip condition only, participants were more accurate at recognising defection. It is possible that defectors were able to successfully mask their intentions, with the information they provided during the long-clips, but failed to do so when judges focused on the crucial decision-making moment when masking might have been imperfect.

Table 2
Mean scores (M) with standard deviations (SD) for the tasks used in Study 2.

Task	M (SD)	Observed range	Maximum possible score
ToM intentionality score	19.68 (2.42)	11–24	25
ToM memory score	20.37 (1.95)	15–24	25
Eyes test	27.57 (3.95)	10–35	36
Cooperative assessment	12.99 (2.80)	8–19	26

The argument that the only factor impairing participants' ability to correctly predict cooperativeness is noise, caused by additional information, can be rejected by the results of Study 2. Although we used the same stimuli as Verplaetse et al. (2007), participants in our sample did not identify cooperative intentions with a probability higher than chance. One possible methodological reason for this difference is the fact that in Study 2, we used only event-related photographs whereas in Verplaetse et al. (2007) study participants could see each face in three contexts: neutral, practice round, and proper round. Perhaps it is necessary for people to see how an event-related face varies from the neutral face in order to pick cues of cooperation or deception.

Humans evolved surrounded by moving and not static faces of others, hence being able to assess biological motion may contribute to the accuracy of distinguishing cooperators from defectors. Movement has been shown to play a role in assessing traits important in mate choice (e.g. Brown et al., 2005), so it could also affect the way in which people perceive partners for cooperative interactions. As demonstrated by Brown et al. (2003), smiling and dynamic expressions under involuntary control, which could have been observed in Study 1 video clips but not in Study 2, were more typical of altruists than non-altruists. This may be the reason why participants performed best when judging the intentions of moving rather than static faces and in the crucial decision making moment rather than for a longer period of time when their judgements could have been affected by persuasion techniques.

The difficulty in assessing cooperative intentions might also have been caused by the ambiguous motives for defection in the one-shot PD. An individual can decide to defect in order to gain the whole reward (in which case he deserves to be called a "cheater") or because of caution and in order not to receive the sucker's payoff. Our results support other reports in which assessments of honesty in faces were not related to real honesty (Zebrowitz, Voinescu, & Collins, 1996). Conceptually, under the assumption that people can accurately distinguish cooperative types, defectors should almost disappear from the population because no one would be willing to interact with them.

Although our results indicate that, on average, participants could not accurately discriminate between cooperators and defectors, it is still valid to examine a potential link between ToM and the ability to assess cooperative intentions. Research on lie detection suggests that, although people are generally poor at predicting deceptiveness, there is a subset of individuals, "the wizards of deception detection", who excel at this task (O'Sullivan & Ekman, 2004). We could imagine that a relatively small number of people who are able to correctly recognise cooperative intentions may have particularly sophisticated ToM skills. We predicted a positive relationship between the social-perceptual component of ToM and the number of correct guesses of cooperativeness. Our data do not allow for supporting this prediction, however, we did obtain some interesting results in Study 1, when participants were exposed to long versions of the clips. We found a positive relationship between ToM skills and the detection of cooperators. Cooperators in the "Golden Balls" show were likely to express consistent emotional states, and were not trying to hide their intentions. The emotional stimuli used in the Eyes test for assessing ToM, although complex, do not involve a mixture of two or more conflicting states. People with high ToM skills as measured by the Eyes Task may perform well at interpreting true, consistent mental states, but not states that are masked or mixed with other states. The negative relationship between ToM and the detection of defectors seems to support this reasoning.

If we assume that at least some people are capable of making correct judgements of cooperativeness, as suggested by the assessment of short clips in Study 1 and some previous studies (Fetchenhauer et al., 2010; Verplaetse et al., 2007), it may be that ToM and cooperative intention recognition employ different cognitive mechanisms. Alternatively, the hypothesis that mind reading ability in humans evolved in order to enable predicting cooperative intentions of anonymous individuals might still be valid under the assumption of a continuous arms race between the ability of cheaters to remain invisible and the ability of others to detect them. This arms race can be driving evolution even if at any point in time no one side is on top. High social intelligence could promote both reading and masking cues of deception. Such an interpretation would support the lack of the ability to assess cooperativeness that we report. Finally, ToM may not play such an important role in cooperative interactions as we expected. It has been shown that economic behaviour of autistic children in whom ToM skills are impaired does not differ dramatically from the behaviour of normally developing children (Sally & Hill, 2006). Perhaps the optimal strategies for playing PD and bargaining games are relatively independent of ToM skills.

In summary, our paper questions human proficiency in recognising cooperative intentions. The consequence of this inability may be the lack of a relationship between ToM and cooperativeness assessment. We believe our results are important in that they encourage caution when categorically asserting that humans can identify cooperative intentions from facial cues. Such findings are exciting and attractive, therefore might receive more attention and publicity than non-significant results which are likely to suffer from the file drawer problem (Møllerand & Jennions, 2001; Rosenthal, 1979). An interesting direction for future research would be to explore the arms race hypothesis that points to co-evolution of interpreting and masking cooperative intentions.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.paid.2011.09.005.

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