**Incongruent autobiographical trustworthiness information affects face
recognition: Empirical investigation of an adaptive memory for social exchanges**

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Abstract

Previous studies suggested we have adaptive abilities to detect cheats, but an alternative view is that rarer or unusual events in social exchanges are more memorable. This study examined how the congruency of information about individuals' perceived trustworthiness affected their recognition, compared to information about perceived intelligence. This was achieved by providing information about each individual's occupation and behaviour, which could be either congruent or incongruent for either trustworthiness or intelligence. Across four experiments, it was found that individuals tagged with low trustworthy rather than high trustworthy behaviours were recognized better, but no effect of congruency was found (Experiment 1a). Conversely, face recognition with incongruent rather than congruent trustworthiness was higher in Experiment 2a. No significant effects of intelligence were observed. These findings provide partial support for an ability to remember faces linked to rarer events specifically when such ability is relevant to social exchanges (trustworthiness).

Keywords: Social exchange; rarity, congruence; cheater detection; face recognition; trust

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Cosmides and Tooby (1992) state that aspects of human cognition are adaptive in social interactions and we have specifically evolved 'cheater detection' mechanisms that are important in guiding our involvement in social contracts. For example, successfully engaging in social contracts would have been adaptive for our ancestors, leading to specific mechanisms that allow us to detect cheats in such evolving. Such a mechanism has subsequently been shown empirically in reasoning tasks that mimic the conditions of social contracts (e.g. Chang & Wilson, 2004; Cosmides, 1989; Cosmides & Tooby, 1992; Fiddick, Cosmides, & Tooby, 2000; Fiddick & Rutherford, 2006; Gigerenzer & Hug, 1992; Sugiyama, Tooby, & Cosmides, 2002).

Similarly, a number of studies has shown that we are better able to remember the faces of cheaters than non-cheaters (e.g. Chiappe et al., 2004; Farrelly & Turnbull, 2008; Mealey, Daood, & Krage, 1996; Oda, 1997; Oda & Nakajima, 2010). However, further research has found no such enhanced memory for cheaters (Barclay & Lalumière, 2006; Mehl & Buchner, 2008) or has found enhanced memory for non-cheaters (Mehl & Buchner, 2008, Felisberti & Pavey, 2010). This suggests a more detailed investigation of just what is preferentially remembered in social contracts is necessary. Barclay (2008) suggests a more effective strategy would be an enhanced memory for behaviours that are *rare* in a population. Accordingly, he found that when cooperators were rarer in a population, participants recognised them better, but the opposite was true when defectors were rarer. Volstorf, Rieskamp, & Stevens (2011) also found better recognition of individuals exhibiting rarer behaviours in the Prisoner's Dilemma game, and also suggest that a more adaptive strategy in memory for social interactions would be based on flexibility to environmental changes. This suggests that

our ability to detect cheats is in fact the product of a more general, efficient and flexible adaptive cognitive mechanism (Bell & Buchner, 2012).

Such a mechanism, therefore, should respond to other salient cues about individuals that could indicate their potential behaviour in social contracts. For example, unusual or unexpected behaviours in social interactions have been shown to affect memory formation (Bettencourt, Dill, Greathouse, Charlton, & Mulholland, 1997; Jussim, Coleman, & Lerch, 1987). Moreover, participants showed higher subjective source memory for partners in economic games who behaved in ways contradictory to what was expected (Chang & Sanfey, 2009). Likewise, Suzuki & Suga (2010) found that when cues of trustworthiness in partners' faces contradicted their behaviour in an economic game, these partners were recalled better later. They suggest that this could be due to protective mechanisms against being exploited rather than a more general expectation violation effect. This suggestion is further supported by Hechler, Neyer, and Kessler (2016), who found that uncooperative individuals were better remembered if they were part of one's ingroup than an outgroup, due to expectations of cooperation among members of the former having been violated. Similarly, Süssenbach, Gollwitzer, Mieth, Buchner, & Bell (2016) report that individuals who were more sensitive to being victimised had an enhanced source memory for targets labelled as untrustworthy who then violated this with being labelled trustworthy subsequently (i.e. "trustworthy tricksters"). Finally, Bell, Buchner, Kroneisen, and Giang (2012) found similar results in a series of experiments with different cues of trustworthiness (ratings of facial trustworthiness and facial expressions in partners) with negative violations (i.e. high trust trait followed by low trust behaviour) being more important in later recognition.

It therefore appears that presenting incongruous information about other individual's trustworthiness enhances our memory of them in social interactions.

However, by concentrating only on either participants' subjective expectancy of behaviour (Chang & Sanfey, 2009) or facial cues of trustworthiness (Bell & Buchner, 2012; Bell et al., 2012; Hechler et al., 2016; Suzuki & Suga, 2010), previous research is limited in its scope by ignoring autobiographical cues of trustworthiness an individual can convey. Social psychology research has shown that we can accurately assess psychological traits in others using various information (e.g. Funder, 1999; Gosling, 2008), and the current study therefore seeks to expand our understanding by incorporating information on an individual's occupation as a possible signal of their trustworthiness. Also, this study examined if the effect of incongruous information on memory recall was limited to information specifically relevant to an individual's likely behaviour in social contracts (trustworthiness), or if it extended to other traits displayed by individuals that are not necessarily relevant to social contracts (i.e. intelligence), a possibility previous research has not fully considered. If it is only the former it suggests a more domain-specific cognitive mechanism that is adaptive for social contracts (Cosmides & Tooby, 1992) by protecting individuals from being exploited (Suzuki & Suga, 2010). However if it is the latter this therefore suggests a more domain-general attentional shift to expectancy violating information in human memory.

To do this, the current study reports on four experiments that test if incongruous information about either an individual's trustworthiness or intelligence leads to their better recognition by others. These four experiments varied the environments in terms of levels of attention and time constraints in which the mechanisms of encoding and recall would take place, to investigate how these may affect recognition. More specifically, Experiments 1a and 1b tested participants with time constraints on encoding and recall in less controlled experimental conditions, whereas Experiments 2a and 2b had no time constraints and was conducted in more controlled conditions.

Two hypotheses were raised; firstly, source memory for faces of individuals would be higher when information about their occupation and behaviour with regards to trustworthiness was incongruent than when it was congruent. Secondly, if an adaptive mechanism for social exchanges exists, then the effect of incongruency on face recognition would only be for information relevant for social contracts (trustworthiness) and not for information that is less relevant (intelligence).

Experiment 1

Methods

Participants.

There were 259 participants, who were undergraduate students at a UK University, and were recruited and mostly received course credits for participating. This study was approved by the university's ethics committee. There were 204 participants in Experiment 1a and 55 participants in Experiment 1b. Sample size was determined as meeting the adequate requirements based on effect sizes for similar findings in existing literature (e.g. Barclay, 2008). These were exceeded here due to the opportunistic nature of data collection outlined below.

Stimuli and materials.

Facial photographs of Caucasian males were gathered from a 2D face database (pics.stir.ac.uk). Eight images were selected on the basis of having neutral expressions and few distinguishing features.

Experiment 1a: Trustworthiness.

Thirty occupations were originally selected, then presented to a separate sample to the main study ($N = 7$). They rated each occupation for the perceived trustworthiness of each, on a Likert scale from 1 (“not at all” trustworthy) to 4 (“very much” trustworthy). From these ratings, eight occupations were selected by the authors to be included in the main study: four ‘low trust’ occupations (politician, lawyer, taxi driver, traffic warden) and four ‘high trust’ occupations (vet, fire fighter, paramedic, nurse)¹. Short specific descriptions of each individual’s behaviour were presented with each of the eight occupations. There were two versions of each description, which described the individual behaving in either a low trustworthy or a high trustworthy manner. Examples are presented below:

- Congruent (low trustworthy occupation with low trustworthy behaviour): *Andrew works as a Lawyer. He regularly enjoys eating out in restaurants with clients but never leaves tips for the service he receives.*
- Incongruent (low trustworthy occupation with high trustworthy behaviour): *Andrew works as a Lawyer. He regularly enjoys eating out in restaurants with clients and always leaves tips for the service he receives.*

Experiment 1b: Intelligence

Similarly to Experiment 1b, 23 occupations were also presented to a different sample ($N = 8$) who rated each occupation for the perceived intelligence levels of each, on a Likert scale from 1 (“not at all” intelligent) to 7 (“very much” intelligent). From

¹ Although mainly based on selecting lowest and highest mean ratings of trustworthiness, the authors also selected on the basis that there would be comparable overall levels of education and salary between the occupations in the low/high trustworthy categories.

these ratings, eight occupations were selected by the authors to be included in the main study. These included four 'low intelligence' occupations (cleaner, factory worker, taxi driver, builder) and four 'high intelligence' occupations (vet, lawyer, doctor, lecturer).

As with the trustworthiness condition, short descriptions of a specific behaviour of each individual were presented with each of the eight occupations. There were two versions of each description, which described the individual behaving in either a low intelligent or a high intelligent manner. Examples are presented below:

- Congruent (low intelligent occupation with low intelligent behaviour): *John works as a cleaner. His favourite types of TV programmes are soap operas and chat shows.*
- Incongruent (low intelligent occupation with high intelligent behaviour): *John works as a cleaner. He goes to his local community centre every Wednesday night to attend classes to learn a foreign language.*

Procedure.

This was conducted in large lecture theatres and the stimuli were presented on a screen for all participants to take part simultaneously and recorded their responses on paper versions provided to them of the study. Data was collected at the start of the same core first year lecture that is taught twice (i.e. different students attend on different days), and each class were presented with only one of the two conditions. In the encoding phase, images of faces of eight individuals were presented sequentially for a time limit of 20 seconds per face, each of which was accompanied by a description that stated the individual's occupation (either high or low trustworthy/intelligence) and a specific behaviour they engaged in (again either high or low trustworthy/intelligence).

For the four low occupations, two were presented with high behaviours, and the other two with low behaviours (which particular occupations were accompanied by high/low behaviours varied, and were randomly allocated). The same was true for the four high occupations. Additionally, the order in which these target individuals were presented within each condition was randomised before being presented to participants. After viewing each target individual and their description, participants were asked to rate them individually on measures of intelligence, attractiveness and trustworthiness on a 5-point Likert scale.

After seeing all eight individuals (eight occupations with either high or low behaviours), participants then completed a word search as a distracter task. This took only approximately 10 min to complete. Participants were then presented with an unexpected recognition task. Each of the eight faces seen in the previous section was presented individually, alongside three other previously unseen images. The horizontal strip had four images, with the target position randomly selected. Participants were required to select the face they remembered seeing in the encoding phase. On the same screen, participants were asked to select what they recalled that individual's occupation to be from a list of twenty different occupations (which contained the eight occupations used in the experiment). Each of these eight faces were again presented for a limit of 20 seconds. After completing this task, participants were notified of the completion of the experiment, debriefed and thanked for their participation. See Figure 1 for further details of the procedure.

Results

Experiment 1a: Trustworthiness.

A repeated measures ANOVA with behaviour (high vs low trust) and occupation (high vs low trust) revealed a significant main effect of behaviour only ($F_{1,203} = 8.00$, $p = .005$, $\eta^2 = .04$), with individuals who behaved in a low trustworthy manner, $M = 3.44$, $SD = .88$, being recalled better than those that behaved in a high trustworthy manner, $M = 3.23$, $SD = .99$.

Experiment 1b: Intelligence.

A similar repeated measures ANOVA revealed no significant main effects or interaction on number of correct faces recalled (all $F_s < 2.18$, all $p_s > .14$, all $\eta^2_s < .04$).

Finally, the findings of Experiments 1a and 1b were analysed together, and a repeated measures ANOVA with experimental condition (trustworthiness, intelligence) and congruence (congruent, incongruent) as independent variables found no significant main effects or interactions on number of correct faces recalled (all $F_s < 1.75$, all $p_s > .18$, all $\eta^2_s < .008$).

Experiment 2

Methods

Participants.

There were 111 participants, who were undergraduate students at a different UK University to Experiment 1, and were recruited and received course credits for participating. There were 71 participants in Experiment 2a (trustworthiness) and 40 participants in Experiment 2b (intelligence). Estimates of sample sizes required to be of sufficient power were based again on existing literature and also here on the findings of Experiment 1. This study was approved by the university's ethics committee.

Stimuli and materials.

The same materials as with Experiment 1 were replicated in Experiment 2.

Procedure.

This was the same as for Experiment 1 apart from some important changes. Firstly, this was conducted in a private laboratory space on a PC running E-Prime software, and participants completed the experiment individually rather than in large groups. Secondly, there were no time constraints to the presentation of information in either the encoding or the recall phase, with participants being able to proceed within each phase at their own pace. Finally the choices of faces and occupations from which participants were required to select the ones they remembered seeing were presented individually rather than at the same time (as in Experiment 1).

Results

Experiment 2a: Trustworthiness

Again a repeated measures ANOVA with behaviour (high trust vs low trust) and occupation (high trust vs low trust) for participants in the trustworthiness condition revealed no main effects, but there was a significant interaction between behaviour and occupation ($F_{1,69} = 6.94, p = .01, \eta^2 = .09$). Subsequent pairwise comparisons revealed that faces were remembered significantly better when presented with incongruent information with low-trust occupations and high-trust behaviour ($M = 1.9, SD = .3$) than when it was congruent for low-trust occupations and behaviour ($M = 1.77, SD = .42, t_{69} = 2.12, p = .038, d = .25$, or congruent for high-trust occupations and behaviour ($M = 1.74, SD = .5, t_{69} = 2.49, p = .015, d = .3$). However, when presented with incongruent information with high-trust occupations and low-trust behaviour ($M = 1.84, SD = .37$),

there was no significant difference in number of faces remembered from when it was congruent for low-trust occupations and behaviour ($t_{69} = 1.22, p = .23, d = .15$) or congruent for high-trust occupations and behaviour ($t_{69} = 1.47, p = .15, d = .18$).

Experiment 2b: Intelligence

A similar repeated measures ANOVA revealed a significant main effect of behaviour only ($F_{1,40} = 5.35, p = .03, \eta^2 = .12$) with individuals behaving in a low intelligent manner ($M = 3.8, SD = .46$), being recalled better than those behaving in a high intelligent manner ($M = 3.54, SD = .78$).

Again the results of the experimental conditions were analysed in a repeated measures ANOVA with condition (trustworthiness, intelligence) and congruence (congruent, incongruent) as independent variables. There was no significant main effect of either condition ($F_{1,109} = .19, p = .67, \eta^2 = .002$) or congruence ($F_{1,109} = 1.28, p = .26, \eta^2 = .01$) on the number of correct faces recalled. There was however a significant interaction between these two ($F_{1,109} = 4.83, p = .03, \eta^2 = .042$). Subsequently, further pairwise comparisons were conducted and it was found that for the trustworthiness condition, faces presented with incongruent information were remembered significantly better than those presented with congruent information ($t_{69} = 2.64, p = .01, d = .32$), but there was no such difference for the intelligence condition ($t_{40} = .72, p = .47, d = .11$).

Discussion

The findings reported in this study provided partial support for the hypotheses. Firstly, individuals tagged with incongruent information about trustworthiness were better remembered than when tagged with congruent information (Experiment 2). Therefore, when participants had unrestricted time and completed individually in a

controlled laboratory environment (thus with increased task concentration/attention) to encode the faces and their associated information about occupation and behaviour, incongruent information was more salient, indicating an enhanced source memory for “trustworthy tricksters” (Süssbach et al., 2016). Also, the enhanced memory for individuals with perceived incongruent behaviour was restricted to the trustworthy condition in Experiment 2, since incongruent autobiographical information about individuals’ intelligence had no effect on recall. This result seems to indicate that trustworthiness is a trait adapted specifically to aid in social interactions and exchanges. Furthermore, there was no increased recognition for individuals tagged with both low trust occupations and behaviours in comparison to individuals with both high trust occupations and behaviours, indicating a lack of support for the existence of an overall cheater detection mechanism (Cosmides, Tooby, Fiddick, & Bryant, 2005) in human memory. On the other hand, the findings support the theory that human memory for others is enhanced when presented with rare or unexpected socially relevant information.

However, no support was found for the hypotheses when Experiment 1 explored if the effect was also observed with a specific time allocated to encoding and recalling faces and in an environment with reduced control (large lecture theatres). Therefore it is possible that the contrasting results in the two experiments was due to the introduction of time constraints in both the encoding and recall phases (in Experiment 1 the encoding time and recall was unrestricted) and possible reduced attention among participants. As a result, the necessary processing of, and subsequent enhanced memory for, incongruent information may have been constrained, leading to simpler recall heuristics being used.

At this stage, it is questionable whether the 20 s encoding and recall durations or the different experimental environments were particularly constraining, and this invites

further investigation. Nonetheless, the results reported here suggest there is possibly a dual processing stream at work: (i) a “slow” processing stream that deals with complex and detailed encoding and complex deliberation in recall, and a (ii) “fast” processing stream dealing with assembling basic information as quick and reliably as possible. Such system has been suggested by Kahneman and others (Kahneman, 2003, 2012), and based on this premise, the results of this study suggest that an adaptive memory for incongruent information in social exchanges, if one does exist, rely on the operations of a slow processing stream (Experiment 2) rather than a fast one (Experiment 1).

An issue may lie in how trustworthiness and intelligence information was used (occupation, behaviour), as the information was based on subjective assessments. However, in both cases there were clear differences based on pre-ratings so we can be confident that the dichotomies between high and low trustworthiness and intelligence were valid. Similarly, previous research has also used subjective measures of trustworthiness such as how this is signalled by the face (e.g. Bell et al., 2012; Suzuki & Suga, 2010). As the current study as well as others that used faces to signal trustworthiness found similar significant findings, it can be concluded that such measures are reliable, and do indeed affect our memory of different individuals in social interactions.

In conclusion, these findings offer some further and important insights into how we remember others in social exchanges. By showing that incongruent information about occupations and behaviours in relation to their trustworthiness can enhance memory of individuals in certain circumstances, this study offers further support to the view that humans have a more flexible memory based on rarity (in this case, incongruence) rather than the traditional view that cheats are just remembered better (Barclay, 2008). Findings from Experiment 2 seem to indicate this memory may only

be activated when sufficient time and attention is available to individuals to encode unexpected and incongruent information. However further investigation of the reliability of the contrasting findings of the two experiments is necessary, to explore how they replicate in both conceptual and direct ways.

By showing that face recognition and source memory are affected by information specific to trustworthiness rather than for autobiographical information in general, this is the first study to show that this is not a general facet of human memory, but instead can be adaptive in specifically aiding the ability to detect potential cooperators and/or cheaters in social exchanges. Further research can examine how different autobiographical information about others affects decision making, with the aims of applying this knowledge to real world scenarios, such as health behaviours (Felisberti & Farrelly, 2016) and also furthering our understanding of how our different cognitive capacities may be adaptive. Furthermore, by identifying these key influences, we will know more about how adaptive our ability is to deal with the wealth of information we gain about others in various social interactions.

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Figure 1. Schematic representation of the procedure of the experiments. Participants saw and rated all eight individuals first, then after the distracter task were presented with each of these in a face recognition task. This was repeated for each of the eight individuals.