The Role of Reasoning Domain on Face Recognition: Detecting Violations of Social Contract and Hazard Management Rules

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Abstract: Face recognition has previously been used to provide evidence for the existence of human cheater detection mechanisms; however such evidence is currently inconclusive. This study aimed to further analyze recognition of violators and cooperators of rules by using two different contexts, social contracts (SC) and hazard management (HM). Participants were presented with male faces alongside either a SC or HM scenario and told whether the individual had violated or cooperated with the rule. Participants were then asked to identify the faces and behavior of those individuals from the first part of the study from a larger set of photographs. Results indicate that faces and behaviors of rule violators were remembered better than those of rule cooperators, and faces (but not behaviors) in SC scenarios were remembered better than those in HM scenarios. These results are interpreted as providing possible evidence of a general rule violator detection mechanism, with face recognition abilities then mediating differences between SC and HM scenarios. Furthermore, the disparity in how humans interpret SC and HM scenarios is discussed from an evolutionary perspective, with reference to how behavior in each rule affects the inclusive fitness of others.

Keywords: Face recognition, social contract, hazard management, precautionary rules, cheater detection.

Introduction

In human reasoning literature, there is a division between researchers who suggest reasoning abilities are the result of generic, domain-general cognitive capacities in various guises (e.g., Cheng and Holyoak, 1985; Cheng and Holyoak, 1989; Fodor, 2000; Johnson-Laird and Byrne, 1991; Kirby, 1994; Manktelow and Over, 1991; Oaksford and Chater, 1994; Sperber, Cara, and Girotto, 1995) and those who suggest that they are mainly due to evolved, content-specific adaptations that were vital to the survival of our ancestors, with
the most famous example of this being reasoning about social exchanges (e.g., Cosmides, 1989; Cosmides and Tooby, 1989; Cosmides and Tooby, 1992). Many proponents of the latter view believe that our ability to reason on such tasks that involve social contracts (SC) (which involve individuals interacting to their mutual benefit) is evidence that such abilities are used to regulate social exchanges, and include evolved “cheater detection” mechanisms (Cosmides, 1989; Cosmides and Tooby, 1989; Cosmides and Tooby, 1992).

The majority of supporting evidence for a cheater detection module in social exchanges comes from a variety of experimental procedures that have used reasoning tasks such as Wason’s (1966) selection task, whereby rule violations in SC versions of this task are akin to cheating (e.g., Chang and Wilson, 2004; Cosmides, 1989; Cosmides and Tooby, 1992; Fiddick Cosmides, and Tooby, 2000; Fiddick and Rutherford, 2006; Gigerenzer and Hug, 1992; Sugiyama, Tooby, and Cosmides, 2002). However, further research has shown that the ability to detect cheaters may also influence face recognition. Mealey, Daoood, and Krage (1996) found that the faces of cheaters in SC tasks were better recognized than cooperators, particularly if they were of lower status (this preference was also stronger in males than females). Furthermore, Oda (1997) has shown that faces of male defectors in one-shot Prisoner’s Dilemma games (equivalent to cheaters in SC tasks) were recognized at greater rates than male cooperators. Also, Chiappe, Brown, and Dow (2004) found that the SC cheaters were considered by participants to be more important to remember, were looked at longer, and had their faces and behaviors better remembered than those of SC cooperators. Further research also suggests that there are certain characteristics of SC cheaters that are detectable from their faces in certain situations (Yamagishi, Tanida, Mashima, Shimon, and Kanazawa, 2003; Verplaeste, Vanneste, and Braeckman, 2007). A potential computational explanation for such effects follows on from Cosmides and Tooby (1992), who postulate that humans possess a “looking for cheaters” algorithm which is activated when there is evidence of social contracts being violated. After identifying an individual as a cheat, a cheater-detection module may lead to negative emotions particularly anger (Fiddick, 2004) being associated with that individual. This emotional response would possibly lead to more general face recognition mechanisms enabling enhanced recognition memory for cheats.

However these findings linking cheater detection with face recognition are somewhat weak and inconsistent, with enhanced recognition of low status cheaters as well as stronger detection from male respondents in Mealey et al. (1996), but only male cheaters being better recognized with no effect of sex of respondent in Oda (1997). Also, recent research has contradicted these with findings that suggest our ability to recognize faces is not preferentially influenced by an innate cheater detection module (Barclay and Lalumière, 2006; Mehl and Buchner, 2008). Furthermore, Barclay (2008) suggests that there has been too much emphasis placed on detecting cheating in previous research. Instead, Barclay (2008) states that it is possible to avoid exploitation in reciprocal interactions by attending more to behaviors that are less common rather than cheating or cooperating per se. By varying the proportion of defectors in a population with whom participants interacted with in reciprocal scenarios, Barclay (2008) found that the faces of defectors were only remembered best when they were rarest, which supports his theory of a more general cognitive mechanism of recognizing the rarest behavior rather than specific cheater detection mechanisms. Therefore, an enhanced ability to recognize the faces of cheaters may not be as straightforward as previous research might have suggested.
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It is important that further investigations into the role of a proposed cheater detection mechanism explore how the content of the rule may affect subsequent face recognition. For example, the inconsistency in the above findings may be due to the different methodologies (e.g., types of cheating, measurement of recognition) that were used to present individuals as either cheaters or cooperators in SC scenarios. To address this possibility, it is important to compare how the detection of rule violators in a similar but different domain to SC, namely precautionary or hazard management rules (Cosmides and Tooby, 1997; Fiddick, Spampinato, and Grafman, 2000), affects recognition of faces. This will therefore lead to a better understanding of how humans differentially remember those individuals who violate or cooperate with such rules.

Reasoning tasks that involve hazard management (HM) scenarios (or “precaution rules”) frame the rule in terms of risk reduction in hazardous situations (such as “if you spill blood, you must wear rubber gloves to clean it up”) and previous findings reveal that, as with SC tasks, humans perform well on these (Cosmides and Tooby, 1997; Fiddick et al., 2000). However, it has been important for researchers to demonstrate that this represents a separately evolved reasoning ability (allowing humans to better perceive and respond accordingly to environmental risks) from SC, and not simply the result of a more general, deontic reasoning mechanism. As a result, research has provided evidence of a distinction between SC and HM reasoning abilities in a patient with neurological deficits (Stone, Cosmides, Tooby, Kroll, and Knight, 2002) and activation of different brain areas as evidenced from fMRI techniques (Ermer, Guerin, Cosmides, Tooby, and Miller 2006; Fiddick et al., 2005) which is taken as clear evidence that SC and HM reasoning abilities are functionally disparate evolved specializations.

This is further supported by behavioral research, which provides evidence that participants respond with different emotions to other individuals’ violations of these tasks (with violations of SC tasks eliciting anger and violations of HM tasks eliciting fear), and that intentionality of these violations was only important in SC tasks (Fiddick, 2004). This therefore indicates that SC and HM reasoning abilities are separately evolved mechanisms that also incorporate different emotional and Theory of Mind (ToM) responses. Further support is provided by the findings of Reis et al., (2007) that showed that levels of emotional intelligence (which in part measures an individual’s ability to manage social interactions) correlated with reasoning speed on SC tasks but not on HM tasks, as well as predicting levels of activation of brain areas previously demonstrated by Stone et al., (2002) as being important when engaging in SC reasoning tasks.

Therefore, the aim of the present study was to examine how well participants remembered the faces of individuals who either violate or cooperate with rules in Wason selection tasks framed within either SC or HM scenarios. In doing so, this study replicated some of the methodology of Chiappe et al., (2004), and required participants to not only state whether they remembered faces but to also ask them to state how they remembered that individual behaving (either violating or cooperating with the rule). By doing so, it explored further the possible role of an innate cheater detection module in recognizing the faces of rule violators by comparing performance between the two domains. As previous research has concentrated on faces of cheaters in SC tasks, the current study will be of value in providing evidence as to whether an ability to preferentially recognize rule violators is due to an adaptation for regulating social exchanges only and is distinct from other forms of rule-breaking, such as those involved in HM scenarios (Fiddick et al., 2000).
Furthermore, this study may also provide further insight into the potential distinctions within human reasoning abilities between SC and HM domains.

It was predicted that if an evolved cheater detection module is specific to SC scenarios and mediates recognition of such individuals, possibly through the suggested computational mechanism outlined above (as the findings of Mealey et al., [1996] and Oda [1997] might reflect), then participants would be better at recognizing the faces and also the behavior of cheaters in SC scenarios than those of rule violators in HM scenarios. Also, there would be no such difference between SC and HM scenarios for rule cooperators. However, if the ability to detect rule violators and face recognition are mental abilities that operate independently (as the findings of Barclay and Lalumière [2006] and Mehl and Buchner [2008] might suggest), then it was predicted that there will be no effect at all of being either a rule violator or cooperator on the recognition of either the faces or behavior of others. Also, if humans have a generic rule violator detection ability that operates independently of whether the rule is either SC or HM, then it was predicted that there would be an overall preference for individuals to better remember the faces and behaviors of rule violators with no further effect of the content of the rule.

Furthermore, it was predicted that there may be significant differences in face recognition between those individuals involved in SC and HM tasks, as previous research has found differences between these tasks in domains other than face recognition (Ermer et al., 2006; Fiddick, 2004; Fiddick et al., 2005; Reis et al., 2007; Stone et al., 2002). However, because this previous research has concentrated on observable distinctions between the two rules in terms of brain activation (Ermer et al., 2006; Fiddick et al., 2005; Stone et al., 2002), emotional responses (Fiddick, 2004) and individual differences (Reis et al., 2007), it was unclear in which direction this predicted difference would occur for face recognition (i.e. were SC or HM faces and behaviors better remembered?) or if indeed there was such a difference. Therefore this analysis was exploratory in nature and no directional predictions were made (a further reason for this is that a finding of no significant difference between recognition of SC and HM faces/behaviors would not necessarily imply that HM and SC reasoning abilities are governed by a domain-general cognitive mechanism. It would only indicate that accuracy of recognizing individuals from these two forms of tasks are equitable, whereas the underlying cognitive mechanisms may not be).

Methods

Participants

Eighty-four participants (mean age = 23.7, SD = 7.0) took part in the study. All were undergraduate students from the University of Sunderland who received either course credit or were paid for their participation, and the majority were Caucasian. The experiment had been approved by the university’s ethics committee.

Materials and Procedure

Participants were first presented with an information sheet explaining the details of the study. None of the information provided contained details about the theoretical background of the study (e.g., cheater detection) and such topics would not have been covered in the participants’ previous teaching. They were then randomly allocated one of four booklets that contained 16 different photographs of Caucasian male faces.
accompanied by different scenarios on separate pages. Each scenario contained a 
description of either a SC rule or a HM rule and stated whether the person in the 
photograph either violated or cooperated with the rule. The 16 scenarios consisted of four 
SC rules and four HM rules. These rules were as follows:

“If you clean up spilt blood, then you must wear rubber gloves.” (HM).
“If you work with toxic chemicals then you must wear a safety mask.” (HM).
“If you pick up broken glass, then you must use a dustpan and brush.” (HM).
“If you enter the building site, then you must wear a hard hat.” (HM).
“If you enter the club, then you must have a stamp on your hand” (SC).
“If you borrow money, then you must make your payments on time” (SC).
“If you receive good service, then you must leave a tip” (SC).
“If you go to the party, then you must work extra hours” (SC).

Each SC scenario was presented so that it was a hypothetical third party (e.g., night-
club, waitress) that experienced the rule violation or cooperation, and not the participant. 
Within each booklet, two scenarios were created for each rule, one where the person in the 
photograph had violated the rule and one where the person had cooperated with the rule 
therefore making the 16 scenarios in total. An example of a scenario can be seen in Figure 
1. To prevent order effects and any idiosyncratic effects of pairing particular photographs 
with scenarios, four booklets were created, each with randomized allocation of photographs 
to scenarios and randomized presentation orders. No photographs were repeated either 
within or between booklets. Participants were also given a response sheet, and had to state 
whether they believed the person in each scenario either “cheated” or “cooperated” with the 
rule. There was no time limit and participants were advised to take as much time as 
necessary and to read each scenario carefully. As with Chiappe et al. (2004), only 
participants who stated the correct behavior of 15 or more of the 16 faces were included in 
the analyses (i.e. those with at least 90% accuracy).
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Figure 1. Example of a scenario from the first part of study (this person “cheated”/violated an SC rule).

Once they had completed this first part, both the booklet and the response sheet were returned to the experimenter and participants were given a distracter task. This was a standard word search which required participants to find 20 words based on the topic of Halloween. Participants were given a maximum of 10 minutes to complete this.

For the second part of the study, presentations were prepared using Microsoft® PowerPoint 97. These were presented on a standard PC. Each presentation consisted of 65
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slides, starting with an opening slide with instructions. These instructions informed participants that they would be presented with a number of faces. For each face they saw, they were asked to state on a corresponding response sheet whether they believed that that face had been present in the first part of the study (yes/no). Furthermore, they were asked that for each face they did believe was present in the first part of the study (i.e. those they had replied “yes” to), to also state whether that person either violated the rule (“Cheater”) or followed the rule (“Cooperator”) in their scenario (please note that the terms “Cheater” and “Cooperator” were used here to facilitate participants’ understanding of the different behaviors, and did not reflect the use of such terms in the social exchange literature [e.g., Cosmides and Tooby, 1992], of which the participants would have been naïve). Each slide following the information slide had a photograph of a male face placed centrally on the screen (height: 19.06cm, width: 15.41cm). Each presentation contained the 16 photos from the first part of the study plus 48 more photos from the same database in a randomized order (64 photographs in total). To prevent order effects, four different presentations were created each with a different, randomized order of the 64 photographs. Participants were randomly assigned to one of the four presentations. After reading the information slide, participants then went on to view each of the 64 face slides. Each slide remained on the screen for 10 seconds, allowing participants to respond as to whether or not they remembered the face from the first part of the study, and if so how that individual had behaved. The slide would then automatically progress to the next slide. The experiment was completed after all slides had been seen, and participants were then fully de-briefed and thanked for their participation.

All photographs were selected from a database of photos from the University of Stirling. These photographs had been pre-rated for attractiveness on a 1-5 Likert scale. To prevent any potential interactions between attractiveness and judgments of cooperativeness (e.g., Farrelly, Lazarus, and Roberts, 2007), photographs of males from either extremes of the attractiveness scale (high/low) were omitted from the study. All the photographs were of Caucasian males, showed only their faces and were presented in colour.

Results

To begin with, an initial analysis was conducted to see if there were any differences between the faces presented with the four different scenarios in the booklets (SC “cheater”, SC “cooperator”, HM “cheater” and HM “cooperator”) on perceived characteristics that may have adversely affected the validity of the results. These were how “attractive”, “cooperative” (which could have confounded any findings in relation to the SC tasks) and “dangerous” they were perceived to be (which could have confounded any findings in relation to the HM tasks). 32 participants who did not participate in the main study (mean = 27.4, SD = 6.4), consisting of 24 females and 8 males, rated each of the 64 males for perceived attractiveness, perceived cooperativeness and how dangerous they perceived the male to be. This test was administered online, with participants responding on a Likert scale from 1 (Not at all) to 7 (Extremely). Between subjects ANOVAs revealed no differences between the four rule type/behaviors of target individuals (SC “cheater”, SC “cooperator”, HM “cheater” and HM “cooperator”) for perceived attractiveness ($F_{[3, 60]} = 0.55, p = .648$), perceived cooperativeness ($F_{[3, 60]} = 1.66, p = .184$), or perceived danger.
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\( F_{[3, 60]} = 1.43, p = .243 \), suggesting no differences due to unforeseen characteristics of the faces between the four conditions that could have confounded the results.

Also, in response to Barclay’s (2008) finding that it is the rarity of actions that affects recognition rather than whether or not a rule is violated, a further independent sample of 24 participants were asked to rate what they believed would be the relative percentage of people who would either violate or adhere to each of the eight rules. Paired samples \( t \)-tests revealed that the percentage of people who would adhere to the rule was rated as being significantly higher than those that would violate the rule, for all eight rules (all \( ts \geq 2.82, all ps < .01 \)).

Table 1 below contains the complete matrix of responses (faces labelled correctly/incorrectly, behaviors labelled correctly/incorrectly, false positives) by participants for each combination of rule and behavior.

**Table 1.** Mean (SD) of responses for each face/rule type (false positives are instances where a photograph was incorrectly labeled as that particular face/rule type).

|                        | SC cooperator | SC violator | HM cooperator | HM violator |
|------------------------|---------------|-------------|---------------|-------------|
| Faces correct*         | 1.86 (1.03)   | 2.32 (.97)  | 1.7 (.99)     | 1.87 (1.0)  |
| Faces incorrect*       | 2.14 (1.03)   | 1.68 (.97)  | 2.3 (.99)     | 2.13 (1.0)  |
| False positives        | .66 (.76)     | .88 (.84)   | .71 (.78)     | 1.17 (.86)  |
| Behavior correct       | 1.12 (1.01)   | 1.38 (1.04) | .95 (.86)     | .89 (.89)   |
| Behavior incorrect     | .74 (.76)     | .94 (.81)   | .75 (.82)     | .98 (.91)   |

* Out of a possible maximum of four

**Faces remembered**

For the number of faces correctly remembered, repeated measures ANOVA revealed a main effect of behavior (\( F_{[1, 83]} = 8.29, p = .005, \eta^2 = .091 \)) with faces of “cheaters” being remembered more than faces of “cooperators”, and a main effect of rule type (\( F_{[1, 83]} = 11.78, p = .001, \eta^2 = .124 \)) with faces of individuals involved in SC rules being remembered more than faces of individuals involved in HM rules. However, there was no significant interaction between behavior and rule type (\( F_{[1, 83]} = 1.83, p = .18, \eta^2 = .022 \)). These results are illustrated in Figure 2.
Figure 2. Graph of mean effect (± S.E.) of rule type and behavior on number of individual faces correctly remembered.

Behaviors remembered

For the number of correctly remembered behaviors (i.e. “cheater” or “cooperator”) of faces from the first part of the study, repeated measures ANOVA revealed a main effect of rule type ($F_{[1, 83]} = 12.1, p = .001, \eta^2 = .127$) with behaviors of individuals involved in SC rules being correctly remembered more than behaviors of individuals involved in HM rules. There was no main effect of behavior ($F_{[1, 83]} = 1.21, p = .274, \eta^2 = .014$) nor a significant interaction between behavior and rule type ($F_{[1, 83]} = 2.42, p = .124, \eta^2 = .028$). These results are illustrated in Figure 3.
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**Figure 3.** Graph of mean effect (± S.E.) of rule type and behavior on number of behaviors correctly remembered of faces from the first part of the study.

![Graph of mean effect (± S.E.) of rule type and behavior on number of behaviors correctly remembered of faces from the first part of the study.](image)

**Discussion**

The finding that overall, the faces of rule violators were remembered better than those of cooperators suggests that humans preferentially recognize rule violators, and thereby contradicts the findings of Barclay and Lalumière (2006) and Mehl and Buchner (2008). However, this was not the case for remembering behaviors, meaning that there is only partial support overall for humans being better able to detect violators of rules. Furthermore, the lack of significant interactions between rule type and behavior for recognizing either faces or behaviors suggests that an overall preference for remembering rule violators is not further influenced by content (i.e. it is not greater for either SC or HM scenarios). Therefore, this suggests that the possible mechanism outlined previously of how a cheater detection algorithm specific to SC scenarios may influence face recognition memory is incorrect in its current form.

The findings that both the faces and behaviors of individuals involved in SC rules were remembered better than those involved in HM rules suggests significant differences between the two rules in terms of recognition of individuals. Therefore, the results of this study may support previous findings that show reasoning on SC and HM tasks is distinct and regulated by different evolved cognitive modules (Ermer et al., 2006; Fiddick, 2004; Reis et al., 2007; Stone et al., 2002). However, an alternative explanation is that both scenarios trigger the activation of the same cognitive mechanism, but recognition is greater for SC rules than for HM rules. This may suggest that the computational explanation of cheater detection as outlined in the introduction needs to be modified. Therefore it may be that humans actually have a “look for rule violators” algorithm (not just cheats) that may be activated when faced with rules in both SC and HM scenarios. Subsequently, the differences observed in previous research between SC and HM reasoning abilities may be reflected here in differences in emotional response for rule violation in each scenario (Fiddick, 2004). Such emotional responses would therefore lead to varying activation of the cognitive mechanisms involved in rule violation processing.
more general recognition abilities, with the anger from SC violations leading to greater memory than the fear from HM violations. This is a potential explanation of human rule violator detection abilities and further investigation is needed.

However, such a mechanism does not explain why overall it was individuals in SC rules who were recognized better. A valid explanation is that interacting with individuals who engage in different behaviors in SC rules will always lead to the same outcome (i.e. interacting with cheaters will always lead to exploitation, with cooperators will always lead to positive alliances), however this is not true for individuals in HM scenarios. For example, a person who interacts with an individual who violates the rule “If you enter the building site, then you must wear a hard hat” may not necessarily receive a negative outcome for two reasons. Firstly, it is the rule violator who is at greater risk, and secondly the violating does not necessarily lead to a negative outcome, only an increased probability of it occurring. The same is true for interacting with someone who cooperates with the rule (i.e. the other person may not directly be affected, and it does not guarantee safety). In other words, we can view SC rule violations as being “other-relevant” traits (Peeters, 1983). These are behaviors that have consequences for persons in the social environment of the trait holder, in other words they are traits that are characterized as having a greater effect on those the trait holder interacts with than the actual trait holder, such as aggression. However, HM rule violations can be considered as being “possessor-relevant” traits (Peeters, 1983) which are behaviors that have consequences primarily for the trait holder, meaning they have a greater effect on them than those they interact with, such as depression. Previous research has shown that attention is stronger towards other-relevant traits in other individuals (Wentura, Rothermund, and Bak, 2000), which would make evolutionary sense as this will have a greater influence over the inclusive fitness of humans when observing others. This would therefore lead to a greater adaptive response in terms of face recognition (possibly due to the mechanism outlined above) in SC scenarios as we have observed in this study.

That the faces of rule violators are better remembered but not their behavior appears paradoxical. If humans possess abilities to detect rule violators in order to avoid these individuals in future interactions, then surely it is of equal importance to remember their faces and also how they behave? Therefore this finding does not appear to support the view of evolved rule violator detection mechanisms. However an explanation for this finding may be that it merely reflects memory abilities; it may be that the encoding of recognition memories of faces is biased towards the faces of rule violators, but this is stronger than subsequent episodic memories of that individual’s behavior. This suggests that the memory processes employed by participants when detecting cheats in this experimental procedure warrant further investigation.

Finally, an alternative explanation for the findings here may come from Barclay (2008) who proposed that face recognition is driven by evolved mechanisms that attend more to those engaging in the less common behavior rather than a cheater detection mechanism. Therefore it is important to see whether the patterns of results observed vary when the perceived prevalence of behaviors (i.e. less/more prevalent) is considered rather than the actual behavior (i.e. violated/cooperated with rule). However the results show that for all the rules, the behavior that was perceived as being significantly less frequent was violations of rules. This means that the possibility of evolved mechanisms for detecting the faces of those that engage in the less common behavior instead of those that cheat cannot
be eliminated as an alternative explanation for the results of this study, and suggests future research must attend to this.

A potential issue that could have confounded the findings of this study was the time period (10 minutes) between the two parts, as previous studies have used longer intervals between initial exposure to faces and testing of recognition memory (e.g., Barclay and Lalumière, 2006; Mealey et al., 1996; Oda, 1997). However, Mehl and Buchner (2008) found that the length of interval had no effect on the results of their experiments, suggesting that although recognition overall may be stronger with shorter intervals, it would have had no effect on the pattern of results here. Similarly, the absence of a ceiling effect in face/behavior recognition in the present study suggests that the relatively short interval used was valid. A further possible confounding influence on the results may be from the use of the potentially leading terms “cheater” and “cooperator” to describe individuals in this study. However, “cheating” and “cooperating” was used only in relation to how individuals behaved in accordance with their specific rule, rather than in more general terms which may have confounding connotations. Furthermore, such terms have been used previously (e.g., Chiappe et al., 2004), and it is also difficult to conceive how their usage may have affected participants’ performance (who were naïve to the use of such terms in the relevant literature), nor the pattern of results obtained. Finally, as with Chiappe et al., (2004) only male faces were used in this study. This was to ensure that any possible confounding effects of sex of target individual were eliminated. However, as previous research has found evidence of interactions between sex and cooperative strategy in face recognition (Oda, 1997), future research can examine further the possible interactions between sex of participant and sex of target individual. This will further shed light on how we detect violators and cooperators of different rules, and how possible factors such as attractiveness may have additional effects.

This study was unique in comparing the recognition of faces and behaviors of individuals involved in both SC and HM rules, and in doing so has contributed to the body of research on SC and HM reasoning. Also, this study raises the issue of the relative importance of SC and HM contexts in our evolutionary history in aiding reasoning and interpretation of rules, as SC scenarios led to greater face and behavior recognition. Previous studies using the Wason selection task have found no difference between SC and HM tasks in terms of reasoning ability (e.g., Cheng and Holyoak, 1989; Fiddick et al., 2000; Stone et al., 2002), however this present study suggests that there are differences in individuals’ memory retrieval and recognition abilities. Therefore, further research can investigate the relative importance of these contexts in more depth using further behavioral measures (e.g., reaction times), paying particular attention to their evolutionary explanations.

In conclusion, this study has further shown that using face and behavior recognition can provide valuable evidence for research into the evolution of human reasoning abilities. Therefore such a methodology can in future provide a full and comprehensive body of research that will greatly aid our understanding of evolved responses to different scenarios we as humans have faced in our evolutionary past. In order to achieve this, it is important that future research utilizes more ecologically valid research techniques (e.g., face-to-face and/or synchronous interactions between participants and rule violators/cooperators) so as to improve the effectiveness of these studies for examining evolved rule violator detection mechanisms and reasoning abilities in humans.
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