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# Personality and Individual Differences

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## General and specific personality traits as predictors of domain-specific and general conditional reasoning

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### ABSTRACT

Personality and individual differences have rarely played a role in human reasoning research, and the sparse previous work has focused on Big 5 personality factors and reasoning in a very general sense. The present research expands this by using the HEXACO model of personality as well as more specific traits (interpersonal trust and reciprocation ideology), and examines conditional reasoning across three theoretically significant domains (social contract, precaution, and descriptive contents). Across two studies, greater trust (higher interpersonal trust and less reciprocation wariness) was associated with better reasoning about conditional rules in general. Concurrently, greater conscientiousness and honesty-humility were differentially predictive of reasoning about social contracts and precautions, but not descriptive contents. Openness was associated with reasoning performance in Study 1 but not in Study 2, and other traits of interest in prior studies (extraversion, emotionality) consistently did not emerge as important predictors. Further research should examine in more detail the effects of individual differences and personality on reasoning, and if certain traits may predict domain specific reasoning abilities. Such findings can provide both a new and informative method for assessing theories of human reasoning, as well as integrate the fields of human reasoning and personality.

### 1. Introduction

Individual differences in reasoning are traditionally considered a nuisance. Research on human reasoning has long used first-order formal logic as the objective standard against which human performance is judged (Woodworth & Sells, 1935), and little provision is made for the existence—much less the study of—individual differences. Indeed, one could argue that because there are uniform correct and incorrect conclusions in reasoning tasks, there is very little room for individual differences in any sense other than error variance.

When individual differences in human reasoning have been considered, they are either very direct applications (e.g., differences in logical style being associated with different reasoning performance; e.g., Visconti & Kunzendorf, 2015; Svedholm-Häkkinen, 2015) or pathologized (reasoning variations associated with aggression: James, 1998, James, McIntyre, Glisson, Bowler, & Mitchell, 2004; reasoning variations associated with depressive symptoms: Pappageorgiou et al., 2012; reasoning biases associated with goal-threatening information: Klaczynski & Lavalley, 2005; faulty reasoning associated with schizotypy: Sellen, Oaksford, & Gray, 2005). To date, only a handful of studies have looked more generally at relationships between human reasoning and personality. These studies have all been based on the five-factor

model of broad personality traits, and either assessed a general consistency/inconsistency model of the relationships between personality traits and reasoning about those traits as task contents, or assessed reasoning ability (normatively correct/incorrect) based on personality traits.

In particular, Bonnefon (2010) found that reasoner's personality positively related to agreement with logical (Modus Ponens) conclusions based on if/then rules describing how a given person with that same personality would feel or act in a specific situation. Similarly, Fumero, Santamaría, and Johnson-Laird (2011) found that people highest in particular personality traits more often made conditional inferences with material thematically related to those traits. Working the reciprocal direction, Fumero, Santamaría, and Johnson-Laird (2010) found that priming conscientiousness increased deduction, whereas priming openness to experience increased inductions, both in reaction to the same conditional rules. These results by Fumero and colleagues were interpreted as consistent with a mental models framework.

Finally, other research on personality differences have noted more general, but conflicting, effects on the quality of reasoning. One finding was that people high in extraversion or neuroticism made more valid inferences (Fumero et al., 2011), but another finding was that people

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high in extraversion were more prone to make incorrect reasoning judgments (Papageorgiou et al., 2012).

### 1.1. Models of human reasoning

This view of deviations from formal logic as an indication of reasoning flaws makes sense when the normative model for human reasoning is formal logic. In particular, this is a normative model of human reasoning as a content-independent, domain-general system. For example, consider when someone is given a conditional statement in the form of *If P, then Q* (where *P* and *Q* can be any pieces of content). Based on that structure, and using standard first-order conditional reasoning, the set of circumstances that can involve logical violations are those of *P* and *not-Q*. For example, the conditional *If it rains, then the grass is wet* is shown to be false if it rains (*P*) and the grass is not wet (*not-Q*). The particular content (grass, wet), though, is not important; the if-then syntax determines the logical implications.

Other theories of human reasoning do not use the formal logic normative model. For example, deontic models of reasoning (such as pragmatic reasoning schemas; Cheng & Holyoak, 1985) propose generalized sets of rules defined by classes of goals and types of relationships. By carving reasoning into different classes, such as “permissions” and “obligations” (reasoning about what one *ought* to do, as opposed to deductive truth or falsity), there is an opening for some types of reasoning that are context-sensitive, as opposed to context-free.

Still other models of human reasoning have gone further, based on an analysis of the ways the human mind would be designed to reason as a result of evolutionary adaptations for solving particular problems. Domain specific adaptations, which include specialized inference processes, have been proposed to exist for a range of contexts that constituted long-standing evolutionary selection pressures. Although this would include situations such as searching for and evaluating food, coalition members, and mates (Brase, 2004), the most notable work on this type of domain-specific reasoning has been in the areas of social contracts (reasoning about agreed social exchanges and the threat of cheaters) and precautions (reasoning about hazards and precautionary behaviors to mitigate them). These are cases in which reasoning that is specific to one domain can be problematic if applied to another domain. Because formal logic uses general purpose rules of inference that can be applied to any subject matter, however, these general rules are poorly suited to context-specific issues such as—for instance—detecting cheaters of social contracts.

Proposals that people have domain-specific, content-dependent reasoning abilities has been a contentious idea. However, starting with Cosmides (1989), it has generated a string of intriguing research findings. The basic finding in this literature has to do with a marked ability to reason well about potential “cheaters”; individuals who take a benefit without the intercontingently associated requirement or cost. Within a conditional social exchange rule of the form, *If one takes the benefit, then one meets the requirement* (e.g., if you take food from the buffet, then you pay a cashier), the inferences about who could be a potential cheater (took food/did not pay) maps on to standard first-order conditional reasoning (i.e., given *If P, then Q*, the potential violations are situations of *P/not-Q*).

Evidence for a particular ability to reason about social contracts has been demonstrated in different labs (Cosmides & Tooby, 1992, 2004; Gigerenzer & Hug, 1992) and in hunter-gatherer populations (Sugiyama, Tooby, & Cosmides, 2002). Additionally, it is consistent with evolutionary models of reciprocal altruism (Trivers, 1971), computational models in game theory (Axelrod & Hamilton, 1981), and specific neurological impairments which have been found to selectively impair social contract reasoning (Stone, Cosmides, Tooby, Kroll, & Knight, 2002). A computational level description of the ability to reason about social contracts (Cosmides & Tooby, 1992, p. 177) outlines a number of specific design features of the involved cognitive programs. A couple of these features suggest a general sensitivity to the nature of

the world in which one lives:

- a) They [the cognitive programs] must include algorithms that estimate the probability that these actions, entities, or states of affairs will come about in the absence of an exchange.
- b) They must include algorithms that store information about the history of one's past exchanges with other individuals (in order to know when to cooperate, when to defect, and when to punish defection).

More recently, domain specific reasoning about precaution rules relating to hazard avoidance (*If you engage in the hazardous activity, then you take the precaution*; e.g., If you handle snakes, then you keep an anti-venom kit nearby) have similarly been accumulating evidence (Fiddick, 2004; Fiddick et al., 2016; Fiddick, Cosmides, & Tooby, 2000). These studies have shown that precautionary rules are processed differently from social exchanges, despite their similarities. For instance, Fiddick (2004) found that people relate different emotional reactions to different violations of social contracts and precautions. Manipulations of an actor's intent also had a significant influence on people's reasoning about social contracts, but not on their precautionary reasoning.

These descriptions and research findings on social contract/precautionary rule reasoning lead to a vision of reasoning abilities that are not only content-specific but context specific: sensitive to baseline likelihoods in the environment, memories of individual interactions, and expectations about other people generally. These design features, if present as hypothesized, might therefore be sensitive to the general views (and individual differences thereof) about the nature of one's social world: how benevolent are people in general? How trustworthy are people in general? If these computational elements are actually tuned to one's general social world (for example, to manage interactions with strangers), then individual differences in traits like interpersonal trust, reciprocity ideology, and even general personality traits (e.g., agreeableness and conscientiousness) could lead to systematic and predictable differences in reasoning about social contracts and precaution rules.

### 1.2. Personality differences and domain-specific reasoning

Because it is not clear to what extent any personality/reasoning associations would be focused on narrow personality dimensions versus broad personality traits, the present research took the approach of including both types of measures.

#### 1.2.1. General personality traits

A recent series of studies (Fiddick et al., 2016) found that the HEXACO model of personality (using six traits: Honesty–humility, Emotionality [similar to neuroticism], eXtraversion, Agreeableness, Conscientiousness, and Openness to experience) was more useful than the five-factor model to identify specific personality traits that indicate the inclination to violate conditional social rules. Specifically, social contract violations were associated with low honesty-humility, whereas low scores on conscientiousness were associated with the violation of precautionary rules (Fiddick et al., 2016). This research also found that people low in honesty-humility said they were more likely to violate social contract violations, people depicted as low in honesty-humility were judged by others to be more likely to violate social contract violations, and people described as violating social contracts were judged by others to be lower in honesty–humility. Within the same studies, people low in conscientiousness said they were more likely to violate precaution rules, people depicted as low in conscientiousness were judged by others to be more likely to violate precaution rules, and people described as violating precautions were judged to be lower in conscientiousness. This research also replicated these results across four different cultures.

The Fiddick et al. (2016) work fits nicely with the proposal that

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