Domains of deontic reasoning: Resolving the discrepancy between the cognitive and moral reasoning literatures

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Deontic reasoning has been studied in two subfields of psychology: the cognitive and moral reasoning literatures. These literatures have drawn different conclusions about the nature of deontic reasoning. The consensus within the cognitive reasoning literature is that deontic reasoning is a unitary phenomenon, whereas the consensus within the moral reasoning literature is that there are different subdomains of deontic reasoning. We present evidence from a series of experiments employing the methods of both literatures suggesting that people make a systematic distinction between two types of deontic rule: social contracts and precautions. The results call into question the prevailing opinion in the cognitive reasoning literature and provide further support for both an evolutionary view of deontic reasoning and the more domain-specific perspective found in the moral reasoning literature.

Sometimes researchers in different disciplines studying the same phenomena develop two independent and isolated literatures. Indeed, researchers in separate disciplines might even come to the opposite conclusions about the same basic phenomenon, as appears to have happened with the psychological literature on the sunk cost effect and the biological literature on the Concorde fallacy (Arkes & Ayton, 1999). It is all the more surprising though, when researchers working within different subdisciplines come to opposing conclusions. Such would appear to be the case with respect to the cognitive reasoning literature and the moral reasoning literature, which have both investigated people's reasoning about deontic rules—rules stipulating what is obligated, permitted, and forbidden.

In the cognitive reasoning literature a consensus has developed that there are no principled distinctions between different deontic rules. Despite widely differing theoretical approaches, the majority opinion is that people reason about obligations, permissions, and prohibitions in a unified manner (e.g., Cheng & Holyoak, 1985, 1989; Girotto, Blaye, & Farioli, 1989a; Holyoak & Cheng, 1995; Kirby, 1994; Manktelow & Over, 1990, 1995; Oaksford & Chater, 1994; Sperber, Cara, & Girotto, 1995). This contrasts sharply with the moral reasoning literature in which a consensus has developed that there are different domains of rules: moral rules, social conventional rules, prudential rules, and personal rules, which people reason about in characteristically different ways (see Smetana, 1995a, or Turiel, 1998, for reviews). Some researchers have even claimed that moral rules can be further subdivided into distinct categories (e.g., Chiu, Dweck, Tong, & Fu, 1997; Rozin, Lowery, Imada, & Haidt, 1999; Shweder, Mahapatra, & Miller, 1987; Shweder, Much, Mahapatra, & Park, 1997).

How is it that these two branches of psychology have reached seemingly contradictory conclusions about people's deontic reasoning? The answer we suggest is cognitive reasoning researchers' reliance upon a single reasoning task, the Wason selection task (Wason, 1968), as a means of investigating people's deontic reasoning and the uncritical adoption of logic as a yardstick for characterizing performance. In the selection task, participants are presented with a conditional rule of the form, *If P then Q*, and four cards with information about *P* on one side and information about *Q* on the other side. The visible sides of the four cards display the information, *P*, *not–P*, *Q*, and *not–Q*. The participant's task is to indicate which of the four cards need to be turned over in order to determine whether or not the rule has been violated. Originally designed as a test of conditional reasoning, performance on the selection task easily lends itself to a content-independent logical analysis. The conditional rule, *If P then Q*, is violated whenever *P* is true, and *Q* is false (i.e., *not–Q*). Participants reasoning according to the norms of propositional logic should select the *P* and *not–Q* cards, as these are the only cards that could potentially be violating instances of *P & not–Q*. Although the logic of conditional obligations and permissions is different—the domain of deontic logic as opposed to classical logic—the same logical characterization of performance is routinely applied to deontic versions of the selection task. Moreover, because deontic rules reliably elicit a distinct, logically consistent selection pattern (*P & not–Q*),[1] there has been a tendency by cognitive reasoning researchers to treat this *logically* identical reasoning as *psychologically* identical reasoning.

To clarify, though, we are not claiming that cognitive psychologists *explain* selection task performance in terms of a mental logic, be it a classical, deontic, and so on. Far from it, many if not most psychologists studying the selection task have abandoned logic as an explanation for participants' performance on the task. The claim we *are* making is that the

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[1] It should be noted that in some deontic versions of the selection task a *not–P & Q* selection pattern is the modal response. This has been observed on tasks employing "switched" social contract rules (e.g., Cosmides, 1989, Exps. 3, 4, 8, & 9; Fiddick, Cosmides, & Tooby, 2000, Exp. 3) and on social contract problems employing a "switched perspective" manipulation (e.g., Gigerenzer & Hug, 1992; Manktelow & Over, 1991; Politzer & Nguyen-Xuan, 1992). Comparable manipulations with deontic rules from other domains have not been reported in published papers; hence it is not clear from published reports whether this alternative pattern of performance is unique to social contracts or whether it characterizes deontic rules in general (though see Fiddick, 2000, for evidence that the "switched perspective" effect is unique to social contracts).

content-independent language of classical logic exerts a powerful influence over the characterization of performance before theorization even occurs—that is, in shaping the way researchers characterize the explanandum it has a carry-over effect on how they formulate the explanans. So to repeat, the observation that different versions of the selection task elicit logically identical performance is taken not as evidence that people possess a mental logic, but as evidence of a scientifically meaningful phenomenon (as opposed to a methodological artifact) requiring a single coherent explanation. Why privilege such a simple task in carving nature at its joints?

Excessive reliance on the selection task is, however, only a partial explanation of the differences between the two subfields, for not all practitioners of the selection task have argued that people reason about deontic rules in a uniform manner. Advocates of social contract theory (SCT) have argued that deontic reasoning is not a unified phenomenon, but is the product of divergent collection of evolved psychological mechanisms (Cosmides & Tooby, 1992, 1997; Fiddick, 1998; Fiddick, Cosmides, & Tooby, 2000; Stone, Cosmides, Tooby, Kroll, & Knight, 2002). A crucial assumption of SCT that converges with views in the moral reasoning literature is the view that there are no universal norms regulating human actions in diverse domains. According to the evolutionary perspective that informs SCT, different cognitive adaptations are assumed to have evolved in response to the computational demands imposed by different adaptive problems.

Expanding upon these evolutionary proposals, we argue that reasoning elicited by deontic versions of the selection task is the product of a collection of domain-specific competencies. These include a cognitive adaptation for social exchange (Cosmides, 1989; Cosmides & Tooby, 1989, 1992) and a cognitive adaptation for hazard management (Fiddick, 1998; Fiddick et al., 2000). Some of the evidence that we present in support of this conjecture involves deontic versions of the selection task. However, we believe it is time to move beyond an exclusive focus on the selection task to make connections with moral reasoning literature. Using the methods employed in the moral reasoning literature, we present additional, converging lines of evidence for a psychological distinction between two types of deontic rule: social contracts (social exchange) and precautions (hazard management).

Deontic rules in the cognitive reasoning literature

In the cognitive reasoning literature, deontic reasoning has primarily been investigated in experiments employing the Wason selection task. A large amount of the interest in deontic rules stems from the facilitatory effect that such rules have on task performance. Despite the selection task's apparent simplicity, it is notoriously difficult for people to solve correctly. Typically, fewer than 10% of participants give the logically correct solution to the task (see Evans, Newstead, & Byrne, 1993, for a review). However, when deontic conditionals are employed performance on the task increases substantially (e.g., Cheng & Holyoak, 1985; Cosmides, 1989; Gigerenzer & Hug, 1992; Girotto, Gilly, Blaye, & Light, 1989b; Griggs & Cox, 1982; Manktelow & Over, 1990, 1991).

Several explanations have been offered for this deontic content effect. Advocates of the pragmatic reasoning schemas theory (e.g., Cheng & Holyoak, 1985, 1989; Girotto et al., 1989a; Politzer & Nguyen-Xuan, 1992) have proposed that the deontic content effect is the product

of goal-directed schemas. Various decision theoretic accounts of the selection task have argued that people select those cards that would maximize their subjective expected utility (e.g., Kirby, 1994; Manktelow & Over, 1991, 1992, 1995; Oaksford & Chater, 1994). Others have interpreted the deontic content effect as an artifact of domain-general interpretation processes (e.g., Almor & Sloman, 2000; Liberman & Klar, 1996; Sperber et al., 1995). Despite widely varying theoretical positions, advocates of these different positions are all in agreement on at least one issue: deontic reasoning is a more domain-general phenomenon than it is construed as by SCT (Almor & Sloman, 2000; Cheng & Holyoak, 1989; Girotto et al., 1989a; Kirby, 1994; Liberman & Klar, 1996; Manktelow & Over, 1990, 1991; Oaksford & Chater, 1994; Politzer & Nguyen-Xuan, 1992; Sperber et al., 1995). SCT alone divides deontic reasoning into more specialized forms of reasoning.

According to SCT, one important component of deontic reasoning is reasoning about social contracts—social exchanges in which people cooperate for mutual benefit. SCT proposes that people possess an evolved "look for cheaters" algorithm that is activated when people encounter exchanges in which there is the potential for cheating. The rationale for this hypothesis is that evolutionary and game-theoretic analyses of cooperation suggest that reciprocity could not evolve without the ability to detect and exclude/punish cheaters (Axelrod, 1984; Axelrod & Hamilton, 1981; Trivers, 1971). In the Wason selection task, an offer to engage in social exchange can be expressed by a social contract rule of the form: *If you take the benefit, then you must satisfy the requirement*. Participants encountering such a rule in the selection task are directed by a hypothesized "look for cheaters" algorithm to investigate potential cheaters: individuals who have accepted the benefit (P) without satisfying the requirement (not-Q). This prediction has received wide support (Cosmides, 1989; Cosmides & Tooby, 1992; Fiddick et al., 2000; Gigerenzer & Hug, 1992; Platt & Griggs, 1993).

As both Cosmides (1989) and her critics have pointed out, social contract rules do not exhaust the range of possible deontic rules. Another class of deontic rules that has routinely elicited improved performance on the selection task are precaution rules of the form, *If the hazard exits, then be protected* (e.g., Cheng & Holyoak, 1989; Girotto et al., 1989a; Girotto et al., 1989b; Manktelow & Over, 1990; Yachanin, 1986). Consequently, many reasoning researchers have argued that SCT is too narrow in its application (Cheng & Holyoak, 1989; Girotto et al., 1989a; Manktelow & Over, 1990, 1991; Politzer & Nguyen-Xuan, 1992). However, rather than proposing a more domain-general deontic reasoning theory, Fiddick et al. (2000) have argued for an additional set of psychological mechanisms—a cognitive adaptation for hazard management—to account for people's reasoning about precautionary rules. In the context of the selection task, the cognitive adaptation for hazard management would, in part, cue people to investigate individuals who are at risk of harm—individuals who face a hazard (P) but are not protected (not-Q). Evidence for a distinction between reasoning about social contract and precaution versions of the selection task includes the following: Reasoning about social contracts and precautions can be doubly dissociated using a priming paradigm (Fiddick, 1998); reasoning about social contracts, but not precautions, can be selectively impaired in patients with "mind reading" deficits (Stone et al., 2002); and people judge different outcomes to be violations of social contracts and precautions (Fiddick et al., 2000, Exp. 3).

Deontic rules in the moral reasoning literature

In the moral reasoning literature, Turiel and his colleagues (see Turiel, 1998, or Smetana, 1995a, for a review of this literature) have proposed that there are three distinct domains of action: the moral domain, the social conventional domain, and the psychological domain. In the moral domain, social actions are regulated by prescriptions that are "obligatory, universally applicable (in that they apply to everyone in individual circumstances), impersonal (in that they are not based on personal preferences), and determined by criteria other than agreement, consensus, or institutional convention" (Smetana, 1995a, p. 86). Other social actions fall within the domain of the social conventional. The rules governing actions in this domain are "Arbitrary and agreed-on behavioral uniformities that structure interactions within social systems" (Smetana, 1995a, p. 87). Actions in the psychological domain are nonsocial and primarily have consequences for the self. The psychological domain includes both personal and prudential acts.

According to the domain theory of moral reasoning, both children and adults reason about acts falling within different domains in characteristically distinct ways. There is considerable evidence that adults and even children make distinctions between rules regulating actions in different domains. Children and adults give domain-specific reasons for rules (e.g., Nucci, 1981; Nucci & Weber, 1995; Song, Smetana, & Kim, 1987; Turiel, 1983). For example, children tend to cite issues of welfare or fairness as justifications for moral rules, but instead tend to cite social agreement/coordination and prevailing customs / rules as justifications for social conventions (Nucci, Camino, & Sapiro, 1996; Song et al., 1987). Children and adults judge the permissibility of rule violations in a domain-specific manner (e.g., Nucci, 1981; Nucci et al., 1996; Nucci & Weber, 1995; Song et al., 1987; Tisak, 1993; Tisak & Turiel, 1984, 1988; Turiel, 1983). For example, children tend to believe that moral rules should never be violated and should apply to all peoples, while social conventional rules may sometimes be legitimately violated and need not be followed by different social groups (Nucci et al., 1996; Song et al., 1987). Children and adults evaluate the seriousness of rule violations in a domain-specific manner (e.g., Nucci, 1981; Smetana & Bitz, 1996; Song et al., 1987; Tisak, 1993; Tisak & Turiel, 1984, 1988; Turiel, 1983). For example, children judge violations of moral rules to be more serious than violations of social conventional or prudential rules, even when they are matched for degree of harm (Tisak, 1993; Tisak & Turiel, 1984, 1988). Children and adults judge the legitimacy of intervention in a domain-specific manner (e.g., Nucci et al., 1996; Nucci & Weber, 1995; Smetana, 1995a; Smetana & Asquith, 1994; Smetana & Bitz, 1996). For example, adolescents believe that parents and teachers have legitimate authority to regulate actions in the moral, conventional and prudential domain, but not in the personal domain— although they sometimes disagree about what acts fall within what domain (Smetana & Asquith, 1994; Smetana & Bitz, 1996). Hence, the moral reasoning literature provides wide empirical support for multifaceted distinctions between different domains of deontic reasoning.

Although moral reasoning researchers do not frame any of their proposed domains in terms of social contracts or precautions, there is suggestive evidence that these two types of rule underlie key domain distinctions. The connection between prudential rules and precautionary rules is straightforward—they are the same thing. The fact that they are predominantly framed as conditionals in the selection task literature is simply a methodological artifact. There are also parallels between social contract rules and social conventional rules.

For example, both require social agreement and promote social interaction. These parallels are further highlighted by Miller and Bersoff's (1988) finding that both children and adults tend to reason in social conventional terms only when there is a high social utility to the rule (i.e., mutual benefit) or when there are clear, proprietary rights. In the absence of either high social benefits or proprietary rights, people tend to view such rules as a matter of personal choice. Hence, the cognitive reasoning literature's distinction between social contracts and precautions roughly maps on to the moral reasoning literature's distinction between social conventional and prudential rules.

If one assumes that social contracts are an important subset of social conventions (not all social conventions deal with rationed benefits), on the one hand, and that precautions are equivalent to prudential rules, on the other, then there is a considerable body of moral reasoning research indirectly suggesting a psychological distinction between social contracts and precautions (e.g., Barbieri, 1993; Nucci et al., 1996; Nucci, Guerra, & Lee, 1991; Nucci & Weber, 1995; Smetana, 1995a, 1995b; Smetana & Asquith, 1994; Smetana & Bitz, 1996; Tisak & Turiel, 1984). There have, however, been no studies that we are aware of that have specifically focused on the distinction between social conventions and prudential rules. Theoretical and empirical interest is primarily concentrated on the moral domain and how it differs from both the social conventional domain and the personal/prudential domain, rather than on the specific character of either social conventional or prudential reasoning and how these two domains of reasoning differ from each other. Part of our aim in this paper is to address this theoretical and empirical gap in the literature.

Moving beyond the Wason selection task

The selection task can be, as we have suggested, a relatively poor assay of people's reasoning about deontic rules because it reinforces a narrow, logical characterization of reasoning. The methods employed by the moral reasoning literature, on the other hand, offer the means to empirically pull apart psychological distinctions that are obscured by the selection task. Therefore, we report the results of two experiments employing methodologies developed in the moral reasoning literature that demonstrate a dissociation between social contracts and precautions. In Experiment 1, we report the results of a study comparing adult judgements about the permissibility of violating precautionary and social contract rules and the rationale for these rules. The procedure employed is similar to that used to elicit criterion judgements and rule justifications in the moral reasoning literature (see Turiel, 1998). In Experiment 2, we report the results of a study employing a methodology devised by Rozin et al. (1999) to elicit moral code distinctions by having people match rule violations to emotional expressions.

EXPERIMENT 1
Criterion judgements and rule justifications

In this first experiment we sought to investigate whether adults make principled distinctions between social contract and precaution rules that evoke logically equivalent performance on the Wason selection task. The experiment involved two parts. First, participants were given either a social contract or a precaution version of the Wason selection task. This was done to assess the uniformity of reasoning about these rules as determined by selection task

performance. Typically, in the selection task literature similarity both in terms of the deontic nature of these rules and in terms of levels of selection task performance would be taken as evidence that participants are reasoning about these rules in roughly the same manner.

Second, a different group of participants were given the same rules and scenarios, but rather than have them look for violations, they were asked to assess the rules in terms of whether it is permissible to violate the rule (criterion judgements) and in terms of the reasons for following the rule (rule justifications). It is standardly assumed in the moral reasoning literature that rules falling in different domains are backed by a different set of reasons. Hence, if contrasting judgements/justifications are elicited by the social contract and precaution rules employed in this experiment, then moral reasoning researchers would tend to interpret this as evidence for domain-specific differences in reasoning about these rules.

Criterion judgement studies typically ask children and adults when it permissible to violate rules. For our study we selected four different criteria for rule violations: (1) *authority*; is it permissible to break the rule if an authority figure permits one to do so? (2) *consensus*; is it permissible to break the rule if everyone agrees that it is all right do so? (3) *universality*; is it permissible for other cultures or social groups to break the rule? (4) *rule contingency*, should one act in accordance with the rule even if the rule did not exist?

Some of the justifications typically offered for rules include concerns for another's welfare, fairness, social agreement, tradition, social order/coordination, avoidance of injury, practical utility, and personal preference. In this study, we chose to focus on three reasons for following a rule: social agreement/consensus, morality, and factual matters. In addition, we added a fourth question suggested by the selection task literature. Pragmatic reasoning schemas theory (Cheng & Holyoak, 1985) argues that the deontic rules that typically elicit correct performance on the selection task are rules instituted by an authority for a social purpose. Hence, we decided to ask participants whether they thought the rule was made for a *social purpose*.

To test the hypothesized connection between social contracts and social conventions we employed two types of social contract rule: a social exchange and a social convention. The social exchange described an exchange of benefits between two identifiable parties. Given the importance of such social exchanges in the evolution of the hypothesized "look for cheaters" algorithm (Cosmides, 1989; Cosmides & Tooby, 1989, 1992), the social exchange rule represents a prototypical social contract from the perspective of SCT. In the social convention scenario, the rule described a traditional, but seemingly arbitrary, religious practice and, hence, represents a prototypical social convention from the perspective of the domain approach. In pilot testing with the social convention, participants indicated that they viewed the regulated action as a benefit; therefore the social convention can also be viewed as a social contract from the perspective of SCT so both rules are predicted to elicit high levels of performance on the selection task.

The complement, that the social exchange can be viewed as a social convention, is less likely. While the terms of an exchange may be arbitrary, cheating on a social exchange is likely to be viewed as a moral matter (another person suffers as a consequence) hence it could be argued that social exchanges would be better viewed as falling within the moral, as opposed to social conventional, domain. Cheating on a social convention in which no readily identifiable second party suffers is less likely to be viewed as a moral matter. So while there is an empirical track record in the cognitive literature suggesting that performance on the social exchange and the social convention versions of the selection task will be comparable, it is an open question

whether criterion judgements and rule justifications for these two rules will be comparable. Nevertheless, we predict that the criterion judgements and rule justifications will be similar for both of these social contracts: the social exchange and the social convention.

Predictions

The predictions for selection task performance in the first part of the experiment are straightforward. Given the track record of social contracts and precautions in eliciting high levels of correct performance (>50% correct), we predict similar performance with each of the scenarios employed here. The theoretical reasons for predicting such performance have been reviewed above and do not concern us here. What are more important are the predictions for participants' criterion judgements and rule justifications in the second part of the experiment.

Contrasting predictions for the second part of the experiment can be generated from the perspective of the mainstream selection task literature, SCT, and the domain theory (DT) in the moral reasoning literature. We begin with predictions suggested by the mainstream selection task literature. Given the predicted equivalence of selection task performance and the fact that all three rules are framed as obligations (*If P then must Q*), the majority opinion in the selection task literature would be that these three rules are psychologically equivalent obligations. The most straightforward prediction, therefore, is that the pattern of performance in the second part of the experiment will be roughly identical across all three scenarios or, under the assumption that the questions posed do not tap into anything meaningfully related to their deontic status, performance could vary randomly across all three scenarios. In short, there should be either one consistent pattern or no pattern at all. Of course, different cognitive theories of deontic reasoning might differ in their predictions of the specific patterns observed (e.g., pragmatic reasoning schemas theory would predict that participants would consistently endorse the view that the rules were initiated for a social purpose, while other theories might not make this specific prediction), but they will, nevertheless, all predict a consistent pattern regardless of what the specific pattern may be.

SCT and DT make exactly the opposite prediction. Both SCT and DT agree that the precaution and social convention rules fall within different domains and will, therefore, elicit different constellations of judgements/justifications. Performance for the social exchange scenario is more difficult to predict from the perspective of DT given the ambiguous nature of the social exchange: Does it fall within the social conventional domain or does it fall within the moral domain? Either way, the judgements/justifications for the social exchange scenario should differ from those elicited from the precaution scenario. The unresolved question is whether the answers elicited by the social exchange will match those elicited by the social convention. We predict, as suggested by SCT, that they will match given that both rules are social contracts.

One should note, however, that these are fairly simplified predictions, especially on the part of SCT and DT. There is no reason to assume that social contracts and precautions should differ along *every* dimension. It is beyond the scope of this paper to argue which and how many dimensions rules must differ along before it is warranted to assign them to separate domains. Without such a theory of domains we believe it is simplest and fairest to present participants with a range of questions suggested by the prevailing literature and to see whether, on balance, social contracts are more or less like precautions.

More detailed predictions could be made by each approach, but again we believe that the simplest contrast—are the patterns of judgements/justifications the same, different, or random?—is the fairest. The cognitive theories, be they SCT or one of its rivals, have not made published predictions regarding the sort of tests used in this experiment. Undoubtedly specific predictions could be surmised from past formulations of these theories, but this would involve secondary assumptions that their advocates may or may not wish to make. Our primary goals are to assess whether social contracts and precautions eliciting comparable performance on the selection task produce contrasting response patterns when an alternate methodology is used and to assess whether social exchanges and social conventions produce similar response patterns across both methods.

Method

Participants

Selection tasks were administered to a group of 58 participants without prior exposure to the task. They were predominantly students and staff, recruited at Humboldt University, Berlin. They consisted of 24 males and 34 females ranging in age from 19 to 31 years ($M = 23.7$ years; median = 23 years). This part of the experiment was conducted in a courtyard at Humboldt University outside of the campus cafeteria, and participants received a chocolate bar for their participation.

Participants in the second part of the experiment were predominantly students and staff, recruited from the Free University, Berlin. Of these, 2 participants were eliminated for being unresponsive. The remaining 73 participants consisted of 34 males and 37 females (2 participants did not report their sex) ranging in age from 20 to 65 years ($M = 27.4$ years; median = 25 years). This part of the experiment was conducted at the Max Planck Institute for Human Development, and participants were paid a fee for participating.

Procedure

In the first part of the experiment, participants received a *tanka* scenario version of the Wason selection task employing one of three different stories. Each participant worked on only one version of the tanka selection task (precaution, $N = 22$; social exchange, $N = 18$; social convention, $N = 18$). Each story was set in the same fictitious culture, the Mubata tribe in Africa, in which a drink called tanka is consumed. In the precaution version of the task, tanka is a poisonous religious drink that could blind a person. However, the caffeine in coffee beans neutralizes the poison, so the chief of the tribe made the following rule: *If you drink tanka, then you must have a coffee bean in your mouth*. In the social contract version of the task, tanka is a desirable (nonpoisonous) drug made from a secret recipe passed down from mother to daughter. In order to acquire tanka a man had to give his wife a gift, hence the chief of the tribe made the following rule: *If you drink tanka, then you must give your wife a gift*. In the social convention version of the task, tanka is a religious drink that people traditionally drank with a coffee bean in their mouth, hence the customary rule was: *If you drink tanka, then you must have a coffee bean in your mouth*. Again, in pilot testing, we have found that people viewed drinking tanka in such circumstances to be a benefit.

Based on the exact same scenarios and rules as those employed in the selection tasks, three separate questionnaires were devised. Each participant received only one questionnaire (precaution, $N = 25$; social exchange, $N = 24$; social convention, $N = 24$). Each questionnaire had the same basic format. The questionnaire featured one of the stories and rules copied directly from the corresponding selection task. The only difference was that all mention of cards and statements supporting the search for rule violations were removed. Instead, the focal rule was followed by a series of questions. For each question a statement

was made for which participants were asked to indicate whether they agreed, disagreed or were uncertain. These included four criterion questions eliciting, in order, judgements about authority, social consensus, universality, and rule contingency. For the precaution and social convention versions, the criterion judgement statements were as follows (in the same order as they appeared):

1. The Mubatas should not drink tanka without a coffee bean, even if the chief allows them to do so. [authority judgement]
2. The Mubatas should not drink tanka without a coffee bean, even if all the Mubatas agree that it is all right to drink tanka without a coffee bean. [consensus judgement]
3. The members of a neighbouring tribe should not drink tanka without a coffee bean, even if they regarded it as acceptable. [universality judgement]
4. No one should drink tanka without a coffee bean, even if the Mubata tribe didn't have the rule. [rule contingency judgement]

The statements in the social exchange version were slightly different to reflect both the different content of the rule—the rule is focused on the men's actions, and drinking tanka was contingent upon the giving of a gift and not having a coffee bean in one's mouth—and to reflect the fact that there are two parties to the exchange: the men and their wives. Therefore, we employed two versions of the consensus and universality statements (in addition to the authority and rule contingency statements), but our interest is only in judgements made in response to the agreement of the women, the rights-bearers in this situation. These read as follows:

2a. The men in the tribe should not drink tanka without giving their wives a gift, even if all the men agree that it is all right to do so. [men's consensus judgement]
2b. The men in the tribe should not drink tanka without giving their wives a gift, even if all the women agree that it is all right to do so. [women's consensus judgement]
3a. The men in a neighbouring tribe should not drink tanka without giving their wives a gift, even if all the men in this tribe agree that it is all right to do so. [men's universality judgement]
3b. The men in a neighbouring tribe should not drink tanka without giving their wives a gift, even if all the women in this tribe agree that it is all right to do so. [women's universality judgement]

Our predictions regarding the similarities between social exchanges and social conventions and differences between social exchanges and precautions relate specifically to judgements made about the women's (the rights-bearers') agreement, not the men's, for both the social consensus and universality judgements.

Following the criterion statements, there were four justification statements that were identical for all three questionnaires, with the exception of the social purpose question as indicated below (the reason for the difference being that the chief did not institute the social convention). The statements read as follows (in the same order as they appeared):

1. The chief made the rule for a social purpose (precaution/social exchange version).
   The rule was made for a social purpose (social convention version).
2. Whether or not this rule should be followed is a matter of social agreement.
3. Whether or not this rule should be followed is a moral matter.
4. Whether or not this rule should be followed is a matter of facts.

Again, for each statement, participants had the option of indicating that they agreed, disagreed, or were uncertain.

TABLE 1
Experiment 1. Pattern of card selections.
Percentage of participants making each selection

		Social contract	
Card pattern	Precaution	Exchange	Convention
P, not–Q	90.9	88.9	72.2
P	9.1	5.6	11.1
P, Q	0	0	5.6
Q	0	0	5.6
not–Q	0	0	5.6
not–P, Q	0	5.6	0
N	22	18	18

Results and discussion

Did the social contracts and precaution elicit similar performance on the selection task?

The selection of the P and not–Q cards was coded as a correct selection for each of the three tanka versions of the selection task. Comparing levels of correct P & not–Q selections, there was little difference in performance across the three tanka versions of the selection task. The precaution version elicited 90.9% correct responses, the social exchange version elicited 88.9% correct responses, and the social convention version of the task elicited 72.2% correct responses. These levels of correct performance are either at or above that typically observed for deontic versions of the selection task; hence researchers studying these rules within the selection task literature would typically find little cause to attribute reasoning about these rules to anything other than a common set of reasoning procedures. The complete patterns of card selections are listed in Table 1.

What pattern of judgements/justifications did the social contracts and precaution elicit?

The pattern of judgements/justifications was largely as predicted by SCT. The results for the criterion judgements and rule justifications are reviewed separately (see Tables 2 and 3, respectively); however, a few preliminary notes apply to the results more generally. For each question the predicted pattern of dissociation was tested with a simple 2 × 2 or 2 × 3 chi–square test, as the case may be. The statistical tests were conducted after collapsing responses for the "disagree" and "uncertain" options on all of the questions. This was done because the "uncertain" response option was an infrequent selection for many of the questions, otherwise violating the assumptions of the chi–square tests that were conducted on each of the contrasts. This removed the cell size problem in all of the analyses except for that conducted in the authority criterion judgement analysis.[2]

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[2]The smallest expected cell sizes in this condition were 4.79, 4.60, and 4.60, for each of the disagree/uncertain response options.

Tables 2 and 3 report the full pattern of participants' responses. The pattern of response to each question is indicated through the use of the superscripts: [P] (precaution pattern) and [s] (social contract pattern) in the *Agree* column. Each question that elicited a similar pattern of response (i.e., no significant difference, $p < .05$, in judgements) is denoted with the same superscript. SCT predicts that the precaution questions will elicit a different pattern of responses from that of the social convention and social exchange questions. Hence, the data should be Precaution[p], Convention[s], and Exchange[s], indicating that the precaution question elicited one pattern of responding while the social convention and social exchange elicited a pattern similar to each other, but different from the precaution. If, on the other hand, only the precaution and social exchange elicited statistically different patterns of response, with responses to the social convention question falling somewhere in between and not significantly different from the other two, then this would be denoted as Precaution[p], Convention[ps], and Exchange[s]. Participants' answers to the *Men* (duty-bearers) questions (social exchange condition) are also provided in Table 2. However, analyses were only conducted on the *Women* (rights-bearers) questions in the social exchange condition, as it is only the answers to these questions that are theoretically relevant.

TABLE 2
Experiment 1. Criterion judgements. Percentage of participants making response

Criterion judgement	*Rule*	*Agree*	*Disagree*	*Uncertain*
Authority	Precaution	84[ps]	16	0
	Convention	71[ps]	20	8
	Exchange	88[ps]	8	4
Consensus	Precaution	76[p]	16	8
	Convention	50[s]*	33	17
	Exchange women	58[ps]	42	0
	Exchange men	79	17	4
Universality	Precaution	76[p]	16	8
	Convention	33[s]	54	13
	Exchange women	29[s]	54	17
	Exchange men	46	42	13
Rule contingency	Precaution	84[p]	16	0
	Convention	25[s]	71	4
	Exchange	25[s]	63	13

Note: Precaution, $N = 25$; social contract, $N = 24$; social convention, $N = 24$. The similarity in responses across the scenarios is indicated by the superscripts: [P] (precaution pattern) and [s] (social contract pattern). See text for further details. * denotes a marginally significant difference between the social convention and the precaution for the social consensus question.

Were there any differences between the rules in the criterion judgements that they elicited?

Participants' responses to the criterion judgement questions are summarized in Table 2. We review these below in the same order in which participants answered the questions.

Contrary to our predictions, the authority question yielded no differences in judgements across the three scenarios. For all three rules, participants did not believe that the chief's authority could override the rule. Hence, not only was there no difference in reasoning about authority between the social exchange and social convention rules, there was likewise no difference in reasoning about authority between the precaution and social exchange rules or the precaution and the social convention rules, $\chi^2(2) = 2.40$, $p > .25$. This finding is not too surprising since, with respect to precautions, the existence of a hazard is an objective matter that cannot be dispelled by the chief's command; therefore people should still follow the rule even if the chief allows them to break it. The Mubatas should also still adhere to the social exchange, but for a different reason. The women making the tanka are entitled to receive the agreed compensation, an entitlement that only the women and not the chief can void (see the social consensus question below). Hence, similar performance could be predicted for both conditions even though the underlying reasons are different: the objective nature of hazards versus who has legitimate authority to void an entitlement. Participants' reasoning in the social convention condition is less clear, but may parallel that in the social exchange condition—questioning whether the chief's authority is legitimate in this case.

The results for the consensus judgements provided better support for the predicted dissociations. As predicted, there was no difference in reasoning about social consensus between the social exchange and the social convention rules, $\chi^2(1) = 0.34$, $p > .50$. The predicted difference between the precaution and the social convention rules was marginally supported, $\chi^2(1) = 3.55$, $p < .06$, while there was no support for the predicted difference between the precaution and the social exchange rules, $\chi^2(1) = 1.73$, $p > .15$. As suggested above, fewer participants thought that the social exchange needed to be adhered to if the women, as opposed to the chief, agreed it was all right to violate it (58% agree/social consensus question vs. 86% agree/authority question, $\chi^2(1) = 5.17$, $p < .025$). One explanation for the high level of "agree" responses in the social exchange condition may be that participants interpreted the question as asking whether it would be ungrateful to not return the favour—that is, the men "should" follow the rule as an act of niceness and not because they are obligated to do so.[3]

The results for the universality judgements provided better support for the predictions. As predicted, there was a difference in participants' reasoning about the universality of the precaution and the social exchange rules, $\chi^2(1) = 10.77$, $p < .001$, and between the precaution and the social convention rules, $\chi^2(1) = 8.99$, $p < .005$. However, as predicted, there was no difference between the social convention and the social exchange rules, $\chi^2(1) = 0.10$, $p > .75$.

Finally, the results for the rule contingency judgements provided the strongest support for the predicted dissociation. After collapsing the "disagree" and "uncertain" response options, the judgements for the social exchange question and the social convention question were identical (25% agreed to both the social exchange and social convention statements), and these

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[3]We would like to thank Leda Cosmides for bringing this possibility to our attention.

judgements were substantially different from those given to the precaution question, $\chi^2(2) = 23.11$, $p > .000001$.

Were there any differences between the rules in the rule justifications that they elicited?

Participants' responses to the rule justification questions are summarized in Table 3. As can be seen in Table 3, the "uncertain" response option was selected more frequently for the rule justification questions. However, the cell size assumptions were still violated for the social agreement question. This was corrected by collapsing responses to the "disagree" and "uncertain" options, and for consistency these options were collapsed for the other questions as well. All analyses were conducted on the collapsed data. We review participants' answers below in the same order in which participants answered the questions.

The results for the rule justification questions were largely as predicted with the exception of the social purpose question (see Table 3). Contrary to our predictions, there was no difference in participants' endorsement of the claim that the precaution and social exchange rules were made for social purpose, $\chi^2(1) = 0.02$, $p > .50$, but, also contrary to predictions, there was a difference between the social exchange and the social convention rules, $\chi^2(1) = 7.38$, $p < .01$. There was, however, also a difference between participants' endorsement of a social purpose for the precaution and social convention rules, $\chi^2(1) = 6.76$, $p < .01$, as predicted. This unpredicted result might be due to the fact that in the social exchange and precaution scenarios

TABLE 3
Experiment 1. Rule justifications. Percentage of participants making response

Rule justification	Rule	Agree	Disagree	Uncertain
Social purpose	Precaution	52^p	20	28
	Convention	17^s	42	42
	Exchange	54^p	29	17
Social agreement	Precaution	20^p	72	8
	Convention	54^s	42	4
	Exchange	75^s	13	13
Morality	Precaution	12^p	68	20
	Convention	33^{s*}	46	21
	Exchange	38^s	42	21
Factual	Precaution	58^p	25	17
	Convention	29$^{s\#}$	46	25
	Exchange	8$^{s\#}$	67	25

Note: Precaution, $N = 25$; social contract, $N = 24$; social convention, $N = 24$. The similarity in responses across the scenarios is indicated by the superscripts: ^{p} (precaution pattern) and ^{s} (social contract pattern). See text for further details. *denotes a marginally significant difference between the social convention and the precaution for the morality question. # denotes a marginally significant difference between the social exchange and the social convention for the factual question.

the chief made the rule, whereas in the social convention scenario, the rule was a tradition. Participants might, therefore, have been basing their answers on intuitions about the execution of authority rather than the content of the rules—that is, whenever the chief institutes a rule, he does it for a social purpose (i.e., with some group goal in mind). Alternatively, participants might have focused on the "purpose" aspect: Because an agent, the chief, instituted the social exchange and the precaution, these rules were made intentionally, whereas the social convention lacking an author also lacked intention. That participants focused on the act of instituting a rule, instead of whether the rule has a *social* purpose, is suggested by the pattern of responses to the social agreement/consensus question.

The answers to the related social agreement/consensus question were more supportive of the predictions. As predicted, participants' endorsements of social agreement as a reason for following the precaution differed significantly from their endorsements for both the social exchange, $\chi^2(1) = 14.85$, $p < .0002$, and for the social convention, $\chi^2(1) = 6.14$, $p < .02$. There was, however, no difference in the pattern of endorsements between the social exchange and the social convention, $\chi^2(1) = 2.28$, $p > .10$. The responses to this and the preceding questions are seemingly at odds with participants judging the social exchange and the precaution to be "social" in the social purpose question, but judging the social exchange and the social convention to be "social" in response to the social agreement question. However, they are slightly different questions, with the former including an element of intent that is lacking in the latter. Pragmatically, being asked two "social" questions in a row, participants may have been more inclined to increase the contrast between these two questions so as to reduce their redundancy. This may have had the effect, as we speculate above, of causing participants to focus on the act of rule institution on the social purpose question.

Participants' judgements regarding whether obeying the rule was a moral matter were also as predicted, with there being virtually no difference in the social exchange and the social convention endorsements, $\chi^2(1) = 0.09$, $p > .50$. The difference in endorsements between the precaution and the social exchange was significant, $\chi^2(1) = 4.30$, $p > .04$, whereas the difference in endorsements between the precaution and social convention was only marginally significant, $\chi^2(1) = 3.20$, $p > .08$. The marginal significance of the latter contrast might be due to floor effect, since judgements of the moral nature of these rules were low, as one might anticipate. Although significantly more participants endorsed the view that following the social exchange, as opposed to the precaution, is a moral matter, it may seem surprising that only 38% of participants agreed that: "Whether or not this rule should be followed is a moral matter." Presumably it is immoral to cheat on the social exchange. However, it is not immoral to never enter into the exchange in the first place, and the question as stated is ambiguous between these two readings, which may have contributed to the low level of endorsement.

Finally, participants' endorsements of the claim that obeying the rule is a factual matter were largely as predicted. There was a significant difference in the pattern of endorsements for precaution and the social exchange, $\chi^2(1) = 15.54$, $p < .0001$, and for the precaution and social convention, $\chi^2(1) = 4.15$, $p < .05$. However, contrary to predictions, there was also a marginally significant difference between the endorsements for the social exchange and social convention rules, $\chi^2(1) = 3.42$, $p < .07$.

In contrast to the picture that immerged in the first part of the experiment where there were few differences between the three rules, the pattern of results produced in the second part of the experiment provides evidence of systematic differences in the way that people reason

about social contracts and precautions, regardless of whether the social contract is a social exchange or a social convention. Across 16 possible contrasts, 12 provided statistically significant support for the predicted dissociation, social contracts versus precautions (10, if marginally significant results are excluded), whereas across 8 possible contrasts, 6 provided significant support for the predicted similarity between the social exchange and the social convention (7, if marginally significant results are excluded). Once again, it is worth reiterating that we have only tested the simplest of predictions in this experiment. On balance, the results favour the dissociation predicted by SCT and DT, and further testing based on more specific hypotheses and questions is obviously called for. Nevertheless, it would appear that a narrow focus on the results of a single task, the Wason selection task, can potentially obscure systematic differences in the ways that people reason about rules.

It is unlikely that these results are due to superficial differences in the content of the scenarios since the differences in judgements/justifications between the precaution and the social convention were greater than the differences between the precaution and the social exchange, despite the fact that the precaution and the social convention scenarios employed literally the same rule. These two scenarios did, however, differ over whether the chief initiated the rule in question, but the social exchange and the social convention scenarios also differed along this same dimension without eliciting similar differences in judgements/justifications.

It is also worth noting that, over all, a clear majority of participants appeared to believe it was obligatory to follow the precaution as indicated by their endorsement of all four criterion–judgement claims. This pattern of judgements is somewhat problematic for advocates of DT since this is a pattern of judgements that is typically assumed to characterize moral rules, yet the participants in this study also clearly believed that the precaution rule was not a moral rule since only 12% thought that obedience to the rule was a moral matter. We return to this matter later in the General Discussion.

EXPERIMENT 2
Emotional reactions to rule violations

One potential problem with the preceding study is that it relied upon a single general scenario. In this second experiment we sought to overcome this difficulty by generalizing the dissociation between social contracts and precautions, not just across a wider range of scenarios, but also to a different methodology. Here we draw upon an independent methodology derived from the moral reasoning literature. Recently, Rozin et al. (1999) devised a novel method for assessing different moral codes. In order to test the hypothesis that different moral codes are associated with different emotions, Rozin et al. gave participants descriptions of acts that were hypothesized to violate different moral codes. In one version of the methodology, the participants' task was to indicate which picture, among of an array of pictures depicting different facial expressions of emotion, depicted how a person would react to this moral violation. As predicted, people selected different facial expressions for different hypothesized moral code violations. We adapted this methodology in order to test whether people associate violations of different rules—social contracts and precautions—with different emotions. We predicted that participants would associate different emotions with violations of social contracts and

precautions: People will associate violations of social contracts with anger and violations of precautions with fear.

Method

Participants

The participants in this study were additional group of 23 German speakers, predominantly students and a few staff, recruited from the Technical University, Berlin and from the Free University, Berlin. They consisted of 10 males and 13 females. They ranged in age from 21 to 32 years ($M = 25.0$ years; median = 24 years). Participants spoke German and had German ethnic backgrounds (one participant had a mixed German–Yugoslav background). Participants were paid a fee for participating in the experiment, which was conducted in German at tables in the corridors of the universities.

Procedure

We created eight emotion–face tasks modelled after Rozin et al.'s (1999, Exp. 1) face task. The tasks were constructed as follows. We selected four precaution and four social contract versions of the selection task that have previously been found to elicit at least 75% correct logical performance (see Table 4). The tasks were then modified in the following way. The cards and any mention of them were removed while the rules and the supporting scenarios were retained. Following the rules, the scenarios said that that someone had caught a person breaking the rule. The participants were then told that it was their task to indicate whom, among an array of four people depicting different facial expressions, they thought caught the person breaking the rule. For each task there were the same four emotions depicted: anger, disgust, fear, and happiness. For example, the poison dart task read as follows:

You are an anthropologist studying the Jibaru tribe.

TABLE 4
Experiment 2. Rules used in the emotion face tasks

Rule	Wording	Type	Performance[a] /Reference	
Poison dart	If you make poison darts, then you must wear rubber gloves.	Precaution	81	Fiddick, 1998
Risk factor	If a worker's risk factor is 7 or more, then the worker must wear a hard hat.	Precaution	85	Yachanin, 1986
Speed	If one drives over 100 km/h, then one must have a fluorescent car.	Precaution	80[b] 85[c]	Girotto et al., 1989
Volcanic rock	If one is going out at night, then one must tie a small piece of volcanic rock around one's ankle.	Precaution	86	Cheng and Holyoak, 1989
Cassava root	If a man uses cassava root, then he must have a tattoo on his face.	Social contract	75	Cosmides, 1989
Day off	If an employee works on the weekend, then that person gets a day off during the week.	Social contract	75	Gigerenzer and Hug, 1992
Duiker	If you eat duiker meat, then you have found an ostrich eggshell.	Social contract	75	Cosmides, 1989
Subsidy	If a homeowner gets a subsidy, then that person must have installed a modern heating system.	Social contract	81	Gigerenzer and Hug, 1992

[a]Performance denotes percentage of logically correct, *P & not-Q* selections, when the rule is employed in the Wason selection task. [b]10–11-year-olds. [c]14–15-year-olds.

The Jibaru hunt with blowguns and poison darts. The poison is a powerful neurotoxin obtained from a small tree frog and has been known to kill humans too. In fact, several Jibaru have died preparing poisoned darts when the poison got onto their exposed skin. You had heard about this problem and brought a supply of rubber gloves for the Jibaru tribesmen to wear to avoid contact with the poison when making darts.

The tribal elders thought that using the gloves was a great idea and so they made the following rule:

"If you make poison darts, then you must wear rubber gloves."

While you were studying the Jibaru, one of the tribeswoman caught a man breaking the rule. Indicate which of the following tribeswomen you think caught the man breaking the rule.

Pictures depicting the facial expression of anger, disgust, fear, and happiness were arranged below in a two-by-two array.

The pictures were scanned images from Matsumoto and Ekman's (1988) *Japanese and Caucasian facial expressions of emotion* (*JACFEE*) slides. The pictures were in black and white and individually measured approximately 9 × 6 cm. Both Japanese and Caucasian pictures were used, as were male and female models. Each array consisted of pictures of only Japanese or only Caucasian pictures of one sex. The Japanese photos were employed in the tasks in anthropological contexts with the *poison dart* (precaution) and *duiker* (social contract) tasks featuring female models and the *volcanic rock* (precaution) and *cassava root* (social contract) tasks featuring male models. The Caucasian photos were employed in the remaining tasks with the *speed* (precaution) and *subsidy* (social contract) tasks featuring female models and the *risk factor* (precaution) and *day off* (social contract) tasks featuring male models. Hence, for both the precaution and social contract tasks, there was an equal and counterbalanced number of Japanese and Caucasian, and female and male, photo arrays. In total, there were eight different photo arrays with two different arrays for each ethnicity/sex combination. Each photo array appeared equally within a precaution context or a social contract context across participants. The arrangement of the four emotions depicted in the arrays was also counterbalanced across the different ethnicity/sex combinations.

Participants received all eight versions of the task, which they completed at their own pace. Their task was to indicate who they thought caught the person breaking the rule mentioned in the story. For each task they were asked to indicate only one person.

Results and discussion

The results strongly supported our predictions that participants would associate violations of the precautions with fear and violations of the social contracts with anger. For each participant we calculated a summary score for each emotion for the four precaution and four social contract tasks. Each time a participant selected a face a score of one was added to the summary score for that participant giving a minimum possible score of 0 and a maximum possible score of 4 for each type of rule (social contract vs. precaution). Hence, if a participant selected the fear face for three of the precautions and the disgust face for the remaining precaution, then that participant's summary score for precautions would be anger = 0, disgust = 1, fear = 3, and happiness = 0. The mean summary scores for each emotion, broken down by rule type, are presented in Table 5.

TABLE 5
Experiment 2. Pattern of emotion selections. Mean
summary score[a]

| | Rule type | | | |
| | Precaution | | Social contract | |
Emotion	M	SD	M	SD
Anger	0.95	1.02	2.52	1.27
Fear	1.91	0.85	0.52	0.79
Disgust	0.65	0.57	0.43	0.59
Happiness	0.47	0.79	0.52	0.73

[a]0 = emotion never selected, 4 = emotion always selected.

Participants showed a strong tendency to associate violations of precautions with fear and social contracts with anger. As predicted, participants were more likely to associate anger with violations of social contracts than with violations of precautions: within subjects, $t(22, pairwise) = 4.81$, $p < .001$, one-tailed. Also as predicted, participants were more likely to associate fear with violations of precautions than with violations of social contracts: within subjects, $t(22, pairwise) = 5.96$, $p < .0001$, one-tailed. There were no significant differences with the other emotions: disgust, within subjects, $t(22, pairwise) = 1.31$, $p > .20$, two-tailed; happiness, within subjects, $t(22, pairwise) = 0.22$, $p > .50$, two-tailed.

The results of this experiment reinforce those of the previous experiment: People distinguish between social contracts and precautions despite the fact that these rules both tend to elicit similar performance on the Wason selection task. Hence, there is further support for DT and SCT's distinction between social contracts (social conventions) and precautions (prudential rules).

One might object that the experiments reported here do not really test people's reasoning in the way that the Wason selection task does—they assess different aspects of the psychology of deontic rules not addressed by the cognitive reasoning theories. There are, no doubt, substantial differences between the thought processes engaged in the above experiments and those engaged by the Wason selection task; however, selection task is not a privileged task that somehow provides greater insight into the human mind than other methods. It is one method among many. Competing theories of deontic reasoning should be judged not solely by their success in explaining selection task performance but by their success in explaining performance across a range of different methods. On this count, the evolutionary account of deontic reasoning that we have proposed, and likewise the domain theory of moral reasoning, appear to fare better than the more domain-general theories that have been proposed in the cognitive reasoning literature.

The Wason selection task revisited

Despite its shortcomings, we do believe that the Wason selection task is and remains a useful tool for studying human reasoning (see Fiddick et al., 2000). The selection task has, for example, a demonstrated potential for studying content effects, precisely the sort of methodological tool that is required to demonstrate differences in reasoning about social contracts and

precautions. But why, if there is a real psychological difference between social contracts and precautions, have these not become apparent in the selection task literature? The answer is straightforward: Few researchers have sought to discover such differences.

In this final experiment, therefore, we provide selection task evidence for a dissociation in reasoning about social contracts and precautions with respect to the influence of attributions of agent intentions—a topic of considerable interest to moral development researchers since Piaget's (1932) pioneering studies. With respect to the cognitive reasoning literature, Nuñez and Harris (1998) have found that children as young as 3 years of age are capable of reasoning appropriately about obligations that are violated accidentally versus intentionally on the eval-uation task,[4] a cognitively less demanding variant of the selection task. With respect to the full selection task, Cosmides and Tooby (1992; see also Barrett, 1999) report that innocent mistakes are less likely to elicit correct performance on a social contract version of the selection task than are incidents of intentional violation. Hence, there is some evidence that reasoning about social contracts is sensitive to the intentions attributed to the rule breakers.

While it makes adaptive sense that reasoning about social contracts is moderated by attribu-tions of agent intent, there is little reason to believe that reasoning about precautions will like-wise be influenced by attributions of intent. The results of Experiment 1 suggest that people view social contracts as social rules: They are a matter of social consensus and can be overruled by social agreement. It has been hypothesized that the adaptive function of mind-reading—the ability to model other's mental states—is to successfully engage in social interactions, like social exchange (Baron-Cohen, 1995). Hence, it is reasonable to assume that agent intent will have a moderating influence on reasoning about social contracts. Conversely, the results of Experiment 1 suggest that people view precautions as nonsocial rules: They are neither a matter of social consensus nor able to be overruled by social agreement. Unlike the social contract, participants judged the precaution relate to objective facts of the world. (Does the hazard objectively exist, and does the proposed countermeasure provide an effective protec-tion?) Hence, it is less likely that agent intent will have a modifying influence on reasoning about precautions. We tested these contrasting predictions in the following experiment.

EXPERIMENT 3
Reasoning about social contracts and precautions is differentially influenced by attributions of agent intentions

In this experiment we attempt to demonstrate that reasoning about social contracts and precautions is differentially sensitive to mental state attributions. To demonstrate this we took the same basic scenario and independently manipulated whether the rule is a precaution or a social contract, and manipulated whether the rule is broken intentionally or accidentally. We predict that whether the rule is broken accidentally or intentionally will influence participants'

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[4]In the evaluation task, participants are given a conditional rule and complete information about the four possible outcomes: $P \& Q$, $P \& not\text{-}Q$, $not\text{-}P \& Q$, and $not\text{-}P \& not\text{-}Q$. The participants' task is to indicate which of these four outcomes violate the rule. While adult participants have little difficulty solving most versions of the evaluation task, young children display a precocious ability to solve deontic versions of the evaluation task, but not truth-testing versions of the evaluation task (Harris & Nuñez, 1996).

reasoning about the social contract rule, but not about the precaution rule. Specifically, following the results reported by Cosmides and Tooby (1992), we predict that participants will display a pattern of specific impairment on the accidental violation version of the social contract problem.

Method

Participants

The participants in this experiment were an additional 89 undergraduate students enrolled in an anthropology class at Harvard University. There were 40 males and 49 females, who ranged in age from 18 to 22 years (M = 19.3 years; median = 19 years). The participants were volunteers in an in-class demonstration.

Procedure

The four selection tasks employed in this experiment described a scenario in which children are being assigned to one of two swimming classes: an introductory class or an advanced class that involves more pool time. In the social contract versions of the problem, the child has to pay an additional $50 to be enrolled in the advanced class because it involves more of the costly pool time. The rule employed in the social contract versions was: *If a child is to be assigned to the advanced class, then that child must have paid an additional $50*. In the precaution versions of the problem, the child has to be an experienced swimmer because in the preceding year a child drowned to death in the advanced class—experienced swimmers are less likely to get fatigued by the additional pool time. The rule employed in the precaution versions was: *If a child is to be assigned to the advanced class, then that child must be an experienced swimmer*. In all versions of the task, the rule was in effect, and participants were instructed to look for rule violations (i.e., the task was not to see whether the rule was in effect, nor were participants explicitly instructed to look for cheaters).

In the intentional violation problems, the people assigning children to the classes were the fathers of the children, whereas in the accidental violation problems, the person assigning the children to the classes was an elderly lady who had been diagnosed with Alzheimer's disease. In the accidental violation problems, there was no suggestion that the elderly lady had any motive for breaking the rule: She was simply absentminded owing to her illness. The intentional violation problems were similar to the accident violation problems, except that they provided a motive for breaking the rule. The persons sorting the documents were fathers of the children who either: (1) were trying to save themselves a bit of money (social contract version), or (2) were competitive and pushing their children beyond their abilities (precaution version).

Participants each received one selection task, which was preceded by an instruction sheet that gave a general description of the task. They were instructed to read the instructions and the problems carefully, and not to compare problems with others.

Results and discussion

As predicted, whether or not the violation was accidental had no effect on precaution performance (intentional violation, 82.6% *P & not-Q* selections; accidental violation, 79.2% *P & not-Q* selections), but it did have an effect on social contract performance (intentional violation, 80% *P & not-Q* selections; accidental violation, 45.5% *P & not-Q* selections). This interaction, a specific decrement in the levels of *P & not-Q* selections in the accidental

TABLE 6
Experiment 3. Pattern of card selections. Percentage of
participants making each selection

| | Precaution | | Social contract | |
Card pattern	Intentional	Accidental	Intentional	Accidental
P, not–Q	82.6	79.2	80.0	45.5
P	13.0	12.5	5.0	4.5
P, Q	4.3	8.3	10.0	4.5
All four cards	0	0	0	18.2
P, not–P	0	0	0	13.6
not–Q	0	0	0	9.1
Q	0	0	5.0	0
not–P, not–Q	0	0	0	4.5
N	23	24	20	22

violation version of the social contract problem, was significant, $\chi^2(3) = 10.20$, $p < .02$. The complete pattern of card selections is presented in Table 6.

Yet again, social contracts and precautions supported a distinct pattern of reasoning, but this time on the Wason selection task. The results of this experiment suggest that reasoning about social contracts, but not precautions, is influenced by mental state attributions. However, some caution is in order in interpreting these results because, in the social contract condition, the intent to break the rule was confounded with the ability to benefit. The senile old lady did not stand to benefit from breaking the rule when it was framed as a social contract, so it is not clear whether performance was reduced because the individual in question did not stand to benefit or because the violation was accidental. It is likely that both the lack of intent and no potential to benefit were contributing factors to the decrease in social contract performance, since Barrett (1999) has shown that both factors have an independent effect on reasoning about social contracts.[5] More importantly though, it is clear that the precaution problems used here were *not* influenced by the same factors, and this null effect cannot be attributed to the weakness of the manipulation since it had a substantial effect on the social contract version of the problem.

GENERAL DISCUSSION

The results from three different experiments, employing three different methodologies from two isolated fields of psychology and applied to widely differing rules, lend little support to the majority view in the cognitive reasoning literature that people reason about social contracts and precautions in the same manner. Instead, the results lend support to the evolutionary proposal that people possess distinct psychological mechanisms for reasoning about social

[5]It is interesting to note that in Barrett's (1999) study intent to cheat and ability to benefit each independently contributed 20 percentage points to performance. In the present study, both intent and benefit were manipulated, resulting in a comparable 35–percentage-point difference.

contracts and precautions (Cosmides & Tooby, 1992, 1997; Fiddick, 1998; Fiddick et al., 2000). Although previous moral reasoning studies have suggested a dissociation in reasoning about social contracts and precautions (e.g., Barbieri, 1993; Nucci et al., 1991, 1996; Nucci & Weber, 1995; Smetana, 1995a, 1995b; Smetana & Asquith, 1994; Smetana & Bitz, 1996; Tisak & Turiel, 1984), the experiments presented here demonstrate this dissociation less ambiguously. The results of these experiments also add to a converging body of evidence in the cognitive reasoning literature supporting the existence of a collection of deontic reasoning mechanisms (see also Fiddick, 1998; Fiddick et al., 2000; Stone et al., 2002). These results have implications for both deontic reasoning literatures.

Implications for the cognitive reasoning literature

The implications for the cognitive reasoning literature are both methodological and theoretical. Methodologically, the experiments reported here point to the importance of employing a wider range of methods than an almost exclusive emphasis on the Wason selection task. Theoretically, as Evans (2002) has noted, the rationale for and belief in the research programme dedicated to elucidating the logicality of human reasoning has waned, yet the tasks and standards devised by that programme carry on a life of their own. They encourage an impoverished, logical characterization of participants' performance, potentially misleading researchers about the underlying psychological mechanisms.

The study of deontic reasoning in the cognitive reasoning literature provides a good illustration of Evans' concerns. Interest in deontic reasoning has long since progressed from the logicality of human reasoning towards an interest in the nature of practical reasoning. Yet a content-free logical characterization of selection task performance continues to drive arguments for and against various proposals. For example, various deontic reasoning theorists have criticized SCT for being unable to provide a unified account of the logically identical pattern of reasoning elicited by both social contracts and precautions (e.g., Cheng & Holyoak, 1989; Girotto et al., 1989a; Manktelow & Over, 1990). These theorists, in turn, have been criticized for failing to account for logically identical reasoning on nondeontic rules (Almor & Sloman, 1996, 2000; Liberman & Klar, 1996; Love & Kessler, 1995; Sperber et al., 1995). Undoubtedly these critiques are fostered, in part, by the fact that most of this research revolves around a single task that was designed to test logical reasoning: the Wason selection task. Logical analyses of comparable deontic reasoning in the moral reasoning literature are completely absent. Indeed, it is difficult to see how logic could provide any meaningful guidance in analysing the results of participants' criterion judgements and rule justifications in Experiment 1 or their emotion selections in Experiment 2.

We have suggested that cognitive reasoning theories other than SCT have difficulty explaining the full pattern of results reported in this experiment. This is not to say, however, that these theories cannot explain at least some of the results. For example, various decision-theoretic accounts of the selection task (e.g., Kirby, 1994; Manktelow & Over, 1990, 1991, 1995; Oaksford & Chater, 1994) could potentially explain the results of Experiment 3 by arguing that while there is some utility in detecting a potentially fatal violation of the precaution, regardless of whether the rule was broken intentionally or accidentally, there is relatively little utility in detecting innocent mistakes in the case of the social contract. Other theories might offer their own accounting of Experiment 3, but as with the decision-theoretic

approach, the alternatives tend to be ill-equipped to explain the nonselection task results. For example, the wider pattern of results calls into question some of the methodological critiques of the deontic content effect that have recently arisen in the cognitive reasoning literature. While conversational pragmatics (Sperber et al., 1995), hypothesis testing (Liberman & Klar, 1996), mental "focusing" (Love & Kessler, 1995), and text comprehension (Almor & Sloman, 2000) all provide reasonable alternative explanations of selection task performance, they fail to provide any meaningful guidance outside of the narrow confines of that task. SCT (Cosmides, 1985; Cosmides & Tooby, 1989, 1992), on the other hand, makes a wealth of predictions that go beyond selection task performance and have inspired, in part, each of the experiments presented here.

But why should SCT succeed where these other theories arguably fail? It is not simply a question of which theory is right and which is wrong, but the way the problem is approached. Unlike SCT, its rivals are not very ecological. SCT begins with an evolutionary task analysis of the adaptive problem to be solved (Cosmides, 1985; Cosmides & Tooby, 1989), before proceeding to a postulation of the sorts of psychological mechanism that one might expect. This focus on evolutionary environments and the adaptive problem to be solved gives SCT a different character in which analyses of environmental structure are central to the theory. Hence, it is legitimate to ask, within the perspective of SCT, how social cooperation differs from hazards in the environment in order to extend and elaborate the theory to account for novel findings beyond the confines of reasoning. The other theories of reasoning are less ecological in this respect, so while they may be supplemented by intuitions about the differences between social cooperation and hazards (e.g., X results in a decrease of utility in the domain of social exchange, but an increase of utility in the domain of hazards) these intuitions only interface with the theories and are not integral to them.

This is not inherently a failing of these theories, but it is when these intuitions are structured and not random. This order needs to be accounted for, regardless of whether it exists in the mind or the environment. As the results presented here suggest, there is structure to our intuitions about social cooperation and hazards, be it in the mind or in the environment, and at present, most cognitive theories of reasoning fail to account for this structure even though it interfaces with their object of study.

The same argument applies whether that structure is in the environment or encoded as knowledge. One could, for example, argue that the inferences made in Experiments 1 and 2 are logically structured and, therefore, potentially within the purview of standard reasoning theories. Consider the case of participants' emotion selections in Experiment 2. Knowledge of which situations evoke which emotions could be represented by a complex conditional, such as: If rule type X is violated, then emotion Y is evoked, where X and Y may vary as the case may be[6]—for example, when X takes on the value social contract, and Y takes on the value anger. The inferences derived from such rules could be formally identical even though they may appear superficially different owing to the specific content of the variables X and Y. Hence, even content-independent reasoning theories could conceivably account for performance on the emotion selection task and, likewise, responses to the criterion judgement and rule justification questions.

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[6]We would like to thank Mike Oaksford for bringing this possibility to our attention.

There would still be some constraints on the inferences derived, reflecting, in this case, the observed associations between precautions and fear and between social contracts and anger, but these constraints would result from domain distinctions in the structure of our knowledge and not domain distinctions in our reasoning, per se. As a reasoning theory, such an account could completely succeed on its own terms—explaining the reasoning involved and leaving the question of knowledge structure to some other theorist. But why accept theorizing on these terms? Human cognizing, more generally, would appear to be patterned regardless of whether the patterning is a reflection of knowledge differences or reasoning differences. Invoking background knowledge to explain domain differences in cognition may amount to little more than an evasion.

Although we have argued that the results presented here suggest that deontic reasoning is not a unified phenomenon (Fiddick, 1998; Fiddick et al., 2000; Stone et al., 2002), we do not mean to imply that people do not possess any domain-general deontic competences. For example, independent of the specific-content domain, people may well agree that *must P* entails *may P*, but as Manktelow and Over (1990, p. 163) have argued: "It appears more likely that people have a basic semantic understanding of deontic terms and possess deontic schemata that do not in themselves constitute a deontic logic." It is probably our semantic understanding of the terms *must* and *may* that guides us through such contentless inferences and gives some guidance in parsing deontic utterances when the context is impoverished. It is in addition to this, not in exclusion, that we also hold that people possess the proposed cognitive adaptations for social exchange and hazard management. Moreover, it is in the richly structured environments in which we act and in which our actions have real consequences that these computationally powerful cognitive adaptations are likely to override our comparatively less powerful semantic intuitions (see Fiddick et al., 2002, on the design principle of *preemptive specificity*). Indeed, content-independent deontic intuitions are not even capable of guiding performance in an environment as impoverished as the Wason selection task (see Cosmides, 1989; Gigerenzer & Hug, 1992; Manktelow & Over, 1992, for experimental demonstrations of the failure of domain-general deontic reasoning).

If interest has truly shifted, from logic to content, as Evans (2002) has suggested, then perhaps it is time for reasoning researchers to employ a broader range of methods. When more methods are applied, the hidden richness of deontic reasoning is revealed in a way that can be obscured by the use of a single task. Across three different experiments, employing the methods of both the cognitive and moral reasoning literatures, a consistent pattern has emerged: People think differently about social contracts and precautions.

Implications for the moral reasoning literature

The experiments reported here present converging lines of evidence for the domain theory of moral reasoning. Participants in these experiments made a consistent pattern of distinctions between social conventional (social contract) and prudential (precautionary) rules.

Do precautions fall within the psychological domain?

The results of Experiment 1, demonstrating a close parallel between people's criterion judgements for precautions and those suggested to characterized moral rules, taken together with similar findings by moral reasoning researchers (Barbieri, 1993; Nucci et al., 1996, Study 1),

suggest that prudential rules might be mischaracterized by the domain approach as psychological rules. Despite the parallels with moral rules, participants in Experiment 1 clearly did not view observance of the precaution as a moral matter. Hence, prudential rules might best be viewed as a distinct domain of rules, not to be confused with personal issues, for the objective reality of dangers and the means of protecting against them sets prudential rules apart from the subjective domain of the personal. It may be a result of the close parallels between the prudential and the moral that health issues often are moralized (Rozin, 1997, 1999). While the prudential domain is often evoked in the moral reasoning literature, little theoretical effort has been devoted to characterizing the domain (with the notable exception of Smetana, 1995a), resulting in surprise when participants in moral researchers' studies view prudential matters as more obligatory than the researchers had previously suspected (e.g., Barbieri, 1993; Nucci et al., 1996). Clearly, the prudential domain requires more theoretical attention than it has received previously.

In general, the results of the experiments presented here suggest that more attention could be focused on the ethical as opposed to the moral—what one should do in the weaker sense as opposed to the stronger sense (cf. Williams, 1985). All too often, the moral reasoning literature has focused on the social conventional and the prudential only secondarily as a convenient contrast to the moral. With the notable exception of Nucci's (1981) work on the personal domain, relatively little research has been devoted to contrasting the different domains of nonmoral social reasoning even though people make important psychological distinctions between these nonmoral domains. More such research would appear to be warranted.

Regardless of whether one specializes in cognitive reasoning or moral reasoning, the results suggest that greater consideration be paid to precautions as a distinct class of rules as opposed to a convenient foil (against either SCT or morality, respectively). A full and satisfactory account of deontic reasoning will have to explain the unique pattern of inferences that precautions elicit as well.

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