

Supporting Information
Adaptive specializations, social exchange, and the evolution of human intelligence
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Subjects and Procedures. All subjects were students at universities in California. Experiments 1, 2, and 5 were conducted at Stanford University; Experiment 1-A was conducted at the University of California, Los Angeles (UCLA). Experiments 3 and 4 were conducted at the University of California, Santa Barbara (UCSB). Each subject was given a packet with an instruction sheet followed by one Wason selection task. They worked individually, seated at a quiet table with several other subjects, and were paid for their participation.

Experiment 1. Kalama benefit experiments.

Experiment 1 varied whether the action to be taken is a benefit to the potential violator (going out at night), neutral (staying home at night), or slightly unpleasant (taking out the garbage). The full text of the three conditions is presented here. Underlined portions indicate differences between conditions; no underlining appeared in the actual stimuli shown to subjects.

Condition 1: Benefit present (going out at night):

80% correct (20/25)

You are an anthropologist studying a tribe in the Kalama Islands. Members of this tribe always wear a small piece of volcanic rock tied around their ankle. These rocks come in an assortment of colors; people wear a different color of rock under different circumstances.

In this tribe, laws are made by a group of elders. One of the laws that the tribal elders made is: “If one is going out at night, then one must tie a small piece of red volcanic rock around one’s ankle.”

You are interested in whether the people of this tribe obey this law, so last night you watched what some of them did. The cards below represent four people who are member of the tribe. Each card represents one person. One side of a card tells whether the person went outside or stayed at home last night, and the other side of the card tells what color volcanic rock that person was wearing.

Indicate only those card(s) you definitely need to turn over **to see if any of these people have broken the law.**

A.

went outside

B.

red rock

C.

stayed home

D.

blue rock

Condition 2: No benefit version (staying home at night)

52% correct (13/25)

Everything identical except the following (underline indicates a change from *Condition 1*):

Rule: “If one is staying home at night, then one must tie a small piece of red volcanic rock around one’s ankle.”

To keep paragraph 3 parallel (with *P* mentioned before *not-P*), it said:

One side of a card tells whether the person stayed at home or went outside last night, and the other side of the card tells what color volcanic rock that person was wearing.

Condition 3: Garbage version

44% correct (11/25)

Everything identical except the following (underline indicates a change from *Condition 1*):

Paragraph 2: In this tribe, laws are made by a group of elders. Some of these laws involve chores. One of the laws that the tribal elders made is:

Rule: “If one is taking out the garbage, the one must tie a small piece of red volcanic rock around one’s ankle.”

Paragraph 3: You are interested in whether the people of this tribe obey this law, so one day you watched what some of them did. The cards below represent four people who are members of the tribe. Each card represents one person. Each of these people did one chore that day.

One side of a card tells what chore the person did that day, and the other side of the card tells what color volcanic rock that person was wearing while doing the chore.

Cards: A. took out garbage B. red rock C: swept up embers D. blue rock

Note 1: Experiment 1, Benefits experiment. The same results obtain when it is made explicit that staying home is dreary compared to going out at night. In addition to the three conditions reported in the main text, we tested Condition 4 at Stanford at the same time. It was identical to the “staying home” problem of Condition 2 (rule 2), except for the insertion of the following paragraph after the first one, saying “The people of this tribe hate to stay home at night; they would much rather go outside and enjoy the nightly festival. Nonetheless, certain people are required to stay home at night to do dreary chores, which they find tedious and irritating.”

Performance on this problem was 48% correct (12/25), right between performance for rule 2 (“staying home” with no commentary: 52%) and rule 3 (the garbage chore problem: 44%).

Similarly, results from the Kalama requirement study at UCLA (Exp 1-A, below) show that performance on the going out at night problem is the same whether the story explicitly states that going out at night is a highly desirable activity (as in the UCLA study) or not (as in Condition 1 of the Stanford study). This is not surprising given the age and culture of college

students, and the use of the term “going out”, when applied to nighttime activities, to indicate a date or other form of socializing/ entertainment.

For those interested in the role of negation in Wason tasks and in reasoning more generally, we note that performance on the going out at night problem at Stanford was the same, whether the problem used an “implicit not” (*not-Q* = blue rock, *Q* = red rock) as in Condition 1, or an “explicit not” (*not-Q* = did not wear a rock tied around ankle, *Q* = had rock tied around ankle) as in a fifth condition that was tested on the same Stanford population at the same time. This fifth condition was identical to Condition 1, except that it used explicit nots (and, therefore, omitted the two sentences “Members of this tribe always wear a small piece of volcanic rock tied around their ankle. These rocks come in an assortment of colors; people wear a different color of rock under different circumstances.”) Performance on this “explicit not” version of the problem was 84% correct (21/25), virtually identical to the 80% correct found for the “implicit not” version (20/25). Many experiments have shown that use of an implicit not makes no difference when the rule clearly expresses a social contract, and detecting a violation corresponds to looking for cheaters.

Experiment 1-A. Kalama Requirement Study.

Experiment 1 varied whether the action regulated by a permission rule was a benefit or not; to count as a social contract, the rule must regulate access to a benefit. But what about the requirement term? Does it matter whether that is a cost or a benefit to the potential violator?

There have been some misunderstandings in the literature about this issue. Cheng and Holyoak (39), for example, thought that the hypothesis that there are social contract algorithms is refuted by evidence that violation detection remains high even when the requirement is not costly to the person who must satisfy it. But social contract theory makes no such prediction (see 14, 16, 25).

Social exchange is cooperation for mutual *benefit*; it is possible that one or both parties will suffer costs by providing benefits, but social exchange is not defined by the mutual imposition of costs. People enter into social exchange arrangements because they expect to *benefit* in some way. That providing a benefit to others can be costly was emphasized by Trivers (29) in his theory of the evolution of reciprocal altruism because his goal was to explain how adaptations for conferring benefits could be favored by selection *even* in cases where the conferrer suffers a cost by providing that benefit.

Of course, adaptations for reciprocation are easier to evolve when no costs are suffered, as in mutualism. Moreover, the ability to impose contingencies allows for increases in the welfare of both parties even when no cost is suffered by either. Suppose, e.g., that agent X is trying to choose between several personally beneficial actions—one of which is also beneficial to agent Y. Y can influence X’s choice through social exchange: If Y controls access to something further that X wants, Y can make it available to X contingent on X choosing the option that benefits Y (25).

In social exchange, an agent imposes a requirement because doing so creates a situation that agent wants. Requiring that people be over 21 before they drink alcohol creates safer streets, which is why lawmakers made access to alcohol contingent on this requirement; yet the

state of being over or under 21 is not, by itself, a cost or a benefit to the lawmakers. A mother may tell her child that she can have a playdate if she gets her homework done—even though doing the homework benefits the distractible child while stressing the mother, and even though the mother, who needs some quiet time to get work done, will be worse off if the playdate does *not* happen. She makes the offer because, if the child follows through, it creates a situation that the mother prefers: Playdate along with completed homework.

In Experiment 1-A we tested the prediction that violation detection will remain high whether the requirement is a cost or benefit to the person who must satisfy it. We also explored whether it matters whether the requirement itself is beneficial to the agent(s) who imposed it. This study was conducted at UCLA, in a large introductory anthropology class. Each subject filled out a packet consisting of an instruction sheet followed by one Wason task.

The problems were versions of Condition 1 of Experiment 1, the Kalama “going out at night” problem. In all of them, the story specified that Kalama teenagers (the potential rule violators) consider going out at night to be a benefit. It explained that the elders have made a law that applies to teenagers: “If one is going out at night, then one must tie a diamond around one’s ankle” (the rock was a diamond in some versions, a pebble in others, just to see if the real-world difference in their value affected performance (it did not)).

What varied across problems was whether a teen wearing a rock is considered a cost or benefit by (i) the teens who are wearing them, and/or (ii) the elders who imposed this requirement. Here is the Elders love/ Teens hate Diamond version, with the key paragraphs underlined:

You are an anthropologist studying a tribe in the Kalama Islands. In this tribe, laws are made by a group of elders.

Kalama teen-agers are very fun-loving. They like to go out at night, to party and visit their friends.

Kalama teen-agers hate to wear a diamond tied around their ankle; among Kalama teen-agers, it is considered ridiculous and embarrassing.

But the tribal elders love it when teen-agers wear a diamond tied around their ankle. They think it looks beautiful, and like it when people from other tribes admire their children.

The tribal elders have made a law that applies to teen-agers:
“If one is going out at night, then one must tie a diamond around one’s ankle.”

You are interested in whether the teen-agers obey this law, so last night you watched what some of them did. The cards below represent four teen-agers who are members of this tribe. Each card represents one teen-ager. One side of a card tells whether or not the teen-ager went out last night, and the other side of the card tells whether or not that teen-ager had a diamond tied around his or her ankle.

Indicate only those card(s) you definitely need to turn over **to see if any of these teen-agers have broken the law.**

Cards: A. went out B. had diamond tied around ankle C. did not go out D. did not have diamond tied around ankle

For conditions in which the teens like the requirement, the first underlined paragraph said this instead: Kalama teen-agers love to wear a diamond tied around their ankle; among Kalama teen-agers, it is considered very hip.

For conditions in which the elders do not like the requirement, but have imposed it anyway (presumably to create a situation they desire), the second underlined paragraph said this instead: But the tribal elders hate it when teen-agers wear a diamond tied around their ankle. They think it looks cheap and degrading, and that the teen-agers might lose them.

In conditions where the tribal elders and teens are in agreement, this second paragraph started “The tribal elders also [hate / love] it when...”

There were conditions where both of the underlined paragraphs were missing, providing no information about whether teens or elders like it when teens wear a diamond (or pebble); there was also a non-social contract permission rule as a point of comparison (the alphanumeric rule, see Exp 3, condition 5, below).

Exp 1-A Kalama requirement study Condition	% correct		Attitude toward teens wearing ankle rock	
	t	# correct /N	Elders	Teens
1. Pebble (no info)	74.3%	26/35	?	?
2. Diamond (no info)	75.7%	28/37	?	?
3. Diamond EL-TH	70.6%	24/34	love it	hate it
4. Diamond EL-TL	71.4%	26/36	love it	love it
5. Diamond EH-TH	69.7%	23/33	hate it	hate it
6. Pebble EH-TH	73.5%	25/34	hate it	hate it
7. Diamond EH-TL	50.0%	17/34	hate it	love it
8. Abstract deontic	9.7%	3/31	--	--

The results were quite clear. Performance was equally high for conditions 1-6. When there was no information, it did not matter if the rock was a pebble or a diamond (conditions 1 and 2). When it was a diamond, performance was just as high when the elders like teens wearing the rock and teens hate it (condition 3) as when elders and teens both like it (condition 4) or both hate it (condition 5; also replicated with the pebble in condition 6).

The only drop in performance was for condition 7: the condition in which elders hate the requirement and teens like it ($0.012 \leq P_s \leq 0.05$, $0.20 \leq \phi \leq .27$). Condition 7 presents the most puzzling set of motivations from a social exchange viewpoint: one wonders why the elders are requiring something that they hate and that the teens are motivated to do anyway. It took the conjunction of these two conditions to make a dent in performance. Nevertheless, this rule is still a social contract, regulating access to a benefit, and it elicited higher performance than the abstract deontic rule tested ($P = 0.0002$, $\phi = 0.44$).

Experiment 2. The Sears problem.

The Sears problem was developed by Roy D'Andrade, a cultural anthropologist at the University of California, San Diego, during the 1970s. The fact that about 70% of subjects answered correctly (*P & not-Q*) was reported in (44). The authors thought performance was so much higher than on other (indicative) Wason tasks because Sears was a culturally familiar context. Since then, it has become clear that familiarity alone is not sufficient to elicit high levels of violation detection (14, 15, 32); familiarity is not necessary either—highly unfamiliar rules can elicit high performance if they are social contracts or precaution rules (14, 15, 39, 43; see also Experiment 1 above, and the unfamiliar precautionary garbage rule, reported below).

Condition 1. Benefit present (high versus low value good).

72% correct (18/25)

The wording of this problem is identical to that of the original Sears problem created by D'Andrade (reported in 44). For this reason, the final question refers to seeing whether the sales clerks “followed” the regulation, rather than seeing whether anyone had violated the rule.

You work as an assistant at Sears. You have the job of checking sales receipts to make sure that any sale over \$30 has been approved by the section manager (This is a rule of the store)

The cards below have information about four sales receipts. Each card represents one sales receipt. One side of a card tells how much the sale was for, and the other side of the card tells whether or not that sales receipt had been signed by the section manager.

Which of the cards would you have to turn over to make sure the sales clerks had followed the regulation?

Cards: A. \$70 B. signed C. \$15 D. not signed

Condition 2. Inventory forms, signature required.

48% correct (12/25)

You work as an assistant at Sears. Each department at Sears (Menswear, Sportswear, Ladies Shoes, etc.) has a different color inventory form to fill out. You have the job of checking inventory forms that the department clerks have filled out to make sure that any blue inventory form has been signed by the section manager. (This is a rule of the store.)

The cards below have information about four inventory forms that have been filled out by department clerks. Each card represents one inventory form. One side of a card tells what color the inventory form is, and the other side of the card tells whether or not that inventory form has been signed by the section manager.

Which of the cards would you have to turn over to make sure the department clerks had followed the regulation?

Cards: A. blue B. signed C. white D. not signed

Condition 3. Inventory forms, filing requirements.

32% correct (8/25)

You work as an assistant at Sears. Each department at Sears (Menswear, Sportswear, Ladies Shoes, etc.) has a different color inventory form to fill out. Filled out inventory forms are to be filed in various bins. You have the job of checking inventory forms that the department clerks have filled out to make sure that any blue inventory form has been filed in the metal bin. (This is a rule of the store.)

The cards below have information about four inventory forms that have been filled out by department clerks. Each card represents one inventory form. One side of a card tells what color the inventory form is, and the other side of the card tells what kind of bin it was filed in.

Which of the cards would you have to turn over to make sure the department clerks had followed the regulation?

Cards: A. blue B. metal bin C. white D. wood bin

Experiment 3. School problems, Innocent mistake Series 1.**Condition 1. Social contract rule, Cheater detection version.**

68% correct (23/34)

You supervise four women who volunteered to help out at the local Board of Education. When you came into work today, you found the place a-buzz with rumor and innuendo. Your volunteers were supposed to follow certain rules for assigning students from various towns to the appropriate school district. Each volunteer is the mother of a teenager who is about to enter high school, and each processed her own child's documents. So now rumors are flying that your volunteers cheated on the rules when it came to assigning their own children to a school.

Here is the situation:

Students are to be assigned either to Dover High School, which is located in Dover City, or to Hanover High School, which is located in the town of Hanover. Dover High is a great school with an excellent record for getting students placed in good colleges. In contrast, Hanover High is a mediocre school with poor teachers and decrepit facilities.

The reason the schools are so different is how willing the parents of each community are to financially support their schools through taxes. Although both communities are equally prosperous, the parents in Dover City have always cared about the quality of their schools, including Dover High, and have been willing to pay for it. In contrast, the parents in the neighboring towns of Hanover and Belmont have never wanted to spend the money, and have opposed any taxes to improve Hanover High.

The Board of Education took these factors into account when it created rules to determine which school a student is to be assigned to; the most important of these rules is:

“If a student is to be assigned to Dover High School, then that student must live in Dover City.”

Your volunteers were supposed to follow this rule when processing *all* student documents—including the documents of their own children! You must find out if the rumors are true: did any of your volunteers cheat on this rule when it came to processing their own children's documents?

The cards below have information about the documents of the four volunteers' children. Each card represents the child of one volunteer. One side of a card tells what school the volunteer assigned her son or daughter to, and the other side of the card tells what town that student lives in.

Most parents want their children to get the best education possible, however, some are not willing to pay for it. It is easy to imagine that your volunteers, being ambitious mothers, might have been tempted to cheat on the rule. Indicate only those card(s) you definitely need to turn over **to see if the documents of any of these students violate the rule.**

- | | | | |
|----|------------------------|----|--------------------|
| A. | Dover High
School | B. | town of
Hanover |
| C. | Hanover
High School | D. | Dover City |

Condition 2. Social contract rule, Sabotage version.

45% correct (15/33)

You supervise four women who volunteered to help out at the local Board of Education. When you came into work today, you found the place a-buzz with rumor and innuendo. Your volunteers were supposed to follow certain rules for assigning students from various towns to the appropriate school district. They are mad at you, however, because you fired their best friend last week. So how rumors are flying that your volunteers have purposely violated the rules when it came to assigning students to a school, in an attempt to create chaos and to make you look like an incompetent supervisor in the eyes of your boss.

Here is the situation:

Students are to be assigned either to Dover High School, which is located in Dover City, or to Hanover High School, which is located in the town of Hanover. Dover High is a great school with an excellent record for getting students placed in good colleges. In contrast, Hanover High is a mediocre school with poor teachers and decrepit facilities.

The reason the schools are so different is how willing the parents of each community are to financially support their schools through taxes. Although both communities are equally prosperous, the parents in Dover City have always cared about the quality of their schools, including Dover High, and have been willing to pay for it. In contrast, the parents in the

neighboring towns of Hanover and Belmont have never wanted to spend the money, and have opposed any taxes to improve Hanover High.

Most parents want their children to get the best education possible, however, some are not willing to pay for it.

The Board of Education took these factors into account when it created rules to determine which school a student is to be assigned to; the most important of these rules is:

“If a student is to be assigned to Dover High School, then that student must live in Dover City.”

Your volunteers were supposed to follow this rule when processing student documents. You must find out if they the rumors are true: did any of your volunteers violate this rule when it came to processing student documents?

The cards below have information about the documents of four students. Each card represents one student. One side of a card tells what school the volunteer assigned the student to, and the other side of the card tells what town the student lives in.

Your volunteers are very angry. It is easy to imagine that they might want to violate the rule; the chaos this would create would make you look incompetent and get you in trouble with your boss. Indicate only those card(s) you definitely need to turn over **to see if the documents of any of these students violate the rule.**

Condition 3. Social contract rule, Innocent mistake version.

27% correct (9/33)

You supervise four elderly ladies who volunteered to help out at the local Board of Education. Your volunteers were supposed to follow certain rules for assigning students from various towns to the appropriate school district. They are all sweet little old ladies, but they have become rather absent-minded lately. So you are worried that they may have inadvertently made some mistakes when it came to assigning students to a school.

Here is the situation:

Students are to be assigned either to Dover High School, which is located in Dover City, or to Hanover High School, which is located in the town of Hanover. Dover High is a great school with an excellent record for getting students placed in good colleges. In contrast, Hanover High is a mediocre school with poor teachers and decrepit facilities.

The reason the schools are so different is how willing the parents of each community are to financially support their schools through taxes. Although both communities are equally prosperous, the parents in Dover City have always cared about the quality of their schools, including Dover High, and have been willing to pay for it. In contrast, the parents in the neighboring towns of Hanover and Belmont have never wanted to spend the money, and have opposed any taxes to improve Hanover High.

Most parents want their children to get the best education possible, however, some are not willing to pay for it.

The Board of Education took these factors into account when it created rules to determine which school a student is to be assigned to; the most important of these rules is:

“If a student is to be assigned to Dover High School, then that student must live in Dover City.”

Your volunteers were supposed to follow this rule when processing student documents. You must find out if they made any mistakes: did any of your volunteers inadvertently violate this rule when they were processing student documents?

The cards below have information about the documents of four students. Each card represents one student. One side of a card tells what school the volunteer assigned the student to, and the other side of the card tells what town the student lives in.

Your volunteers are very nice and helpful ladies who try to follow the rules, but they have been getting so absent-minded lately that it is easy to imagine that they might have made some mistakes. Indicate only those card(s) you definitely need to turn over **to see if the documents of any of these students violate the rule.**

Condition 4. Permission rule that is NOT a social contract rule: School rule.

10% correct (3/29) Although the rule is identical, the story has been changed in condition 4, removing the elements that made it a social contract in conditions 1-3. Although performance in condition 3—a social contract with mistakes—it was even lower for this rule, which is not a social contract ($P = 0.046$)

The secretary you replaced at the local Board of Education may have made some mistakes when she processed student documents. It is important that certain rules for assigning students from various towns to the appropriate school district be followed, because the population statistics they provide allow the Board of Education to decide how many teachers need to be assigned to each school. If these rules are not followed, some schools would end up with too many teachers, and other schools with too few.

Students are to be assigned either to Dover High School or to Hanover High School.

Some students live in the town of Dover City, some live in Hanover, and some live in Belmont. There are rules that determine which school a student is to be assigned to; the most important of these rules is:

“If a student is to be assigned to Dover High School, then that student must live in Dover City.”

Shortly before she retired, the secretary you replaced was supposed to sort through the documents that specify what town the students live in, and make school assignments according to this rule. She was a sweet little old lady who had become rather absent-minded, and who often made mistakes when categorizing student documents.

The cards below have information about the documents of four students. Each card represents one student. One side of a card tells what school the retired secretary assigned the student to, and the other side of the card tells what town the student lives in.

You suspect the retired secretary may have inadvertently categorized some of the students' documents incorrectly, so you decide to see for yourself whether she ever violated the rule. Indicate only those card(s) you definitely need to turn over **to see if the documents of any of these students violate the rule.**

Condition 5. Permission rule that is NOT a social contract: Alphanumeric rule.

6% correct (2/31)

Part of your new clerical job at the local high school is to make sure that student documents have been processed correctly. Your job is to make sure that the documents conform to the following alphanumeric rule:

“If a student has a ‘D’ rating, then that student’s documents must be marked code ‘3’”.

You suspect the secretary you replaced did not categorize the students' documents correctly. The cards below have information about the documents of four students who are enrolled at this high school. Each card represents one student. One side of a card tells a student's letter rating, and the other side of the card tells that student's number code.

Indicate only those card(s) you definitely need to turn over **to see if the documents of any of these students violate the rule.**

Cards read: A. **D** B. **3** C. **F** D. **7**

Experiment 4. Parametric study of benefits, intentions, and ability.

In this study, we systematically varied whether the potential for violators to gain the *benefit* regulated by the rule was present or absent (B+, B-), whether the *intention* to violate was present or absent (I+, I-), and whether the situation provided them with the *ability* to violate the rule (A+, A-). In ability absent conditions (A-), the scenario stated that students were identified by code numbers to prevent volunteers from knowing whose documents they were processing.

Underlining denotes portions of stimuli that varied across conditions. Underlining did not appear in actual stimuli.

Benefit Present conditions:

Intention present: B+I+A+; B+I+A-

BIA (Benefit +, Intent +, Ability +)

64% correct (49/77)

You supervise four women who volunteered to help out at the local Board of Education. Your volunteers were supposed to follow certain rules for assigning students from various towns

to the appropriate school district. Each volunteer is the mother of a teenager who is about to enter high school, and each processed her own child's documents. You overheard that some of your volunteers intended to break the rules when it came to assigning their own children to a school. Here is the situation:

Students are to be assigned either to Grover High School, which is located in Grover City, or to Hanover High School, which is located in the town of Hanover. Grover High is a great school with an excellent record for getting students placed in good colleges. In contrast, Hanover High is a mediocre school with poor teachers and decrepit facilities.

The reason the schools are so different is how willing the parents of each community are to financially support their schools through taxes. Although both communities are equally prosperous, the parents in Grover City have always cared about the quality of their schools, including Grover High, and have been willing to pay for it. In contrast, the parents in the neighboring towns of Hanover and Belmont have never wanted to spend the money, and have opposed any taxes to improve Hanover High.

The Board of Education took these factors into account when it created rules to determine which school a student is to be assigned to; the most important of these rules is:

“If a student is to be assigned to Grover High School, then that student must live in Grover City.”

Your volunteers were supposed to follow this rule when processing all student documents, including the documents of their own children. However, you overheard that some of your volunteers intended to break this rule. You must find out if any of your volunteers broke the rule.

The cards below have information about the documents of children that the volunteers processed. Each card represents the child of one volunteer. One side of a card tells what school the volunteer assigned her son or daughter to, and the other side of the card tells what town the student lives in.

It could benefit a volunteer if her child were assigned to a good school that she did not pay for. You overheard that some of your volunteers intended to break the rule. Please indicate only those card(s) you need to turn over **to see if the documents of any of these students violate the rule.**

A. Grover High School B. Grover City C. Hanover High School D. town of Hanover

BI (Benefit +, Intent +, Ability -)

46% correct (18/39)

You supervise four women who volunteered to help out at the local Board of Education. Your volunteers were supposed to follow certain rules for assigning students from various towns to the appropriate school district. Each volunteer is the mother of a teenager who is about to enter high school. The students were identified by code numbers so that parents could not know which documents were those of her own child. Nevertheless, you overheard that some of your

volunteers intended to try to break the rules when it came to assigning children to schools. Here is the situation:

Students are to be assigned either to Grover High School, which is located in Grover City, or to Hanover High School, which is located in the town of Hanover. Grover High is a great school with an excellent record for getting students placed in good colleges. In contrast, Hanover High is a mediocre school with poor teachers and decrepit facilities.

The reason the schools are so different is how willing the parents of each community are to financially support their schools through taxes. Although both communities are equally prosperous, the parents in Grover City have always cared about the quality of their schools, including Grover High, and have been willing to pay for it. In contrast, the parents in the neighboring towns of Hanover and Belmont have never wanted to spend the money, and have opposed any taxes to improve Hanover High.

The Board of Education took these factors into account when it created rules to determine which school a student is to be assigned to; the most important of these rules is:

“If a student is to be assigned to Grover High School, then that student must live in Grover City.”

Your volunteers were supposed to follow this rule when processing all student documents, including the documents of their own children. Student documents were identified by code numbers only, not names, to ensure this. Nevertheless, you overheard that some of your volunteers intended to break this rule. You must find out if any of your volunteers broke the rule.

The cards below have information about the documents of children that the volunteers processed. Each card represents the child of one volunteer. One side of a card tells what school the volunteer assigned the student to, and the other side of the card tells what town the student lives in.

It could benefit a volunteer if her child were assigned to a good school that she did not pay for. Even though a volunteer could not know which documents were those of her child, you overheard that some of your volunteers intended to break the rule. Please indicate only those card(s) you need to turn over **to see if the documents of any of these students violate the rule.**

Benefit Present conditions:

Intention absent: B+I-A+; B+I-A-

BA (Benefit +, Intent -, Ability +)

41% correct (16/39)

You supervise four women who volunteered to help out at the local Board of Education. Your volunteers were supposed to follow certain rules for assigning students from various towns to the appropriate school district. Each volunteer is the mother of a teenager who is about to enter high school, and each processed her own child’s documents. You believe your volunteers are honest, but you suspect that they may have made some innocent mistakes: they may have broken the rules for assigning each child to a particular school. Here is the situation:

Students are to be assigned either to Grover High School, which is located in Grover City, or to Hanover High School, which is located in the town of Hanover. Grover High is a great school with an excellent record for getting students placed in good colleges. In contrast, Hanover High is a mediocre school with poor teachers and decrepit facilities.

The reason the schools are so different is how willing the parents of each community are to financially support their schools through taxes. Although both communities are equally prosperous, the parents in Grover City have always cared about the quality of their schools, including Grover High, and have been willing to pay for it. In contrast, the parents in the neighboring towns of Hanover and Belmont have never wanted to spend the money, and have opposed any taxes to improve Hanover High.

The Board of Education took these factors into account when it created rules to determine which school a student is to be assigned to; the most important of these rules is:

“If a student is to be assigned to Grover High School, then that student must live in Grover City.”

Your volunteers were supposed to follow this rule when processing all student documents, including the documents of their own children. You believe your volunteers are honest, but you suspect that they may have made some innocent mistakes; they may have broken this rule. You must find out if any of your volunteers broke the rule.

The cards below have information about the documents of children that the volunteers processed. Each card represents one child. One side of a card tells what school the volunteer assigned the child to, and the other side of the card tells what town the student lives in.

Although it could benefit a volunteer if her child were assigned to a good school that she did not pay for, you suspect your volunteers may have broken the rule by mistake. Please indicate only those card(s) you need to turn over **to see if the documents of any of these students violate the rule.**

B (Benefit +, Intent -, Ability -)

26% correct (10/39)

You supervise four women who volunteered to help out at the local Board of Education. Your volunteers were supposed to follow certain rules for assigning students from various towns to the appropriate school district. Each volunteer is the mother of a teenager who is about to enter high school. The students were identified by code numbers so that parents could not know which documents were those of her own child. You believe your volunteers are honest, you suspect that they may have made some innocent mistakes: they may have broken the rules for assigning each child to a particular school. Here is the situation:

Students are to be assigned either to Grover High School, which is located in Grover City, or to Hanover High School, which is located in the town of Hanover. Grover High is a great school with an excellent record for getting students placed in good colleges. In contrast, Hanover High is a mediocre school with poor teachers and decrepit facilities.

The reason the schools are so different is how willing the parents of each community are to financially support their schools through taxes. Although both communities are equally prosperous, the parents in Grover City have always cared about the quality of their schools, including Grover High, and have been willing to pay for it. In contrast, the parents in the neighboring towns of Hanover and Belmont have never wanted to spend the money, and have opposed any taxes to improve Hanover High.

The Board of Education took these factors into account when it created rules to determine which school a student is to be assigned to; the most important of these rules is:

“If a student is to be assigned to Grover High School, then that student must live in Grover City.”

Your volunteers were supposed to follow this rule when processing all student documents, including the documents of their own children. Student documents were identified by code numbers only, not names, to ensure this. You believe your volunteers are honest, but you suspect that they may have made some innocent mistakes; they may have broken this rule. You must find out if any of your volunteers broke the rule.

The cards below have information about the documents of children that the volunteers processed. Each card represents the child of one volunteer. One side of a card tells what school the volunteer assigned the student to, and the other side of the card tells what town the student lives in.

It could benefit a volunteer if her child were assigned to a good school that she did not pay for. Even though a volunteer could not know which documents were those of her child, you suspect your volunteers may have broken the rule by mistake. Please indicate only those card(s) you need to turn over **to see if the documents of any of these students violate the rule.**

Benefit absent conditions:

Intention present: B-I+A+, B-I+A-

IA (Benefit -, Intent +, Ability +)

44% correct (17/39)

You supervise four women who volunteered to help out at the local Board of Education. Your volunteers were supposed to follow certain rules for assigning students from various towns to the appropriate school district. None of your volunteers have children in school and so could not benefit from their positions, but you overheard that some of them may have mischievously intended to break the rules when assigning children to schools. Here is the situation:

Students are to be assigned either to Grover High School, which is located in Grover City, or to Hanover High School, which is located in the town of Hanover. Grover High is a great school with an excellent record for getting students placed in good colleges. In contrast, Hanover High is a mediocre school with poor teachers and decrepit facilities.

The reason the schools are so different is how willing the parents of each community are to financially support their schools through taxes. Although both communities are equally

prosperous, the parents in Grover City have always cared about the quality of their schools, including Grover High, and have been willing to pay for it. In contrast, the parents in the neighboring towns of Hanover and Belmont have never wanted to spend the money, and have opposed any taxes to improve Hanover High.

The Board of Education took these factors into account when it created rules to determine which school a student is to be assigned to; the most important of these rules is:

“If a student is to be assigned to Grover High School, then that student must live in Grover City.”

Your volunteers were supposed to follow this rule when processing all students. However, you overheard that some of your volunteers mischievously intended to break this rule. You must find out if any of your volunteers broke the rule.

The cards below have information about the documents of children that the volunteers processed. Each card represents one student. One side of a card tells what school the volunteer assigned the student to, and the other side of the card tells what town the student lives in.

Although your volunteers do not have children in school and so could not benefit by mis-assigning students, you overheard that some of your volunteers intended to break the rule. Please indicate only those card(s) you need to turn over **to see if the documents of any of these students violate the rule.**

I (Benefit -, Intent +, Ability -)

28% correct (11/39)

You supervise four women who volunteered to help out at the local Board of Education. Your volunteers were supposed to follow certain rules for assigning students from various towns to the appropriate school district. None of your volunteers have children in school and so could not benefit from their positions. Furthermore, the students were identified by code numbers so that volunteers could not know which documents were those of which child. Nevertheless, you overheard that some of your volunteers intended to break the rules when assigning children to schools. Here is the situation:

Students are to be assigned either to Grover High School, which is located in Grover City, or to Hanover High School, which is located in the town of Hanover. Grover High is a great school with an excellent record for getting students placed in good colleges. In contrast, Hanover High is a mediocre school with poor teachers and decrepit facilities.

The reason the schools are so different is how willing the parents of each community are to financially support their schools through taxes. Although both communities are equally prosperous, the parents in Grover City have always cared about the quality of their schools, including Grover High, and have been willing to pay for it. In contrast, the parents in the neighboring towns of Hanover and Belmont have never wanted to spend the money, and have opposed any taxes to improve Hanover High.

The Board of Education took these factors into account when it created rules to determine which school a student is to be assigned to; the most important of these rules is:

“If a student is to be assigned to Grover High School, then that student must live in Grover City.”

Your volunteers were supposed to follow this rule when processing all student documents. Student documents were identified by code numbers only, not names, to ensure that volunteers would not know whose documents they were processing. However, you overheard that some of your volunteers intended to break this rule. You must find out if any of your volunteers broke the rule.

The cards below have information about the documents of children that the volunteers processed. Each card represents one student. One side of a card tells what school the volunteer assigned the student to, and the other side of the card tells what town the student lives in.

Although your volunteers do not have children in school and so could not benefit by mis-assigning students, and although student documents were identified by code numbers, you overheard that some of your volunteers intended to break the rule. Please indicate only those card(s) you need to turn over **to see if the documents of any of these students violate the rule.**

Benefit absent conditions:

Intention absent: B-I-A+, B-I-A-

A (Benefit -, Intent -, Ability +)

23% correct (9/39)

You supervise four women who volunteered to help out at the local Board of Education. Your volunteers were supposed to follow certain rules for assigning students from various towns to the appropriate school district. None of your volunteers have children in school and so could not benefit from their positions. You believe your volunteers are honest, but you suspect that they may have made some innocent mistakes: they may have broken the rules for assigning each child to a particular school. Here is the situation:

Students are to be assigned either to Grover High School, which is located in Grover City, or to Hanover High School, which is located in the town of Hanover. Grover High is a great school with an excellent record for getting students placed in good colleges. In contrast, Hanover High is a mediocre school with poor teachers and decrepit facilities.

The reason the schools are so different is how willing the parents of each community are to financially support their schools through taxes. Although both communities are equally prosperous, the parents in Grover City have always cared about the quality of their schools, including Grover High, and have been willing to pay for it. In contrast, the parents in the neighboring towns of Hanover and Belmont have never wanted to spend the money, and have opposed any taxes to improve Hanover High.

The Board of Education took these factors into account when it created rules to determine which school a student is to be assigned to; the most important of these rules is:

“If a student is to be assigned to Grover High School, then that student must live in Grover City.”

Your volunteers were supposed to follow this rule when processing all students. You believe your volunteers are honest, but you suspect that they may have made some innocent mistakes; they may have broken this rule. You must find out if any of your volunteers broke the rule.

The cards below have information about the documents of children that the volunteers processed. Each card represents one student. One side of a card tells what school the volunteer assigned the student to, and the other side of the card tells what town the student lives in.

Although your volunteers do not have children in school and so could not benefit by mis-assigning students, you suspect your volunteers may have broken the rule by mistake. Please indicate only those card(s) you need to turn over **to see if the documents of any of these students violate the rule.**

None (Benefit -, Intent -, Ability -)

26% correct (10/39) This condition was added to the study later, for completeness. The subjects were drawn from the same UCSB student population; we confirmed that the population sampled at this later time was the same as that sampled earlier by giving the BIA condition to 39 more subjects at the same time we collected the data for the “none” condition. The BIA percent correct was virtually identical to that found earlier (24/38 and 25/39; resulting in an overall percent correct of 49/77 for the BIA condition).

You supervise four women who volunteered to help out at the local Board of Education. Your volunteers were supposed to follow certain rules for assigning students from various towns to the appropriate school district. None of your volunteers have children in school and so could not benefit from their positions. Furthermore, the students were identified by code numbers so that volunteers could not know which documents were those of which child. You believe your volunteers are honest, but you suspect that they may have made some innocent mistakes: they may have broken the rules for assigning each child to a particular school. Here is the situation:

Students are to be assigned either to Grover High School, which is located in Grover City, or to Hanover High School, which is located in the town of Hanover. Grover High is a great school with an excellent record for getting students placed in good colleges. In contrast, Hanover High is a mediocre school with poor teachers and decrepit facilities.

The reason the schools are so different is how willing the parents of each community are to financially support their schools through taxes. Although both communities are equally prosperous, the parents in Grover City have always cared about the quality of their schools, including Grover High, and have been willing to pay for it. In contrast, the parents in the neighboring towns of Hanover and Belmont have never wanted to spend the money, and have opposed any taxes to improve Hanover High.

The Board of Education took these factors into account when it created rules to determine which school a student is to be assigned to; the most important of these rules is:

“If a student is to be assigned to Grover High School, then that student must live in Grover City.”

Your volunteers were supposed to follow this rule when processing all student documents. Student documents were identified by code numbers only, not names, to ensure that volunteers would not know whose documents they were processing. You believe your volunteers are honest, but you suspect that they may have made some innocent mistakes; they may have broken this rule. You must find out if any of your volunteers broke the rule.

The cards below have information about the documents of children that the volunteers processed. Each card represents one student. One side of a card tells what school the volunteer assigned the student to, and the other side of the card tells what town the student lives in.

Although your volunteers do not have children in school and so could not benefit by mis-assigning students, and although student documents were identified by code numbers, you suspect your volunteers may have broken the rule by mistake. Please indicate only those card(s) you need to turn over **to see if the documents of any of these students violate the rule.**

Note 2. The effects of removing the intention to violate the rule (*intention* absent) and introducing measures to prevent cheating (*ability* absent) are all the more remarkable when one considers the *benefit present* problems alone. Although none of them said that the rule has been violated when a student who lives in Hanover is assigned to Grover High, the four problems in this series each said “It could benefit a volunteer if her child were assigned to a good school that she did not pay for.” This is as close as one can come to explaining what counts as violating the rule without saying it outright. Nevertheless, there was a significant drop in violation detection when either the intention or the ability to violate (but not both) were removed—from 64% (BIA) to 41% (BA, $P = 0.01$) and 46% (BI, $P = 0.036$)—and removing both factors dropped performance to 26% (B).

Note 3. In Experiment 4, the rule is created by members of the Board of Education. To elicit good performance on social contract rules, the story does not need to specify what specific goal the agent who is restricting access to the benefit is trying to achieve by doing so (e.g., Exp 1, the going out problem). The Board’s intent may have been to offer better service to those who pay more, or to incentivize tax support for local schools from the prosperous citizens of the other towns. But whatever their goal was, it is thwarted when the rule is violated. Failure to comply results in them being cheated, even if it was not caused by a cheater.

Experiment 5

Precautionary rule, Garbage version.

72% correct, 18/25 Stanford students. Performance on this problem was significantly higher than on the very similar garbage problem tested in Experiment 1.

The high level of performance found on this problem shows two things. First, the garbage rule (rule 3) is capable of eliciting strong violation detection—when it is embedded in a

precautionary context. Second, it shows that, when a rule is precautionary, it does not need to regulate access to a *benefit* to elicit good violation detection. This is another way in which reasoning about precautionary rules differs from reasoning about social contracts.

A tribe in the Kalama Islands believes that vicious spirits attack people when they are taking out the garbage, but that these spirits do not attack people at any other time. These people also believe that fastening a small piece of volcanic rock (which is abundant and free on the islands) around one's ankle will make one invisible to the spirits and thus safe from them.

Tribespeople therefore have the following rule:

“If one is taking out the garbage, then one must tie a small piece of volcanic rock around one's ankle.”

You are an anthropologist studying this tribe. You are interested in whether the people of this tribe follow this rule, so one day you watched what some of them did. The cards below represent four tribespeople who you observed that day. Each card represents one person. One side of a card tells whether or not the person took out the garbage, and the other side of the card tells whether or not that person had a piece of volcanic rock tied around his ankle.

Indicate only those card(s) you definitely need to turn over **to see if any of these people have broken the rule.**

A. took out garbage B. had rock tied around ankle C. did not take out garbage D. did not have rock tied around ankle

In this problem, not- Q is an “explicit not” ($not-Q$ = not wearing a rock, Q = wearing a rock), whereas it is an “implicit not” in Exp 1 ($not-Q$ = wearing a blue rock, Q = wearing a red rock). Use of an implicit not cannot explain the poorer performance of this rule in Exp 1, for two reasons. First, the matching problem about going out at night used the exact same implicit not as the garbage rule, yet elicited the correct response from 80% of subjects. Second, that 80% correct was not different from the 84% correct (21/25) obtained when we ran a version of the going out at night problem that used an explicit not. Many experiments have shown that use of an implicit not makes no difference when the rule clearly expresses a social contract.

Exp 1-A Kalama requirement study Condition	% correc t	# correct /N	Attitude toward teens wearing ankle rock	
			Elders	Teens
1. Pebble (no info)	74.3%	26/35	?	?
2. Diamond (no info)	75.7%	28/37	?	?
3. Diamond EL-TH	70.6%	24/34	love it	hate it
4. Diamond EL-TL	71.4%	26/36	love it	love it
5. Diamond EH-TH	69.7%	23/33	hate it	hate it
6. Pebble EH-TH	73.5%	25/34	hate it	hate it
7. Diamond EH-TL	50.0%	17/34	hate it	love it
8. Abstract deontic	9.7%	3/31	--	--