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NOT ALL POTENTIAL CHEATERS ARE EQUAL: PRAGMATIC STRATEGIES IN DEDUCTIVE REASONING

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ABSTRACT

This work briefly discusses one of the central problems in the current psychology of reasoning: that of explaining the effects of content. Two competing theories recently proposed to explain such effects (pragmatic reasoning schemas and social contract theories) are illustrated with reference to an experiment on reasoning in children employing a selection problem, which requires a search for the potential counterexamples of a conditional rule. On the one hand, the theory of pragmatic schemas (i.e. clusters of rules related to pragmatically relevant actions and goals) predicts that correct selection performance derives from the activation of specific contractual schemas, such as obligation and permission, the production rules of which correspond to the logic of implication. On the other hand, according to the social contract theory, people are able to detect potential counterexamples only when they correspond to the potential cheaters of rules having the form 'If benefit A is received, then cost B must be paid'. The results of the experiment show that performance on tasks of this kind is not determined simply by the possibility of representing the rule in question in cost-benefit terms; to predict performance one necessary factor is knowledge of the nature of the possible cheating behaviour that one is requested to check.

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The ability to search for counterexamples has a central role in reasoning, since the ability to search for them can be regarded as the basis of the discovery and evaluation of hypotheses, concept attainment, and deductive inferences. However, a great deal of empirical evidence exists that adults perform poorly in reasoning problems requiring a search for potential counterexamples, for example in general statement evaluation problems. Studies that utilized the well-known Wason four-card selection task (Wason, 1966, 1968), showed that the majority of adult subjects did not search for counterexamples to a rule such as "If a card has a vowel on one side, then it has an even number on the other side". Most adults typically fail to select a card with an odd number, one of the potentially falsifying cards. In general terms, the rule used in such problems is a universal statement, typically a conditional statement, *if p then q*, and the relevant cases are *p* and *not-q*, in the above indicated example "a card with a vowel" and "a card with an odd number".

The long tradition of research with tasks of this type has shown that in some cases people are able to search for counterexamples, particularly when problems are phrased in "concrete" terms (Johnson-Laird, Legrenzi and Sonino-Legrenzi, 1972; for reviews see Griggs, 1983; Wason, 1983).

Among the different proposals for explaining the ensemble of findings produced with selection problems, the most convincing seems to be the pragmatic reasoning schemas interpretation (Cheng and Holyoak, 1985). Pragmatic schemas, such as permissions, obligations and causations, are clusters of rules which concern pragmatically relevant actions and goals. Under certain circumstances, some of these schemas lead to the correct solution of problems demanding a search for counterexamples. In particular, the activation of a permission or obligation schema can help people to solve a selection problem. Although their production rules go beyond those of the logic of material implication (for example, by including modal verbs such as "must" and "can"), their productions lead to card selections which *correspond* to those prescribed by a logical analysis of the task. For example, a permission rule '*If you want to do action A, then you have to satisfy precondition B*', implies the contrapositive rule '*If you do not satisfy precondition B, then you are not allowed to do action A*'. This equivalence makes clear that the potential violators of the permission rule are people who have done action A without satisfying precondition B.

Cheng and Holyoak (1985) obtained empirical findings that corroborate the pragmatic schemas hypothesis. They have shown

that adult subjects are able to search for potential violators of unfamiliar but rationalized permission rules, and that successful performance is also elicited with an abstract description of a permission situation. Moreover, facilitation of selection performance in conditions concerning permission and obligation rules has been obtained with preadolescent children (Giroto, Light and Colbourn, 1988).

A different interpretation of the content effect in reasoning performance has been recently proposed by Cosmides (1989). According to her "social contract theory", people process information regarding social exchanges using specific, naturally evolved algorithms. In particular, social contract algorithms express an exchange in which an individual is obliged to pay a cost in order to be entitled to receive a benefit. They contain an inferential procedure ('*look for cheaters* ') that enables people to detect potential cheaters (i.e. individuals who have not paid the required cost, and individuals who have accepted the benefit). In a series of experiments, Cosmides (1989) showed that wording a selection problem in terms of a social contract (*If one accepts benefit A, then one has to pay cost B*) can produce formally correct performance when the cases indicating possible cheating ('benefit accepted' and 'cost not paid') correspond to the formally relevant cases, i.e. the potential counterexamples.

There has been a lively and still open debate between the two described positions. According to Cosmides' theory, only social contracts, which are a subset of all permission rules, produce "robust and replicable content effects" on selection tasks.

Cheng and Holyoak (1989) have criticized this position, in which only the cost/benefit representation is considered to be psychologically real. Moreover, a number of empirical studies have shown that correct reasoning performance, both for adult and child subjects, can be obtained in conditions which, following social contract theory predictions, should not activate the described 'look for cheater' procedure. This has been the case, in particular, of certain prudential (Cheng and Holyoak, 1989; Giroto, Gilly, Blaye and Light, 1989; Manktelow and Over, 1990), obligation (Giroto, Blaye and Farioli, 1989) and permission (Light, Giroto and Legrenzi, in press) rules which did not directly map the cost/benefit structure of standard social contracts.

In the present paper, we will briefly present the results of a research about children's reasoning on conditional promises and permissions (reported in detail in Light *et al.*, in press). We will discuss their theoretical implications in relation to the indicated debate.

Consider a conditional contractual promise, like the following, made by a teacher to her pupils:

"If you get at least 10 points, then you can have a sweet "

And suppose that there are four pupils:

Mary (who had 10 points), Ben (4 points), Sue (who has received a sweet) and Rob (who has not received a sweet).

Clearly, in this scenario it is unlikely that the promisor (the teacher) will violate her own promise (by not giving the reward to the deserving pupils).

A more likely outcome is that some promisees will try to cheat by taking a reward which they do not deserve.

A teacher-promisor who decides to check whether her promise has been respected should thus make sure that Ben (the pupil with 4 points) and Sue (the pupil with the sweet) have not cheated, that is, that they have not respectively taken a sweet and obtained less than 10 points.

If this checking condition is considered as a version of the selection task, it is clear that the pragmatically correct choice will be that of examining the two pupils just mentioned (Ben and Sue), whose formal values are respectively *not-p* and *q* (which are different from those indicating the potential counterexamples of a conditional rule '*if p then q*', namely the values *p* and *not-q*).

Now, if we consider a condition in which the teacher-promisor has delegated a specific pupil to administer the promise, this agent may commit two types of infraction. If the agent acts selfishly, he will tend to withhold the cake from the pupil who deserves it. For this reason, a teacher-promisor wishing to check the agent's behaviour should ensure that Mary (the pupil with 10 points) and Rob (the pupil with no sweet) have not been unfairly deprived of the reward. If instead the agent has behaved nepotistically, then the teacher-promisor will have to check not only the two pupils just indicated but also the others (Ben and Sue), who might have received the reward, although underserving, because they were friends of the agent. In the first case (selfish agent) the formal values of the cases to be checked are *p* and *not-q*; in the second case (nepotistic agent) all four values must be checked: *p*, *not-p*, *q*, *not-q*.

As can be seen, for a conditional contractual promise there can be various possible combinations of cases that indicates a violation. The formal values of these cases do not always correspond to the combination *p* and *not-q*.

Three versions of a selection task concerning these three possible situations of promise violation were presented by Light *et al.* (in press) to some English children aged 11-12 years (a fourth condition, which serves as a control, concerned a permission rule "*If you want a sweet, then you must get at least 10 points*", which could be violated by Sue, formally p , and Ben, formally $not-q$).

The results of this research have shown that preadolescent children do master the complex pragmatic factors underlying the control of conditional contractual promises and permission. Their patterns of responses correspond, in most cases, to the selection of the different combinations of the potential violations above indicated: In the condition where the pupils-promisee could violate the promise by themselves ('direct promise' condition), the most frequent choice (50%) was the selection of the cards $not-p$ and q . In the two conditions where the teacher-promisor had to check agent's behaviour, children's selection turned out to be different. In the 'selfish agent' condition, the p (10 points) and $not-q$ (no sweet) cards were indeed selected most regularly (90% and 83% respectively). However, only 22% of the subjects selected just these two cards. In addition, 'sweet' card (q) continued to be selected by many children. In the 'nepotistic agent' condition, the prevalent choices was the combination of *all cards* (39%). Finally, in the permission condition, the correct pattern p and $not-q$ was most frequently selected (78%).

It is possible to compare, although indirectly, these data with those reported by Cosmides (1989). Some of the social rules used in her experiments are in fact conditional contractual promises. For example, in two experiments, her subjects had to check the behaviour of the promisor (an African hunter, called Bo) of the following deal "*If you give me your ostrich eggshell, then I'll give you duiker meat*". This condition is similar to Light *et al.*'s 'selfish agent' condition: In both cases, in order to detect the possible cheaters one has to check whether the deserving promisee (pupil with 10 points or man who gave Bo eggshells) had received the earned reward (sweet or meat), excluding, at the same time, that the persons who actually ran the deal (the selfish agent or the promisor himself, Bo) had illegally kept it. In other words, in both cases, the relevant cards correspond to p and $not-q$. Now, despite this similarity in the structure of the two problems, the elicited performance turned out to be different. While Cosmides' scenario elicited about 70% of p and $not-q$ selections, in Light *et al.*'s selfish agent condition, this pattern of response was produced only by 22% of the subjects.

If we compare the ways in which the runners of the deal are presented in the two scenarios, several differences seem to appear.

In the story used by Cosmides, the subjects had to check a promisor (Bo) who was, at the same time, 1) *owner* of the goods (duiker meat) that he should have given to the others in exchange for the fulfillment of the contractual requirements; 2) *motivated to keep* for himself the maximum amount of these goods (Bo was actually presented as an "unscrupulous man...(who) had very little duiker meat and a large family to feed"); 3) personally *motivated to obtain* the fulfillment of the contract (Bo was presented as someone who was "always accidentally breaking his ostrich eggshells and would like to 'stockpile' some").

In Light et al. 's 'selfish agent' condition, the agent of the promise, 1) was *not* the *owner* of the goods (sweets) that he should allocate to the deserving pupils; 2) even if he was allowed to keep for himself the non allocated goods, it was *not specified* whether he was really *motivated* to do so (i.e. whether he was a glutton); 3) he was *not* personally *interested* in obtaining the fulfillment of the contractual requirements (i.e. the successful school performance of the classmates); 4) his *relationships* with the promisees were *not* specified (i.e. he could be a good friend or an enemy of the other pupils).

Thus, while in the Cosmides' stories it was clearly specified that the promisor was motivated to a selfish cheating behavior, in Light et al. 's condition the agent of the promise could plausibly behave both nepotistically and selfishly. This possibility to attribute different goals to the agent can explain why Light et al. 's children did not limit themselves to the selection of the 'selfish' cards *p* and *not-q*.

This comparison shows the importance of the *information about the nature of the cheating behaviour* that one is requested to check. Both children (selfish agent condition) and adults (cf. Politzer and Nguyen-Xuan, 1988) seem to have difficulties in performing consistently this check when this information is not sufficient. However, it should be noted that in conditions where sufficient information about the goals of the possible cheaters is given, children can produce consistent selection performance. This was the case of the permission and direct promise conditions in Light et al. 's study, where the nature of the potential cheating behaviour could only be 'selfish' (as the pupils acted alone). In the former case, children consistently (78%) checked the two pupils who could have violated the permission rule (the pupil with the sweet and the pupil with 4 points, i.e. *p* and *not-q*). Children (50%) still consistently selected these two cases in the latter condition, even if their logical

values (i.e. *not-p* and *q*) where different from those of the cards selected in the permission condition. This specific response pattern is similar to that obtained by Cosmides (1989) in versions of the task in which a contractual promise (social contract) was modified to a sort of obligation (switched social contract). For examples, the original Bo's promise ("If you give me your ostrich eggshell, then I'll give you duiker meat ") was modified to "If I give you duiker meat, then you must give me your ostrich eggshell ". In this case, people had still to check Bo's behaviour, and they still selected the cards corresponding to 'benefit for Bo' and 'cost unpaid by Bo', which have formal values (*q* and *not-p* , respectively) different from those of the original condition (*p* and *not-q*).

In conclusion, the results presented by Light *et al* (in press) show: a) that, regardless of the similarity of rules and scenario, reasoning performance can dramatically change as a function of the *actor* who could have infringed a conditional promise (and his/her goals); b) despite the possibility of recognizing a situation as one of social exchange (*sensu* Cosmides), subjects do not consistently look for potential cheating behaviour, when complete information about it is not provided. Therefore, while previous research has demonstrated that succesful reasoning performance can be obtained even in conditions which cannot be represented in the cost/benefit terms of a social contract, Light *et al* 's study demonstrates that conditions which can be represented in these terms do not necessarily elicit the pattern of responses predicted by the social contract theory.

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