# THE ROLE OF SCENARIO, DEONTIC CONDITIONALS AND PROBLEM CONTENT IN WASON´S SELECTION TASK*

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## INTRODUCTION

In recent years considerable interest has been expressed by psychologists regarding the influence of pragmatic factors on human reasoning. We reports here an experiment on pragmatic influences upon conditional reasoning, using the experimental paradigm *par excellence* in conditional inference: Wason's selection task (Wason, 1966, 1968).

In the standard form task, participants are shown four cards displaying two letters (say A, D) and two numbers (say 3, 7) and a conditional rule. "*If there is an A on one side then there is a 3 on the other side*". They are told that each card has a letter on one side and a number on the other side. The task consists of selecting those cards they would need to turn over in order to discover whether the rule is true or false. This task is often referred to as the abstract selection task, due to arbitrary problem content. It is also now recognised to be an *indicative selection task*, since the conditional makes an assertion about truth relations in the world and the task is to discover whether or not the rule is in fact true.

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The poor logical performance observed on this version of the task (less than 10% of participants typically select the correct cards: A and 7 or, in general, *p* and *not-q*) has been associated with the abstract nature of the rule with facilitation claimed for thematic versions of the task in a number of papers (Wason and Shapiro, 1971; Johnson-Laird, Legrenzi & Sonino Legrenzi, 1972; see Evans, Newstead & Byrne, 1993, chapter 4 for a detailed review). However Manktelow & Evans (1979) showed that thematic content may not facilitate performance if it lacks pragmatic cues which help people to retrieve relevant prior knowledge.

One of the studies in which the highest levels of correct performance was registered was Griggs and Cox's (1982), with the "drinking age rule". Here people are asked to imagine they are police officers checking whether the following rule is being obeyed with regard to people drinking in a bar: "*If a person is drinking a beer then that person must be over 19 years of age*". Most people correctly investigate a person drinking beer (*p*) and one under 19 years of age (*not-q*). Note that this is framed as a deontic task (discovering whether a rule is being obeyed) and it has a short preceding scenario setting the police officer perspective. Pollard & Evans (1987) manipulated both the content of the rule and the presence or absence of a scenario. When the scenario was eliminated in the drinking age task, the facilitation effect disappeared. However, adding a scenario to an abstract selection task did not facilitate. The authors observed that both factors, content and scenario were the required for the correct performance. A number of studies have also looked at the role of deontic/indicative framing in the selection task (see Evans et al., 1993, pp. 104-107). The findings are similar to those of the scenario manipulation. That is, use of an indicative frame can weaken or eliminate the facilitation observed with typical

thematic versions such as the drinking age rule, but deontic framing in itself does not lead to facilitation observed with typical thematic versions such as the drinking age rule, but deontic framing in itself does not lead to facilitation of abstract versions of the problem.

In a previous study done by Valiña, Seoane, Ferraces and Martín (1998a), participants were shown three selection tasks (one abstract and two thematic versions). The availability of the scenario in which the tasks were included (available vs. non-available) and the instructions (true/false vs. violation) were also manipulated. Two new results were found. On one hand, against what it was predicted, there was no significant interaction between content and scenario. On the other hand, there was a significant interaction between content and instructions. Performance was better in both the abstract version and one of the thematic versions, with violation instructions. In contrast with permission rule performance was better with verification instructions. Additionally, the rules which included the modal verb “must”, gave higher logical indices. These results seem to suggest the effect of the deontic nature of the rule and may be explained within the context of the theory of pragmatic reasoning schemas (Cheng & Holyoak, 1985, 1989). More precisely, the abstract-deontic and the thematic-obligation versions could be assimilated to the *obligation schema* ($O_1$ rule: “If the precondition is satisfied, then the action must be taken”) and the thematic-permission task to the *permission-schema* ($P_3$ rule: “If the precondition is satisfied, then the action may be taken”; see Holyoak & Cheng, 1995, p. 70). However, in this experiment the authors also obtained results not easily explained by the theory of pragmatic reasoning schemas. Moreover, the deontic variable had not been manipulated in this experiment (see also Valiña, Seoane, Ferraces & Martín, 1999).

On the other hand, in the study of Pollard & Evans (1987), the use of deontic and indicative framing was confounded with the use of thematic and abstract materials as is frequently the case in the literature. Thus we feel it would be useful to provide further investigation of the scenario effect in which this variable is also investigated.

In the experiment described here, all rules are thematic but one is neutral in nature, so that prior knowledge is not likely to help performance. We also use two other contents involving permission and obligation relationships which have been shown to facilitate performance in a number of studies in the literature when presented with scenarios and deontic framing. All participants attempted problems in all three contents. However, in this experiment half were given indicative and half deontic framing. Each of these groups was further divided according to whether or not a scenario was present.

## METHOD

### Participants

152 (131 females and 21 males) undergraduate psychology students from the University of Santiago de Compostela (Spain), took part in this study.

### Design

Each participant was given three selection tasks corresponding to three different contents of the rule. We called them neutral, permission and obligation. In addition to the thematic content, two other factors were manipulated between groups: (a) presence or absence of a scenario; (b) presence or absence of deontic framing. In deontic versions the word

"must" was added in the conditional and participants were instructed to discover whether or not the rule had been obeyed. With indicative framing the word "must" was omitted and participants were asked to discover whether the rule was true or false.

**Materials**

The problems were presented in booklets. Each booklet contained three thematic selection tasks. We elaborated two parallel versions. Each participant only saw one of those versions and they received the following information for the three experimental tasks: "Each of the four cards shown below has something written on each one of their two sides. Of course, as the cards are lying flat, you can only see one side of each card". Participants had to reason according to the following rules and cards shown for each content of the rule:

(a) Neutral: *"If a card has cat written on one side, then it must have/has rose written on the other side"*. The four cards shown were: "CAT", "LION", "ROSE", "CARNATION".

(b) Permission: *"If a card has beer written on one side, then it must have/has* over *18 years of age written on the other side"*. The four cards shown were: "BEER", "COKE", "22 YEARS OF AGE", "16 YEARS OF AGE".

(c) Obligation: *"If a card has bricklayer written on one side, then it must have/has hard hat written on the other side"*. The four cards shown were: "BRICKLAYER", "CHEF", "HARD HAT", "CAP".

For half of the subjects the rules for each of the three experimental tasks included the modal verb *must* (Deontic frame condition). The other half received identical rules except that they did not contain the modal verb *must* (Indicative frame condition). In the *"Scenario conditions"*, the same rules and cards were presented, but in these conditions rules and cards were included in a scenario.

### Procedure

Each participant was randomly allocated to each of the four experimental groups (Scenario-Deontic frame, Scenario-Indicative frame, No Scenario-Deontic frame, No Scenario-Indicative frame). Participants were tested in small groups in the same laboratory. They completed the tasks individually. Each received one booklet which contained three experimental tasks presented in random order. Participants performed the experimental tasks without time limit.

## RESULTS

Table 1 shows the percentage of frequencies of selection of each card on each thematic rule and Figure 1 presents the frequencies of correct selection broken down by the three experimental variables.

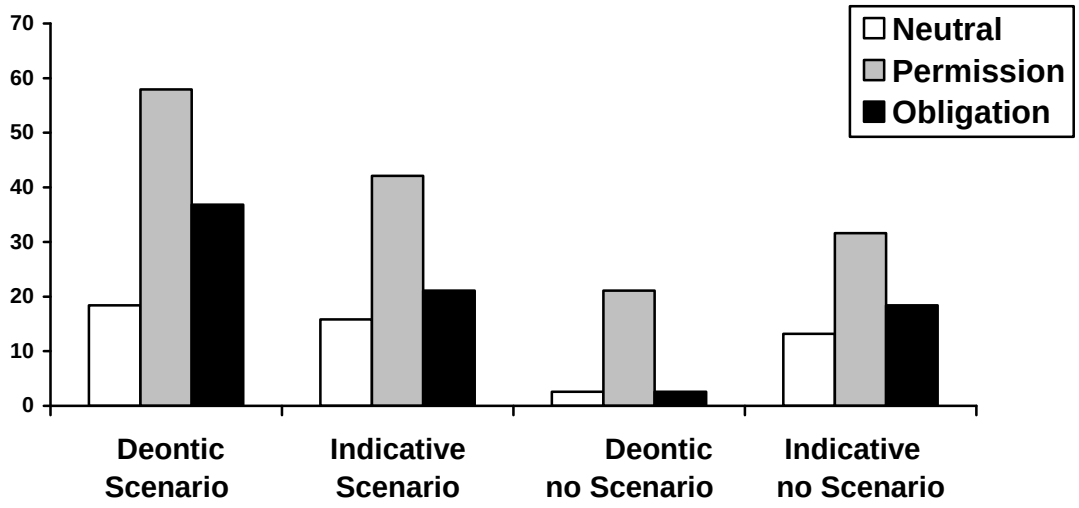
**Table 1**. Percent selections for each content of the rule in each experimental condition (N = 38 in each experimental condition)

| | Neutral | | | | Permission | | | | Obligation | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | TA | FA | TC | FC | TA | FA | TC | FC | TA | FA | TC | FC |
| Deontic & Scenario | 89 | 42 | 39 | 58 | 89 | 8 | 0 | 60 | 87 | 29 | 3 | 39 |
| Indicative & Scenario | 76 | 39 | 11 | 24 | 74 | 13 | 5 | 50 | 84 | 37 | 8 | 37 |
| Deontic & No Scenario | 29 | 0 | 84 | 66 | 87 | 56 | 18 | 34 | 87 | 66 | 16 | 34 |
| Indicative & No Scenario | 82 | 56 | 13 | 24 | 84 | 37 | 13 | 47 | 89 | 50 | 13 | 29 |

Note:
TA = True-Antecedent (*p*), FA = False-Antecedent (*not-p*),
TC = True-Consequent (*q*), FC = False-Consequent *(not-q*).
TA and FC (*p* and *not-q*) is the logically correct choice on the three rules

As Figure 1 shows, the highest percentage of correct selections was obtained with rules expressing a *permission* for all experimental conditions. In contrast, the lowest frequency of correct responses was obtained with *neutral* rules. The selection of correct answers is substantially higher when the scenario is present, specially with *permission* and *obligation* rules. Scenario effects appear most marked when deontic framing is used.

**Figure 1**. Correct selection (%) on each content of the rule



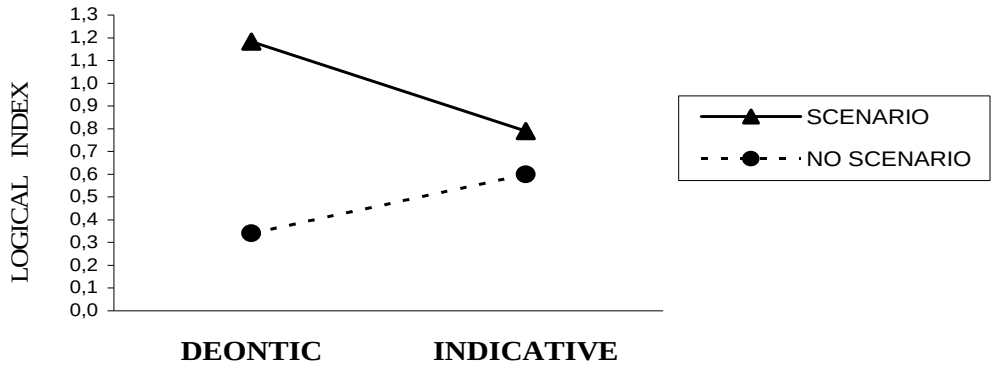

In order to provide statistical assessment of these trends, a Logical Index was computed in the manner described by Pollard & Evans (1987). This index is computed for each attempted solution to each problem by adding a score of one for each correct *p* or *not-q* selection made and subtracting one for each incorrect *not-p* or *q* selection made. The logic index can thus range from – 2 to + 2. A 3 x 2 x 2 ANOVA was performed on the index with one within group factor: content, on three levels, and two between group factors: scenario and framing with two levels each.

The results show a significant main effect of the *problem content* ($F(2, 147)= 16.60$; $p < .0001$). Post hoc analyses revealed significant differences between *neutral* content ($M= .50$) and *permission* content ($M= .97$), $p < .0001$. There was also a significant difference between *permission* and *obligation* rules ($M= .28$, $p < .027$). Overall higher logical indices were obtained with *permission* content. The lowest logical indices were registered with *neutral* rules.

A significant main effect of *Scenario* was also obtained ($F(1,148)= 19.24$; $p < .0001$). For all three types of content, the logical indices were higher in the *Scenario* condition ($M= .986$), than in the *No-Scenario* condition ($M= .464$).

Finally a significant interaction between Scenario and Frame was registered: $F(1,148)= 7.64$; $p < .006$). As shown in Figure 2, performance was considerably higher with scenarios present rather than absent when deontic framing was used, but there was little effect of scenario with indicative framing. Nevertheless, there was no significant interaction between scenario and content.

**Figure 2.** Interactive effects between scenario and frame in the logical index



## DISCUSSION

The results of this study offer empirical evidence about the importance of semantic and pragmatic factors in performance with Wason's selection task. The main effect of the content is broadly consistent with earlier findings in the literature. Although all problems are thematic, the neutral problem provides no helpful pragmatic cues to the correct solution and logical performance with this content is generally low. By contrast, the problems which cue a permission or obligation context produce much higher rates of successful solution. Performance was, however, significantly better with the permission than with the obligation rule.

The main results of interest obtained in this study refers to the importance of the context on performance as manipulated by the presence or absence of scenarios. The presence of a scenario which contextualised the task appears to facilitate the elaboration of a mental framework for reasoning and facilitates logical performance. However, as proposed by Pollard & Evans (1987) and more recently Evans (1995), the mere presence of a scenario does not always facilitate correct performance. Recall that Pollard &Evans found a scenario effect restricted to thematic materials, but -in contrast with the current experiment- failed to separate the use of permission content and deontic framing.

Having separated the two variables in this study, we find -consistent with the results found by Valiña et al. (1998a)- that it is not the problem content as such with which scenario interacts, but the presence or absence of deontic framing. There is a large facilitatory effect of using a scenarios, but only when problems are framed in a deontic manner (Figure 2). The dual process theory (Evans & Over, 1996) proposes an explanation of this

finding. Evans & Over (1996, chapter 4) provide detailed discussion of the differences between deontic and indicative selection task. The deontic task requires decisions about appropriate actions and can thus be correctly cued by the implicit, pragmatic reasoning system. However, such cueing requires the retrieval of relevant knowledge from memory which is evoked by use of a scenario. Thus scenario and deontic framing combine to assist the reasoner. The indicative task, by contrast, requires hypothetical reasoning about truth and falsity. This depends upon use of our much less reliable explicit reasoning system. The absence of a scenario effect on the indicative selection task is very interesting in this context. Hence even when pragmatic cues to prior knowledge are provided by a scenario, they do not assist people in the task of deciding whether some indicative conditional may be true or false.

Although further research is needed on this question, this interpretation is supported by some recent results obtained by Stanovich & West (1998), in an investigation of individual differences in reasoning. These authors also recorded an improved performance in different thematic and deontic versions, compared to abstract and indicative versions. However, they found that the small number of participants who performed correctly the indicative versions of the tasks had a significantly high “g” factor level of general intelligence than those who failed. By contrast, there was no relationship between intelligence and success on deontic versions of the task. This finding -as Stanovich & West note- is best interpreted within the dual process framework. Indicative selection tasks require use of the explicit thinking system for hypothetical reasoning and this system is related to general intelligence. On the other hand performance on deontic

selection task depends only upon the use of the implicit system which is independent of g.

If this interpretation is correct, then different performance would be expected by participants in different versions of the task, according to their particular individual abilities. One subject which we consider requires further investigation is the study of individual differences in reasoning (Dominowski & Dallop, 1991;Valiña, Seoane, Ferraces & Martín, 1995, 1998b). We believe that the study of the differential analyses of reasoning is a course which will allow us to advance in the knowledge of the mechanisms which permit the process of human reasoning to be explained.

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