Pragmatics at Work: Formulation and Interpretation of Conditional Instructions

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Abstract

Formulation and interpretation of conditional instructions (conditionals relating the occurrence of an event to the taking of an action) are studied from a pragmatic standpoint: It is argued that formulations of the instructions differ in perceived naturalness as a function of the adequacy between the necessity and sufficiency relations they embed and the goal-structure of the situation. Two experiments are reported to support this claim.

Conditional Instructions as a Peculiar Subclass of Conditional Statements

As Austin (1962) has observed, we use words to get things done – and there are indeed lots of things we can get done by using the word "if", that is, by asserting a conditional statement. With a conditional statement, we can tell others what conclusion they should draw (e.g., "if it is a three-star restaurant, then the food there is certainly divine"), or what action they should take (e.g., "if you wear this suit, you will make a very good impression on her") – and in particular, especially in working situations, we can give others *instructions* to follow would a specific situation occur (e.g., "if a customer buys two make-up products, offer her a sample of this perfume").

It is common knowledge among psychologists that people do not do very well in conditional reasoning tasks. For example, they have a disturbing tendency to derive the wrong conclusions from a conditional argument (e.g., they commit the fallacies of Asserting the Consequent: "If P then Q; Q; therefore P," and of Denying the Antecedent: "If P then Q; not-P; therefore not-Q") and not to derive the right ones (e.g., they do not apply Modus Tollens: "If P then Q; not-Q; therefore not-P"). (See Evans, Newstead, & Byrne, 1993, for a review.) Does this poor performance extend to this subclass of conditional statements we just dubbed *conditional instructions*? Since conditional instructions are so very common in working situations, that could be bad news.

Fortunately, people seem to be better at handling conditional instructions than at solving conditional reasoning problems. In this paper, we want to show that when dealing with conditional instructions, people are able to (a) select the better way to express a conditional relation between two events according to the goal-structure of the context, and (b) interpret a conditional relation in a normatively (logically) valid way.

Goal-Structure of the Context and Formulation of a Conditional Instruction

From our pragmatic point of view, the context will determine what a speaker will aim to achieve by uttering a conditional instruction: Thus, conditional instructions make points, and do so well or badly depending on their perceived relevance to contextually specified goals. Context will be considered here through an analogy between complying with a conditional instruction and being engaged in a signal detection task. (See Kirby, 1994, for another view on the analogy between conditional reasoning tasks and signal detection tasks.)

In a signal detection task, the observer has to judge whether a signal actually indicates its putative referent or not. Does a certain kind of blip on a sonar screen indicate the presence of an enemy submarine (that has to be sunk) or not? Two types of error are conceivable here: (a) other kinds of objects may have caused the blip, for example whales or friendly submarines, leading to a "false alarm" (FA); and (b) an enemy submarine may really be out there, his sonar "signature" being distorted by underground wave patterns or rock formations in such a way that the operator fails to recognize it, leading to a "miss" (MS).

Now, whether a MS or a FA has the highest expected cost may depend on the situation. In a state of war, MS are likely to prove costly: If you do not sink the enemy submarine first then it will sink you. However, a FA may also prove costly: If you mistakenly sink a neutral country's submarine or ship, you may provoke that country to declare war on you, which could prove especially costly if the neutral country happens to be, say, the United States. (Think of the Lusitania…)

Now, imagine a warship commander wishing to give his operators a conditional instruction linking the observing of an enemy submarine "blip" and the launching of depth charges. In context A, the commander knows that enemy submarines are lethal if allowed within range and must be destroyed at first sighting. Clearly, what he should fear are MS, that is, enemy submarines which are not attacked. In context B, the commander knows that enemy submarines are outside range at first sighting, and that there is a considerable risk of destroying his own submarines, or those of a neutral superpower that are also lurking in the area. What he should fear here are FA, that is, non-enemy submarines which are attacked.

What would be the best way for the commander to frame his conditional instruction in context A? "If you see an enemy blip, then launch the depth charges?" "If and only if you see an enemy blip, then launch the depth charges?" "If you do not see an enemy blip, then do not launch the depth charges?" "Launch he depth charges only if you see an enemy blip?" And what would be the best choice in context B?

Our prediction is that people can and do perceive differences in the naturalness of these formulations as a function of what they perceive to be the goal-structure of the context, that is, "avoid misses" vs. "avoid false alarms". Experiment 1 below offers an experimental investigation of this claim.

Experiment 1

Participants A total of 46 students at the University of Heidelberg took part in this study.

Material & Method Three additional scenarios were created on the model of the Submarine scenario: each scenario came either in an avoid-FA context or in an avoid-MS context. In the Airport scenario, a security officer was to decide whether he would search suspicious-looking luggage, knowing that (avoid-MS context) the airport was situated within a "hot" area where terrorists were liable to smuggle weapons, or (avoid-FA context) the airport was mostly frequented by high-ranking executives that would not appreciate losing their time with a luggage search. In the Border scenario, a policeman equipped with a speed radar of some poor quality had to decide whether he would arrest drivers slightly exceeding the speed limit when entering France from Germany via a subway (the speed limit in France being lower than in Germany), knowing that (avoid-MS context) officials insisted on strictly implementing the French regulation, or (avoid-FA context) the officials insisted on the importance of fluent circulation prior to the strict implementation of the French regulation. In the Mail scenario, which was adapted from Gigerenzer and Hug (1992) in order to vary costs and benefits from a single perspective, an office worker was told to stamp letters over 20 grams in weight at 2 marks, knowing that (avoid-MS context) understamping (i.e., putting 1 mark stamps on letters over 20 grams) would damage the firm's public image, or (avoid-FA context) overstamping (i.e., putting 2 marks stamps on letters under 20 grams) would be costly to the firm's finances.

Each questionnaire featured the four scenarios, all of them in their avoid-MS or avoid-FA version (context was thus a 2-level between-subject factor), rotated over two experimental blocks, with two orders within each experimental block, such that each subject saw two avoid-MS and two avoid-FA contexts paired with different content scenarios. Following each scenario, four conditional instructions were introduced (if P then Q, if and only if P then Q, Q only if P, if not-P then not Q); participants had to rate on a 7-point scale the naturalness of each instruction in the situation that had just been described to them (formulation of the conditional instruction was thus a 4-level within-subject factor). The experiment was conducted in German.

Results & Discussion Table 1 displays the mean naturalness ratings (across the four scenarios) assigned to the four formulations as a function of the goal-structure of the context. (The observed pattern of results was remarkably stable across scenarios.)

Table 1: Naturalness ratings (7-point scale) of conditional formulations as a function of context.

	Context: avoid-MS	Context: avoid-FA
If P then Q	5.74 [a]	3.10 [c]
If and only if P then Q	4.03 [b]	4.47 [b]
Q only if P	3.19 [c]	4.33 [b]
If not-P then not-Q	2.42 [d]	4.91 [b]

N = 22 for avoid-MS context, N = 24 for avoid-FA context. Values that do not share the same subscript differ at $p < .05$.

In the avoid-FA context, all formulations appear to be of acceptable naturalness (4 to 5 on a 7-point scale), except the "if P then Q" formulation which is judged significantly less felicitous. On the contrary, this formulation is by far the most felicitous in the avoid-MS context, the formulations "Q only if P" and "if not-P then not-Q" being this time judged unnatural.

Now why these differences in naturalness as a function of context? One possible answer is related to the notions of necessity and sufficiency. In the avoid-MS context, one would like to stress the *sufficiency* of P (observing an enemy blip) in regard to Q (launching the depth charges), whereas in the avoid-FA context, stress should be on the *necessity* of P in regard to Q. Hence, the ideal formulation in the avoid-MS context would be "if P then Q", whereas this same formulation would be inappropriate in the avoid-FA context. In a given context, a natural formulation will be one that direct the attention of the hearer to the relevant aspects of the situation: is P necessary rather than sufficient for Q? This explanation assumes that people's interpretation of the necessary and/or sufficient character of P in regard to Q in the four considered formulations coincide with what it should be according to formal logic. In the light of previous research (see again Evans, Newstead, & Byrne, 1993), this could be seen as a rather bold assumption. The next section will focus on the reasons why this assumption may hold in the specific case of conditional instructions.

Interpretation of Conditional Instructions as Constraint Perception

Does each of our four conditional formulations (if P then Q, if and only if P then Q, Q only if P, if not-P then not Q) have its own stable interpretation in terms of necessity and sufficiency relations? That is, do people consider these formulations to embed different basic patterns of necessity and sufficiency, even if they have no idea of the goal-structure of the instruction? Moreover, do these patterns coincide with the patterns predicted by traditional logic?

The standard approach to this issue would have been to give participants a scenario (e.g., selling clothes in a clothing store), an instruction (e.g., "if a customer is not touching any clothes, do not offer him your help"), a situation (e.g., "a customer is touching some clothes"), and ask them what they would do in this situation if they had to follow the rule (e.g., "I would offer my help", "I would not offer my help", "I do not know"). But this approach would actually miss the point, for it would not assess the interpretation subjects made of the rule, but their final decision on what they should do, a decision that does not solely depend on the interpretation they made of the rule. (In the above example, a participant may well answer that she would offer her help to a customer that is touching some clothes, after being told that "if a customer is not touching any clothes, do not offer him your help". Is this participant interpreting the rule as meaning that a customer touching some clothes is a sufficient condition to offer him some help? Or is she just taking her best bet on what to do when the rule does not strictly apply?)

Therefore, in order to assess the interpretation participants make of a conditional instruction, what has to be checked is not *what they would do* in the situations P and not-P, but *how they perceive the way the instruction is constraining their behavioral options* in these situations. Thus, given the rule "if a customer is not touching any clothes, do not offer him your help", and the situation "a customer is touching some clothes", the relevant set of answers to choose from would be: "I must offer my help", "I must not offer my help", and "I am free to decide what to do."

We proposed that the function of the different formulations of the instruction was to direct attention

Table 2: Most frequent patterns associated to each formulation of the conditional instruction (N = 39).

Formulation	Most frequent pattern	Frequency: Shop scenario	Frequency: Restaurant scenario
If P then Q	Situation P: Must do Q Situation not-P: Free to decide	82%	82%
If and only if P then Q	Situation P: Must do Q Situation not-P: Must not do Q	85%	82%
If not-P then not-Q	Situation P: Free to decide Situation not-P: Must not do Q	85%	90%
Q only if P	Situation P: Free to decide Situation not-P: Must not do Q	56%	46%
	Situation P: Must do Q Situation not-P: Must not do Q	31%	46%

on different aspects of the context. Efficient illocutionary uptake would then depend on the possibility for the hearers to rely on some basic, conventional meaning of the four formulations regarding the necessity and sufficiency relations they embed. Were these basic meanings to coincide with what they are in traditional logic, then given a conditional instruction "if P then Q", "if and only if P then Q", "Q only if P", or "if not-P then not Q", and the set of choices "I must do Q", 'I must not do Q", "I am free to decide what to do", participants' answers in the situations P and not-P would exhibit normative (logical) validity in terms of the necessary and/or sufficient relationships between P and Q. Experiment 2 below was designed to provide an empirical investigation of this hypothesis.

Experiment 2

Participants A total of 39 students of the Ecole Supérieure des Sciences Economiques et Commerciales (ESSEC) at Cergy-Pontoise took part in this study.

Material & Method Two scenarios were constructed, the Shop scenario and the Restaurant scenario. In the Shop scenario participants were told that they were selling clothes in a shop; they had to decide whether they would offer a customer some help, knowing that there was an instruction to be strictly followed (e.g., "if a customer is touching some clothes, offer him some help"). In the restaurant scenario, participants were told they were establishing a list of providers for the chef; they had to decide whether a provider should be put on the list, again knowing that there was an instruction to be strictly followed (e.g., "if a provider does not offer you a reduced price, do not put him on the list").

Each questionnaire featured the Shop scenario and the Restaurant scenario. Within each scenario, the four formulations of the conditional instruction were introduced in turn. (For the Shop scenario, the four formulations went:
"If a customer is touching some clothes, offer him your help", "If and only if a customer is touching some clothes, offer him our help", "Offer a customer your help only if he is touching some clothes", and "If a customer is not touching any clothes, do not offer him your help.") The formulation of the instruction was thus a 4-level within-subject factor. For each rule, participants were asked to choose from the three following answers, first in the situation P, then in the situation not-P: "I must do Q", "I must not do Q", "I am free to decide what to do." The experiment was conducted in French.

Results & Discussion A first way to look at the results is to consider the most frequent pattern of answer elicited by the participants for each formulation (see Table 2). Regarding the formulations "if P then Q", "if and only if P then Q", and "if not-P then not-Q", there is a clear dominance of a single pattern for each rule (eliciting 82 to 90% of answers), whereas the formulation "Q only if P" elicits two main patterns. (Whatever the formulation, no other pattern elicited more than 13% of answers.) The dominant patterns elicited by the formulations " if P then Q", "if and only if P then Q", and "if not-P then not-Q" are precisely those that would be predicted by classical logic. Of the two main patterns elicited by the formulation "Q only if P", one is predicted by classical logic, the other one is the biconditional pattern.

Another way to look at the results is to consider, for each formulation of the instruction, the frequency with which participants answered as if P was necessary (see Table 3) or sufficient (see Table 4) for Q. In order to compute the percentages in Tables 3 and 4, participants have been considered as (a) answering as if P was necessary for Q if they answered that they would have to avoid doing Q in the situation not-P, and (b) answering as if P was sufficient for Q if they answered that they would have to do Q in the situation P.

Whatever the scenario, P was overwhelmingly considered to be necessary for Q with all formulations except "if P then Q", which is what one would expect according to classical conditional logic. In particular, the fallacy of Denying the Antecedent ("if P then Q, not-P, therefore not-Q") was endorsed by only 8 to 13% of the participants, which is well below the usual rate observed in conditional reasoning experiments.

Table 3: Necessity of P in regard to Q (in percentage of answers), as a function of instruction formulation.

	Shop scenario	Restaurant scenario
If P then Q	08 % [a]	13 % [a]
If and only if P then Q	95 % [b]	95 % [b]
Q only if P	87 % [b]	92 % [b]
If not-P then not-Q	92 % [b]	97 % [b]

N = 39. Values that do not share the same subscript differ at $p < .05$.

Turning to the sufficiency of P in regard to Q, results are unambiguous for the formulations "if P then Q", "if and only if P then Q", and "if not-P then not-Q": This time, P is overwhelmingly deemed as sufficient for Q, as classical logic would predict. The unexpected result (from a logical standpoint) comes from the formulation "Q only if P", with P being deemed sufficient for Q by 36 to 51% of participants. This last result may be used to rule out the idea that logical competence only could be responsible of participants' answers: If participants recovered logical competence when dealing the instructional subclass of conditional statements, then

why would the specific formulation “Q only if P” elicit logical errors?

Table 4: Sufficiency of P in regard to Q (in percentage of answers), as a function of instruction formulation.

	Shop scenario	Restaurant scenario
If P then Q	87 % [a]	92 % [a]
If and only if P then Q	87 % [a]	85 % [a]
Q only if P	36 % [b]	51 % [b]
If not-P then not-Q	08 % [c]	08 % [c]

N = 39. Values that do not share the same subscript differ at $p < .05$.

Without resorting to an explanation in terms of logical competence, it could be argued that the *deontic* nature of conditional instructions is responsible for the normatively correct performance of participants, since deontic contents are known to be a powerful facilitator of conditional reasoning. First, it should be noted that a conditional instruction is *not* a social contract the way Cosmides (1989) has defined it: A conditional instruction does not relate perceived benefits to perceived costs, it does not express a social exchange in which an individual is required to pay a cost (or meet a requirement) to another individual in order to be eligible to receive a benefit from that individual. Having no cost-benefit structure, conditional instructions do not leave room for cheating, that is, obtaining the benefit without paying the cost. Therefore, if participants' performance has benefited from some deontic facilitation, this facilitation does not fall within the scope of Cosmides' (1989) social contract theory or Gigerenzer and Hug's (1992) cheater-detection algorithm.

Would this deontic facilitation be explainable by Cheng and Holyoak's (1985) pragmatic reasoning schemas theory? In Cheng and Holyoak's terms, improved performance would be due to some content or context-based prompting of either a permission or an obligation schema. Yet, since context and semantic content of the instruction stay the same across our conditions, why should syntax alone determine the nature of the prompted schema? We fail to see why, content and context remaining stable, "if P then Q" would lead to the activation of an obligation schema, whereas "if not-P then not-Q" or "Q only if P" would lead to the activation of a permission schema.

As demonstrated by Thompson (2000) in her study of interpretative processes in various types of conditional reasoning tasks, performance in a conditional *argument* task (contrary to performance in Wason's selection task) is predicted by necessity and sufficiency conditions, and not by the deontic or factual nature of the conditional. Is it possible to explain our results in terms of perceived necessity and sufficiency relations?

Indeed, conditional instructions are meant to embed very strong necessity and sufficiency relations: In the instruction "put a provider on the list only if he offers you a reduced price", the necessity of the offer is clearly not a matter of degree. Due to the intrinsic nature of conditional instructions, any necessity or sufficiency relation between the two propositions involved will be of maximal perceived strength, which would explain the extreme frequencies observed in Tables 3 and 4. The fact that participants did so well in perceiving the valid necessity and sufficiency relations and dismissing the invalid ones in the instructions they were given can conceivably be explained by one distinctive aspect of conditional instructions: Contrary to most conditionals (e.g., causal conditionals, conditional warnings, etc.) instructions are not meant to change the epistemic state of their recipient, but *to constrain his or her behavior*. As one's natural preference will usually be to exert one's free will, it is not much surprising that one will be accurate in recognizing in which situation one's behavior will be dictated or not by the instruction, that is, recognizing the necessity and sufficiency relations embedded in the instruction.

Conclusion

The focus of this paper has been the formulation and interpretation of conditional instructions, that is, conditionals that relate the occurrence of some event to the undertaking of some action. Drawing an analogy from signal detection theory, we labeled a "Miss" the situation in which the event is occurring but the action is not taken, and a "False Alarm" the situation in which the action is taken without the event occurring.

We proposed that context allows to determine the relative expected costs of Misses and False Alarms, which in turn allows to determine the goal-structure of the situation and the aim of the speaker asserting the instruction: What is to be avoided in the situation? Misses? False Alarms? Both?

Depending of the goal-structure of the situation (and consequently of the aim of the speaker), syntactic formulations of the instruction differ in perceived naturalness (Experiment 1). For example, the usual conditional formulation “if P then Q” will be perfectly appropriate for situations where Misses must be avoided, but will be of poor felicitousness in situations where False Alarms must be avoided.

We proposed that judgements of naturalness are based on the understanding people have of the necessity and sufficiency relations embedded in the various possible formulations of the instruction. A formulation in which P is sufficient for Q is appropriate for situations where Misses must be avoided, a formulation in which P is necessary for Q is appropriate for

situations where False Alarms must be avoided. Experiment 2 showed that when dealing with conditional instructions, people have a much clearer understanding of those relations than what could have been expected from their usual performance in conditional reasoning tasks.

Taken together, these two studies suggest that speakers' perception of the felicity of different kinds of conditional expressions is strongly determined by goal-structure (avoid miss vs. avoid false alarm), and that hearer's reactions to these conditionals is well aligned with this goal-structure, even if hearers have no explicit knowledge of these goals. The results therefore suggest that the function of these different formulations of conditional instructions is to direct the hearer's attention to aspects of his decision-making situation that the speaker considers important. That hearers so successfully detect the speaker's intentions not only suggests – in the language of Austin – high illocutionary uptake, but also successful coordination of action by the speaker and the hearer.

For the rational speaker to get what he wants done with words, he should therefore choose a form of the conditional that encodes the goal-structure implicit in the context, in the knowledge that the hearer should react in a way that will fulfill his intention. Rationality here is thus social and pragmatic, determined by the successful coordination of the speaker and the hearer to achieve shared organizational goals.

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