

Conversational inference and rational judgment

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Conversational Inference and Rational Judgment

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CONVERSATIONAL INFERENCE AND RATIONAL JUDGMENT

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Abstract

Conversational inference is inductive in nature, requiring the listener to go beyond the information explicitly given in a message. This requirement runs counter to the assumption that rational subjects should only operate on the information explicitly given in judgment tasks. Rational interpretations of messages are guided by hearers' hypotheses about the speaker's intended meaning. An attributional model of conversational inference is presented which shows how these interpretations are governed by conversational assumptions, which in turn are governed by the attributions the speaker makes about the hearer. The model is then applied to the analysis of experiments on reasoning processes in cognitive psychology, developmental psychology, social psychology and decision research. It is shown that the conversational model can predict how experimental manipulations of relevant source and message attributes affect subjects' judgments. In conclusion, failure to recognize the role of conversational assumptions in governing inference processes can lead rational responses to be misclassified, and misattributed to cognitive shortcomings

Most psychologists conceive of judgment and reasoning as cognitive processes, which go on "in the head" and involve intrapsychic information processing (e.g. Kahneman, Slovic and Tversky, 1982; Nisbett and Ross, 1980). While it is incontestable that processes of attention, memory and inference underpin judgment and reasoning, psychologists have perhaps overlooked the extent to which these mental processes are governed by higher-level assumptions about the social context of the information to be processed. On the other hand, philosophers have in recent years drawn attention to the extent to which reasoning from ordinary language is shaped by higher-order assumptions about the nature of social interaction and conversation (Austin, 1962; Grice, 1975; Searle, 1969; Strawson, 1952). These higher-level assumptions can determine what we attend to, which memories we search and what kinds of inference we draw.

Recognition of conversational constraints on inference has important implications for experimental psychologists. No psychological experiment or investigation takes place in a social vacuum. All experiments and surveys are forms of social interaction between the experimenter and subject, which invariably involve communication through ordinary language. Thus psychologists who explain patterns of judgment in terms of purely intrapersonal factors such as memory capacity, attention factors, memory activation levels, search strategies, judgmental heuristics, and so on, may be in danger of committing an attribution error (cf. Cheng and Novick, 1990). They may be in danger of misattributing patterns of inferential behaviour to features of the person, when in fact the behaviour is determined by its interpersonal context.

In particular, recognition of conversational constraints on inference has important implications for the debate about rationality in human judgment. Conversational assumptions often require us to go beyond the information explicitly given in an utterance. A perennial problem for students of judgment and reasoning has been to determine whether a "mistake" is due to incorrect reasoning about the information given, or to the application of correct reasoning procedures to incorrect or "irrelevant" information (Henle, 1962; Johnson-Laird, 1983). Thus a seemingly incorrect or inconsistent judgment may be attributable to the judge's use of additional information in coming to a conclusion. Often the final judgment may be highly rational given the subject's use of conversational assumptions in forming a representation of the reasoning task.

In this paper I outline an attributional model of conversational inference. I show the implications of Grice's (1975) analysis of conversational assumptions for attribution processes in discourse comprehension. Thus the qualities (e.g. knowledge, intentions, group membership) that the hearer attributes to the speaker can affect the hearer's interpretation of the speaker's utterances. I discuss the logical properties of conversational inference, and their implications for models of rational judgment. I then apply the model to the analysis of experiments on reasoning drawn from developmental psychology, social psychology, cognitive psychology and decision research. I show that the attributional model of conversational inference organises phenomena found in these diversified literatures within a common framework. The attributional model reinterprets many "cognitive" phenomena in terms of conversational inference processes. In addition, failure to appreciate the role of conversational pragmatics may have led many patterns of judgment

to be wrongly classified as errors.

PROPERTIES OF CONVERSATIONAL INFERENCE

The inductive nature of conversational inference

Conversational inference is itself a form of judgment under uncertainty. Hearers have to make hypotheses about the speaker's intended meaning on the basis of what is explicitly said. For example, most hearers routinely go beyond the information given to infer that the utterance "I went to the cinema last night" would imply that the speaker meant to convey that she saw a film last night. The additional information conveyed in this way by the speaker is termed a conversational implicature. The difference between the literal meaning of an utterance ("what is said") and what is actually conveyed ("what is implicated") corresponds to an important distinction made by Grice (1968) between "sentence meaning" and "speaker's meaning".

Conversational inference thus shares some important properties with inductive inference (Levinson, 1983). The first is that it is ampliative; i.e. the conclusion contains more information than the premises. Just as from observing that the first 1000 carrots that I dig up are orange I make the stronger conclusion that "All carrots are orange", so the inference that the speaker went to the cinema and saw a film contains more information than the assertion that she just went to the supermarket. Consequently, the conclusions of both conversational and inductive inference are both defeasible, i.e. they can be cancelled by the addition of new information. Thus, just as the conclusion that "All carrots are orange" may be cancelled by digging up a 1001st carrot that is brown, so the speaker may cancel the implicature that he saw a film at the cinema last night by saying "I went to the cinema last night, but couldn't

get in".

Conversational inference is thus unlike deductive inference, where conclusions contain no new information but simply demonstrate what can be inferred from the premises, and cannot be cancelled by the addition of new information. Thus the fact that Socrates is mortal necessarily follows from the fact that Socrates is a man and all men are mortal, and nothing can be done to change this conclusion except to change the original premises.

Consequently, in conversational inference, as in inductive inference, we encounter Hume's problem, namely that we can never draw correct conclusions with certainty. Just as theory is underdetermined by data, so hypotheses about the speaker's intended meaning are underdetermined by what is said. There may be an innumerable number of theories or hypotheses about intended meaning which are consistent with the data given and thus have the chance of being true. How then do we decide which theory or hypothesis is best?

We do seem to have some criteria for determining the rational choice in both cases. In fact, proposals made by philosophers of science and philosophers of language are broadly similar. Roughly speaking, rational inferences are those which, as well as being likely to be true, convey the most new implications for the least effort. This position is implicit in Popper's (1972) enjoinder that scientific hypotheses be "powerful and improbable", in Sperber and Wilson's (1985) suggestion that the relevance of an inference should be calculated in terms of the number of implications it carries for the amount of processing effort needed, and in Grice's (1975) logic of conversation.

INSERT TABLE 1 ABOUT HERE

Grice's (1975) statement of the co-operativeness principle underlying conversation and the four conversational maxims that derive from it are detailed in Table 1. Although some theorists have sought to revise this approach, e.g. by reducing all the maxims to a superordinate one of relevance (Sperber and Wilson, 1986), Grice's approach is adopted here because of its ability, when suitably interpreted, to explain a wide range of phenomena in conversational pragmatics (see Brown and Levinson, 1987; Levinson, 1983; 1987; for more detailed discussion). In particular, as will be shown below, the co-operativeness principle and the subordinate maxims seem to correspond to important psychological dimensions, and tensions between them to produce important logical and linguistic consequences.

Attributional bases of Grice's logic of conversation

As well as capturing important properties of discourse, Grice's (1975) assumption of co-operativeness and the corresponding maxims of conversation seem to correspond to important psychological distinctions (see Table 2). In

INSERT TABLE 2 ABOUT HERE

particular, the assumption of co-operativeness presupposes that utterances are produced by an intentional agent who wishes to co-operate with us, and has the ability to realize this intention. From these basic assumptions of intentionality and co-operativeness, several consequences follow.

Thus, the maxim of quality concerns the likely truth-value of an utterance. If the hearer attributes properties such as sincerity, reliability and knowledgeability to the speaker, then the hearer may well consider the probable truth-value of an utterance to be high. If, on the other hand, the hearer considers the speaker to be insincere, unreliable or unknowledgeable, then

the hearer may well consider the probable truth of the utterance to be low.

The maxim of quantity concerns the perceived informativeness of an utterance. Speakers should not burden hearers with information they are already likely to know. What speakers and hearers take for granted may in part depend on perceptions of class membership. Competent members of Western society do not need to be told why a customer who ate a good meal with good service in a restaurant left a big tip. From their own world knowledge they are able to make the necessary bridging inferences (Clark and Haviland, 1974; Schank and Abelson, 1977). Thus hearers will often go beyond the information given in making inferences, since they assume that relevant information that they are likely to know already has been omitted.

The maxim of relevance enjoins speakers to mention information that is relevant to the goals of the interaction. Hearers are entitled to assume that any relevant information which they are not likely to know will have been included. They are also entitled to assume that information which has been included is relevant. Otherwise why mention it? One problem for experimental research is that psychologists routinely violate this assumption by introducing information precisely because it is irrelevant to the judgment task in hand (e.g. Nisbett, Zukier and Lemley, 1980). If hearers (subjects) continue to attribute essentially co-operative intentions to speakers (experimenters) then they are liable to be misled by the information given.

The maxim of manner enjoins speakers to be brief, orderly, clear and unambiguous. The extent to which speakers can adhere to these prescriptions often depends on their control of the language. Hearers may take this into account in interpreting utterances. For example, a German tourist in England might

conceivably ask a passerby for directions to "the Townhouse" when she meant "the Town Hall". Rather than direct the tourist to the nearest renovated Georgian Yuppie residence in the centre of town, a co-operative hearer might attribute the speaker's unclarity to her inexperience in British English and direct her to the Town Hall. Usually such misunderstandings in conversation can be corrected through discussion. However, such opportunities for repair do not exist in experimental and survey research. Consequently, experimenters may not notice ambiguities in their response formats which are systematically re-interpreted by subjects, thus leading to systematic biases in the results obtained. This seems to have been the case in much basic attribution research.

Attributions in utterance interpretation

The trade-off between the maxims of quality and quantity implies that speakers should try and be as informative as possible without running the (undue) risk of being false. This results in important issues of interpretation. The interpretations hearers choose may in large part depend on attributions they have made about the speaker. To illustrate, the utterance:

1. "Some of the policemen beat up the protester"
could convey one of two different implicatures. It could mean one of the following:

2. "Some of the policemen beat up the protester" (but the speaker knows that not all of them did).
3. "Some of the policemen beat up the protester" (but the speaker does not know whether all of them did).

Levinson (1983) characterises the first implicature as a K-implicature (because the speaker knows that the stronger assertion is not the case) and the second a P-implicature

(because the stronger assertion is possible , due to the speaker's lack of knowledge). One may reasonably surmise that the hearer is more likely to draw the K-implicature if he or she considers the speaker to be very knowledgeable about the topic (e.g. an eye-witness who was there) than not (e.g. a person reporting the incident at second or third-hand).

However, in some circumstances the hearer may not draw the K-implicature even if he or she assumes that the speaker is indeed knowledgeable about the event under discussion. Such would be the case if the speaker were a police spokesman at a press conference who wished to limit perceptions of police brutality in a critical public. The spokesman may not want to tell lies, thus observing the maxim of quality, but may only commit himself to the weakest possible statement about police intransigence that is consistent with evidence known to the public. If the hearer attributes non-cooperativeness of this kind to the speaker, then the hearer may assume that the spokesman may be seeking to avoid committing himself to stronger statements that would be relevant, but damaging to presentational goals that the police force might have.

It is not difficult to think of other factors that might affect the interpretation of such statements. For example, if the hearer knows that the speaker is a foreigner with a limited control of English and who did not know words such as "A few" or "many" which the speaker might reasonably have used to specify the proportion of policemen involved, then the hearer might treat "some" as being vague, and consistent with either a low or high proportion of policemen.

In sum, the full meaning of utterances needs to be determined by reference to context (cf. Shanon, 1988). There is

more to what is said than what is literally expressed. Hearers are required to go beyond the information given in order to understand what is said. This leads to a problem which hypothesis about the speaker's intended meaning to select. Selection can be constrained by reference to Grice's (1975) maxims, whose application is in turn constrained by attributions that the hearer may have made about the speaker. Conversational inference is therefore inductive in nature, which thus poses severe problems in assessing the rationality of judgments made on the basis of experiments using verbal materials. This will be discussed in further detail below.

Rationality and the interpretation of the judgment task

It is often pointed out that widely shared assumptions about co-operative communication (Grice, 1975; Levinson, 1983) license interpretations of the experimental task that the experimenter may not have intended. Much criticism of experiments on rationality has been directed to the question of how subjects interpret the information that they are given in such experiments (e.g. Adler, 1984; Cohen, 1981; Donaldson, 1978; 1982; Funder, 1987; Hilton, 1990; Kruglanski and Ajzen, 1983; MacDonald, 1986; Markus and Zajonc, 1985; Rommetveit, 1978).

To take a simple example, reported in Cohen (1980). Some years ago, psychologists became interested in the logical reasoning abilities of peasants. In an experiment, some peasants were given syllogisms which stated a major premise and a minor premise, as below:

Major premise: If Diego has a plough, then he will sow his corn

Minor premise: Diego does not have a plough

The experimenters expected the subjects to draw the conclusion that Diego would not sow corn if he did not have a plough.

However, the peasant subjects disagreed. They concluded that Diego would surely borrow a plough from a neighbour if he did not have one himself.

The peasants' response is only irrational if we expect them only to operate on the information given, and not to use their world knowledge to evaluate the task in a realistic context. However, it is crucial to note that this criterion of rationality - not to go beyond the information given in what is explicitly stated in making judgments - is quite at variance with the requirement of rational communication that we should go beyond the information given in interpreting what is said to us. In this latter view, part of the inferential task is how to decide what implicit information is relevant to interpreting what is said (e.g. Levinson, 1983; 1987; Sperber and Wilson, 1986).

This tension between "scientific" rationality, whereby the judge should apply normative rules of inference to draw the "logical" conclusion from the information given, and "conversational" rationality, which requires the listener to go beyond the information given, provides the focus of this paper. Put simply, the subject in experiments on judgments in reasoning is usually a listener as well as a judge. Since the use of verbal vignettes or verbal instructions is widespread in experiments on judgment and reasoning, the implications for such research of the properties of conversational inference warrant serious and systematic consideration. Below we review how the hearer's attributions about the speaker guide judgment through influencing the subject's interpretation of experimenter-given information.

ATTRIBUTIONS ABOUT THE EXPERIMENTER AND CONVERSATIONAL INFERENCE

Social psychological research quite clearly suggests that

subjects attribute serious purposes even to patently absurd experiments (Orne, 1962), and to behave in a highly co-operative manner in response to some very questionable experimental demands when they perceive the experimenter as being authoritative (Milgram, 1974). In addition, it is well known that source attributes such as expertise, credibility and prior attitude affect subjects' responses to experimental attempts at belief change (e.g. McGuire, 1968). Consequently, the question of how subjects' perception of the experimenter him/herself affects the kind of inferences the subject draws about the experimental task in hand should be considered in detail.

In fact, the hearer's perception of the speaker is quite central to Grice's model of conversation. For example, the higher-order co-operativeness principle explicitly enjoins the hearer to assume that the speaker is being co-operative, and draw inferences accordingly. The lower-order maxims of conversation make implicit references to particular attributes of the speaker. These may include his honesty and credibility (the maxim of quality), his knowledgeability about what may be taken for granted in a conversation (the maxim of quantity), his conversational purposes (the maxim of relevance) and his control of the language (the maxim of manner). As will be shown below, factors which may affect these assumptions may affect the responses subjects make to experimental tasks.

The assumption of intentionality and conversational inference.

The most fundamental assumption we make in hearing conversation is that utterances are intentionally produced by the speaker. If they were not, there would be no basis for making judgements about the credibility, informativeness, purpose or

style of what is said on the basis of perceptions of the speaker. Conversation is a form of action, and if the actions performed are not perceived as being intentional in nature, then we cannot attribute those actions to inferred or known dispositions of the actor (cf. Jones and Davis, 1965).

Unless told otherwise, subjects seem to be very resistant to attributing experimental manipulations to the operation of random or accidental processes. Subjects are very liable to perceive palpably random behavior in experiments as if they were guided by intentions. Examples are the description of the random movement of dots in a film in terms of intentional actions such as "chase" and "follow" by 49 out of 50 of Heider and Simmel's (1944) subjects. Oatley and Yuill (1984) found that cues such as "jealous husband" led subjects to exert considerable ingenuity in explaining why the dots in Heider and Simmel's (1944) film moved as they did. Perhaps most germane to the present issue is the behavior of naive users of Weizenbaum's ELIZA system. Although ELIZA produces some rather stereotyped examples of therapeutic discourse through the operation of an English language generator coupled with some random response selectors and a few procedures for recognizing key words, users are very prone to read deep intentions into the program's utterances (Boden, 1977).

People appear to distinguish between behavior that is produced by a person and some impersonal agent. For example, Faucheux and Moscovici (1968) showed that subjects' strategies in an experimental game were affected by information indicating that their partner was a person or "nature". Subjects' behavior often appears to be determined by subjects' perceptions of the experimenter's intentions and goals, a fact that has caused some to question the usefulness for psychology of experimental procedures drawn from natural science (e.g. Harré and Secord,

1972).

Consequently, factors which undermine the perception that the actions performed by the experimenter are intentional may, according to the conversational model, have critical effects on how experimental manipulations are interpreted and responded to. One consequence of this phenomenon is that "biases" in judgment that are in fact attributable to processes of conversational inference may disappear or be attenuated when the assumption of intentionality is undermined. As will be shown below, this often seems to be the case.

"Accidental" and intentional transformations in conservation experiments

The procedures devised by Piaget to test children's ability to conserve quantities such as number and mass (Piaget and Inhelder, 1969) have been very widely employed in developmental psychology. For purposes of exposition, one of the procedures used to test conservation of number will be considered in detail. For example, a child may be shown two rows of four counters which are equal in length. The child is asked whether there is more in one row rather than the other, or whether they are the same. Typically, the child agrees that they are the same. The experimenter then modifies one of the rows so that the same four counters are now arranged in a longer row, and repeats the question. Commonly, the child will reply that there is "more" in the longer row. This is taken to imply that the child has failed to conserve the number of counters, and has perhaps confused length with number.

However, note that the traditional Piagetian procedure involves an obviously calculated and deliberate transformation of the experimental array by the experimenter. Children may

therefore have made the inference that the transformation was meant to be significant in some way. For example, they may have recognized that the two rows still had the same number of counters, but may have decided that the experimenter is interested in determining whether the child has recognized that the length dimension has been changed. Children may therefore have re-interpreted the question focus from "number" to "length" in order to give the experimental manipulation relevance (cf. Donaldson, 1982).

McGarrigle and Donaldson (1974) tested the above hypothesis by effecting the transformation "accidentally". Specifically, after the child had been shown the two rows of counters and asked which one had more, a "naughty teddy" was introduced who "accidentally" disturbed the length of one of the rows in the process of "spoiling the game". Of course, the teddy's behavior was carefully contrived to transform the length of counters exactly as much as the experimenter did in the normal procedure. Although the transformation was objectively the same, children's performance in the "accidental" condition was vastly superior to that obtained in the "intentional condition". Using one criterion of conservation, 50 of the 80 children aged between 4 and 6 years showed conservation in the "accidental" condition, whereas only 13 showed conservation in the "intentional" condition.

This result has been replicated and extended to other Piagetian conservation procedures (see Donaldson, 1982, for a review). Moreover, it is consistent with other studies which suggest that children only judge the shorter line as having "more" when they have been asked to make an initial judgment when the two lines were equal (Rose and Blank, 1974). Clearly, when the array has been transformed, and the question asked again, children seem to experience a demand to change their response,

and may re-interpret the question. When children were not asked to make an initial commitment before the transformation, they were more likely to give correct answers to the question asked after the transformation.

Siegal, Waters and Dunwiddy (1988) extended these results by investigating whether 4- 5- and 6-year old children are aware of how demand effects may affect responses. They showed children a puppet doing a conservation task. In one condition the puppet underwent the one-question procedure of Rose and Blank (1974) and in the other, the two-question procedure. They found that children attributed children's incorrect responses in the two-question task to external factors (e.g. "to please someone else"), but the same responses in the one-question task to internal factors (e.g. "because they really thought it was true"). Children thus seem to be aware of the role of social pressures in determining responses in such experiments.

In sum, As Donaldson (1982) notes, such results are consistent with Grice's (1968) distinction between sentence-meaning (what the sentence "literally" means) and speaker's meaning (what the sentence means when interpreted in its context of use). Although Donaldson (1982) is careful to note that many non-conserving responses are still made in the "accidental" condition, she also notes that conventional conservation procedures seriously underestimate children's ability to conserve. In particular, many failures to conserve which have been attributed to cognitive deficits such as "perceptual domination" (Piaget and Inhelder, 1969) or "attentional deficits" (Gelman, 1972) may simply reflect the operation of generally adaptive principles of conversational inference.

Intentional and "random" presentations of information in

base-rate experiments

One of the most widely known studies on decision-making has been the "engineers and lawyers" problem introduced by Kahneman and Tversky (1973), and described in a Science article (Tversky and Kahneman, 1974). Berkeley and Humphreys (1982) found that the Science article was cited 227 times between 1975 and 1980, with approximately one fifth of the citations coming from sources outside of psychology, all of which used the citation to support the claim that people are poor decision-makers.

Kahneman and Tversky's (1973) basic finding was that subjects were more likely to rely on individuating information about the target than base-rate information. For example, subjects in some conditions were told that the target person "shows no interest in political and social issues and spends most of his free time on his many hobbies which include home carpentry, sailing, and mathematical puzzles". These people predicted that the target person is probably an engineer, regardless of whether they had been told whether there were 30 or 70 engineers in the sample. Kahneman and Tversky attributed this pattern of judgment to the operation of the "representativeness heuristic", i.e. subjects based their decision about the probability that the target was an engineer on the similarity of the target to their stereotype of engineers.

However, evidence has since to come to hand that this phenomenon of "underuse of base-rate information" is restricted to "word problems" in which the base-rate information is presented verbally to subjects. Thus studies which present base-rate information on-line to subjects in the form of learning trials, show that subjects can use base-rate information appropriately when making judgments (Christensen-Szalanski and Beach, 1982; Medin and Edelson, 1988). Other studies which

require subjects to make judgments in which they have prior real-world experience or expertise also find no tendency to underutilise base-rate information (e.g. Wallsten, Fillenbaum and Cox, 1986; Weber et al., 1990; Weber and Hilton, in press; see also the discussion of attribution research below). Consequently, subjects' use of the representativeness heuristic may be governed by contextual factors, such as the assumptions that subjects make about verbally presented base-rate information.

In fact, subjects' use of base-rate information has been shown to be affected by various pragmatic factors. Li, Krosnick and Lehman (1989) noted that subjects always read individuating information first and base-rate information second in Kahneman and Tversky's (1973) procedure and other similar ones. They hypothesised that the order of presentation of information may have served as a cue to subjects to weight the initial information more and the later information less. Consistent with this reasoning they found that subjects used the base-rate information more when it was presented first. Li et al. (1989) also took memory measures and were able to rule out the hypothesis that the greater weighting of earlier information was due to enhanced recall at the time of judgment.

If subjects were indeed using order of presentation as a cue to determine the intended relevance of the information, then the significance of the cue should be invalidated if the subject believes that it has not been intentionally produced by the experimenter. And this indeed appears to be the case; Li et al. (1989) found that the order effect disappeared when subjects were told that the order of presentation had been randomly determined.

Ginossar and Trope (1987 Expt. 6) presented the engineers

and lawyers problem to subjects as if the information had been generated as part of a card game. Framing the description as having been produced by a "game of chance" would undermine the assumption that the information was produced as part of an intentional communication. Consistent with the conversational model, it was found that subjects were more likely to use base-rate information in this condition.

Schwarz et al. (in press) employed a related manipulation to undermine the assumption of intentionality. They told subjects that the individuating information had either been produced by a panel of psychologists or statisticians who had conducted the original set of interviews with the sample of engineers and lawyers, or had been drawn randomly from the psychologists' or statisticians' files by a computer. In all cases, subjects were given the personality description that is "representative" of an engineer, and were told that there were 30 engineers in the sample of 100. When told in the psychology condition that the individuating information had been given them by a human researcher, subjects on average estimated the probability that the target was an engineer was .76, replicating Kahneman and Tversky's (1973) original findings. However, when told that the statements had been drawn at random from the psychologists' file by a computer, subjects' average estimate was .40, in line with the normative use of base-rate information.

On the other hand, in the "statistics" condition, subjects were more likely to weight individuating information when it was drawn at random by a computer from a larger sample of descriptive information (.74) than when it was written by a non-specified "researcher" (.55). One possible explanation is that random sampling is a valued procedure in a statistics framework, and subjects therefore attached greater significance to the

"representative" (i.e. randomly selected) information here. Although this explanation is post hoc, it does underscore the importance of attention to subjects' inferences about the particular expertise and credibility possessed by the source of information. As will be shown below, explicit information about the source does indeed affect subjects' judgments in this task.

Source attributes and the use of base-rate information

Grice's (1975) maxim of quality enjoins speakers not to say what they know to be false, or at least not to say what they lack adequate evidence for. Consequently, varying the credibility of the speaker should affect the weight attached to the speaker's messages. Ginossar and Trope (1987, Experiment 5) varied the credibility of the source of information in the engineers and lawyers problem. They found that subjects rated the personality description as having the highest probability of being true when the source was a trained psychologist ($M=.78$), lowest when the source was a palm reader ($M=.31$) and intermediate when the source was a beginning interviewer ($M=.59$).

Although Ginossar and Trope (1987) discuss these results in the terminology of "rule activation", "accessibility" and "mismatching", unlike Li et al. (1989) they took no measures such as salience or availability in any of their experiments which explicitly addressed such cognitive hypotheses. Interestingly, their "salience" manipulations which led to greater use of base-rate information both involved violations of conversational norms, either by presenting prior tasks with uninformative nondiagnostic information before the target task (Expt. 1) or by rewriting the target task in a "list" style uncharacteristic of normal "conversational" communication (Expt. 2). Consequently, their results may also be treated as just as consistent with a

conversational model which suggests that the weighting of individuating information is based on inferences about the Gricean quality of that information based on perceptions of the source.

In related vein, Zukier and Pepitone (1984 Expt. 1) enjoined their subjects to either behave like clinicians or scientists in making judgments. Thus when the task was framed as being one of "clinical judgment", subjects were asked to call on their "general knowledge, sensitivity and empathy" in understanding "the individual's personality, profession and interests" (p. 353). Although not discussed in Gricean terms, these instructions clearly invite subjects to stretch the maxim of quality and say what, in other circumstances, they might feel they lack evidence for. On the other hand, the instruction in the "scientist" condition to behave like "a scientist analyzing data" seems to enjoin subjects to be strict with the maxim and quality, and not to say what they lack adequate evidence for. As might be expected, the results showed that subjects are more likely to weight individuating information in the "clinical" condition than in the "scientist" condition. Interestingly, subjects in the "scientist" condition gave lower probability estimates overall for both the stereotypic and neutral personality descriptions. This would be consistent with a general orientation towards caution, consistent with a strict application of the maxim of quality.

In sum, the above studies on the engineers and lawyers problem suggest that subjects' use of base-rate information is governed by their assumptions about its conversational quality and relevance. When subjects' assumptions about the intentionality, relevance and quality of the information are undermined, subjects tend to use base-rate information more

(Ginossar and Trope, 1987; Li et al., 1989; Schwarz et al., in press; Trope and Ginossar, 1988). When, in line with the precepts of conversational inference, they are enjoined to go beyond the information given they weight individuating information, whereas when they are enjoined to be "scientific", they stick to hard facts and figures (Zukier and Pepitone, 1984). This pattern of results suggests that subjects typically enter the psychology experiment with the default assumption of conversational rationality which enjoins them to go beyond the information given in making inferences about what is required of them. Importantly, however, they can also make inferences which correspond to "scientific" norms when their conversational assumptions are cancelled by the context. Consequently, the production of bias in such tasks may be less attributable to cognitive factors such as representativeness (Kahneman and Tversky, 1973) or availability (Ginossar and Trope, 1987) than was first thought, and may be more attributable to inferences about the social context of the experimental message that are guided by conversational assumptions.

Attributions of co-operativeness and the effect of leading questions

The default assumption made by Grice's (1975) model of conversational inference is that utterances are co-operatively produced. The attribution of co-operativeness to the speaker is, of course, a special case of the attribution of intention. Other intentions, including adversative ones, may also be attributed to the speaker. As will be suggested below, many "cognitive" explanations of biases may have to be supplanted or supplemented with "conversational" explanations.

Children, of course, are often subjected to "trick

questions" in testing situations by adults. Winer, Hemphill and Craig (1988) showed that both children and adults give more non-conserving responses when the question seems to imply that conservation is not possible. Thus the question "When do you weigh the most, when you are standing or crouching?" seems to imply that body weight changes from one state to another, and leads to more responses which indicate that the weight changes from one state to another than when the question is asked with the tag "or do you weigh the same?".

Kwock and Weiner (1987) explored social context variables which would lead children to reject misleading questions. Children were given classifications tasks, where they were shown a picture and asked whether it was X or Y when in fact was both. thus, when shown a picture of a dog, children were asked "Is this a dog or an animal?" or when shown a picture of a black square they were asked "Is this black or a square?". Some children had previously been exposed to a training set in which they were questions which flagrantly violated conversational norms, e.g. they were shown a picture of a couch and asked "Why is this a car?". These children were more likely to reject the misleading implication of the classification question that the object could not be both than children who had not been exposed to the questions which violated the rules of conversation. In a second experiment, Kwock and Winer (1987) found that third-graders were more likely to reject the misleading implication of the question when they were asked by another third grader rather than by an adult.

Both children and adults are vulnerable to misleading questions. Children are less so when the questions are asked by low credibility sources, such as other children. In addition, children's susceptibility to misleading questions decreases when

children's susceptibility to misleading questions decreases when they have had experience of flagrantly bizarre questions asked by the adult, presumably because the credibility of the adult experimenter is then undermined (see Siegal, in press, for an extensive review).

Conversational inference and the effect of leading questions on memory

One of the best-known "framing" effects concerns the effect of leading questions on memory. In a classic experiment, Loftus and Palmer (1974) showed that the presuppositions loaded into questions about an automobile accident affected subjects' memory about that accident. Thus, if subjects were asked how fast a car was going when it smashed into a truck, they were more likely to give a higher estimate of the speed of the car in a subsequent memory test than if they had been asked how fast the car had been going when it hit the truck. These findings were consistent with other results which showed that subjects were inclined to falsely accept presuppositions associated with descriptions of scenes, even when those presuppositions were not actually true of the scenes described (Hornby, 1972; 1974).

However, the effect of leading questions on memory may only occur in social settings where the co-operativeness principle is assumed to hold valid, such as psychology experiments. Subjects may have assumed that the experimenter in Loftus and Palmer's (1974) study was co-operative, and have thus uncritically accepted the presuppositions loaded in the question. To test this interpretation, Dodd and Bradshaw (1980) found no effect of leading questions on memory as compared to a control condition when the source was specified as "a lawyer representing the defendant", although they were able to replicate the original

as in Loftus and Palmer's original procedure.

Dodd and Bradshaw's (1980) results are thus consistent with the suggestion that when the leading question was attributed to an adversative source, such as a defending lawyer in an American court, subjects suspended the assumption of co-operativeness and were thus not vulnerable to the biasing effects of leading questions. Interestingly, subjects were still vulnerable to biasing effects from the recall probes. However, the recall probes all emanated from the same source (the experimenter) regardless of experimental condition, and thus may still have been treated as being guaranteed by the assumption of co-operativeness, and used to infer the speed of the vehicle. Consequently, although the Loftus and Palmer (1974) results are typically discussed as demonstrating the effect of cognitive biases on memory, they may plausibly be attributed to the operation of conversational assumptions, which guide reconstructive inferences about the speed of the car.

THE GIVEN-NEW CONTRACT AND THE DETERMINATION OF SPEAKER FOCUS

Grice's (1975) logic of conversation requires that speakers should be brief (satisfying the maxim of manner) and informative (satisfying the maxim of quantity). For this reason, speakers often do not explicitly refer to old information and treat it as given. Correspondingly, hearers are expected to focus on the new information contained in an utterance. This expectation is sometimes referred to as the "given-new" contract (Clark, 1985).

Part-whole contrasts and children's learning of names

The given-new contract, and the assumptions behind it, often forces contextually based interpretations of what is said. For example, Markman and Wachtel (1988) showed 3- and 4-year old

children a familiar object such as a banana and an unfamiliar one such as a lemon wedgepress. Children were then asked "Show me the x" where x was a nonsense syllable. Children almost invariably selected the unfamiliar object. Clearly, children's reasoning may be based on conversational assumptions that a co-operative experimenter would have said "Show me the banana" if they had wanted the banana, and so the unfamiliar word must refer to the unfamiliar object. Only if the adult were violating Grice's maxim of manner, and using an obscure, unknown word to refer to the banana when a well-known one ("banana") exists, could the adult have reasonably intended the nonsense syllable to refer to the familiar object.

Markman and Wachtel (1988) extended this procedure to the study of part-whole relations. They showed children pictures of an object with a salient part. The object (e.g. a lung) was either familiar or unfamiliar to the children, whereas the part (e.g. trachea) was always unfamiliar. When the object was unfamiliar, children tended to treat the new word (i.e. "trachea") as referring to the whole object (i.e. lung). However, when children already knew the word "lung", they were more likely to interpret the unfamiliar word "trachea" as referring to the specific part of the lung, i.e. the trachea. Clearly, the children may have been reasoning that the adults wished to be informative by Grice's maxim of quantity, and name the object that they did not know. Otherwise, this particular "conversation" would seem to have no point.

Although Markman and Wachtel's (1988) results seem very consistent with the application of Gricean rules of inference, they do not discuss their studies in these terms. Rather, they suggest that children assume that words are mutually exclusive,

and cannot refer to the same object. Consequently, the unknown word must be interpreted as referring to the same object. However, because children's interpretation of the referents of names can be explained in Gricean terms (cf. the "given-new" contract of Clark and Haviland, 1974), there seems to be no need to posit a special assumption of "mutual exclusivity" to explain children's successful performance on this naming task.

Part-whole contrasts and the interpretation of survey questions

Strack, Martin and Schwarz (1988) reasoned that if a specific question precedes a general one that logically includes it, hearers will interpret the general question to exclude the information already mentioned in the first question. Suppose a man is asked:

"How is your family?"

He will probably reply on the basis of how his wife and children are. If his wife is very well but one of the children is sick, he might reply "Quite well on the whole, thank you." If, on the other hand, he is asked first:

"How is your wife?"

and then,

"How is your family?"

he might interpret the question as referring to that part of his family other than his wife. If one of the children is unwell, he might now reply "Not too good, I'm afraid".

Strack et al. (1988) applied this reasoning to the analysis of seemingly inconsistent responses to survey questions. In one condition, which they termed the "conversational context", they introduced the two questions by saying "Now, we would like to learn about two areas of life that may be important for people's

overall well-being: (a) happiness with dating, (b) happiness with life in general". In this condition, they hypothesised that the focus of the general question will be interpreted as excluding the focus of the specific question which has been asked first. Since answers to the two questions will be based on different information there should not be much correlation. When students were asked to rate their satisfaction with life in general after rating their satisfaction with their dating life, the correlation was very low (0.26).

However, when the specific question was asked at the end of one page and the general question was asked at the beginning of the next page, Strack et al. (1988) reasoned that the two questions would not be perceived as being related, and that there should be no such "subtraction" effect. Consistent with this reasoning, a much higher correlation (.55) was obtained for subjects' ratings of their responses to these two questions in this condition. Similar results were obtained by Strack, Schwarz and Waenke (in press).

Consequently, seemingly inconsistent responses can be explained in terms of conversational pragmatics. Also important to note is that the exclusion of the information from the preceding question (e.g. about the respondent's satisfaction with his or her marriage) from the response to the subsequent question (e.g. about satisfaction with life in general) cannot be explained in terms of priming theories. Because the information about marriage has been so recently mentioned, it should be highly available in memory and thus, according to a straightforward priming theory, have more impact on the subsequent judgment. Although cognitive accessibility may often affect salience, principles of conversational inference can override the the application of the availability heuristic (cf.

override the the application of the availability heuristic (cf Strack, in press).

Part-whole contrasts and the conjunction fallacy

Dulany and Hilton (1990) applied this logic to the analysis of Tversky and Kahneman's (1983) conjunction fallacy task. In the "model" condition of the best known task, subjects read a detailed description of a target woman, Linda, who is attributed many characteristics associated with being a feminist (single, bright, politically radical, etc.) but not a bank teller. In the "no model" condition, subjects received only the minimal information that Linda is 31 years old. The rich information given to the subject in the "model" condition may justify the inference that the experimenter knows a lot about the target. The subject may reason that if the experimenter knows a lot about the target, Linda, then the reason he omitted to say that Linda is not active in the feminist movement is because he knows this not to be the case, i.e. implying that Linda is not active in the feminist movement. By contrast, in the "no-model" condition, the subject may reason that the experimenter omitted to say that Linda is a bank teller because he does not know whether this is the case or not, i.e. implying the logical possibility that Linda is or is not a bank teller. Consequently, when the subject is asked to judge whether it is more probable that "Linda is a bank teller and is active in the feminist movement" and "Linda is a bank teller", subjects may be more likely to draw the K-implicature that "Linda is a bank teller" implicates "Linda is a bank teller who is not active in the feminist movement" in the model condition than the no-model condition. In a study that elaborates on the above analysis, Dulany and Hilton (1990) found that this was indeed so.

This result has important consequences for Tversky and Kahneman's claim that subjects commit the conjunction fallacy in this experiment. Subjects in these experiments reliably judge the subset ("Linda is a bank teller and a feminist") to be more probable than the whole ("Linda is a bank teller"). Tversky and Kahneman argue that this judgment violates a basic rule of probability, that an item cannot be more likely to be a member of a subset than of the superset which includes the subset. They suggest that subjects are misled by the representativeness heuristic, whereby the probability of the target person being the member of a set is assessed by the semantic similarity of the target and the set. Because the target description of Linda has more features in common with "bank teller and feminist" than "bank teller", she is judged to be more probably a member of the subset than the inclusive superset. However, many subjects in the model condition interpret the statement "Linda is a bank teller" to the the implicated conjunct "Linda is a bank teller and is not active in the feminist movement", and therefore do not commit the conjunction fallacy.

Tversky and Kahneman (1983) acknowledge the above possibility, but do not test it directly. Instead, they developed a "direct" version of the task in which the extensional nature of the conjunct was explicitly stated. Thus subjects were asked to judge the probability of "Linda is a bank teller whether or not she is active in the feminist movement". However, this solution is also unsatisfactory as it could be re-interpreted as "Linda is a bank teller even if she is active in the feminist movement", in much the same way as "We will go to the zoo tomorrow whether or not it rains" can be interpreted as "We will go to the zoo tomorrow even if it rains". Dulany and Hilton (1990) developed an unambiguous version of the direct test and found less than half

the conjunction fallacies obtained by Tversky and Kahneman (1983). Thus it seems that ambiguities in the wording used may have led Tversky and Kahneman to overestimate the number of conjunction fallacies committed.

Implicit focus and biases in causal explanation

Attribution theorists have long pointed to the existence of biases in the explanation process. Two biases in particular are the tendencies to attribute others' behavior to characteristics of the actor but one's own behavior to the situation (Jones and Davis, 1972) and one's own success to oneself but failure to external factors (Weiner et al., 1972).

In an intriguing series of studies, McGill (1989) has suggested that these biases may be attributable to implicit focus. For example, when asked a question about why someone else did something, the hearer may assume that the implicit question is of the form "Why did x (rather than y) do z?" , whereas when asked why they themselves did something, the hearer may assume that the implicit question is of the form "Why did I do z (rather than y)?" . When the implicit focus is overridden by the use of explicit focus adjuncts such as "in particular" (Quirk, Greenbaum, Svartvik and Leech, 1972), actor-observer differences are greatly reduced. Likewise, using a similar procedure success/failure asymmetries in explanation can be attenuated (McGill, 1989). Consequently, the presence of these biases seems to be largely attributable to pragmatic factors shaping the interpretation of the causal question.

Use of base-rate information in causal inference tasks

Much attention has been paid to the apparent underuse of baserate information, particularly consensus information, in

causal attribution tasks (Alloy and Tabachnik, 1984; Higgins and Bargh, 1987; Kassin, 1979; McArthur, 1972; 1976; Nisbett and Borgida, 1975; Nisbett, Borgida, Crandall and Reed, 1976; Nisbett and Ross, 1980). However, recent research has suggested that these findings may be more the product of experimental artefacts than of deficient judgment strategies. In properly designed experiments, subjects quite clearly use consensus information in the manner predicted by a strict interpretation of Kelley's (1967) ANOVA model (Cheng and Novick, 1990; Försterling, 1989; 1990; Iacobucci and McGill, in press).

Here I briefly illustrate how taking a "conversational" perspective enables understanding of how base-rate information is used in attributional inference (see Hilton, 1990, for elaboration). Subjects seem to employ knowledge of base-rate information in the form of knowledge of whether an event normally happens or not. For example, when given the following target event together with high consensus, low distinctiveness, high consistency (HLH) information configuration:

Sally buys something on her visit to the supermarket

Almost everyone else buys something on their visit to the supermarket

Sally buys something on her visit to almost every other supermarket

In the past, Sally has almost always bought something on her visit to this supermarket

subjects appear to assume that Most people buy something on most visits to most supermarkets. This information can be used to fill the "cells" necessary to perform an analysis of variance on the effect of the person (Sally) and the stimulus (the supermarket) on the behaviour (shopping). In order to perform an analysis of variance to test for the causal effect of the person and the stimulus in a 2x2 design, four cells of information are needed

(see Table 3). In this example the consistency dimension has been

INSERT FIGURE 1 ABOUT HERE

omitted to simplify exposition. Subjects only receive information in three of the four necessary cells in experiments such as those of McArthur (1972). Thus, using "1" to indicate that the effect normally occurs in a given cell and "0" to indicate that it does not, we can see that all the cells in this case are filled with a "1". According to a normative analysis of variance there is no effect of either the person or the stimulus in this case. And this indeed corresponds to what subjects say; they attribute the event to "Nothing special about Sally, the supermarket, the present occasion (or any combination of the three)" in this condition.

When a target event with a different "norm" or presupposed base-rate is used, a different picture emerges. consider the high consensus, low distinctiveness, high consistency (HLH) configuration below:

Ralph trips up over Linda dancing

Almost everyone else trips up over Linda dancing

Ralph trips up over almost everyone else dancing

In the past, Ralph has almost always tripped up over Linda dancing

Here the norm cell may be filled with a "1/2" to signify that "People sometimes trip up over other people dancing". The other cells are filled as in the above supermarket example. Here, a normative analysis of variance would indicate two main effects attributable to the person (Ralph) and the stimulus (Linda). And indeed, this is subjects' preferred response in this category: they attribute the behaviour to "Something about Ralph and something about Linda (even when they are not together)".

In sum, subjects have assumed that their own world knowledge is relevant and have used it to fill out "missing cells" of

information that have not been explicitly supplied by the experimenter. Paradoxically, it is the experimenter who has omitted base-rate information in these experiments and the subjects who have both supplied it and used it in line with the normative predictions of the analysis of variance. When the experimenter explicitly mentions information in the "missing cells", subjects use the explicitly mentioned information in the manner specified by an analysis of variance (Cheng and Novick, 1990; Forsterling, 1989; 1990; Pruitt and Insko, 1980). Failure to find the results predicted by a normative analysis of variance in previous experiments (McArthur, 1972; 1976; Orvis, Cunningham and Kelley, 1975) seems in part to have been due to a failure to appreciate the role of subjects' presuppositions in "completing the design" of information given to subjects in these experiments (cf. Hilton, 1988; 1990).

More generally, these results are consistent with findings which suggest that people adjust their estimations of the probabilities indicated by probability words such as "likely" and "possible" to reflect the a priori probability of that event occurring (Wallsten, Fillenbaum and Cox, 1986; Weber and Hilton, in press).

THE RELEVANCE OF "INCIDENTAL" INFORMATION

Grice's (1975) maxim of relevance enjoins speakers to be relevant. Speakers should not mention irrelevant information. Thus, hearers are entitled to assume that all the information given to them is relevant to the task in hand, and, according to the maxim of quality, not misleading in any way. However, experimenters often include "irrelevant" information which may in fact be used by subjects to interpret their experimental task. As will be shown below, such "irrelevant" information may be

conveyed through the kinds of dependent measures used, or through interpretations of the independent variables that were not intended by the experimenter.

The relevance of the range and phrasing of response sets: A re-examination of attribution experiments

As noted above, it is often claimed that subjects "underuse" consensus information (Higgins and Bargh, 1987; Kassin, 1979; McArthur, 1972; 1976; Nisbett and Borgida, 1975; Nisbett and Ross, 1980). One reason for this claim is that in an influential study, McArthur (1972; 1976) found little influence of consensus information on attributions. However, Hilton (1990b) has suggested that this pattern may be the result of methodological artefacts. One factor of key importance is McArthur's (1972; 1976) failure to specify interactional attributions in her response format. Subjects were given "main effect" attributions to the person, stimulus or circumstances to select, or were asked to write any interactional attributions in a space provided. This, in combination with her use of the ambiguous term "the circumstances" may have caused subjects not to make predicted interactional attributions to combinations of factors (e.g. the person and the occasion). Subjects may have taken the lack of interactional attributions explicitly specified in the response format as a cue not to produce them, and may have also used "the circumstances" to indicate interactional attributions. Studies which did give a full range of interactional attributions in the response format found 61% (Jaspars, 1983) and 47% (Hilton and Jaspars, 1987) interactional attributions, whereas studies which did not use such response formats found only 37% (McArthur, 1972) and 35% (Hewstone and Jaspars, 1983) interactional attributions. Together with other problems, the data collected by McArthur (1972) may have been systematically biased (Hilton, 1990b).

Studies which used full response formats show the predicted effect of consensus information on person attribution (Cheng and Novick, 1990; Försterling, 1989; 1990; Hilton and Jaspars, 1987; Jaspars, 1983). Consequently the original finding that consensus information is underused may be attributable to methodological problems, in part caused by how subjects interpreted the response sets that they were given (Hilton, 1990b).

The relevance of information contained in response scales

Although experimenters generally use response scales in order to assess subjects' judgments and not to influence them, there is considerable evidence that subjects often use response scales as cues about the character and extent of the behaviour probed (Schwarz, in press).

For example, the range indicated by the response scale may cue subjects' interpretation of the behaviour. Schwarz et al. (1988) asked subjects how often they had felt "really irritated" recently. One group of subjects was given a scale ranging from "several times daily" to "less than once a week" whereas other subjects were given a scale ranging from "several times a year to less than once every three months". Schwarz et al. argued that subjects would use their world knowledge to decide what kind of irritations were implied by the experimenter's question. Consistent with their reasoning, subjects given the former scale reported less extreme examples of irritation (e.g. having to wait for service in a restaurant). Subjects given the latter scale reported more extreme examples of irritation (e.g. having a fight with one's spouse).

Subjects may also use response scales to decide the likely frequency of a target behaviour. For example, Schwarz et al. (1985) asked German adults to rate how frequently they watched

television. Half the subjects received a scale ranging in half-hour steps from "up to 1/2 hour" to "more than 2 1/2 hours", while the other half received a scale ranging from "up to 2 1/2 hours" to "more than 4 1/2 hours". Only 16.2 % of the subjects who were presented the low frequency scale reported watching TV for more than 2 1/2 hours whereas 37.5% of the subjects presented the high frequency scale did so. Similar effects of range of response alternatives for estimations of sexual intercourse and masturbation in dating couples (Schwarz and Scheuring, 1988).

It might be conjectured that the effect of scale ranges on frequency estimation may reflect "anchoring" effects (Tversky and Kahneman, 1974). However, subjects' susceptibility to the effect of scale ranges is mediated by their knowledgeability of the topic in question. Thus U.S. college students were least likely to be biased by scale ranges when estimating their own or a friend's frequency of watching television than when estimating the TV consumption of a "typical" undergraduate. Moreover, college students who are high on private self-consciousness (Fenigstein, Scheier and Buss, 1975) are less likely to be influenced by scale ranges than students low on private self-consciousness. This is consistent with the view that high private self-consciousness individuals are more likely to know how often they watch television.

Comparable results were obtained by Joyce and Biddle (1981). They showed that trained accountants were not subject to anchoring effects on an auditing task when they themselves provided the anchors. Self-provided anchors cannot provide information about the experimenter's estimate of the frequency of a behaviour in the target population. However, trained accountants were still susceptible to anchoring effects on tasks

where the experimenter did provide the anchors (Joyce and Biddle, 1981).

In sum, these results suggest that when subjects do not have direct access to the frequency information required they use the frequency range provided by the experimenter to estimate the likely frequency of a behaviour in the population, which they then use to calculate their response, e.g. as to their position on that scale. Subjects' responses seem to be guided by a strategy of guessing on the basis of the response scales having been provided by a co-operative experimenter who does not wish to mislead the subject about the likely range of responses in the population studied. "Cognitive" explanations based on anchoring and adjustment cannot explain why self-provided anchors are ineffective, or why experimenter-provided anchors are most effective in domains which the subject knows little about.

The relevance of nondiagnostic information

Although Grice's (1975) maxim of relation prescribes that speakers should only include relevant information, experimenters routinely violate this assumption by deliberately including information that is meant to be irrelevant to the task in hand. A clear example of this is the "dilution" effect studied by Nisbett, Zukier and Lemley (1981). Given diagnostic information relevant to some attribute (e.g. grade point average, being a child abuser), subjects rationally used that information to judge the probability of the target person possessing the target attribute. However, when the description of the target person included information that was not relevant to the judgment task in hand, subjects made less use of the diagnostic information. There is no rational reason for this, as the diagnostic information is still as predictive when presented with

nondiagnostic information as when presented alone. Nisbett et al. (1981) posit an intrapsychic explanation in terms of the representativeness heuristic (Tversky and Kahneman, 1974), attributing this effect to the dilution of the "representativeness" of the description of the target person of the target category (cf. Tversky and Kahneman, 1974).

However as Tetlock and Boettger (1989) point out, the effect is also consistent with an explanation in terms of conversational inference. Subjects may assume that all the information that they are given, whether diagnostic or nondiagnostic, is relevant. They may therefore weight all the information as "diagnostic". On the assumption that nondiagnostic information is weighted negatively, the "dilution" effect would be observed. Although still an "error", this effect would not be attributed to faulty reasoning due to the application of the representativeness heuristic, but due to faulty assumptions about the diagnosticity of the information presented by the experimenter. As Tetlock and Boettger (1989) suggest, these explanations need to be disentangled by experiments which dissuade subjects from using a "conversational" mental set in such experiments.

Pragmatic inferences and stimulus vocabulary choice

Some pragmatic phenomena are not determined by inferences about the speaker's intended meaning derived through application of Grice's principles (Levinson, 1983). These include inferences about focus determined through "pragmatic particles". Pragmatic particles such as "and", "but", "few", "a few", "occasionally" and "seldom" conventionally determine the interpretation of words they are conjoined with as well as having truth values which determine their own range of applicability. For example, although "seldom" and "occasionally" indicate approximately the

same frequency of occurrence of a behaviour, and thus have the same truth values. However, although similar in semantic terms, they have different pragmatic properties. Thus they focus attention on different aspects of the behaviour (Moxey and Sanford, 1987). Thus if we are asked to explain why John seldom walks the dog we are apt to come up with reasons for the non-occurrence of the behaviour (e.g. "Because he is always busy"), whereas if asked to explain why he occasionally walks the dog we tend to give reasons which account for the occurrence of the behaviour (e.g. "Because he likes the exercise").

Experimental psychologists and survey researchers who are not aware of the functions of pragmatic particles are liable to produce unintended effects or to misattribute effects that they obtain. An example can be seen to be in the stimulus material used by Kahneman and Miller (1986) to test norm theory. Kahneman and Miller (1986) argue that unusual events are more likely to activate counterfactual alternatives in which the non-occurrence of the target event is brought to mind. However, if an experimenter describes an event as "seldom" rather than "occasionally" happening, then this would serve as a cue to the subject to focus on why the event did not happen rather than did happen, regardless of the actual normality of the event. Such is the case in one of the stimulus passages used by Kahneman and Miller (1986). Hence one cannot be sure whether the effects obtained are attributable to the normality of the events described or to the focus indicated by the speaker's choice of temporal quantifier.

A related effect may be the "forbid/allow" asymmetry studied by Hippler and Schwarz (1987). Forbidding something and not allowing something appear to be semantically similar; they would seem to be true of the same kind of event. However, survey

respondents are much more likely to agree, for example, that peepshows should not be allowed than that they should be forbidden (Hippler and Schwarz, 1987). Although it is not altogether clear why the forbid/allow asymmetry should exist, it is clear that seemingly irrelevant changes in phrasing which appear to preserve the literal meaning of the target stimulus nevertheless change the meaning conveyed to the subject.

Speaker goals and judgment

The research reviewed so far has mainly focused on how the hearer's perceptions of the speaker's goals, as mediated by attributions, affects the speaker's interpretation of the information given and judgment. However, a further direction for research is to investigate how the speaker's own goals affect inference and judgment. Thus Sedikides (1990) has shown that the effect of primes on impression formation obtained by Higgins and King (1977) and many others (for reviews see Bargh, 1984; Higgins and Bargh, 1987) only emerges under "non-communicator" conditions. When subjects are told that they are going to be required to communicate their impression of the target person to a third party, the primed concept appears to have no influence on the impression they report of the target person. Thus the role of the subject's own communicational goals, as well as the subject's perception of the experimenter's communicational goals, should merit investigation.

CONCLUSIONS

The attributional model of conversational inference presented above underscores the role of social context in utterance comprehension. In particular it explains how hearers' assumptions about utterances, as modelled by Grice's (1975)

maxims of conversation, may be governed by attributions they make about the speaker's co-operativeness, intentionality, competence and so on. As such the attributional model goes beyond most previous work (see Clark, 1985; Kraut and Higgins, 1984; for reviews) which notes the relations between Grice's (1975) maxims of conversation and inference processes, but does not explain how deployment of these assumptions can be modified by the hearer's attributions about the speaker. As such, the attributional model of conversational inference conforms with recent work which demonstrates that utterance interpretation is affected by the hearer's beliefs about the speaker (Slugoski and Turbull, 1988).

Implications of conversational inference for the thesis of negative rationality

The attributional model of conversational inference has important implications for research on human judgment and decision-making. Experimental psychological research does not take place in a social vacuum (cf. Orne, 1962). In particular, because conversational inference is inductive in nature (Levinson, 1983; Sperber and Wilson, 1986), routinely requiring listeners to go beyond the information given, experimental psychologists need to give careful attention to this issue in evaluating the results of experiments using verbal materials. According to the logic of conversation, subjects may interpret what is said to them in particular ways and be justified in adding extra premises which seem to be relevant to what is said. Since, in normal conversation, it is usually expected that such additional assumptions should be taken into account, subjects are often warranted in transforming their judgment task into something different to that which has been explicitly given to them.

The inductive nature of conversational inference poses a general problem for the metaphysical assumptions of workers interested in assessing errors in human judgment. This is because such workers normally assume that the "correct" answer can be determined by applying a normative model to the explicitly given data set. The inference task is thus essentially deductive in nature; given the premises the "correct" answer can be deduced. However, according to conversational inference it is rational to add to or re-interpret the information given, subject to Gricean assumptions. Consequently, the overall experimental task, of forming a representation of the information given and of reasoning from that representation also becomes inductive in nature. In assessing the overall rationality of the subject's response, the experimenter has to take the rationality of his or her interpretation of the task into account, as well as the rationality of his or her reasoning processes.

It is easy to see that most researchers on rationality conceive of the experimental task in essentially "deductive" terms. Thus those researchers interested in demonstrating that human judgment may be irrational generally operate according to the canons of "negative rationality" (Rommetveit, 1978). That is, they establish a normative model of judgment for some task, usually based on an analogy with a scientific or logical model. Thus, the Bayesian inference procedure is frequently used as a normative model for belief updating, and reversible logical operations for reasoning about conservation tasks. Researchers then perform an experiment that demonstrates that people do not produce the judgment predicted by the normative model. Deviations from the normative model may then be classified as errors of judgment. These are taken to suggest that the subject is using some logically suboptimal judgment procedure such as a

"heuristic" (Tversky and Kahneman, 1974) or is overly influenced by irrelevant cues, such as the perceptual appearance of objects of judgment (e.g. Inhelder and Piaget, 1958).

The "negative rationality" perspective has been adopted in studies of many different domains of judgment. Sometimes, the comparison to a normative scientific or formal logical model is quite explicit. One example is probability judgment, where judgments are compared to Bayesian models (Tversky and Kahneman, 1974) and the conjunction rule (Tversky and Kahneman, 1983), revealing, respectively, seemingly irrational tendencies to under-use base-rate information and to judge a conjunction to be more probable than its conjunct. A second example is the "child scientist" perspective in developmental psychology, where the child's cognitive development is characterised in terms of attainment of formal logical competences, such as the use of reversible operations (Inhelder and Piaget, 1958) or the concept of mutual exclusivity (Markman and Wachtel, 1988). A third example is the "man the scientist" perspective in attribution theory (Heider, 1958; Kelley, 1967) based on an analogy of lay inference with Mill's (1872/1973) methods of induction and their derivative, the scientific analysis of variance (ANOVA). This perspective has revealed apparent deficiencies in the "lay scientist", such as the underuse of consensus information and a tendency to overattribute effects to the person (e.g. Nisbett and Ross, 1980). A final example comes in Wason and Johnson-Laird's (1972) programme of research into the psychology of reasoning, where subjects' reasoning patterns were compared unfavourably with normative models based on formal logic and Popper's (1972) philosophy of science.

In addition, the study of "framing effects" (e.g. Tversky

and Kahneman, 1981) can also be seen to take the perspective of "negative rationality". This is because the production of seemingly inconsistent responses through ostensibly irrelevant changes in the wording of a question or the context in which it is asked appeals to the implicit equation between "being consistent" and "being logical" (cf. Strawson, 1952). Consequently, studies of memory reports (Loftus and Palmer, 1974) and attitude and opinion reports (Hippler and Schwarz, 1987; Krosnick and Alwin, 1987) which suggest that the wording or context of a question may lead to inconsistent responses may also be treated as taking the "negative rationality" perspective from the present perspective.

In addition, although not usually described as errors, many judgmental effects which have traditionally attributed to cognitive biases may in fact reflect the operation of conversational assumptions. One example is Brown's (1986) insightful analysis of Asch's (1946) impression formation paradigm which suggests that both the primacy and centrality effects can be attributed to the operation of a principle of information gain consistent with that of the maxim of quantity. Thus information which is presented earlier rather than later (primacy) and information which is semantically rich but nonredundant with what has gone before (centrality) is likely to have more effect on the impression formed.

While particular attention has been paid to the re-interpretation of experimental results that have been attributed to faulty reasoning, it is not claimed that subjects never make bona fide errors of reasoning. Rather, it is argued that specification of these inference processes should enable researchers to identify cases where mistakes may be attributable to conversationally-guided interpretations of the judgment task,

as opposed to cases where mistakes are due to genuine errors of reasoning. Rather than deny the applicability of normative models to judgment tasks, the conversational inference model is intended to help provide a systematic framework in which claims about the rationality of human judgment in such tasks can be assessed.

Nor is it claimed here that the conversational inference model provides the only constraint on claims of "negative rationality". Other perspectives are possible and valid. One approach has been to accept that heuristics or logically suboptimal "rules of thumb" are employed, but that they are employed flexibly and rationally with an eye to the costs and benefits of accurate inference, and are thus normative (Payne, in press). Others have drawn attention to the question of whether the experimental tasks used are truly representative of real-life decision tasks (e.g. Funder, 1987; Hogarth, 1981; Tetlock, 1985). Sometimes it can be suggested that an alternative normative model of judgment can describe subjects' patterns of reasoning, as when Cohen (1979) suggested a Baconian model of judgment as an alternative to the Bayesian model used by Tversky and Kahneman (1974).

However, attention to the social context of experiments and surveys should lead to a better understanding of which effects are attributable to "conversational" factors and which are attributable to other factors. For example, "conversational" re-interpretations of questions may be avoided by manipulations undermining the assumption of intentionality, such as informing subjects of the randomness of the order in which information is given or questions are asked. Alternatively, the production of responses may be controlled by explicitly instructing subjects to either maximize the maxim of quality or the maxim of quantity.

Indeed, one significant advantage of the conversational perspective is that it enables one to see where a normative model of judgment proper has been incorrectly applied and inappropriately tested. Thus, sensitivity to pragmatic constraints on the interpretation of causal questions has enabled researchers to argue that subjects follow Mill's canons of induction in causal attribution much more closely than was previously thought (Cheng and Novick, 1990; Forsterling, 1989; Hilton, 1988; 1990). Examples such as these underscore the intimate relationship between logic and ordinary language, and the important insights into human thought processes to be gained through appreciation of this relationship.

Assumption /Maxim of Conversation	Message characteristics	Characteristics Attributed to Speaker
Co-operativeness	Observes 4 maxims (see below)	Intentional Helpful
Quality	Truth-value Probability	Sincerity Honesty Reliability Competence
Quantity	Informativeness	Mutual knowledge Group membership
Relation	Goal-relevance	Interactional goals
Manner	Clarity	Knowledge of language

Table 2: Assumed characteristics of message and speaker implied by Grice's logic of conversation

The Co-operative Principle

Make your contribution such as is required, at the stage at which it occurs, by the accepted purpose or direction of the talk exchange in which you are engaged.

The Maxim of Quality

Try to make your contribution one that you believe to be true, specifically:

- (1) Do not say what you believe to be false
- (2) Do not say that for which you lack adequate evidence

The Maxim of Quantity

- (1) Make your contribution as informative as is required for the current purposes of the exchange.
- (2) Do not make your contribution more informative than is required

The Maxim of Relation

Make your contributions relevant

The Maxim of Manner

- (1) Avoid obscurity
- (2) Avoid ambiguity
- (3) Be brief
- (4) Be orderly

Table 1: Grice's (1975) Co-operative Principle and the Maxims of Conversation

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Target event: 'Ralph trips up over Joan dancing'

Explanation: 'Something about Ralph' and 'Something about Joan'

	S	\bar{S}
P	Target event 1	Distinctiveness 1
\bar{P}	Consensus 1	Norm 1/2

Target event: 'Sally buys something on her visit to the supermarket'

Explanation: 'Nothing special about Sally or the supermarket'

	S	\bar{S}
P	Target event 1	Distinctiveness 1
\bar{P}	Consensus 1	Norm 1

Key : P = Target person present, \bar{P} = Other target persons present

S = Target stimulus present, \bar{S} = Other target stimuli present

Figure 1: 2 X 2 data-matrices for high consensus, low distinctiveness events as a function of presupposed norms

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