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The Social Context of Reasoning: Conversational Inference and Rational Judgment

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Social rules governing communication require the listener to go beyond the information given in a message, contrary to the assumption that rational people should operate only on the information explicitly given in judgment tasks. An attributional model of conversational inference is presented that shows how hearers' message interpretations are guided by their perceptions of the speaker. 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 model can predict how experimental manipulations of relevant source and message attributes affect respondents' judgments. Failure to recognize the role of conversational assumptions in governing inference processes can lead rational responses to be misclassified as errors and their source misattributed to cognitive shortcomings in the decision maker.

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, & Tversky, 1982; Nisbett & Ross, 1980). Although 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 the nature of social interaction and conversation (Austin, 1962; Grice, 1975; Hart & Honoré, 1959/1985; Mackie, 1974; 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.

Consider the way the word *family* can be differentially interpreted according to context and thus lead to seemingly inconsistent judgments expressed in a conversational exchange (cf. Strack, Martin, & Schwarz, 1988):

Q. How is your family?
A. Fairly well, thank you.

A married man might reply this way if he considers that his wife has recently been saddened by the loss of a close friend but that his two children are in good form. The respondent interprets *family* to mean *the wife and kids.*

Suppose, however, that a woman had asked this man about his wife and then his family. The exchange might have run as follows:

Q. How is your wife?
A. Not too good, I'm afraid.
Q. And how is your family?
A. Extremely well, thank you!

In this case, the respondent would normally feel bound to interpret *family* as *the kids* because he already gave information about his wife and did not wish to burden the questioner with redundant information that she already has. So he gives an answer about his family that is apparently inconsistent with his earlier answer to the same question, "How is your family?"

From one point of view, giving two different answers to the same question asked on different occasions may seem irrational. After all, inconsistency is usually taken as a sign of illogicality and irrationality in ordinary life (Strawson, 1952). We might therefore be tempted to conclude that our imaginary interlocutor is mentally unable to deliver a stable and consistent evaluation of his family's well-being and is therefore irrational. We might suppose, for example, that he is unable to activate the same representation of the concept *my family* on the two occasions that the question is asked because of defective or biased memory retrieval processes. This kind of argument is familiar from much research on rational judgment. Thus, irrationality is often demonstrated experimentally through producing different responses to the same question asked in different contexts, such as in the study of framing effects on risky choice (Tversky & Kahneman, 1981) and preference reversals (Payne, Bettman, & Johnson, 1992) or through question-order effects on responses in survey research (Schuman & Presser, 1981).

However, attributing irrationality to the respondent in the

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above case may be premature. Norms of rational communication (e.g., Grice, 1975) require a speaker to be cooperative with a hearer by not burdening him or her with redundant information. Specifically, in the case where the hearer has just been told about the health of the speaker's wife, one can argue that interlocutors are entitled to assume that the reference to *family* meant *just the kids,* rather than *the wife and kids.* This interpretation of the word *family* is conversationally rational in the context of the previous exchange about the health of the speaker's wife. The context-dependent interpretation of the word *family* would thus absolve the speaker of the charge of cognitive inconsistency. Rather, he has cooperatively and rationally altered his answers to the question as a function of the interactional context.

Recognition of conversational constraints on utterance interpretation and inference may thus have 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 participant, which invariably involves communication through ordinary language. Thus, survey researchers who attribute inconsistent patterns of response to questions to cognitive shortcomings, or experimental psychologists who explain patterns of judgment in terms of purely intrapersonal variables—such as memory capacity, attention factors, memory activation levels, search strategies, and judgmental heuristics—may be in danger of committing an attribution error (cf. Cheng & Novick, 1990). They may be in danger of misattributing patterns of inferential behavior to features of the person and overlooking how it is constrained by its interpersonal context.

Theories of judgment should therefore include a front-end component that determines how the incoming message is interpreted in its context. This may remove many anomalies in the interpretation of respondents' behavior. It has been a perennial problem for students of judgment and reasoning 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 that a respondent has incorporated in his or her representation of the reasoning problem (Henle, 1962; Johnson-Laird, 1983). Conversational assumptions often require one to go beyond the information explicitly given in an utterance. Thus, the final judgment may often be highly rational given the participant's use of these assumptions in forming a representation of the reasoning task.

Although many researchers have noted that widely shared assumptions about cooperative communication (Grice, 1975; Levinson, 1983) may license interpretations of the experimental task that the experimenter may not have intended, work on this topic remains fragmentary and underdeveloped in nature. On the one hand, experimental psychologists typically define a particular judgment phenomenon first and then consider how it might be analyzed from the point of view of conversational pragmatics. This practice has led to the accumulation of piecemeal knowledge about the relation between conversational pragmatics and rational inference. Thus, the conversational aspects of such diverse phenomena as the base-rate fallacy (Krosnick, Li, & Lehman, 1990; Schwarz, Strack, Hilton, & Naderer, 1991), the conjunction fallacy (Dulany & Hilton, 1991; Markus & Zajonc, 1985; Morier & Borgida, 1984; Politzer & Noveck, 1991; Tversky & Kahneman, 1983), actor–observer differences in causal explanation (Hilton, 1990a), conservation judgments (Donaldson, 1978, 1982; McGarrigle & Donaldson, 1975), and interpretation of survey questions (Schwarz & Strack, 1991; Tourangeau & Rasinski, 1988) have been for the most part considered independently of each other. In addition, articles that review several phenomena from the point of view of conversational pragmatics do not offer an integrated view of the philosophical and linguistic bases of conversational inference that would enable its relation to rational judgment to be explicated systematically (e.g., Adler, 1984; Bless, Strack, & Schwarz, 1993; Cohen, 1981; Hilton, 1990a; Macdonald, 1986; Schwarz, 1994; Shanon, 1988).

I therefore begin by reviewing some of the logical and linguistic properties of conversational inference with particular reference to the question of rationality in research on judgment and reasoning. I show how these logico–linguistic properties may be moderated by inferences about the social context of communication and particularly the hearer or respondent's attributions about the speaker or experimenter (e.g., the speaker's knowledge, intentions, and group membership). This attributional model generates predictions about the ways conversational inference may affect the representation of judgment and reasoning tasks. I 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 organizes phenomena found in these diversified literatures within a common framework and enables the reinterpretation of many judgment biases in terms of conversational inference processes. More important, the framework can help elucidate which biases are not susceptible of explanation in conversational terms. I conclude by discussing methodological implications for future research.

Properties of Conversational Inference

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 in the utterance "I went to the cinema last night" to infer that the speaker meant to convey that he or she saw a film last night. The additional information conveyed in this way by the speaker is termed a *conversational implicature* (Grice, 1975). Grice argued that to understand a speaker's full meaning, the listener must understand both the meaning of the sentence itself (what is said) and what it conveys in a given context (what is implicated).

Conversational inference shares some important properties with inductive inference (Levinson, 1983). First it is ampliative, that is, the conclusion contains more information than the premises. For example, by observing that the first 1,000 carrots that I dig up are orange, I make the stronger conclusion that "All carrots are orange." The inference that the speaker went to the cinema and saw a film contains more information than the assertion that he or she just went to the cinema. Consequently,

the conclusions of both conversational and inductive inference are defeasible, that is, they can be canceled by the addition of new information. Thus, just as the conclusion that "All carrots are orange" may be canceled by digging up a 1,001st carrot that is brown, so the speaker may cancel the implicature that he or she 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 unlike deductive inference, where conclusions contain no new information but simply demonstrate what can be inferred from the premises, and cannot be canceled 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. Nothing can be done to change this conclusion except to change the original premises.[1]

Consequently, in conversational inference—as in inductive inference—one encounters Hume's problem, namely that one 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 that are consistent with the data given and thus have the chance of being true. How does one decide which theory or hypothesis is best?

There are some criteria for determining the rational choice of a hypothesis 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) injunction that scientific hypotheses be "powerful and improbable," in Wilson and Sperber'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.

Grice's (1975) statement of the cooperative principle underlying conversation and the conversational maxims that derive from it are detailed in the Appendix. Grice's logic of conversation describes a form of rational communication in which the maximum amount of valuable information is transmitted with the least amount of encoding and decoding effort. Although some theorists have sought to revise this approach, for example, by reducing all the maxims to a superordinate one of relevance (Sperber & 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 (for more detailed discussion, see P. Brown & Levinson, 1987; Grice, 1989; Levinson, 1983, 1987; Neale, 1992). As is shown below, the cooperative principle and the subordinate maxims seem to correspond to important psychological dimensions and the tensions between them to produce important logical and linguistic consequences.

Attributional Bases of Conversational Inference

Grice's (1975) assumption of cooperativeness and the corresponding maxims of conversation depend on the hearer making certain default attributions about the speaker. In particular, the assumption of cooperativeness presupposes that utterances are produced by an intentional agent who wishes to cooperate with us and has the ability to realize this intention. I argue that each set of conversational maxims implies certain kinds of attributions about the speaker (see Table 1).

The maxims of *quality* concern the likely truth value of an utterance. Thus, 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 maxims of *quantity* concern 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 depend in part on perceptions of class membership. Competent members of western society do not need to be told why a customer who ate a good meal in a restaurant with good service left a big tip. From their own world knowledge, they are able to make the necessary bridging inferences (Clark & Haviland, 1977; Schank & Abelson, 1977). Thus, hearers often go beyond the information given in making inferences because they assume that the relevant information they are likely to know has already been omitted.

The maxim of *relation* enjoins speakers to mention information that is relevant to the goals of the interaction. Hearers are entitled to assume that any relevant information they are not likely to know has been included. They are also entitled to assume that information that 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 (e.g., Nisbett, Zukier, & Lemley, 1981). If hearers (participants) continue to attribute essentially cooperative intentions to speakers (experimenters), then they are liable to be misled by the information given.

The maxims of *manner* enjoin speakers to be brief, orderly, clear, and unambiguous. The extent to which speakers can adhere to these prescriptions often depends on their command of the language. Hearers may take this into account when interpreting utterances. For example, a German tourist in England might conceivably ask a native for directions to "the Townhouse" when he or she meant "the Town Hall." Rather than direct the tourist to the nearest renovated Georgian residence in the center of town, a cooperative hearer might attribute the speaker's unclarity to inexperience with British English and direct her or him 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 that are systematically reinterpreted by participants, thus leading to systematic biases in the results obtained. This seems to have been the case in much basic attribution research (Hilton, 1990b).

Although Grice (1975) formulated his maxims as injunctions to the speaker ("Be brief," "Be clear," etc.), they can also

[1] Sperber and Wilson (1986), while acknowledging the importance of inductive inference in comprehension, also considered that deductive inference plays an important role.

Table 1
Assumed Characteristics of Message and Speaker Implied by Grice's Logic of Conversation

Assumption/maxim of conversation	Message characteristics	Characteristics attributed to speaker
Cooperativeness	Observes four 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

be understood as general expectations about discourse built into the comprehension processes of hearers (cf. Dulany & Hilton, 1991). I assume that these assumptions are used flexibly in utterance interpretation. For example, as Grice (1975) intended, I assume that the maxims of conversation guide utterance interpretation both when they are respected and when they are flouted. There is considerable evidence that such assumptions are used in language understanding (see Clark, 1985, 1992; Clark & Schober, 1992; Kraut & Higgins, 1984, for reviews). I do not, however, commit myself to a psycholinguistic process model that specifies how these constraints are used in comprehension (cf. Dascal, 1989; Gibbs, 1984, 1989). I simply assume that these higher order assumptions are guided by attributions about the speaker and that they are used to choose interpretations of utterances that are rational in the conversational context.

Attribution Processes in the Interpretation of Utterances

Grice's (1975) maxims of conversation are often considered as descriptive of the rules of idealized conversations between cooperative rational hearers. However, Grice clearly considered that speakers are flexible with the maxims of conversation and indeed often flout them deliberately to create special effects such as metaphor and irony. However, when speakers flout the maxims of conversation, hearers have to *calculate* the intended implicatures by working out the speaker's intentions. This is clear from Grice's example of an unusually short letter of recommendation that violates the maxims of quantity by not giving enough information to evaluate a job candidate properly:

> *A* is writing a testimonial about a pupil who is a candidate for a philosophy job, and his letter reads as follows: "Dear Sir, Mr. X's command of English is excellent, and his attendance at tutorials has been regular. Yours, etc." (Gloss [explanation]: *A* cannot be opting out since if he wished to be uncooperative, why write at all? He cannot be unable, through ignorance, since the man is his pupil. He must, therefore, be wishing to impart information that he is reluctant to write down. This supposition is tenable only if he thinks Mr. X is no good at philosophy. This, then, is what he is implicating.) Grice, 1975, p. 52

The calculation of implicatures clearly involves inferences about the speaker's knowledge of the topic under discussion (the pupil) and his intentions (not to be openly critical). In this example, Grice (1975) appealed to a higher order assumption about the writer that he or she is cooperative. However, it is easy to imagine how other beliefs about the speaker would incline one to either accept or reject the proposed interpretation of the letter. For example, if one knew that the writer is normally very knowledgeable about and supportive of his pupils about whom he writes at great and glowing length, then one would certainly be inclined to accept Grice's proposed interpretation. On the other hand, if one knew that the pupil was a blunt-speaking person with ideas of his or her own and that the teacher was a rather dogmatic type, one might be inclined to consider the hypothesis that the writer has been offended by this pupil and wishes to stop him or her embarking on an academic career precisely to prevent the development of a brilliant philosophical opponent.

Such beliefs about the stable personality characteristics of actors are termed by social psychologists *dispositional attributions*. An important statement of the process of dispositional attribution by Jones and Davis (1965) bears some important resemblances to the process of utterance interpretation proposed here. Both processes begin with an action (behavioral act or utterance) that is to be explained in terms of intentions (e.g., to help or to harm) in both models. In both cases, dispositional attributions may be particularly likely to be triggered by unusual actions (e.g., socially undesirable behaviors or flouting the maxims of conversation) that may lead to inferences about the nature of the person or speaker (that they are a kind or unkind person in general). Thus, it should be of little surprise that Grice's (1975) model of utterance comprehension should be compatible with models of action attribution (Jones, 1979; Jones & Davis, 1965; Jones & McGillis, 1976), given his insistence that communication should be viewed as a form of action governed by the same general concerns of rationality as action in general.

The attributional model of utterance comprehension assumes that, all things being equal, the average hearer will assume that the average speaker is cooperative. However, if relevant evidence or beliefs are at hand, then the hearer may revise this assumption in a process of dispositional attribution. Attributional processes are particularly likely to be triggered by unexpected or undesirable events (Bohner, Bless, Schwarz, & Strack, 1988; Brown & van Kleeck, 1989; Hastie, 1984; Hilton

& Slugoski, 1986; Weiner, 1985). Consequently, one may expect more attributions to be made about a speaker when he or she flouts the maxims of conversation by being untruthful, uninformative, irrelevant, and unclear than if he or she respects them by being truthful, informative, relevant, and clear. Consistent with this position, Turnbull and Smith (1985) found that neutral observers perceived a person who conveyed a defective answer as being inconsiderate and hostile and as having a negative and distant relationship with the questioner.[2]

The emphasis in classic models of dispositional attribution is a bottom-up one: The direction of inference most studied is from acts (utterances) through intentions to dispositions (Jones, 1979; Jones & Davis, 1965). In this view, information in the form of acts or utterances may lead to revision of prior beliefs about the actor or speaker. However, a reverse top-down direction of inference is also quite possible, where the observer holds strong prior beliefs about the actor, such as knowledge of his or her social category membership (Jones & McGillis, 1976). In the realm of utterance comprehension, Slugoski and Turnbull (1988) produced evidence for such top-down inference processes by showing that neutral observers revised their interpretation of literal insults and compliments in line with their knowledge of the interactants' relationship. Thus, if the interactants in question were known to hate each other, observers would reinterpret a literal compliment ("Wow, that's a great hairstyle you just got!") as a sarcastic insult ("What an awful hairstyle!"). Conversely, literal insults from friends were reinterpreted as playful banter.

The relationship among a speaker, a hearer, and an utterance can be represented as a cognitive triad (see Figure 1). According to Heider (1958), perceivers will try to ensure cognitive balance by ensuring that the signs connecting the elements of the triad multiply out positively. In Slugoski and Turnbull's (1988) experiment, the speaker or subject (S) always has a positive relationship of possession to the utterance he or she makes because he or she "owns" it. If the hearer or observer (H) believes that the speaker or subject (S) likes him or her (H), then S and H have a positive affective relationship. A compliment to the hearer or observer (H) indicates a positive relationship between H and U, resulting in three positive signs and a balanced relationship. However, if an imbalanced triad is produced when the speaker makes a literal insult to a hearer who believes the speaker likes him or her, cognitive imbalance is created due to the negative relationship between H and U. This can be reduced by changing the signs of one of the relationships. This can be achieved by (a) reinterpreting the insult as a compliment; (b) reinterpreting the speaker's attitude to the hearer as negative rather than positive; or (c) disowning the speaker's possession of the remark ("Something got into him," "He was in a bad mood," "He didn't really mean it").

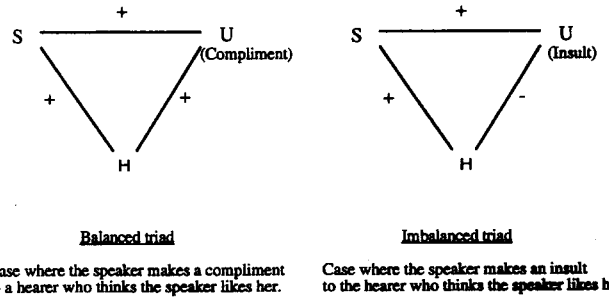

Figure 1. Examples of balanced and imbalanced speaker-hearer-utterance relationships. S = speaker; H = hearer; U = utterance; + = positive relationship between elements; − = negative relationship between elements.

Interpreting an utterance thus requires a kind of cognitive balancing act (cf. Brown & van Kleeck, 1989). Although the previous example and Figure 1 are only schematic, they do illustrate how the hearer's perceptions of the speaker and the utterance can be reconciled according to the principles of cognitive consistency. Both top-down (revision of utterance interpretation) and bottom-up (revision of beliefs about the speaker) processes of inconsistency resolution can occur. Following research on inconsistency resolution, I speculate that weakly held beliefs will be modified more than strongly held ones (Tannenbaum, 1968). Thus, if a hearer is confident that the speaker likes the hearer, the hearer will probably change the interpretation of a literal insult to a conveyed compliment. However, if the hearer has no prior preconceptions about the speaker's attitude to the hearer, then the hearer may infer that the speaker is hostile to the hearer. This process of reinterpretation to preserve cognitive balance is consistent with Asch's (1940) demonstration of "change of meaning" effects,

The attributional model of conversational inference claims that the application of higher order assumptions about conversation is relativized to particular characteristics known or assumed about the speaker, such as the degree of cooperativeness, friendliness, group membership, knowledge about the topic, beliefs about the hearer, and skill in the language. Consistency and coherence criteria are used to choose the speaker's most likely intended meaning and thus the most rational interpretation of an utterance.

Although the attributional model of conversational inference has been developed from Grice's (1975) characterization of the logic of conversation, its main assumptions are quite consistent with other approaches to conversational pragmatics (e.g., Allwood, 1987; Recanati, 1993; Sperber & Wilson, 1986). All share the view that conversational utterances are interpreted in the light of higher order assumptions about the speaker's intentionality. They could therefore allow that the most rational interpretation of an utterance is the one most consistent with relevant beliefs held about the speaker. Below, I consider how beliefs about the speaker may determine the interpretation of an utterance in a routine way.

Attributions About the Speaker and the Choice of Rational Interpretations

As noted above, a major criterion for attributing rationality is consistency (Strawson, 1952). Below, I show how rational in-

[2] Grice (1989) himself was quite categorical about the centrality of attribution in the calculation of implicatures and indeed in his last writings defined implicatures in terms of attributed mental states: "Implicatures are thought of as arising in the following way; an implicatum (factual or imperatival) is the content of that psychological state or attitude which needs to be attributed to a speaker to secure one or another of the following results: (a) that a violation on his part of a conversational maxim is in the circumstances justifiable, at least in his eyes, or (b) that what appears to be a violation by him of a conversational

terpretations of utterances are selected because they are consistent with the conversational context and specifically with beliefs about the speaker. I begin with an example of how attributions about the speaker might guide interpretations of the quantifier *some*.

The trade-off between the maxims of quality and quantity implies that speakers should try to be as informative as possible without running the (undue) risk of being false. Consequently, the interpretations hearers choose may in large part depend on attributions they have made about the speaker's knowledge of and interests in the topic under discussion. Here's an example:

1. Some of the police officers beat up the protester.

This statement could convey one of two different implicatures. It could mean one of the following:

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

Levinson (1983) characterized the first implicature as a *K*-implicature (because the speaker knows that the stronger assertion is not the case) and the second as a *P*-implicature (because the stronger assertion is possible, because of the speaker's lack of relevant 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 eyewitness who was there) than not knowledgeable (e.g., a person reporting the incident second-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 spokesperson at a press conference who wished to limit perceptions of police brutality in a critical public. The spokesperson may not want to tell lies, thus observing the maxim of quality, but may only commit to the weakest possible statement about police aggression that is consistent with evidence known to the public. If the hearer attributes noncooperativeness of this kind to the speaker, then the hearer may assume that the spokesperson may be seeking to avoid commitment 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 command of English and does not know such words as *a few* or *many* which the speaker might have used to specify the proportion of police involved, then the hearer might treat *some* as being vague and consistent with either a low or high proportion of police (for a further discussion of pragmatic interpretation of quantifiers, see Politzer, 1993).

maxim is only a seeming, not a real violation; the spirit, though perhaps not the letter, of the maxim is respected" (p. 370).

Consistency in Interpretation and Reasoning

In experimental tasks, there are two major stages for arriving at a judgment from the information given, both of which require the participant to make rational choices. The first comprises the interpretation of the task by the participant. Here the participant chooses the most rational interpretation using the criterion of consistency with higher order assumptions about conversation and knowledge about the discourse context, specifically, attributions about the speaker. The second stage involves applying a normative model of reasoning to the representation formed, for example, by applying Bayes' theorem to a belief updating problem (Kahneman & Tversky, 1973), Mill's method of difference to a causal problem (Hilton & Jaspars, 1987), or laws of physics to conservation problems (Piaget & Inhelder, 1969). A schematic diagram of this two-stage process is given in Figure 2.

Most research on judgment and reasoning has focused on the second stage of rational inference. As is seen below, anomalies found in experiments on judgment and reasoning have typically been attributed to inadequate understanding of normative models of inference, such as Bayes' rule (Kahneman & Tversky, 1973), Mill's method of difference (Hilton & Jaspars, 1987), or the laws of conservation (Piaget & Inhelder, 1969). However, less attention has been paid to the first stage of rational inference. Clearly, apparently "irrational" judgments may be due to interpretations made at the conversational inference stage.

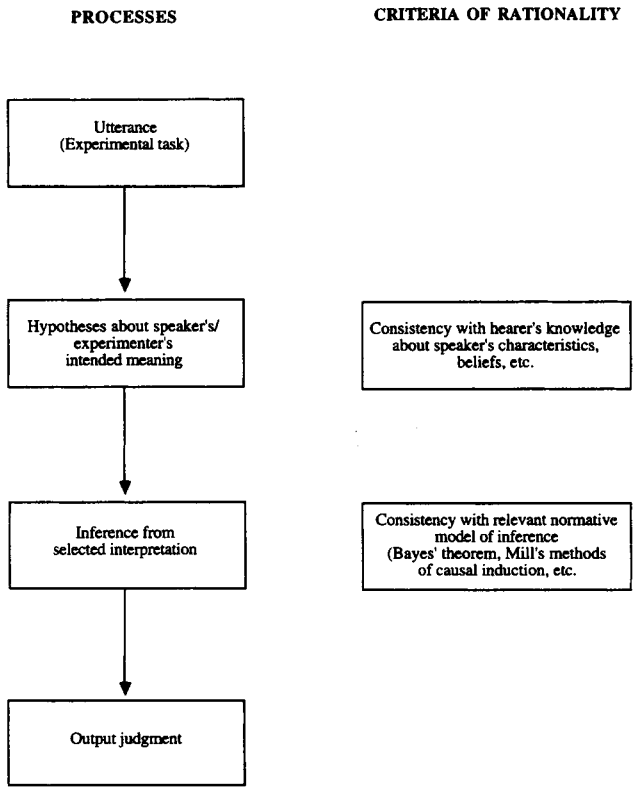

Figure 2. Two-stage resolution of uncertainty: utterance interpretation and judgment.

I argue that participants enter the experimental and survey situation with prior expectations about the experimenter. Manipulating participants' perceptions of the experimenter or survey researcher's cooperativeness, intentionality, authority, and knowledge should affect the interpretations made and thus the final judgments produced. In addition, the general assumption of cooperativeness may cause information normally thought of as incidental to the experimental task—such as response scales—to be treated as relevant. These interpretations are orderly in the sense that certain patterns of conversational inference (e.g., that triggered by part–whole contrasts) can be found across a variety of experimental tasks (probability judgment, conservation, and surveys). They are rational because these interpretations seem to make the most sense given reasonable attributions about the speaker.

Next, I review evidence that supports these claims. First, this provides support for the attributional model of conversational inference by showing how information about source characteristics such as the intentionality, cooperativeness, and authority of the speaker changes output judgments. Even where task interpretations have not been directly assessed, this at least offers prima facie evidence that participants may be applying Grice's (1975) maxims of conversation to the interpretation of experimental messages. And second, in so doing, this also calls into question the classification of some of the participants' responses as errors.

Attributions About the Experimenter and Rational Inference

There is general evidence that experiments may be regarded as social interactions in which the participant's attributions about the experimenter affect his or her behavior. Social psychological research clearly suggests that participants attribute serious purposes even to patently absurd experiments (Orne, 1962). They behave in a highly cooperative manner in response to some very questionable experimental demands when they perceive the experimenter as authoritative, but they reduce this compliance when the experimenter is perceived as lacking in authority (Milgram, 1974). In addition, it is well known that source attributes such as expertise, credibility, and prior attitude affect participants' responses to experimental attempts at belief changes (e.g., McGuire, 1969).

In addition, Singer, Hippler, and Schwarz (1992) showed that respondents to survey questionnaires may possess a certain amount of skepticism as to the researcher's trustworthiness. These researchers found, for example, that overly emphatic confidentiality assurances may lead respondents to have less faith that the confidentiality of their responses would be respected. In sum, I surmise that adult experimental participants and survey respondents are generally compliant and treat the experimenter as authoritative and cooperative, albeit with some skepticism.

Assumption of Intentionality in 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 judgments about the credibility, informativeness, purpose, or style of what is said on the basis of perceptions of the speaker. Unless told otherwise, respondents seem to be very resistant to attributing experimental manipulations to the operation of random or accidental processes. Respondents 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) participants. Oatley and Yuill (1985) found that cues such as "jealous husband" led participants to exert considerable ingenuity in explaining why the dots in Heider and Simmel's film moved as they did. Perhaps most germane to the present issue is the behavior of naive users of Weizenbaum's (1976) 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 adopt an "intentional stance" (Dennett, 1984) to explain ELIZA's behavior and assume that ELIZA's utterances are produced by a human being (Boden, 1977).

People appear to distinguish between behavior that they are told is produced by a person or by some impersonal agent. For example, Faucheux and Moscovici (1968) showed that participants' strategies in an experimental game were affected by information indicating that their partner was a person or nature. Gibbs, Kushner, and Mills (1991) also showed that information about authorial intentions affected metaphor comprehension. Participants who were told that the metaphors they were given were produced by 20th century poets rather than by a computer were more likely to judge them meaningful, produced more interpretations of them, and made meaningfulness judgments faster. Consequently, variables that undermine the perception that the actions performed by the experimenter are intentional, in line with the attributional model, may have critical effects on how experimental manipulations are interpreted and responded to. As is 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 & Inhelder, 1969) have been very widely used in developmental psychology. For purposes of exposition, one of the procedures used to test conservation of number is considered in detail. For example, a child may be shown two rows of four counters that are equal in length. The child is asked whether there is more in one row than in 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, children younger than 7-years-old 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 perhaps has 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, the children may have recognized that the two rows still had the same number of counters, but they 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 reinterpreted the question focus from number to length to give the experimental manipulation relevance (cf. Donaldson, 1982).

McGarrigle and Donaldson (1975) tested this 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" (p. 343). 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, the 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 between 4 years old and 6 years old showed conservation in the accidental condition, whereas only 13 children showed conservation in the intentional condition.

This result has been replicated and extended to other Piagetian conservation procedures (for a review, see Donaldson, 1982). Moreover, it is consistent with other studies that suggest children only judge the shorter line as having more when they have been asked to make an initial judgment of whether the two lines were equal (Rose & Blank, 1974). Clearly, when the array has been transformed and the question has been asked again, children seem to experience a demand to change their response and may reinterpret 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 Dinwiddy (1988) extended these results by investigating whether 4-, 5-, and 6-year-old children are aware of how demand effects may influence 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 the incorrect responses in the two-question task to external factors (e.g., to please someone else) but attributed 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.

Although Donaldson (1982) was careful to note that many nonconserving responses are still made in the accidental condition, she also noted that conventional conservation procedures seriously underestimate children's ability to conserve. In particular, many failures to conserve that have been attributed to cognitive deficits such as "perceptual domination" (Piaget & Inhelder, 1969) or "attentional deficits" (Gelman, 1969) 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 & 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 participants were more likely to rely on individuating information about the target than on base-rate information. For example, participants 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" (pp. 24). They were then presented with base-rate information indicating that the target person came from a sample of 100 people that included either 30 or 70 engineers, depending on the experimental condition. The participants predicted that the target person is probably an engineer, regardless of which base-rate they had been given. Kahneman and Tversky attributed this underuse of base-rate information to the operation of the representativeness heuristic, that is, participants based their decision about the probability that the target was an engineer on the similarity of the target to a stereotype of engineers.

However, evidence has since suggested that this phenomenon of "underuse of base-rate information" is restricted to "word problems" in which the base-rate information is presented verbally to participants in the form "30% of the group are engineers," etc. Thus, studies that present base-rate information to participants in the form of learning trials show that participants can use base-rate information appropriately when making judgments (Christensen-Szalanski & Beach, 1982; Medin & Edelson, 1988). Other studies that have required participants to make judgments in which they have prior real-world experience or expertise also have found no tendency to underutilize base-rate information. For example, participants use their own implicit knowledge about the base-rate of diseases when judging the probability of a doctor's prediction that they will suffer from a particular illness (Wallsten, Fillenbaum, & Cox, 1986; Weber & Hilton, 1990). Doctors make appropriate adjustments for the base-rate probability of illnesses in a diagnosis task where they deploy implicit knowledge about symptom–group associations (e.g., weight loss in young girls suggests anorexia, but weight loss in old men suggests cancer) in medium-fidelity diagnosis tasks (Fox, 1980; Weber, Böckenholt, Hilton, & Wallace, 1993), whereas they fail to use explicitly presented base-rate information in a medical prognosis task presented in the form of a verbal vignette (Eddy, 1982). Consequently, participants' use of the representativeness heuristic may be governed by contextual factors, such as the assumptions that participants make about verbally presented base-rate information.

In fact, participants' use of base-rate information has been shown to be affected by various pragmatic factors. Krosnick et al. (1990) noted that participants always read individuating

information first and base-rate information second in Kahneman and Tversky's (1973) procedure and other similar ones. Krosnick et al. hypothesised that the order of presentation of information may have served as a cue to participants to weight the initial information more and the later information less. Consistent with this reasoning, they found that participants used the base-rate information more when it was presented first. Krosnick et al. 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 participants 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 participant believes that the cue has not been produced intentionally by the experimenter. This indeed appears to be the case. Krosnick et al. (1990) found that the order effect disappeared when participants were told that the order of presentation had been randomly determined.

Ginossar and Trope (1987, Experiment 6) presented the engineers-and-lawyers problem to participants 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 attributional model, they found that participants were more likely to use base-rate information in this condition.

Schwarz, Strack, et al. (1991) used a related manipulation that undermines the assumption of intentionality. They told participants 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, participants 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 to them by a human researcher, participants on average estimated the probability that the target was an engineer at .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, the participants' average estimate was .40, in line with the normative use of base-rate information.

On the other hand, in the statistics condition, participants were more likely to weight individuating information when it was drawn at random by a computer from a larger sample of descriptive information ($M = .74$) than when it was written by a nonspecified researcher ($M = .55$). One possible explanation is that random sampling is a valued procedure in a statistics framework, and therefore participants attached greater significance to the representative (i.e., randomly selected) information. Although this explanation is post hoc, it does underscore the importance of attention to participants' inferences about the particular expertise and credibility possessed by the source of information. As is shown below, explicit information about the source does indeed affect participants' judgments in this task.

Source Characteristics 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 participants 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" (pp. 465–471), unlike Krosnick et al. (1990) they took no measures—such as salience or availability—in any of their experiments that explicitly addressed such cognitive hypotheses. Interestingly, their salience manipulations that led to greater use of base-rate information involved violations of conversational norms, either by presenting prior tasks with uninformative nondiagnostic information before the target task (Experiment 1) or by rewriting the target task in a list style uncharacteristic of normal conversational communication (Experiment 2). Consequently, their results may also be treated as just as consistent with the attributional model that suggests the weighting of individuating information is based on inferences about the Gricean quality of that information, based on perceptions of the source.

In a related vein, Zukier and Pepitone (1984, Experiment 1) enjoined their participants to either behave like clinicians or scientists in making judgments. Thus, when the task was framed as being one of "clinical judgment," participants 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 participants 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" (p. 353) seems to enjoin participants to be strict with the maxim of quality and not to say what they lack adequate evidence for. As might be expected, the results showed that participants are more likely to weight individuating information in the clinical condition than in the scientist condition. Interestingly, participants 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 toward caution and consistent with a strict application of the maxim of quality.

In sum, the above studies on the engineers-and-lawyers problem suggest that participants' use of base-rate information is governed by their assumptions about its conversational quality and relevance. When participants' assumptions about the intentionality, relevance, and quality of the information are undermined, participants tend to use base-rate information more (Ginossar & Trope, 1987; Krosnick et al., 1990; Schwarz, Strack, et al., 1991; Trope &

Ginossar, 1988). When, in line with the precepts of conversational inference, the participants 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 & Pepitone, 1984). This pattern of results suggests that participants typically enter the psychology experiment with the default assumption of conversational rationality that enjoins them to go beyond the information given in making inferences about what is required of them. More important, however, they can make inferences that correspond to scientific norms when their conversational assumptions are canceled by the context. Consequently, the production of bias in such tasks may be less attributable to cognitive factors such as representativeness (Kahneman & Tversky, 1973) or availability (Ginossar & 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. Below, I consider another example of how the operation of the representativeness heuristic may be constrained by conversational norms.

Assumed Relevance of Nondiagnostic Information: Accountability and the Activation of Conversational Norms

Although Grice's (1975) maxim of relation prescribes that speakers should include only relevant information, experimenters routinely violate this assumption by deliberately including information that is meant to be irrelevant to the task. A clear example of this is the "dilution" effect studied by Nisbett et al. (1981). They found that participants rationally used information about a target person such as IQ or an effort that is diagnostic of that person's grade point average. However, when the description of the target person included information that was not relevant to the judgment task (such as age, hair color, etc.), participants made less use of the diagnostic information. From the point of view of probability theory, 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. posited an intrapsychic explanation in terms of the representativeness heuristic due to the dilution of the diagnostic information with irrelevant nondiagnostic information, which reduced the perceived similarity of the target person to the target category (cf. Tversky & Kahneman, 1974).

However, as Tetlock and Boettger (1991) pointed out, the effect is also consistent with an explanation in terms of rational processes of conversational inference. Participants may assume that all the information that they are given, whether diagnostic or nondiagnostic, is mentioned because it 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. Such an effect would be removed if participants believed that the information had been presented without conscious design.

Tetlock and Boettger (1991) therefore presented the information to participants as having been screened for its relevance (thus activating conversational norms) or randomly sampled from a computer database (deactivation of conversational norms), with no information about the conversational relevance of the information. Half the participants were subjected to an accountability manipulation, being told that they would have to explain their decision to others when the experiment was over. This manipulation has been extremely successful in attenuating biases in judgment usually attributed to heuristics because of its presumed effect in inducing more cognitive effort (for a review, see Tetlock, 1992).

Tetlock and Boettger (1991) found that the accountability manipulation led to more use of the nondiagnostic information in the conditions where conversational norms had been activated or no information either way had been given. This is consistent with participants' belief that the nondiagnostic information must be relevant (otherwise it would not have been mentioned), and the accountable participants' wish to perform well in the judgment task by making maximum use of information that they presume has been guaranteed by the maxim of relevance. These results replicate the findings of Tetlock and Boettger (1989) and suggest that the participants' default assumption is that conversational rules are operative in the experiment. Significantly, when conversational norms have been deactivated, participants were less likely to use the nondiagnostic information, and thus exhibit the dilution effect. Compared with nonaccountable participants in this condition, accountable participants were actually less likely to fall prey to this error, further reinforcing the view that the dilution effect is attributable to the unreciprocated respect participants have for conversational norms in this particular experimental paradigm.

Attributions of Cooperativeness and the Effect of Leading Questions

The default assumption made by Grice's (1975) model of conversational inference is that utterances are cooperatively produced. The attribution of cooperativeness 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. 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 nonconserving 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. This question leads to more responses that indicate the weight changes from one state to another than when the question is asked with the tag "or do you weigh the same?" (p. 198).

Kwock and Winer (1986) explored social context variables that would lead children to reject misleading questions. Children were given classifications tasks in which they were shown a picture and asked whether it was *X* or *Y*, when in fact it was both. Thus, when shown a picture of a dog, children were asked "Is this a dog or an animal?" 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 questions flagrantly violated conversational norms. For example, 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 that violated the rules of conversation. In a second

experiment, Kwock and Winer found that third graders were more likely to reject the misleading implication of the question when they were asked by another third grader than by an adult.

Both children and adults are vulnerable to misleading questions. Children are less vulnerable when the questions are asked by low-credibility sources, such as other children. In addition, children's susceptibility to misleading questions decreases when they have experienced flagrantly bizarre questions asked by the adult, presumably because the credibility of the adult experimenter is then undermined (for an extensive review, see Siegal, 1991).

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 participants' memory about that accident. Thus, if participants 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 that showed participants were inclined to 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 occur only in social settings where the cooperativeness principle is assumed to hold valid, such as psychology experiments. Participants may have assumed that the experimenter in Loftus and Palmer's (1974) study was cooperative and thus have uncritically accepted the presuppositions loaded into the question. To test this interpretation, Dodd and Bradshaw (1980) found no effect of leading questions on memory as compared with a control condition when the source was specified as a lawyer representing the defendant, although they were able to replicate the original result when the source of the leading question was the experimenter, as in Loftus and Palmer's original procedure.

Dodd and Bradshaw's (1980) results are consistent with the suggestion that when the leading question was attributed to an adversative source, such as a defending lawyer in an American court, participants suspended the assumption of cooperativeness and thus were not vulnerable to the biasing effects of leading questions. Interestingly, participants were still vulnerable to biasing effects from the recall probes about the speed of the car, which varied the descriptive cues used ("How fast was the car going when it hit/collided with/smashed" . . . etc.). However, the recall probes all emanated from the same source (the experimenter) regardless of experimental condition and thus may still have been treated as guaranteed by the assumption of cooperativeness 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 be plausibly attributed to the operation of conversational assumptions, which guide reconstructive inferences about the speed of the car. This interpretation is consistent with the findings of Strack, Schwarz, Bless, Kübler, & Wänke, (1993) who showed that when participants are made aware of the priming episode, they appear to discount its influence, much in the manner suggested above. However, as Martin, Seta, and Crelia (1990) suggested, such discounting may require extra cognitive effort and therefore occur only when people are motivated by the task and have sufficient cognitive resources to allocate to it.

Given–New Contract and Mutual Knowledge

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, treating 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.* Considerable evidence exists that speakers are sensitive to the mutual knowledge they share with listeners in the formulation of their utterances and that hearers are better at decoding messages from speakers with whom they share common ground (Clark, 1985, 1992; Fussell & Krauss, 1989, 1992; Krauss & Fussell, 1991).

The given–new contract can force reinterpretations of *wholes* in the context of *parts* that they logically include. As Adler (1984) noted, children may interpret the class-inclusion questions in Piagetian conservation experiments this way: If asked the question, "Are there more primulas or are there more flowers?" children may treat *primulas* as given information and reinterpret *flowers* to mean flowers other than primulas and correspondingly answer that there are more primulas than flowers. Politzer (1993) presented experimental evidence that supports this analysis. As is shown below, this subtraction rule can explain many patterns of response that might otherwise be attributed to cognitive deficiencies, as done in Piagetian experiments.

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 cooperative experimenter would have said "Show me the banana" if they had wanted the banana, so the unfamiliar word must refer to the unfamiliar object. Only if the adult were violating Grice's (1975) 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 objective with a salient part. The object (e.g., a lung) was either familiar or unfamiliar to the children, whereas the part (e.g., a 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 (1975) maxim of quantity and asked the children to name the object that they did not know. Otherwise, this particular conversation would seem to have no point.

Subsequent research has shown conditions in which children do not follow the principle of mutual exclusivity and accept that two expressions can refer to the same object. For example, when context suggests that one word indicates a subset of another larger set (e.g, dingo dogs and dogs), children between 3 and 5 years old consider that both expressions refer to members of the lower level category (Au & Glusman, 1990; Gelman, Wilcox, & Clark, 1989). This effect seems acceptable conversational practice: Using a more specific term to refer to a previously categorized object adds precision even though the object may have been categorized at a more general level.

Another condition in which children do not follow the assumption of mutual exclusivity is when they know that the speaker is bilingual and may use words from both languages to describe the same object. In such cases, bilingual children between 3 and 7 years old who have heard the experimenter use both languages readily accept that two words can refer to the same object, as do monolingual children between 3 and 5 years old who have been led to believe that they are going to learn words from the foreign language. Clearly, children's expectations about their interlocutor's capacities and intentions can determine whether they assume mutual exclusivity of names. For example, in a teaching or testing situation, it is still informative and relevant for the adult to teach or test for Spanish vocabulary even if the adult knows the child has the requisite English vocabulary and thus attributes two different names to the same object.

Although the nonapplication of mutual exclusivity seems very consistent with Gricean rules of inference, none of the articles cited explicitly use this approach. However, children's decisions about the rational interpretation of the referents of names can be explained in terms of the assumption that the speaker was trying to be informative. If children's successful performance in naming objects in these tasks depends on conversational assumptions, this hypothesis could be tested by performing experiments that use nonadult interlocutors for the children (e.g., naughty teddies and other children) or that explicitly signal to the children that their normal conversational assumptions should be suspended (see Kwock & Winer, 1986; for a thorough discussion of such techniques, also see Siegal, 1991).

Part–Whole Contrasts and the Interpretation of Survey Questions

Strack et al. (1988) reasoned that if a specific question precedes a general one that logically includes it, hearers interpret the general question to exclude the information already mentioned in the first question. Suppose a female survey respondent is asked about satisfaction with her life in general, she is likely to report her global satisfaction with her personal and professional life. If, however, she is asked first about her professional life and then about her life in general, she will treat life in general as referring to nonprofessional parts of her life if she wishes to respect the maxim of quantity and give her questioner new information.

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*, Strack et al. 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" (p. 434). In this condition, they hypothesised that the focus of the general question be interpreted as excluding the focus of the specific question that has been asked first. Because answers to the two questions would 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 (.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 respondents' ratings of their responses to these two questions in this condition. Similar results were obtained by Schwarz, Strack, and Mai (1991).

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 application of the availability heuristic (cf. Strack, 1992).

Part–Whole Contrasts and the Conjunction Fallacy

Dulany and Hilton (1991) applied this logic to the analysis of Tversky and Kahneman's (1983) conjunction fallacy task. In the best-known version of this task, participants read a detailed description of a target person:

> Linda is 31 years old, single, outspoken, and very bright. She majored in philosophy. As a student she was deeply concerned with issues of discrimination and social justice, and also participated in anti-nuclear demonstrations. (pp. 297)

Participants are then asked to check which one of the following two alternatives is most probable:

> Linda is a bank teller. (*T*)
> Linda is a bank teller and is active in the feminist movement. (*T and F*) (p. 297)

Tversky and Kahneman (1983) reported that 85% of the participants rated the conjunction of constituents (*T and F*) as

more probable than the single constituent (*F*). This *conjunction effect* is considered a fallacy because a conjunction of two constituents cannot be more probable than one of the constituents alone. The logic of extensional sets requires that the class of people who are bank tellers and feminists be a subset of the class of people who are bank tellers. Tversky and Kahneman argued that people make this error in probability judgment because they are guided by the representativeness heuristic, which finds the conjunction (*T and F*) to be more similar to the *model* (i.e., the target description of Linda) than the constituent (*T*) alone and therefore is judged as more probable. As support of this, they noted that very few participants commit the conjunction fallacy in the *no-model* condition where minimal information about the target ("Linda is 31 years old") is presented because this fails to activate the representativeness heuristic.

Several researchers have argued from conversational principles that participants interpret "Linda is a bank teller" (*T*) to mean Linda is a bank teller who is not active in the feminist movement (*T and not F*) in this context (Morier & Borgida, 1984; Politzer & Noveck, 1991). If so, the judgment that *T* is more probable than *T and F* is no longer a fallacy because *T* is implicitly read as indicating another kind of conjunction, namely *T and not F*. On the basis of an analysis of attribution processes in conversational inference, Dulany and Hilton (1991) sought to predict the conditions under which participants would draw the absolving interpretation of "Linda is a bank teller." They argued that the rich information given to the participant in the model condition may justify the inference that the experimenter knows a lot about the target. The participant may reason that if the experimenter knows a lot about the target, Linda, then the reason the experimenter omitted to say that Linda is not active in the feminist movement is because he or she knows this not to be the case, thus conveying a *K*-implicature (Levinson, 1983) that Linda is not active in the feminist movement. By contrast, in the no-model condition, the participant may reason that the experimenter did not say that Linda is a bank teller because he or she does not know whether this is the case or not, thus implying the *P*-implicature (Levinson, 1983) that it is logically possible that Linda either may or may not be a bank teller. The *P*-implicature corresponds to the extensional interpretation of the constituent that would imply that the conjunction effect is indeed a logical fallacy. Dulany and Hilton found that participants did in fact draw more *K*-implicatures in the model condition as predicted. Thus, they were most likely to make interpretations that would absolve them of charges of fallacious reasoning in just those conditions where they were most likely to judge the conjunction as more probable than the constituent. When interpretations were controlled, Dulany and Hilton found a greatly reduced fallacy rate of 25% to 30%.[3]

Tversky and Kahneman (1983) acknowledged that participants may be interpreting *T* to mean *T and not F* and sought to deal with this problem by developing a *direct* version of the task in which the extensional nature of the conjunct was explicitly stated. Thus they asked participants to judge the probability of "Linda is a bank teller whether or not she is active in the feminist movement." However, this phrasing is also unsatisfactory as it could be reinterpreted 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." Following Grice's (1975) maxim of manner, Dulany and Hilton (1991) developed a less ambiguous version of the direct test and found less than half the conjunction fallacies obtained by Tversky and Kahneman. Thus, it seems that ambiguities in the wording used may have led Tversky and Kahneman to overestimate the number of conjunction fallacies committed.

In a closely related analysis, Politzer and Noveck (1991) showed how changes to the linguistic structure of the conjunction task that preserve its logical form also reduce error rates. In one of their problems, participants were told that Daniel was a bright high school student and were then asked to judge the probability of the following three predictions about his performance in further studies:

> Daniel entered medical school. (*M*)
> Daniel dropped out of medical school for lack of interest. (*presupposed M and D*)
> Daniel graduated from medical school. (*presupposed M and G*) (p. 93)

In this case, the constituent "Daniel entered medical school" is presupposed by his later dropping out or graduating. Following the conjunction rule, the implicit conjunctions should be judged as less probable than the constituent. Thirty percent of the participants did in fact judge one of the conjunctions (*presupposed M and D* or *presupposed M and G*) to be more probable than the constituent (*M*), thus committing the fallacy.

The Daniel problem resembles Tversky and Kahneman's (1983) Linda problem in terms of the class inclusion relations between the alternatives but differs in that these class inclusion relations are not suggested explicitly. However, it is possible to change the Daniel problem such that these relations are expressed explicitly through the connective *and,* as follows:

> Daniel entered medical school. (*M*)
> Daniel entered medical school and dropped out for lack of interest. (*M and D*)
> Daniel entered medical school and graduated. (*M and G*) (p. 93)

Politzer and Noveck (1991) argued that, as in the Linda problem, the use of *and* will force the implicature that the constituent implies a conjunction (either *M and not D* or *M and not G*). In this explicit condition, 53% of the participants rated one the conjunctions (*M and D* or *M and G*) as more probable than the constituent (*M*). Politzer and Noveck thus claimed that making the inclusion relation explicit through the use of the connective *and* actually worsens performance, thus casting doubt on Tversky and Kahneman's (1983) claim that "people are not accustomed to the detection of nesting among events, even when the relations are clearly displayed" (p. 304). Equally, they observed that the increase in the error rate produced by the introduction of *and* seems to contradict Tversky and Kahneman's (1983)

[3] Dulany and Hilton (1991) also studied empirical possibility implicatures, such as "Linda is a bank teller who is probably active in the feminist movement." They also treat these as interpretations that absolve conjunction effects of being fallacies.

view that "the conjunction fallacy is not restricted to esoteric interpretations of the connective *and*" (p. 303).

Unlike Dulany and Hilton (1991), Politzer and Noveck (1991) did not assess how their manipulation of the explicitness of the class inclusion relation might have affected the implicature drawn from the constituent. Nevertheless, although much remains to be done to elucidate how the response alternatives used in conjunction tasks are interpreted (see Adler, 1991; Fiedler, 1988; Wolford, Taylor, & Beck, 1990, for alternative approaches), enough already seems to have been done to illustrate the value of using conversational pragmatics to analyze these issues.

Relevance of Incidental Information

Grice's (1975) maxim of relation 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 at hand and, according to the maxim of quality, not misleading in any way. However, experimenters often include irrelevant information that may in fact be used by participants to interpret their experimental task. As is 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.

Relevance of Information Contained in Response Scales

Although experimenters generally use response scales to assess participants' judgments and not to influence them, there is considerable evidence that participants often use response scales as cues about the character and extent of the behavior probed (Schwarz, 1990; Wyer, 1981).

For example, the range indicated by the response scale may cue participants' interpretation of the behavior. Schwarz, Strack, Mueller, & Deutsch (1988) asked participants how often they had felt really irritated recently. One group of participants was given a scale ranging from *several times daily* to *less than once a week*, whereas other participants were given a scale ranging from *several times a year* to *less than once every three months* (p. 112). They argued that participants would use their world knowledge to decide what kind of irritations were implied by the experimenter's question. Consistent with their reasoning, participants given the former scale reported less extreme examples of irritation (e.g., having to wait for service in a restaurant). Participants given the latter scale reported more extreme examples of irritation (e.g., having a fight with one's spouse).

The numeric values assigned to points on a rating scale may also affect how a survey question is interpreted. Suppose respondents have to evaluate how successful they have been in life on an 11-point rating scale, ranging from *not at all successful* to *extremely successful*. However, the numerical labeling of the scale may influence how the question is perceived. Thus, if the 11 points on the scale are labeled from 0 to 10, respondents may interpret *not at all successful* to indicate lack of outstanding success. On the other hand, a scale ranging from −5 through 0 to 5 may lead them to interpret *not at all successful* as *extremely unsuccessful*. Accordingly, respondents may mark the absence of outstanding successes as 0 on the 0 to 10 scale, but also as 0 on the −5 to 5 scale, because they interpret −5 to mean a resounding failure rather than the absence of success. This would lead to greater use of the bottom end of the 0 to 10 scale than the −5 to 5 scale, where the bottom end would be reserved for resounding failures. Schwarz, Knäuper, et al. (1991) did indeed observe that 34% of the respondents checked the lower half of the 0 to 10 scale, whereas only 13% checked the lower half of the −5 to 5 scale. Subsequent studies also indicated that respondents were more likely to treat 2 on a 0 to 10 scale as indicating the absence of success but −4 on a −5 to 5 scale as the presence of failure, although the two scales are formally identical.

Respondents may also use response scales to decide the likely frequency of a target behavior. For example, Schwarz, Hippler, Deutsch, & Strack (1985) asked German adults to rate how frequently they watched television. Half the respondents received a scale ranging in $^1/_2$-hr steps from *up to* $^1/_2$ *hour* to *more than* $2\,^1/_2$ *hours*, and the other half received a scale ranging from *up to* $2\,^1/_2$ *hours* to *more than* $4\,^1/_2$ *hours* (p. 390). Only 16% of the respondents who were received the low-frequency scale reported watching television for more than $2\,^1/_2$ hours, whereas 38% of the respondents received the high-frequency scale did so. Similar effects of range of response alternatives for estimations of sexual intercourse and masturbation in dating couples exist (Schwarz & Scheuring, 1988).

Moderating Effect of Expertise on Range Effects

It might be conjectured that the effect of scale ranges on frequency estimation may reflect anchoring effects (Tversky & Kahneman, 1974). However, respondents' 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 television consumption of a typical undergraduate. Moreover, college students who are high on private self-consciousness (Fenigstein, Scheier, & 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-on-private-self-consciousness individuals, who reflect more about the nature of their behavior, are more likely to know how often they watch television (Schwarz et al., 1985).

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 generated the anchors. Self-generated anchors cannot provide information about the experimenter's estimate of the frequency of a behavior in the target population. However, trained accountants were still susceptible to anchoring effects on tasks when the experimenter provided the anchors (Joyce & Biddle, 1981).

Similar results were obtained by Sanbonmatsu, Kardes, and Herr (1992), who showed that expertise moderated the effects of incomplete information on preference judgments. Respondents were presented either with four or eight statements about a camera that were uniformly positive (e.g., "The Brand A camera is lighter and more compact than most other 35-mm cameras"). The respondents had been classified as possessing

either high, medium, or low knowledge about cameras. Expertise had no effect on preference when the amount of information given was large. However, when the amount of information given was small, high-knowledge respondents were significantly less positive in their evaluations. Presumably, low- and medium-knowledge respondents considered the range of relevant information given to be complete, whether they received four or eight items of information. However, high-knowledge respondents who received four items of information presumably recognized that information about important dimensions of judgment was missing. In the absence of explicitly positive statements about dimensions known by the experts to be relevant, they may have implicitly presumed relatively negative attributes on these dimensions. This would have resulted in the more negative evaluation reported. Sanbonmatsu et al. suggested that these findings are inconsistent with the predictions of the anchoring and adjustment hypothesis, which would predict that the effect of set size on favorability of impressions should generalize across all respondents, regardless of expertise.

In sum, experimental results suggest that when respondents 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 behavior in the population, which they then use to calculate their response, for example, their position on that scale. Respondents seem to be guided by a strategy of guessing on the basis of the response scales that had been provided by a cooperative experimenter who did not wish to mislead the respondent 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, why experimenter-provided anchors are most effective in domains about which the respondent knows little, or why set size effects on preference judgment are most pronounced for experts.

Relevance of the Range and Phrasing of Response Sets: A Reexamination of Attribution Experiments

It is often claimed that respondents underuse consensus information, a form of base-rate information referring to how other people would have behaved in the target situation (Alloy & Tabachnik, 1984; Higgins & Bargh, 1987; Kassin, 1979; McArthur, 1972, 1976; Nisbett & Borgida, 1975; Nisbett, Borgida, Crandall, & Reed, 1976; Ross & Fletcher, 1985). One reason for this claim is that in an influential study, McArthur found little influence of consensus information on attributions. However, Hilton (1990b) suggested that this pattern may be the result of methodological artifacts. One factor of key importance is McArthur's failure to specify interactional attributions in her response format. In such studies, respondents are given a target event such as "Sue is afraid of the dog" and three items of covariation information: consensus, indicating covariation of the target behavior over other persons (whether other people are afraid of the dog); distinctiveness, indicating covariation of the target behavior over other stimuli (whether Sue is afraid of other dogs); and consistency, indicating covariation of the target behavior over other times (whether Sue has been afraid of this dog on other occasions). A representative information pattern that respondents might receive in such studies is the low-consensus, high-distinctiveness, low-consistency information configuration below:

> Sue is afraid of the dog.
> Hardly anyone else is afraid of the dog.
> Sue is afraid of hardly any other dog.
> In the past, Sue has hardly ever been afraid of this dog.

In McArthur's (1972, 1976) original tests of Kelley's (1967) model, respondents 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.

> Please circle the cause of the event.
> a) Something about Sue caused her to be afraid of the dog.
> b) Something about the dog caused her to be afraid of it.
> c) Something about the circumstances caused Sue to be afraid of the dog.
> d) Some combination of these causes. (please write your answer in the space below)

The attribution predicted by the application of Mill's (1872/1973) method of difference is the combination of the person, the stimulus, and the circumstances (Jaspars, Hewstone, & Fincham, 1983). However, McArthur (1972, 1976) found a strong preference to attribute this configuration to a single effect, the circumstances (cf. Orvis, Cunningham, & Kelley, 1975).

This attributional pattern could reflect a bias produced by the response set. This set of response alternatives, in combination with the use of the ambiguous term *the circumstances*, may have caused respondents not to make predicted interactional attributions to combinations of factors (e.g., the person and stimulus and the occasion). Respondents 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. This supposition is supported by results obtained by studies that used a full set of response alternatives:

> Please circle the cause of the event.
> a) Something about Sue caused her to be afraid of the dog.
> b) Something about the dog caused her to be afraid of it.
> c) Something about the circumstances caused Sue to be afraid of the dog.
> d) Some combination of Sue and the dog caused her to be afraid of it.
> e) Some combination of Sue and the circumstances caused her to be afraid of the dog.
> f) Some combination of the dog and the circumstances caused Sue to be afraid of it.
> g) Some combination of Sue, the dog, and the circumstances caused her to be afraid of it.

With this format, the most favored response is the predicted interactional attribution to the combination of the person, the stimulus, and the circumstances (Jaspars, 1983). More generally, studies that did give a full range of interactional attributions in the response format found 61% (Jaspars, 1983) and 47% (Hilton & Jaspars, 1987) interactional attributions, whereas studies that did not use such response formats found only 37% (McArthur, 1972) and 35% (Hewstone & Jaspars, 1983) interactional attributions. Thus, the data collected by

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

Another explanation for the apparent underuse of consensus information may have been the failure of earlier research to take into account the role of respondents' pragmatic presuppositions about event base rates in causal inference (Cheng & Novick, 1990; Försterling, 1989). In addition, actor–observer differences (Jones & Nisbett, 1972) and success–failure asymmetries in explanation (Weiner et al., 1972) are amenable to explanation in terms of pragmatic question focus (McGill, 1989). Interested readers are referred to Hilton (1990a, 1991) for a detailed discussion.

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 (1975) principles (Levinson, 1983). These include inferences about focus determined through *pragmatic particles*. Pragmatic particles—such as *but, few, a few, occasionally,* and *seldom*—conventionally determine the interpretation of words with which they are conjoined, as well as having truth values that determine their own range of applicability. For example, *seldom* and *occasionally* indicate approximately the same frequency of occurrence of a behavior 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 behavior (Moxey & Sanford, 1987). If one is asked to explain why John seldom walks the dog, one is apt to come up with reasons for the nonoccurrence of the behavior (e.g., because he is always busy), whereas if one is asked to explain why he occasionally walks the dog, one tends to give reasons that account for the occurrence of the behavior (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 found in the stimulus material used by Kahneman and Miller (1986) to test norm theory. Kahneman and Miller argued that unusual events are more likely to activate counterfactual alternatives in which the nonoccurrence 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 respondent to focus on why the event did not happen rather than why it 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: "On the day of the accident, Mr. Jones left the office earlier than usual, to attend to some household chores at his wife's request. He drove home along his regular route. Mr. Jones occasionally chose to drive along the shore, to enjoy the view on exceptionally clear days, but that day was just average" (p. 143). Hence, one cannot be sure whether the effects obtained (e.g., events undone by counterfactual reasoning) are attributable to the normality of the events described or to the focus indicated by the experimenter's choice of temporal quantifier.

A related effect may be the *forbid–allow* asymmetry studied by Hippler and Schwarz (1986). 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 & Schwarz, 1986). Although it is not altogether clear why the forbid–allow asymmetry should exist, it is clear that seemingly irrelevant changes in phrasing that appear to preserve the literal meaning of the target stimulus, nevertheless, change the meaning conveyed to the respondent.

Transparency of Reference and Use of Base-Rate Information

Grice's (1975) maxim of manner exhorts speakers to be clear and unambiguous. Using methods similar to those of Dulany and Hilton (1991), Macchi (1991) showed that respondents use base-rate information in response to questions that clarify the nature of the judgment required. In one of Macchi's experimental tasks, adapted from the suicide problem of Tversky and Kahneman (1980), respondents were informed that 80% of a population of young adults were married whereas 20% were single. They were also told that the percentage of deaths is three times higher among single individuals than among married individuals. Macchi suggested that the phrasing "three times higher" is ambiguous between the percentage of all suicides (implying that 75% of deaths are singles whereas 25% are marrieds) and the percentage among singles as opposed to the percentage among marrieds. It is an empirical question as to the interpretation that is more likely to be preferred here and a normative question for the rules of conversation to decide which is more rational. In any case, respondents' median response (3:1) is entirely consistent with the former interpretation. Thus, respondents appear not to use the base-rate information about the proportion of marrieds and singles in the population in making their judgments.

Noting that this effect may be due to a misunderstanding, Macchi (1991) rephrased this item of information as "30% of single individuals and 10% of married individuals commit suicide" (p. 9), which has the merit of being unambiguous, clear, and coherent with the manner of describing the base-rate information, which was also expressed in percentages. In this condition, respondents used the base-rate information appropriately.

Macchi (1991) also showed that similar changes in discourse structure that add no information but simply clarify the relationship between supersets and subsets produce similar variations in use of base-rate information in Tversky and Kahneman's (1980) suicide problem. In particular, she showed that the manipulation of causal relevance that induced use of base-rate information may have done so because it manipulated discourse structure by explicitly mentioning both the superset (young adults) and the subset (suicides) in the same question. A similar superset–subset phrasing of a logically similar but noncausal problem involving books and paperbacks likewise induced use of base-rate information, whereas a question that

referred explicitly to the subset but not to the superset did not induce corresponding use of base-rate information. As has been noted above with other paradigms, an effect (the use of base-rate information) may have been misattributed to a cognitive factor (causal relevance) when in fact it is attributable to discourse processes.

Implications of Conversational Inference for the Attribution of Rationality

The larger issue addressed in this review has been the attribution of rationality or irrationality to human judgments. I have argued that in many cases judgments that have been or could be considered irrational may in fact be considered rational if prior processes of conversational inference are taken into account. These shape the representation of the task used by the experimental or survey respondent. Moreover, these processes of conversational inference are not ad hoc or defective in some way but reflect the rationality of social interaction and communication, where trade-offs have to be made, for example, between explicitness and economy in communication. Consequently, as in everyday communication, respondents may transform the information given explicitly by the experimenter by adding information they assume to be relevant but omitted by a cooperative experimenter who assumed that such information was implicitly shared. Alternatively, they may assume that all the information given by the experimenter must be relevant, otherwise why mention it? Or, they may assume that the order in which the information is presented indicates its degree of importance or relevance to the judgment task.

In each case, the respondent goes beyond the information given (or intended to be given) by the experimenter. Such departures from the explicit reasoning task may not be so much the result of an individual's failure to apply normative rules of inference properly to the information given (the cognitive bias explanation) but to the socially skilled application of shared rules of message interpretation (the conversational inference interpretation). These rules of inference have a quite general application. Thus, undermining the assumption of intentionality reduces biases in such diverse tasks as Piagetian conservation tasks, the engineers-and-lawyers task of Tversky and Kahneman (1974), and the leading questions paradigm of Loftus and Palmer (1974). Another example is the similar kinds of experimental demands created by juxtaposing questions comparing specific and general quantities in tasks involving conservation, object naming, probability judgments, and survey judgments of life satisfaction. Conversational inference thus has general features that emerge in a wide range of tasks.

In particular, I have argued that two important features of conversational inferences are their ampliativeness and their defeasibility. Like good inductions, good conversational inferences go beyond the information given and can be corrected by empirical evidence. However, these general properties of conversational inference are in direct conflict with basic assumptions of much judgment research, as is discussed below.

Implications of Conversational Inference for the Thesis of Negative Rationality

According to the logic of conversation, respondents may interpret what is said to them in particular ways and be justified in adding extra premises that seem to be relevant in interpreting what is said. 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, such as Bayes' rule for probabilistic inference tasks (Tversky & Kahneman, 1974) or the assumption of reversibility of logical operations for conservation tasks (Inhelder & Piaget, 1958).

In the negative rationality perspective (Rommetveit, 1978), errors are defined by deviations from the predictions of the normative model. 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, elaborate, or reinterpret 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 participant'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.

The inductive nature of conversational inference suggests that many of the experimental results that have been attributed to faulty reasoning may be reinterpreted as being due to rational interpretations of experimenter-given information. However, the attributional model of conversational inference does not imply that respondents never make bona fide errors of reasoning. Rather, better specification of these inference processes should enable researchers to identify cases in which mistakes may be attributable to conversationally guided interpretations of the judgment task, as opposed to cases in which mistakes are due to genuine errors of reasoning. Below, I consider how the present framework can help classify errors more clearly, by either explicitly controlling respondents' assumptions about the conversational relevance of information or assessing the representations built on the basis of such assumptions.

Controlling for Conversational Inference: Methodological Implications

The present framework suggests that the interpretation of experimenter-given information should be systematically investigated and controlled for in experimental and survey research. Although the research reported in this review gives support to the attributional model of conversational inference, much of it was not conducted with this model in mind and therefore did not examine variables that would enable a full test of the model. Below, I suggest some general methodological procedures that can aid in this task.

First, as suggested by the attributional model of conversational inference, assumptions about the source of a message can be manipulated or otherwise controlled. For example, the basic assumption of conversational inference that the source is intentional can be undermined by persuading the respondent that the information provided has been randomly generated (e.g., by computer) or has been generated by the respondent (e.g., through the respondent's own search efforts).

Second, even where the source is intentional, the respondent's perception of the reliability of the source may be affected by the cooperativeness or knowledgeability of the source. As argued above (e.g., Dulany & Hilton, 1991), the inference that what is left unsaid did not in fact happen because it would otherwise have been mentioned by a cooperative and knowledgeable speaker rests on attributions about the speaker. These attributions can be measured and manipulated. For example, the intuition that a witness who gives more details is more credible (although precise descriptions must necessarily have less chance of being true than vague ones, see Macdonald, 1986) may rest on the assumption that detailed testimony indicates a clear mind, attentiveness, and first-hand experience of the event in question. However, where detailed testimony indicates unreliability (e.g., when it seems improbable that any witness could form a coherent and detailed impression of the scene, for example, in the seconds after the assassination of President John F. Kennedy), it may be perceived as less probable than a fleeting description of the scene. Such questions are open to empirical verification.

Third, key words should be checked for conventional implicatures. Words such as *but* and *although* suggest an adversative relation between items of information and signal the experimenter's expectancies. Likewise, quantifiers such as *a few* and *few,* and adverbs such as *occasionally* and *seldom,* signal the speaker's focus of interest (e.g., on reasons for doing or not doing, respectively). Although words signaling conventional implicatures are few (Grice, 1968), they are frequently used. Consequently, where their use may signal the experimenter's hypothesis, they should be suppressed, or alternatively, dual versions of the task should be created that signal both the hypothesis and its contrary (e.g., the use of *occasionally* in tests of the norm theory, Kahneman & Miller, 1986, p. 143). For example, Krosnick et al. (1990) made use of this technique in comparing the effects of *but* and *although* on the integration of base-rate and diagnostic information.

Fourth, experimenters need to be fully sensitive to conversational implicatures. For example, Tversky and Kahneman (1983) were quite aware of conversational explanations of the conjunction fallacy and tried to rebut these with a direct phrasing of the conjunction. However, their extensional phrasing "Linda is a bank teller whether or not she is a feminist" (the intended meaning is "bank teller and either feminist or not a feminist") can be rationally understood as "Linda is a bank teller even if she is a feminist" (the conveyed meaning is "bank teller and feminist"), just as the everyday phrase "Let's go to the zoo whether or not it rains" conveys "Let's go to the zoo even if it does rain." Such examples suggest that even those psychologists sensitive to conversational processes may benefit from a deeper consideration of the nature of conversational implicature (cf. Adler, 1991).

Fifth, respondents' interpretations of experimenter-given information can be checked by either multiple-choice check methods or analysis of open-ended protocols (e.g., Dulany & Hilton, 1991; Macchi, 1991). Of course, to be effective, the coding of such data needs to be in terms of categories that can be justified on theoretical grounds.

Sixth, the production of open-ended responses may be controlled by explicitly instructing respondents to maximize the maxim of either quality or quantity. Such variation in instructions has been shown to affect respondents' verbal protocols (Fiedler, Semin, & Bolten, 1989) and may be a useful technique in exploring respondents' representations of their task. For example, respondents may be more likely to include inferred conversational implicatures in a verbal protocol when told to be as informative as possible, but less so if instructed to stick as close as possible to the truth.

Seventh, researchers need to test for evidence supporting the implication of any nonconversational variables they hypothesize as causing a pattern of judgment. For example, theorists have sometimes made claims about the role of cognitive variables in judgment such as salience (Trope & Ginossar, 1988) or causal relevance (Tversky & Kahneman, 1980), without collecting relevant recall, recognition, and belief measures. That they have not felt the need to do so perhaps testifies to a perception shared by editors and reviewers that a plausible alternative position does not exist. In the future, more studies should include measures that test for the operation of both cognitive biases and conversational inference processes.

Eighth, if changes with age in performance on various reasoning tasks are due to development of conversational inference strategies, then such changes should appear simultaneously on several tasks. For example, if young children's failure in the conservation task and their use of the mutual exclusivity assumption in word learning are both dependent on their assumption that the experimenter is respecting the given–new contract, then an ability to recognize that the given–new contract is not being respected should lead to simultaneous changes on both tasks.

Finally, data should be sought that distinguishes conversational and cognitive bias explanations. For example, Bar-Hillel and Neter (1993) reported an experiment in which monetary incentives failed to remove a misinterpretation of a reasoning task (cf. Wolford et al., 1990). However, it is not clear why increasing the financial stakes in an experiment should cause respondents to abandon an interpretation that is pragmatically correct and rational. Recall that Tetlock and Boettger (1991) manipulated their respondents' conversational interpretations of the judgment task by undermining the respondents' assumption of intentionality. Respondents then rejected or used nondiagnostic information on the basis of its perceived conversational relevance. Then they found that accountability manipulations, which, like monetary incentives, should accentuate the value of getting a right answer, simply amplified the effect of conversational relevance, suggesting that incentives simply made respondents adhere more strongly to the answer that seemed conversationally rational. Incentives are not going to make respondents drop a conversationally rational interpretation in favor of a less plausible one in the context.

The above issue highlights a difference between the conversational inference approach to rationality and others that argue that a larger context than the experiment should be taken into account in establishing rational judgment. For example, one approach has been to accept that heuristics or logically suboptimal rules of thumb are used, but they are used flexibly and rationally with an eye to the costs and benefits of accurate inference and are thus normative (Payne, Bettman, & Johnson, 1993). However, when the decision is important, respondents use more accurate but resource-expensive strategies. Like Tet-

lock's (1992) accountability approach, this perspective therefore predicts that performance becomes more accurate where the decision outcomes become more important. However, as noted above, the conversational inference approach does not predict that increased incentives lead respondents to change an interpretation that seems rational in the context.

A clear list of criteria and methods for specifying and controlling conversational inference will also enable conversational absolutions of errors to be distinguished from others. For example, Fiedler (1988) showed a dramatic reduction in Tversky and Kahneman's (1983) conjunction effect by framing the task in terms of frequencies rather than probabilities. If the frequentistic frame changed the way respondents interpreted the task (cf. Dulany & Hilton, 1991), then this effect could fairly be considered conversational, if not then another presumably cognitive bias explanation of this improved performance should be considered.

In some cases, investigators have used multiple methods to evaluate claims about biases. For example, in a variant of the engineer-and-lawyer study, Kahneman and Tversky (1973) not only gave respondents personality descriptions and then asked them to estimate the probability that the person described would major in a number of subjects but also to give the base rate of people majoring in that subject. They found that respondents underused their own base-rate information—an error that cannot be attributed to conversational inference processes as defined in this article. Although underuse of base-rate information may occur in certain conditions, this should not be taken as invalidating the current perspective. Understanding how the conversational factors reviewed earlier, such as source characteristics, information order, and question-phrasing, influence use of base-rate information help us better understand when its underuse is truly due to cognitive shortcomings rather than to communicational factors.

Controlling for Conversational Inference in the Identification of Errors of Reasoning

It may therefore be that many patterns of judgment that have been classified as errors appear quite rational when systematic and normal processes of conversational inference are taken into account. However, the approach also allows us to deem as irrational errors that cannot be explained by processes of conversational inference. For example, Tversky and Kahneman (1974) reported that numerical anchors produced randomly by a roulette wheel biased subsequent estimates of the number of African countries in the United Nations. Because randomness prevents the attribution of intentionality to the number given as an anchor, such an effect can only be the result of a cognitive bias. Likewise, Tetlock's (1985) finding that anchoring effects are reduced by making respondents accountable for their judgments are consistent with the heuristics view that the effect can be reduced with incentives inducing more cognitive effort.

However, other effects attributable to anchoring with insufficient adjustment may in fact be the result of conversational factors (e.g., a tendency to treat early information as more important) if presented in conversational form (e.g., Krosnick et al., 1990). For example, R. Brown (1986) gave an insightful analysis of Asch's (1946) impression formation paradigm that 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. According to R. Brown, traits that come later in a description of a person's character (e.g., kind) are likely to have less effect if they are redundant with earlier traits (e.g., honest) that are used to predict them. For this primacy effect to be classified as nonconversational in nature, for example, it should be shown to be reduced by accountability instructions (Tetlock, 1985) and also to occur in conditions where respondents have been made to believe that the information was presented in random order.

Conclusions

Judgments about the intended meaning of utterances are themselves judgments under uncertainty. The likely intended meaning is likely to be affected by the hearer's perceptions about the speaker. The implication for psychological experiments on rationality is that respondents' answers may not deviate from what might be expected from a normative model because of an individual's cognitive shortcomings, but because of the application of consensually shared rules of conversational inference.

Like previous work on experimental demand effects, the attributional model of conversational inference predicts that source characteristics affect the experimental respondent's performance. However, previous work on source effects has focused on how respondents comply with experimental demands, for example, by detecting the experimenter's hypothesis and producing the desired behavior (Orne, 1962; Rosenthal & Rubin, 1978). The present approach focuses on how respondents deviate from the judgments predicted by the normative model considered relevant by the experimenter by using rules of conversational inference very different than those assumed by the experimenter.

Understanding conversational inference may help clarify the question as to which normative model is appropriate in a given situation. Thus, various writers have addressed 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 respondents' 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). One advantage of the conversational framework is, of course, that it can help identify how responses reflect one reasoning process more so than another by better specifying the implicit premises that the respondent derives from the information explicitly given. For example, Hilton (1990a, 1991) showed how laypeople's causal attributions can be seen to follow a normative model of causal inference, namely the analysis of variance, when the role of presupposed knowledge in completing the data matrix necessary for the computation of an analysis of variance or its equivalent is taken into account.

Recognition of the conversational context of the psychology experiment thus may enable researchers to better recognize the rationality of respondents' judgments. However, it is also important to recognize how processes of conversational inference may produce errors in real-world settings. This could happen in

several ways. First, hearers may be inaccurate in their perceptions of speakers, thus causing them to misinterpret utterances. Although this is a common source of miscommunication, it may be that some errors in social perception are systematic. For example, Fussell and Krauss (1992) suggested that hearers overestimate the mutual knowledge they share with speakers because of the false consensus effect. Second, as Levinson (in press) suggested, many reasoning heuristics may have evolved because they are adaptive in contexts of social interaction. For example, the expectation that errors of interpretation will be quickly repaired may be correct when we are interacting with a human being but incorrect when managing a complex system such as an aircraft, a nuclear power plant, or an economy. The evolutionary adaptiveness of such an expectation to a conversational setting may explain why people are so bad at dealing with lagged feedback in other settings.

Recognition of linguistic and conversational factors may also have practical implications for facilitating statistical reasoning. Presentations of numerical information in terms of frequencies rather than probabilities (Fiedler, 1988) or that make set–superset relations clear (Macchi, 1991) are likely to facilitate correct understanding of statistical problems. Clearly, newspapers and other media should take advantage of this.

Thus, the attributional model of conversational inference introduces a social dimension to the study of reasoning and inference. It suggests that no utterance is depersonalized, that all messages have a source, and that reasoning and inference processes typically operate on socially communicated information. However, it does by no means deny the importance of cognitive processes. Rather, it argues that the processes of inference, reasoning, and understanding are shaped by interpersonal assumptions, even in supposedly neutral settings such as the laboratory experiment or survey questionnaire. As such it offers a view of social cognition other than the application of cognitive psychology to the understanding of how information is processed about social objects, important though this enterprise is (see Fiske & Taylor, 1991, for a review). Instead, by locating reasoning and inference processes in communicative settings, the attributional model of conversational inference offers another view of social cognition, namely, the social psychology of higher mental processes.

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Appendix

Grice's (1975) Cooperative Principle and the Maxims of Conversation

The Cooperative 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 Maxims of Quality

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

(a) Do not say what you believe to be false.

(b) Do not say that for which you lack adequate evidence.

The Maxims of Quantity

(a) Make your contribution as informative as is required for the current purposes of the exchange.

(b) Do not make your contribution more informative than is required.

The Maxim of Relation

Make your contributions relevant.

The Maxims of Manner

(a) Avoid obscurity.

(b) Avoid ambiguity.

(c) Be brief.

(d) Be orderly.

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