COUNTERFACTUAL CONDITIONALS AND THE CONJUNCTION FALLACY

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INTRODUCTION

A counterfactual conditional is a statement of the form:

(1) If X were the case, then Y would be the case.

where X is a proposition that is not true in the current situation. The following are examples of counterfactual conditionals:

(2) If John F. Kennedy had not been assassinated, he would have run for the presidency in 1964.

(3) If John F. Kennedy had not been assassinated, U.S. involvement in Vietnam would have ended by 1968.

For brevity, we will refer to such statements as counterfactuals.

We are concerned here with the mental processes underlying judgments of whether a counterfactual is true or false. We will argue that intuitive verification of counterfactuals is based on judgments of representativeness like those described by Kahneman and Tversky (1972, 1973). In ways to be made precise, we propose that a counterfactual is judged to be true to the extent that the hypothetical situation described in the counterfactual is thought to be similar to the actual world as we know it. The idea that the truth of a counterfactual depends on the similarity of alternative, hypothetical situations to the actual world is not new. This notion is captured in a possible worlds semantic analysis of counterfactuals (Lewis, 1973; Stalnaker, 1968).

What is new, however, is that we have found systematic fallacies in the intuitive verification of counterfactuals that are analogous to representativeness errors in probabilistic reasoning. Experimental evidence will be presented, showing that intuitive judgments of the truth of counterfactuals systematically violate implications of the possible worlds semantics for counterfactuals. To explain our results, we first discuss possible worlds semantics for counterfactuals. Next we describe conjunction fallacies in probabilistic reasoning discovered by Tversky and Kahneman (1983), and suggest how analogous fallacies might be found in counterfactual reasoning. We then present experimental evidence demonstrating conjunction fallacies in counterfactual reasoning. Our results also establish the existence of disjunction fallacies in counterfactual reasoning.

STALNAKER'S POSSIBLE WORLDS SEMANTICS FOR COUNTERFACTUALS

Philosophers have long recognized that counterfactual inference is fundamental to scientific epistemology (Chisholm, 1946; Goodman, 1955). Here, we cannot discuss the general role of counterfactual inference in epistemology, but will restrict our discussion to a semantic analysis of counterfactuals developed by Stalnaker and Thomason (Stalnaker, 1968; Stalnaker & Thomason, 1970; Thomason, 1970). Our purpose is to derive certain semantic relations among counterfactuals that are subject to experimental test. These relations can also be derived in Lewis's (1973) semantics for counterfactuals, but his analysis contains complexities whose discussion must be omitted for the sake of brevity.

Stalnaker (1968) proposed a logical analysis of counterfactuals using possible worlds semantics as developed by Kripke (1963). In Kripke's semantics, propositions are not simply true or false; rather they are true or false relative to a possible world. A proposition might be true in some worlds, and false in others. Stalnaker's analysis assumes that possible worlds are related by degrees of similarity. Furthermore, he makes the strong assumption that for any world i and proposition X, if there exists any world in which X is true, then there exists a unique world that is most similar to i in which X is true (X is false in every world if it is self-contradictory).

Let X ==> Y symbolize a counterfactual of the form (1). Stalnaker proposed that X ==> Y is true at the world i if and only if either (a) there is no world at which X is true, or (b) Y is true in the world k, where k is the unique world such that X is true in k and k is most similar to i. Clause (a) of this truth condition merely excludes trivial cases, e.g., "If 2 + 2 = 3, then the national debt would be eliminated" is true because there are no worlds in which 2 + 2 = 3. Clause (b) of the truth condition is the heart of Stalnaker's analysis. To evaluate the truth of X ==> Y at the world i, we find the most similar world k where X is true. If Y is true in k, then X ==> Y is true; if Y is false in k, then X ==> Y is false. For example, to decide whether statement (2) is true relative to the actual world, we must check whether John F. Kennedy ran for president in 1964 in the most similar world where he was not assassinated. If he ran, then (2) is true; otherwise (2) is false.

Let Y AND Z and Y OR Z denote, respectively, the truth functional conjunction and disjunction of Y and Z. In Stalnaker's analysis, truth functional implications are logically valid. Thus if Y AND Z is true in world i, then Y must be true in i and Z must be true in i. Similarly, if Y OR Z is true in i, then Y must be true in i, or Z must be true in i, or both. This leads to two critical implications of Stalnaker's theory. First, if X ==> Y AND Z is true at world i, then X ==> Y and X ==> Z must also be true at world i. Second, if X ==> Y OR Z is true at world i, then either X ==> Y or X ==> Z must be true at world i. For example, consider the following statements:

(4) If John F. Kennedy had not been assassinated, he would have run for the presidency in 1964, and U.S. involvement in Vietnam would have ended by 1968.

(5) If John F. Kennedy had not been assassinated, he would have run for the presidency in 1964, or U.S. involvement in Vietnam would have ended by 1968.

Statements (2)-(5) have the respective forms, X ==> Y, X ==> Z, X ==> Y AND Z, and X ==> Y OR Z. Let k denote the most similar world where John F. Kennedy was not assassinated. Stalnaker's analysis claims that (4) is true if and only if in the world k, John F. Kennedy ran for the presidency in 1964 and U.S. involvement in Vietnam ended by 1968. Thus, if (4) is true, (2) is true because John F. Kennedy ran for the presidency in k, and (3) is true because U.S. involvement in Vietnam ended by 1968 in k. Similarly, if (5) is true, then in the world k, either Kennedy ran for president in 1964, or U.S. involvement in Vietnam ended by 1968, or both. Therefore, if (5) is true, either (2) is true or (3) is true, or both. These examples suggest the following:

(6) If a counterfactual with a conjunctive consequent is true, then the counterfactuals with either clause of the conjunction as consequent are also true.

(7) If a counterfactual with a disjunctive consequent is true, then the counterfactuals with either clause of the disjunction as consequents cannot both be false.

It is easy to show that (6) and (7) are implied by Stalnaker's theory, and also by Lewis's (1973) generalization of Stalnaker's theory. Our experimental results suggest that (6) and (7) are both violated in intuitive reasoning.

CONJUNCTION FALLACIES IN PROBABILISTIC REASONING

Tversky and Kahneman (1983) have shown that intuitive judgments of probability systematically violate the principle that the probability of a conjunction of events can never exceed the probabilities of its constituent events. Let P(Y AND Z), P(Y) and P(Z) denote the probabilities of Y AND Z, Y, and Z, respectively. When P(Y AND Z) is judged to be greater than either P(Y) or P(Z), the judgment is said to constitute a conjunction fallacy. Tversky and Kahneman found that if Y is a highly representative outcome, and Z is mildly unrepresentative, then P(Y AND Z) will often be judged greater than P(Z).

For example, suppose that Linda is described to be 31 years old, single, and deeply concerned about social issues. A representative outcome would be the outcome Y that Linda is active in the feminist movement, and an unrepresentative outcome would be the outcome Z that Linda is a bank teller. By the laws of probability, it is more likely that Linda is a bank teller than that she is both a bank teller and active in the feminist movement. Tversky and Kahneman (1983) found that 85% of 142 subjects judged Y AND Z to be more probable than Z alone. Similar examples of conjunction fallacies have been elicited in many contexts, using a variety of stimulus materials and modes of response (Tversky & Kahneman, 1983; Leddo et al., 1984).

Why do conjunction fallacies occur? Kahneman and Tversky have argued that the judged probability of events is often determined by the representativeness of the events (Kahneman & Tversky, 1972, 1973; Tversky & Kahneman, 1971, 1982). Although the concept of representativeness itself has several aspects to it (see Tversky & Kahneman, 1982), for present purposes representativeness can be construed as the degree of similarity of an instance to typical members of a class or category. For example, the description of Linda is similar to that of a prototypical feminist, hence being active in the feminist movement is representative of Linda. Linda's description is not particularly similar to that of a bank teller, thus working as a bank teller is mildly unrepresentative of Linda. An independent sample of subjects judged Linda to be most similar to an active feminist, least similar to a bank teller, and of intermediate similarity to a bank teller who is active in the feminist movement (Tversky & Kahneman, 1983). Note that the ranking of outcomes by judged similarity coincides with the rankings of the outcomes by judged probability, as predicted by the hypothesis that probability judgments are based on the representativeness of outcomes.

As demonstrated by the Linda example, an instance (Linda) can be more similar to a conjunction of categories (bank teller and active feminist), than to one of the categories alone. Tversky (1977) has proposed a theory of similarity according to which the similarity of objects is an increasing function of the features shared by the objects, and a decreasing function of the features that distinguish the objects. If the category Y is representative of an instance and Z is not, the conjunction Y AND Z will share more features with the instance than Z alone. Thus, an instance will be more similar to a conjunction of representative and unrepresentative categories, than to the unrepresentative category alone. Tversky and Kahneman explain the occurrence of conjunction fallacies by combining the representativeness hypothesis with Tversky's theory of similarity. Events will be regarded as more probable if they are more representative. A conjunction of events will appear more representative of an instance than one of the events in the conjunction if the conjunction shares more features with the instance than does the single event. When this occurs, the conjunction of events will appear more probable than the single event.

CONJUNCTION FALLACIES IN COUNTERFACTUAL REASONING

We propose that representativeness also plays a fundamental role in counterfactual reasoning. In judging whether X ==> Y is true, we postulate that the individual evaluates whether X AND Y or X AND NOT Y is more representative of the actual situation. If X AND Y is much more representative, X ==> Y will be judged to be true. If X AND NOT Y is much more representative, X ==> NOT Y will be judged to be true. Finally, if neither X AND Y nor X AND NOT Y is clearly more representative, then neither counterfactual will be judged to be true, but the counterpossible ("If X were the case, then Y might be the case") will be judged to be true.

If intuitive verification of counterfactuals is based on representativeness, conjunction fallacies in counterfactual reasoning should be easy to construct. Consider statements (2)-(5) above. If John F. Kennedy had not been assassinated (X), then his running for president in 1964 (Y) is a representative outcome, but the ending of U.S. involvement in Vietnam by 1968 (Z) is rather unrepresentative. We conjecture that the combination X AND Y is more representative than X AND Y AND Z, which is more representative than X AND Z. Hence the counterfactual (2) should be more plausible than (4), which should be more plausible than (3). Symbolically, X ==> Y should be more plausible than X ==> Y AND Z, which should be more plausible than X ==> Z.

The Stalnaker/Lewis semantics implies that in no instance can X ==> Y AND Z be true if X ==> Z is false. Here we will present evidence that violations of this principle can be found in the judged degree of truth of counterfactuals. In our experiment, subjects were presented with a story which they were told to regard as reliable information, and then were asked to rate the degree of truth of counterfactuals pertaining to the story. The counterfactuals were chosen as matched sets of the form:

X ==> Y	(Representative statement)
X ==> Z	(Neutral statement)
X ==> Y AND Z	(Conjunction statement)
X ==> Y OR Z	(Disjunction statement)

We chose propositions X, Y and Z such that in the context of the story, Y would have been a representative outcome, and Z would have been neither clearly representative nor unrepresentative if X had been the case. For any matched set, Y will be called the representative statement and Z the neutral statement of that set. Our hypothesis is that a subject will rate X ==> Y AND Z as more true than X ==> Z. If this pattern of ratings is observed, we will say that the subject has committed a conjunction fallacy.

METHOD

Subjects. Subjects were 280 undergraduates at the University of Washington who participated in the experiment for credit in a psychology course. Subjects were run in small groups in sessions lasting about 15 minutes. Eight subjects were dropped from the experiment because they failed to follow instructions.

Materials. Two stories, "Donald" and "Harper City," were written for the experiment. For each story, two matched sets of four related counterfactuals were prepared, along with two anchoring statements. One anchoring statement was obviously true and the other was obviously false. When subjects were asked to rate the truth of counterfactuals, the anchoring statements were presented first in order to elicit extreme judgments that would mitigate end effects in the rating response (cf. Anderson, 1982). An abbreviated version of one story and a matched set of related counterfactuals is presented below.

> Harper City is a port town on the Gulf Coast that has enjoyed a booming economy because of productive oil wells and prosperous fishing industry. Local tax revenues created a large surplus in the city treasury that the citizens targeted for city improvement. Because interest in sports was intense and widespread, a coalition of citizens and business interests lobbied for the construction of a football stadium, with the intention of attracting a professional football franchise to the city. There was also some support for replacing the public library with a new facility. Unfortunately, Harper City was struck by a hurricane last year. The damage was severe. The cost of cleaning up the city and replacing buildings that had been destroyed, including the library, was so great that the people of Harper City were forced to drop all plans for civic improvement.

R1. If the hurricane had not struck, the people of Harper City would have decided to build a professional football stadium. (Representative)

N1. If the hurricane had not struck, the people of Harper City would have decided to build a new public library. (Neutral)

C1. If the hurricane had not struck, the people of Harper City would have decided to build a professional football stadium and a new public library. (Conjunction)

D1. If the hurricane had not struck, the people of Harper City would have decided to build a professional football stadium or a new public library. (Disjunction)

Each subject received one story and rated the truth of the statements associated with the story. All subjects rated the anchoring statements, two representative statements, two neutral statements, and two conjunction statements. A subset of subjects also rated the two disjunction statements. The order of the statements was varied twelve ways for each story, with anchoring statements preceding all other statements. Each statement was rated by marking a slash through a horizontal response line, labeled "virtually impossible," "somewhat unlikely," "somewhat likely," and "virtually certain," from left to right. Responses were coded by dividing the response line into 20 equal intervals, with 1 denoting the greatest certainty that the statement was false, and 20 the greatest certainty that the statement was true.

We should mention a typographical error in one disjunction statement of the "Donald" story. Donald is a high school football player who broke his leg before the season and thus could not play. The counterfactual antecedent X asks what would have happened if he had been able to play football. The representative outcome Y is that he would have been captain of the football team. The neutral outcome Z is that his grade point average would have been 3.4. The representative, neutral and conjunction statements have the respective forms X ==> Y, X ==> Z, and X ==> Y AND Z. Unfortunately, the disjunction statement had the form X ==> Y OR Q, where Q asserts that Donald's grade point average would have been 3.5. This typographical error does not affect the comparisons of conjunction statement to neutral statement, or of the disjunction statement to representative statement. The Stalnaker/Lewis semantics predicts that X ==> Y AND Z should receive a lower rating than X ==> Z, and that X ==> Y OR Q should receive a higher rating than X ==> Y. We predict that the opposite will occur, based on considerations of representativeness.

Design and Procedure. Subjects were informed that the study concerned reasoning about hypothetical events. Subjects read a story which they were instructed to regard as reliable information from a news magazine, and were asked to rate the truth of the counterfactuals associated with the story. The use of the response line was explained, the anchoring statements were identified, and subjects were instructed to give the true anchor the highest rating, and the false anchor the lowest rating among all statements. A total of 133 subjects rated representative, neutral, and conjunction statements based on "Donald", with 57 of these subjects also rating disjunction statements. Representative, neutral, and conjunction statements based on "Harper City" were rated by 139 subjects, with 56 subjects also rating disjunction statements. All dependent variables were within subject variables.

RESULTS AND DISCUSSION

In the following analysis, the term conjunction fallacy will be reserved for cases where the rating of a conjunction statement is greater than the rating of a corresponding neutral statement. This operational definition of a conjunction fallacy is conservative, for it underestimates the true prevalence of conjunction fallacies (it omits cases where the conjunction statement is rated higher than the representative statement, but not the neutral state-

TABLE 1
Median Ratings of Statements: All Subjects

	Harper City N = 139		Donald N = 133	
	Set 1	Set 2	Set 3	Set 4
Representative	15.4	15.9	16.1	14.1
Neutral	10.6	10.3	9.4	7.0
Conjunction	12.5	13.2	11.4	7.9

TABLE 2
Conjunction Statements versus Neutral Statements:
All Subjects

	N	Ties	% Conjunction Fallacies	Signed Ranks Test z score	Signed Ranks Test p value
Set 1	139	16	67%	-4.148	.000
Set 2	139	20	71%	-6.168	.000
Set 3	133	20	56%	-1.145	.252
Set 4	133	21	64%	-2.236	.025

ment). The adoption of this conservative policy is suggested by statistical issues which cannot be discussed here*.

Table 1 presents median ratings of conjunction, representative and neutral statements. Note that in every case, the conjunction statement receives a higher median rating than the corresponding neutral statement. Three of the four median ratings were significantly higher for the conjunction statement ($p < .05$, two-tailed Wilcoxon signed ranks test). Table 2 lists z scores for the signed ranks tests, and the percentage of subjects who rated conjunction statements over corresponding neutral statements. In every case, the majority of the subjects produced conjunction fallacies. The three largest percentages are significantly greater than .5 ($p < .01$, two-tailed sign test).

These findings conclusively demonstrate the existence of conjunction fallacies, for even if some conjunction fallacies were due to random variation in ratings, one would not expect the median rating of conjunctions to exceed the median rating of neutral statements, nor would one expect the probability of conjunction fallacies to exceed .5. It might be argued that subjects have misinterpreted "and" as "or," i.e., interpreted the conjunction statements as

* We wish to thank Bob Frick for useful criticism of our statistical analysis, and Elizabeth Moore for advice on computation.

TABLE 3

Median Ratings of Statements:
Subjects Who Rated Disjunction Statements

	Harper City N = 56		Donald N = 57	
	Set 1	Set 2	Set 3	Set 4
Representative	16.2	15.5	16.9	16.0
Neutral	10.0	8.5	8.3	6.7
Conjunction	13.5	13.5	12.8	8.2
Disjunction	15.5	15.5	14.6	8.0

TABLE 4

Conjunction Statements versus Disjunction Statements[a]:
Subjects Who Rated Disjunction Statements

	N	Ties	Signed Ranks Test z score	Signed Ranks Test p value
Set 1	56	14	-2.882	.004
Set 2	56	7	-3.293	.001
Set 3	57	5	-4.107	.000

[a] The conjunction and disjunction statements of set 4 are not directly comparable due to a typographical error. (See methods section.)

disjunction statements. Tables 3 and 4 show that three of four disjunction statements received significantly higher median ratings than corresponding conjunction statements ($p < .005$, signed ranks test).

The Stalnaker/Lewis semantics also predicts that a disjunction statement will receive an equal or higher rating than the corresponding representative statement. Contrary to this prediction, three of four disjunction statements received lower median ratings than the corresponding representative statements (Tables 3 and 5). Two of the four differences in median rating were highly significant ($p < .005$, two-tailed signed ranks test). It should be noted that the statistical test is conservative in that it tests the null hypothesis of no difference in median ratings. This hypothesis essentially claims that subjects do not distinguish disjunction statements from representative statements. Under the more plausible assumption that subjects do distinguish these statements, the Stalnaker/Lewis semantics would predict that disjunction statements would receive higher median ratings than representative statements. Thus, even in the two cases where the difference in median ratings were not significantly different, the percentage of disjunction fallacies was close to

TABLE 5
Disjunction Statements versus Representative Statements:
Subjects Who Rated Disjunction Statements

	N	Ties	% Disjunction Fallacies	Signed Ranks Test z score	p value
Set 1	56	10	52%	-1.903	.275
Set 2	56	9	49%	-0.825	.409
Set 3	57	8	69%	-2.860	.004
Set 4	57	2	98%	-6.422	.000

50%, a much higher percentage than one would expect if the fallacies were due only to random variation in rating responses.

To develop a representativeness analysis of disjunction fallacies, one needs an account of the representativeness of disjunctions. Tversky (1977) proposed that that the similarity of objects A and B increases with the number of features common to A and B, and decreases with the number of features that distinguish A from B, and B from A. Although the situation described by a disjunction statement would seem to have more features in common with the actual world, it also has more distinguishing features. Hence, whether disjunction fallacies occur may depend on the balance of the common and distinguishing features. Although disjunction fallacies have not been demonstrated in probabilistic reasoning, our results for counterfactuals suggest that similar results can also be obtained for probability judgment. If this is so, a representativeness analysis of disjunctive events will be required whether or not one accepts the extension of representativeness to the analysis of counterfactuals.

CONCLUSION

The Stalnaker/Lewis semantics fails to describe the intuitive verification of counterfactuals because truth functional consequences are valid in any possible world, and conjunction and disjunction fallacies violate truth functional implications. We propose that intuitive verification of counterfactuals is based on a judgment of relative representativeness. The individual compares the representativeness of a situation or scenario where the antecedent and consequent of the counterfactual are true, to the representativeness of a situation where the antecedent is true and the consequent is false. Conjunction fallacies occur when the antecedent and conjunctive consequent are more representative than the antecedent and one clause of the conjunction. Disjunction fallacies occur when the antecedent and disjunctive consequent are less representative than the antecedent and one clause of the disjunction.

One way to contrast the two analyses is to consider what entities are claimed to enter into similarity relations. The Stalnaker/Lewis semantics proposes that degree of similarity applies to possible worlds, i.e., entities that completely determine the truth or falsity of every proposition. Our analysis proposes that degree of similarity applies to sets of features that characterize situations or scenarios. Tversky's (1977) similarity model suggests how a situation where a conjunction is true might be more similar to the actual world than a situation where a single clause of the conjunction is true. This is paradoxical from the possible worlds standpoint, for the most similar world where a conjunction is true could never be more similar than every world where one clause of the conjunction is true. Our results thus suggest that the mental representation of similarity, and the entities to which similarity applies are rather different from structures assumed in the possible worlds semantics.

A common objection to studies attempting to demonstrate logical errors in human reasoning is the claim that the subjects may have failed to interpret the questions in the manner intended by the experimenter (Henle, 1962). The study reported above contains no control for the possibility that X ==> Z was interpreted as X ==> Z AND NOT Y, a circumstance which could yield apparent conjunction fallacies without logical error. Tversky and Kahneman (1983) and Pennington (1984) have conducted studies of probabilistic reasoning which attempt to exclude this interpretation. In one study, ratings of conjunctions were elicited from one group, and ratings of neutral statements from another group. The between subjects design also yields conjunction fallacies. Another study explicitly asked subjects to evaluate the probability of Z whether or not Y was true. Again, conjunction fallacies were prevalent.

Counterfactual conjunction and disjunction fallacies are symptomatic of the difference between truth in a possible world as the logician understands it, and realization in the mental construction of a situation or scenario. Mental constructions are affected by representational and processing constraints that are usually ignored in model theoretic semantics. When we better understand the factors influencing judgments of the truth of counterfactuals, it may be possible to use the cognitive theory of counterfactual judgment to elucidate causal and dispositional conceptions that appear to depend on counterfactual inference.

REFERENCES

Anderson, N. H. (1982). *Methods of information integration theory*. New York: Academic Press.

Chisholm, R. M. (1947). The contrary-to-fact conditional. *Mind*, *56*, 289-307.

Goodman, N. (1955). The problem of counterfactual conditionals. In N. Goodman, *Fact fiction and forecast*. New York: Bobbs-Merrill.

Henle, M. (1962). On the relation between logic and thinking. Psychological Review, 69, 366-378.

Kahneman, D. & Tversky, A. (1972). Subjective probability: A judgment of representativeness. Cognitive Psychology, 3, 430-454.

Kahneman, D. & Tversky, A. (1973). On the psychology of prediction. Psychological Review, 80, 237-251.

Kripke, S. A. (1963). Semantical analysis of modal logic 1. Normal modal propositional calculi. Zeitschrift fur Mathematische Logik und Grundlagen der Mathemathik, 9, 67-96.

Leddo, J., Abelson, R. P., & Gross, P. (1984). Conjunctive explanations: When two reasons are better than one. Journal of Personality and Social Psychology, 47, 933-943.

Lewis, D. (1973). Counterfactuals. Oxford, UK: Blackwell.

Pennington, N. (1984). Technical note on conjunctive explanations. Center for Decision Research, Graduate School of Business, The University of Chicago.

Stalnaker, R. C. (1968). A theory of conditionals. In N. Rescher (Ed.), Studies in logical theory. Oxford, UK: Blackwell.

Stalnaker, R. C., & Thomason, R. H. (1970). A semantic analysis of conditional logic. Theoria, 36, 23-42.

Thomason, R. H. (1970). A Fitch-style formulation of conditional logic. Logique et Analyse, (New Series Vol. 13), 397-412.

Tversky, A. (1977). Features of similarity. Psychological Review, 84, 327-352.

Tversky, A., & Kahneman, D. (1971). Belief in the law of small numbers. Psychological Bulletin, 2, 105-110.

Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. Science, 185, 1124-1131.

Tversky, A., & Kahneman, D. (1982). Judgments of and by representativeness. In D. Kahneman, P. Slovic, & A. Tversky (Eds.), Judgment under uncertainty: Heuristics and biases. Cambridge, UK: Cambridge University Press.

Tversky, A., & Kahneman, D. (1983). Extensional versus intuitive reasoning: The conjunction fallacy in probability judgment. Psychological Review, 90, 293-315.