THE EXPERIMENTAL ANALYSIS OF REASONING:
A REVIEW OF GILOVICH'S
HOW WE KNOW WHAT ISN'T SO¹

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A September 18, 1994, article in the *New York Times* describes the results of an Air Force report on "flying saucer wreckage" found in New Mexico in 1947. The Air Force now admits that the materials recovered were not the remains of a weather balloon, as reported at the time, but were parts of a device used to spy on faraway nuclear explosions. But although the incident has now been explained to most people's satisfaction, no one really expects the official explanation to satisfy flying saucer cultists. As a retired Air Force officer told the interviewers, "The psychology is simple: People believe what they want to believe. In New Mexico, flying saucerism has become a minor industry. There are whole museums dedicated to the presentations of outrageous fictions" (Broad, 1994, p. 1).

And there are everyday reminders that human reasoning is fallible. When we study human behavior in the laboratory, we can often avoid problems caused by fallacious reasoning. However, given the ubiquity of such reasoning, it seems that behavior analysts should confront the determinants of fallacious reasoning in direct laboratory assessments. From that standpoint the topic of this book, the "fallibility of human reason in everyday life," should be of central interest to behavior analysts. Consider these statistics cited by Gilovich: (a) More people believe in extrasensory perception (ESP) than in evolution; (b) in the United States there are 20 times as many astrologers as there are astronomers. The author points out that people do not hold erroneous beliefs because they have not en-

countered the relevant evidence for holding beliefs consistent with the data, for questionable beliefs are held by experienced professionals as well as more poorly informed laypeople. Moreover, the great majority of laypeople have the intellectual tools for adequately dealing with large amounts of relevant data. As Gilovich points out, "our questionable beliefs derive primarily from the misapplication or overutilization of generally valid and effective strategies for knowing" (p. 2). Although Gilovich does not discuss reasoning from a behavioral perspective, many of the phenomena he presents invite such a discussion. In this review, we initiate such a discussion and explore some research directed at promoting a behavioral perspective of judgment. First we briefly compare the nature of this book with an earlier work by Rachlin (1989) and then summarize Gilovich's approach.

Rachlin's (1989) aim was to provide a synthesis of cognition and behavior analysis. He devoted three chapters to a thoughtful overview of cognitive decision making and another four chapters to a review of behavior analysis. Only in his final chapter did he attempt the difficult task of integrating the cognitive and behavioral viewpoints, stressing that they are compatible perspectives. As we discussed in an earlier review (Stolarz-Fantino & Fantino, 1990), Rachlin's synthesis was largely successful, at least as an important initial step in bridging the cognitive and behavioral viewpoints.

Gilovich's aims are quite different. He is a cognitive and social psychologist with primary interest in human cognitive errors. More specifically, he is concerned with understanding how we form erroneous beliefs, with the rationale that achieving such an understanding will enable us also to appreciate how we are routinely misled by the ostensible evidence of everyday experience. He is, then, not a be-

¹ Gilovich, T. (1991). *How we know what isn't so: The fallibility of human reason in everyday life*. New York: The Free Press.

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havior analyst, nor does his book make any attempt to present the behavioral perspective, so behaviorally oriented readers interested in the phenomena Gilovich discusses will need to provide their own behavioral interpretations. As Rachlin's (1989) book suggests, and as we hope to show, translation from a cognitivist to a behavioral interpretation should be both possible and profitable. The behavior analyst should be able to go further by providing experimental analyses of how errors in human reasoning are shaped.

Gilovich has grouped his material into four sections. The first describes cognitive determinants of questionable beliefs and provides an entertaining introduction to the literature on human reasoning. One example drawn from this section is failure to appreciate regression to the mean, which results in spurious explanations for phenomena such as the "*Sports Illustrated* jinx," in which it is thought to be bad luck to appear on the cover of *Sports Illustrated* magazine. Because an athlete must have done something extraordinary to be pictured on the cover of *Sports Illustrated*, his or her performance may be less illustrious during the following weeks or months; hence, the apparent deterioration attributed to the jinx. Of more interest to behavioral psychologists are studies cited by Gilovich that show how regression-to-the-mean effects can act to make rewards appear less effective and punishment more effective than they are, thus making it more difficult for some parents and teachers to accept that it is more desirable to reward good performance than to punish poor performance. Gilovich notes that rewards are more apt to be administered following an extraordinarily good performance. Because the facts of regression suggest that such extraordinary performance may be followed by some deterioration, any strengthening effect of the reward is likely to be masked. The reward may thus appear to be ineffective. On the other hand, because particularly bad performances are likely to be followed by improvement, punishment applied after an extraordinarily bad performance is likely to appear to be beneficial. This account of the ostensible effectiveness of punishment has much in common with behavioral discussions stressing the short-term consequences of punishment (e.g., the "criticism trap," Becker, 1971, and more gener-

ally, Baum's 1994, discussion of "contingency traps"). Another of the phenomena discussed in this section is the problem of missing data. An example of this concerns graduate admissions committees, which may develop an exaggerated idea of the effectiveness of their selection criteria if the successful candidates do well in graduate school. The success of the students legitimizes the selection criteria and reinforces the behavior of the committee members in having adhered to them. The difficulty, of course, is that no one knows whether the unsuccessful applicants would also have done well given the same opportunities.

The second section of the book covers motivational and social determinants of questionable beliefs, including the biasing effects of secondhand information. Especially interesting is the account of how Watson and Raynor's study with "Little Albert" has been modified over years of appearances in textbooks. As reported by Harris (1979), various authors have contended that Albert's fear generalized to many objects not reported in the original study, including a cat, a white glove, and a teddy bear. Other texts have given the Albert story a happy ending, in which Albert's fear was eliminated through "reconditioning." Gilovich reasons that the distortions generated by successive episodes of secondhand information, as in the Little Albert case, are in the service of telling a better story, one that is understandable and entertaining. In terms of behavior analysis, telling a story that is coherent and amusing is more likely to result in listener approval than telling one that is recondite and dull. From childhood our repertoires of storytelling are shaped in ways that emphasize interest at the expense of precision. In this section Gilovich also addresses the contribution of listeners (as well as speakers) to misinformation. He maintains that adults are generally reluctant to contest a speaker's beliefs. Most "casual acquaintances generally try to sidestep the awkwardness of disagreement and thus leave us without essential corrective feedback" (p. 119). In other words, instead of providing differential feedback that might sharpen the speaker's views, the listener is more likely to respond in a neutral or positive fashion. As Gilovich concludes,

our beliefs are not properly shaped by healthy scrutiny and debate. The absence of such argument also leads us to exaggerate the extent to which other people believe the way that we do. Bolstered by such a false sense of social support, our beliefs strike us as more warranted than is actually the case, and they become rather resistant to subsequent logical and empirical challenge. (p. 122)

In the third section of the book, Gilovich applies the principles set out earlier to explain specific examples of questionable beliefs such as the belief in ESP phenomena despite continuing lack of scientific evidence for their existence. This is a difficult task, and this section is less satisfying than the earlier introductions to laboratory studies of judgment and reasoning. Still, the historical account of ESP research makes enjoyable reading. The final section of the book ("Where Do We Go From Here?") discusses the role of social scientists in challenging dubious beliefs. Unfortunately, it is quite brief, although Gilovich does offer suggestions to improve reasoning skills through education. To this end, he describes a study by Lehman, Lempert, and Nisbett (1988) that compares the effects of graduate training in various disciplines on the use of statistical and methodological rules such as using control groups and spotting artifacts in correlational studies. Some of the questions posed were scientific in context, and some involved everyday life. Graduate students in psychology, chemistry, law, and medicine were tested at the start of their 1st or 3rd years; 1st-year students were retested 2 years later. The results showed that psychology students had a 70% improvement in test scores after 2 years, and medical students showed a 25% improvement. Neither law nor chemistry training had any effect. As Gilovich points out, social scientists are accustomed to dealing with less-than-perfectly-predictable phenomena such as those encountered in everyday life, and may be in a unique position to help students learn to apply their reasoning skills outside the classroom. In other words, specific types of experience may influence response to novel problems. However, the nature of the experience and its similarity to the novel problem are probably of central import, a topic raised by Gilovich and to which we now turn.

The research about social-science training

notwithstanding, elsewhere Gilovich makes the point that professionals are not immune to common reasoning errors. In support of this contention, consider a type of reasoning error known as the *conjunction effect*, reported by Tversky and Kahneman (1982) and discussed at length by Stolarz-Fantino and Fantino (1990). To summarize briefly, subjects demonstrating the conjunction effect report that the conjunction of two events is more rather than less likely to occur than one of the events alone. We administered a standard conjunction problem to students at our institution (UCSD) who were just completing a course in logic. Their logic professor, a celebrated philosopher, introduced the task as one involving "reasoning." Despite this context 43% of the students committed the conjunction fallacy. Comparably fallacious reasoning was observed by Arkes and Blumer (1985), who found that economics students enrolled in a course covering the "sunk cost effect" (an example of irrational economic behavior) were just as likely to display the effect as students who were not enrolled in the course. Fantino and Savastano (in press) took a more behavioral approach to the problem of how humans react to novel compound stimuli. They exposed UCSD students to compound stimuli and found summation: more responding to the compound than to either of the component stimuli. But when other subjects were given training with a single compound that was associated with a lower rate of reinforcement than either of the individual component stimuli, they no longer responded to future novel compounds more than to the component stimuli. In other words, after experiencing a single exemplar compound associated with a low rate of reinforcement, they no longer displayed summation to novel compounds. Clearly then, as Gilovich maintains, our experiences with events readily affect our responding to sufficiently similar events encountered subsequently.

Of course if our conditioning history can affect our decisions for the better, it can also do so for the worse, should that history interfere with optimal choice. This has been long known and was demonstrated graphically by Luchins (1942) in our favorite example. He assessed the problem-solving ability of children, college students, and college in-

structors with a computational task performed on the blackboard, in which subjects were required to state how they would obtain a given amount of water, using three measuring jars. They were required to work out a series of these problems. Although the dimensions of the jars varied across trials, the same strategy always worked: Fill Jar B and then reduce the amount by pouring enough from it to fill Jar A once and Jar C twice; in other words, the equation $B - (A + 2C)$ provided the solution to all of the problems in this first series. Then, in the next problem, Jars A, B, and C held 23, 49, and 3 units, and subjects were required to determine how to obtain 20 units. Those who had worked on the first series continued to employ the strategy that had been successful in all of the previous problems (that described by the equation above). Subjects were embarrassed to learn that a much simpler solution existed ($A - C$), one that was readily used by control subjects who had not had the prior experience with the first series of problems.

A related point regarding the role of our conditioning history in molding our judgments is made by Gilovich: Many distorted judgments arise from basic processes that are adaptive in most environments. He discusses Tversky and Kahneman's (1982) notion of "judgment by representativeness" that can be characterized as the habitual tendency

to assess the similarity of outcomes, instances, and categories on relatively salient and even superficial features, and then to use these assessments of similarity as a basis of judgment. People assume that "like goes with like": Things that go together should look as though they go together. . . . It is the *overapplication* of representativeness that gets us into trouble." (Gilovich, p. 18, italics in original)

One implication of this notion is that we may acquire certain strategies for dealing with events that result in misapplication when different events are encountered. This, of course, is the familiar phenomenon of generalization, or, more precisely, overgeneralization, although again Gilovich does not use these terms.

When reviewing Rachlin's synthesis of cognition and behavior analysis (Rachlin, 1989; Stolarz-Fantino & Fantino, 1990), we noted Skinner's (1966) caution that subjects do not necessarily respond to descriptions of contin-

gencies in the same way that they would respond to the actual contingencies. We speculated that "subjects performing 'paper and pencil' tasks like those given them by Tversky and Kahneman (1982)—and ourselves—fail to respond logically partly because their responses have no real consequences" (Stolarz-Fantino & Fantino, 1990, p. 321). Because in daily life most of our inferential errors have few or no serious behavioral consequences, we will continue to use our intuitive strategies if they generally appear to suffice. What if we presented a reasoning task that typically produces erroneous judgments in a laboratory setting in which actual rewards were made contingent on accurate judgment? Would we now obtain accurate judgments? If so, prior demonstrations of erroneous judgments may be attributed to inadequate reinforcement contingencies in everyday environments.

Goodie and Fantino (1995) explored this question in the context of base-rate errors, a prevalent type of judgment error and one discussed by Gilovich. In one problem first developed by Tversky and Kahneman (1982), subjects are told that a cab was involved in a hit-and-run accident and that a witness identified the cab as blue. Information is then given about the prevalence of blue and green cabs in the city and about the reliability of the witness. Even when the witness is unreliable and the optimal strategy would be to rely on the base-rate information, subjects in paper-and-pencil tasks typically equate the probability that the cab was blue with the reliability of the witness, apparently ignoring the more valuable base-rate information (a fuller description of this problem is given in Stolarz-Fantino & Fantino, 1990, p. 319).

In the first of several behavioral approaches to this problem, Goodie and Fantino (1995) tested college students in a delayed matching-to-sample (DMTS) procedure designed to explore how multiple competitive sources of control interact in affecting the behavior of matching sample stimuli with comparison stimuli. Goodie and Fantino's subjects committed the base-rate error even when they were paid for correct answers, and thus even when the error resulted in reduced income. Hence, the base-rate error occurs in more overtly behavioral tasks and not only in paper-and-pencil versions of the problem. However, in a comparable experiment with

pigeons, Hartl (1994) found optimal responding: Pigeons did not display the base-rate error. Unlike Goodie and Fantino's college students, pigeons responded optimally in terms of maximizing rate of reinforcement. What might account for this different susceptibility to the base-rate error in humans and pigeons? Perhaps humans have acquired certain repertoires of dealing with matching problems such as DMTS that they misapply in our base-rate analogue. The pigeon, unfettered by a history of matching problems, readily acquires an optimal response pattern. In particular, humans have been exposed since early childhood to innumerable matching tasks (perhaps beginning with block play and picture books). Thus, they may have a strong tendency to match the sample in a DMTS task, a tendency not easily overridden. Indeed, to the extent that we have acquired matching repertoires on the basis of rules imparted by parents, siblings, and teachers, we may display the kind of insensitivity to changes in contingencies that often characterizes rule-governed behavior (e.g., Catania, 1992).

Takahashi and Iwamoto (1986) made a similar point in their study of human concurrent performances. They found that human schedule performance was comparable to that of pigeons only under carefully specified procedural constraints. Following the lead of Bentall, Lowe, and Beasty (1985), they suggested that covert verbal behavior in adult humans may determine their more overt behavior, and that when they operate according to their own rules their behavior may no longer be readily influenced by experimenter-arranged contingencies of reinforcement. As in Luchins' (1942) example discussed earlier, rules acquired in our environmental interactions may be helpful in dealing efficiently with new instances but may also lead to insensitivity to variables in our contemporary environment. So-called failures in reasoning may result.

In sum, we recommend Gilovich's book for three reasons: (a) It provides an engaging and thoughtful review of the fallibility of human decision making. (b) The book makes the important point that social-science training can be uniquely didactic in helping people to reason effectively about everyday situations and decisions. In our opinion,

behaviorally oriented courses that make transparent the relation between cause and effect in behavior change should be particularly helpful in promoting the application of classroom-based skills in novel situations. (c) Although the book does not approach human reasoning from a behavioral perspective, the discussion provided should set the occasion for productive insights by a behaviorally oriented reader. If such insights lead to an experimental analysis of fallacious reasoning, we shall be in a stronger position to argue for the relevance of behavior analysis to problems of human judgment, problems that are of central interest to many experimental psychologists and to society at large.

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