

Explanation-Based Judgments

For thousands, maybe millions of years, people have been telling stories to each other. They have told stories around the campfire; they have traveled from town to town telling stories to relate the news of the day; they have told stories transmitted by electronic means to passive audiences incapable of doing anything but listening (and watching). The reason that humans constantly relate stories to each other is that stories are all they have to relate.

—Roger Schank and Robert P. Abelson, 1995

6.1 Everyone Likes a Good Story

Ask people how likely it is that an alcoholic tennis star who starts drinking a fifth a day will go on to win a major tournament 8 months later, and they will probably answer that it is extremely unlikely. Now ask other people how likely it is that an alcoholic tennis star who starts drinking a fifth a day will join Alcoholics Anonymous (AA) a month later, quit drinking, and win a major tournament 8 months later; to most people, that seems much more likely.

It is logically necessary, however, that the first outcome (winning the tournament) is more likely for the alcoholic star who starts drinking a fifth a day than is the second (joining AA *and* quitting *and* winning the tournament). The probability of three events must be less than the probability of one of them alone. A moment's thought tells us there are ways in which the star could win the tournament without joining AA (for instance, quitting drinking on his own, bribing the other players, maybe just being extraordinarily lucky).

Hence, winning the tournament must be more likely than winning it after the specific action of joining AA, which in turn is followed by the specific action of quitting. But joining AA links the parts of the story together into a plausible, coherent scenario, and scenarios are persuasive (Heath & Heath, 2007). Human beings, perhaps uniquely among all animals, create mental models of the situations they are in, and those situation models often take the form of stories (the biologist Stephen Jay Gould once described humans as “the story-telling primate”). And, like every other fundamental characteristic of our minds, story construction plays a role in judgment and decision making. Scenarios, or narratives, are representations of temporally ordered sequences of events glued together by causal relationships—much of this “glue” is based on motives and intentions of goal-directed actors. Usually, narratives come in the form of simple linear causal chains—the missing nail caused the horse to throw a shoe, which caused the horse to go lame, which caused the message to arrive late, which caused the army to be unprepared, which caused the invader’s victory, which caused the nation to lose the war, which caused the monarch to lose her throne . . .

6.2 The Conjunction Probability Error (Again)

Tversky and Kahneman (1983) term the belief that a specific combination of events can be more likely than parts of that combination the *conjunction fallacy*. A more precise designation is *conjunction probability error*, and we saw it earlier in the “Linda the feminist bank teller” representativeness-based error for category membership judgments. This same fallacy occurs in judgments of scenarios like the alcoholic tennis player scenario. Another example, in the context of scenario-based judgments, is provided by Tversky and Kahneman, again, who presented college students with the following:

John P. is a meek man, 42 years old, married with two children. His neighbors describe him as mild-mannered but somewhat secretive. He owns an import-export company based in New York City, and he travels frequently to Europe and the Far East. Mr. P. was convicted once for smuggling precious stones and metals (including uranium) and received a suspended sentence of 6 months in jail and a large fine. Mr. P. is currently under police investigation. Please rank the following statements by the probability that they will be among the conclusions of the investigation. Remember that other possibilities exist and that more than one statement may be true. Use 1 for the most probable statement, 2 for the second, etc.

- Mr. P. is a child molester.
- Mr. P. is involved in espionage and the sale of secret documents.

- Mr. P. is a drug addict.
- Mr. P. killed one of his employees. (p. 306)

Eighty-six undergraduates ranked the events above; another sample of 86 students ranked a modified list with the last event replaced by “Mr. P. killed one of his employees to prevent him from talking to the police.” Although the addition of the specific motive reduces the extent of the event (directly analogous to the case of Linda the feminist bank teller compared with Linda the bank teller, in Chapter 5), the mean rank of the conjunction event (“killed to prevent him from talking”) was reliably higher (ranked at 2.90 on average) than the global “killed” (for any reason) event (ranked lower, at 3.17).

The statement that he killed an employee “in order to . . .” must be kept distinct from the “in order to” as a reason if we begin by knowing that he killed an employee. Because a combination of causes can yield an effect with higher probability than each cause alone, belief that an effect is “due to” a combination of things does not constitute a conjunction probability fallacy. For example, believing that someone was chilled because the person was outside and the temperature outside was below zero is more reasonable than believing that the person was chilled simply as a result of being outside (which would include being outside in the summer).

Tversky and Kahneman (1983) also discovered the conjunction probability fallacy when they asked medical internists questions about symptoms and diagnoses in an even more obviously “life and death” situation, detailed below.

A 55-year-old woman had a pulmonary embolism (blood clot in the lung). How likely is it that she also experiences the following?

- Dyspnea [shortness of breath] and hemiparesis [partial paralysis]
- Calf pain
- Pleuritic chest pain
- Syncope [fainting] and tachycardia [accelerated heart beat]
- Hemiparesis
- Hemoptysis [coughing blood] (Tversky & Kahneman, 1983, p. 301)

Of the 32 internists questioned, 91% believed that the combination of a probable symptom (in this case, dyspnea) and an improbable one (in this case, hemiparesis) was more likely than the improbable symptom alone. The combination of the two symptoms formed a coherent or good explanation in the minds of the medical experts.

6.3 Judging From Explanations

Conjunction probability violations of rationality are widespread. When we imagine the future, the content of our imagination tends to conform to our intellectual schemas. Thus, many of our scenarios are conjunctions of specific events that we believe are highly probable. Again, such belief is fairly automatic. Those of us whose thought processes are primarily visual tend to anticipate the future by “seeing” what we and others are likely to do, and our images will be quite concrete. Our knowledge that almost nothing turns out exactly the way we imagine does not stop us from imagining the future concretely by building vivid scenarios of sequences of likely events. It is only upon reflection that we attempt to assess the probability of events in isolation and thereby become less vulnerable to the conjunction probability fallacy. (The conclusion that the likelihood of events can better be considered by viewing them in isolation—rather than as part of a meaningful, holistic, apparently probable sequence—may be jarring to some readers.)

The scenario construction process and its consequences for judgment are summarized in Figure 6.1. Story construction, at least the perception of causal relationships between events, is so natural that we would list it as an automatic cognitive capacity along with our capacities for frequency registration, memory recognition, and similarity judgments. Roger Schank and Robert Abelson (1995) have made an interesting argument that virtually all of our everyday knowledge, from arithmetic skills to the fact that a whale is a mammal, is stored in narrative formats. This is probably going too far, but an enormous amount of knowledge in our memories is represented in or linked to stories. The essential cognitive function of maintaining a situation model that places us in our current context, prepared for action, is dominated by narrative formats. Experience is a temporal sequence of events, and that is the cognitive format we use to summarize the past and to project to the future.

Of course, it is no surprise that we look for good reasons for an event that we are predicting (or retrospectively diagnosing): The knowledge that a key player has been injured, that a company has a new CEO, or that a person is a drug addict is often enough cause to make a confident prediction, even if that is all we know about the situation. We humans have a compulsion to explain events in the world around us; this compulsion is part of a generally adaptive habit of maintaining useful mental models of our current situations, a habit with obvious survival value. Many prefabricated scenarios are available to our imaginations either because they correspond to stereotyped scripts or because they are available through particular past experiences. (Such availability need not be based on actual frequency, as pointed out at some length

in Chapter 5.) Availability here, however, must refer to availability to *our imagination* rather than availability *in fact*—because it is logically impossible for us to experience conjunctions of events more frequently than we experience the individual components of these conjunctions. Nonetheless, imagination is an important determinant of feelings, thought, and action.

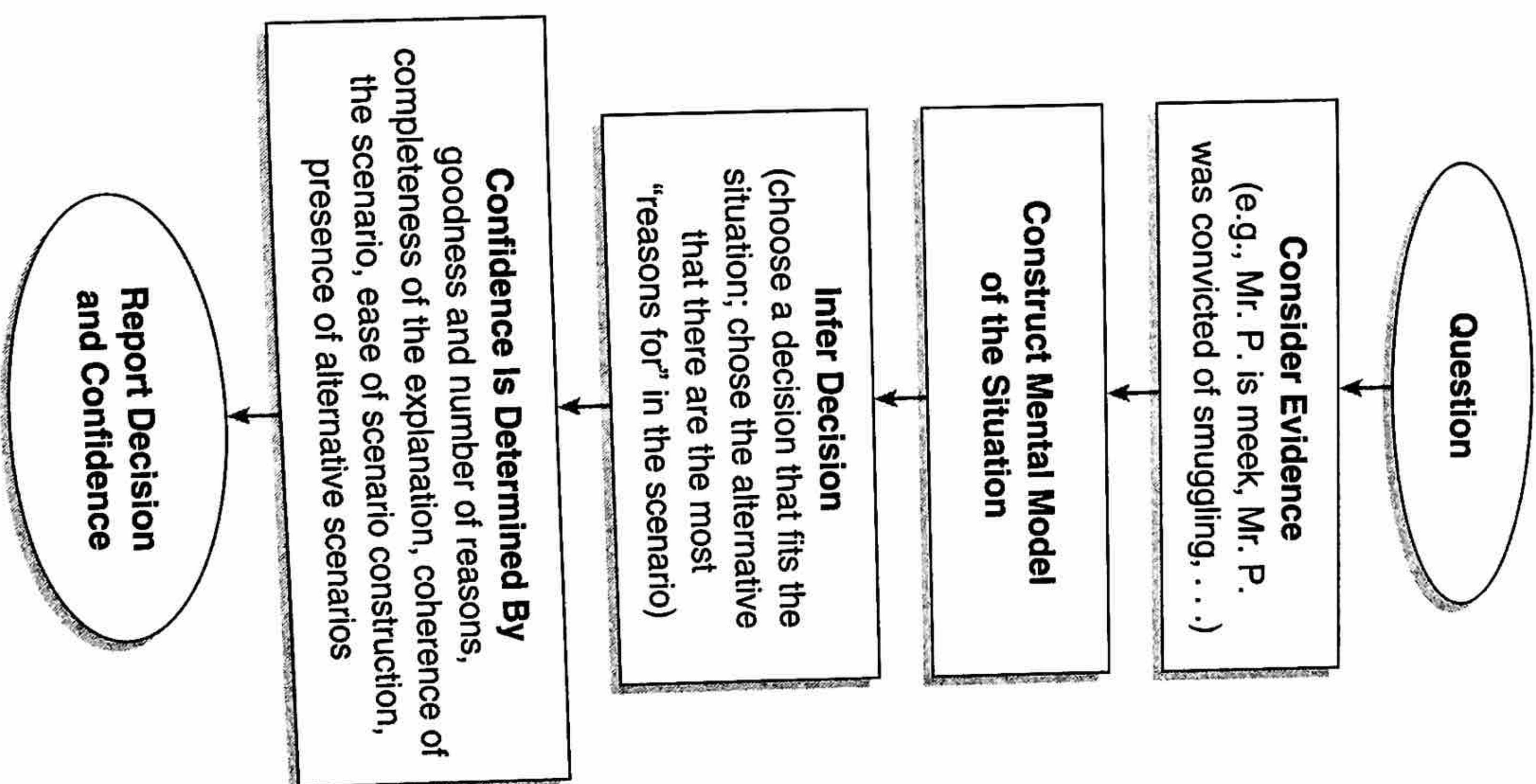


Figure 6.1 A summary of the explanation-construction process and its effects on judgments and decisions

Belief in the likelihood of scenarios is associated with belief in the likelihood of their components; believable components yield believable scenarios (and often vice versa as well). Complete stories, detailed stories, and sensible stories (with reference to other stories or to our general beliefs about human motivation and natural causality) are influential stories. It is somehow plausible to us that Cleopatra's physical charms could lead two of the most powerful men in the Classical world to behave like 15-year-olds, or that the sexual temptation of a 24-year-old intern could lead a U.S. president, one of the most powerful men in the modern world, to behave in the same manner.

Scenarios are even more believable if the components form a good gestalt because they fit into or exemplify some familiar narrative schema. For example, we might say the story of the alcoholic athlete who joins AA, is rehabilitated, and triumphs is a prototypical recovery narrative. Coherence leads to overestimation of the likelihood that a scenario is true or will occur; it is an overestimate for the following three reasons.

First, the combination of events may be improbable even though each event in it is probable; the probability of a combination of events $1, 2, \dots, k$ is $p_1 \times p_2 \times \dots \times p_k$, where p_1 is the probability of the first, p_2 is the probability of the second *given* the first, p_3 is the probability of the third given the first two, and so on ($p_1 \times p_2 \times \dots \times p_k$ may be quite small, even though each p_i in it is large—for example, $.90 \times .80 \times .85 \times .80 \times .85 \times .90 = .37$, even though .80 is the smallest number in this sequence). To estimate the probability of the sequence on the basis of its “typical” component probabilities (average = .85), as many people do, seriously overestimates this number. In fact, the probability of any conjunction of events, even if they don't compose a plausible narrative, is often overestimated—for example, the probability of getting four cherries on a casino slot machine. Painstaking behavioral studies suggest that this overestimation is usually the result of an anchor-and-adjust estimation strategy; people anchor on a typical component event probability (the probability of getting one cherry) and then under-adjust (see Chapter 4).

Second, the same cognitive factors—such as *imaginability*—that lead to an overestimation of the probability of a component may also lead to an overestimation of the probability of the scenario as a whole. In fact, the imaginability of the entire scenario may lead to greater belief in the likelihood of the whole than in one of its parts, as illustrated by the belief that Mr. P. being guilty of murder for a specific motive was more probable than his being guilty of murder for any reason.

And third, in many domains (e.g., sports, crime, health), when dramatic coincidences occur, composed of an unlikely combination of components,

they tend to draw attention and are repeated and remembered, amplifying the basic conjunction overestimation effect through availability (see Chapter 5).

6.4 Legal Scenarios:

The Best Story Wins in the Courtroom

In one of the most significant jury trials in recent history (*Silkwood v. Kerr-McGee Corp.*, 1984), the famous attorney Gerry Spence told jurors to think about the situation in terms of a zookeeper who carelessly left a cage door unlatched, allowing a ferocious lion to escape and attack a hapless woman who had the bad fortune to be in harm's way. The story about the negligent zookeeper “told” the jurors what to do about the corporation that had allegedly allowed employees to become contaminated with radioactive plutonium, and they found the company liable for \$10 million in punitive damages. There seems to be little question that jurors' decisions are driven primarily by the stories they construct to comprehend and remember the evidence presented to them at trial.

Good trial attorneys know that good stories win cases. Another famous trial attorney, with the colorful nickname “Racehorse” Haynes, was quoted as saying, “The lawyer with the best story wins.” He went on to advise (defense) attorneys, “The surest way to win a murder case is to convince the jury that the best ending for the story told by the evidence is that the defendant deserved to die.” Anthony Amsterdam, another legendary attorney, has analyzed transcripts of attorneys' arguments to the jury to demonstrate that they often tell two kinds of stories: First are stories about the evidence, the “what happened” at the crime scene, and second are stories about the trial, with careful attention to the role that the attorney wants the jurors to play in that narrative (Amsterdam & Hertz, 1992). In the O. J. Simpson murder trial, Marcia Clark's closing argument as prosecutor included a detailed summary of the prosecution crime story, complete with a timeline; in contrast, the defense attorney, Johnnie Cochran, concluded by exhorting the jurors to accept the role, at trial, of protector, even avenger, of oppressed minority defendants (Hastie & Pennington, 1996).

The central cognitive process in juror decision making is *story construction*—the creation of a narrative summary of the events under dispute. Thus, the central claim of this hypothesis is that the story the juror constructs, often quite deliberately to “piece together the puzzle of historical truth,” determines the juror's verdict. Ask any juror why he or she decided on a particular verdict, and you will more likely than not get an answer that begins, “Let me tell you what happened . . .” Using converging measures to “take cognitive snapshots”

of the contents of several hundred mock jurors' thoughts, before and after rendering verdicts in a variety of cases, Nancy Pennington and Reid Hastie (1991) found that a narrative story structure was consistently the best summary of the jurors' memory structures. For example, when asked to decide a well-known civil case in which a mall employee (Kathleen Hughes) sued the mall owners (the Jardel Company) for damages after she was assaulted on her way to her car after work, the modal juror exhibited a cognitive representation of the evidence that looks like the network in Figure 6.2.

Note that the evidence at trial is almost never presented to the jurors in the chronological order of the events in the original crime, so the jurors must reorganize evidence, as they comprehend it, to produce memory structures that reflect the original chronological order of events depicted in Figure 6.2. This is a precedent-setting case of a lawsuit on behalf of the victim of a brutal assault as she left work at the Jardel-owned Blue Hen Shopping Mall. At issue in this complex trial was whether the mall owners were negligent in not providing more security guards to prevent incidents like Kathleen Hughes's assault. Mock jurors who heard the evidence as presented in the scrambled, nonchronological sequence from the original trial, all remembered it in the proper historical-temporal order.

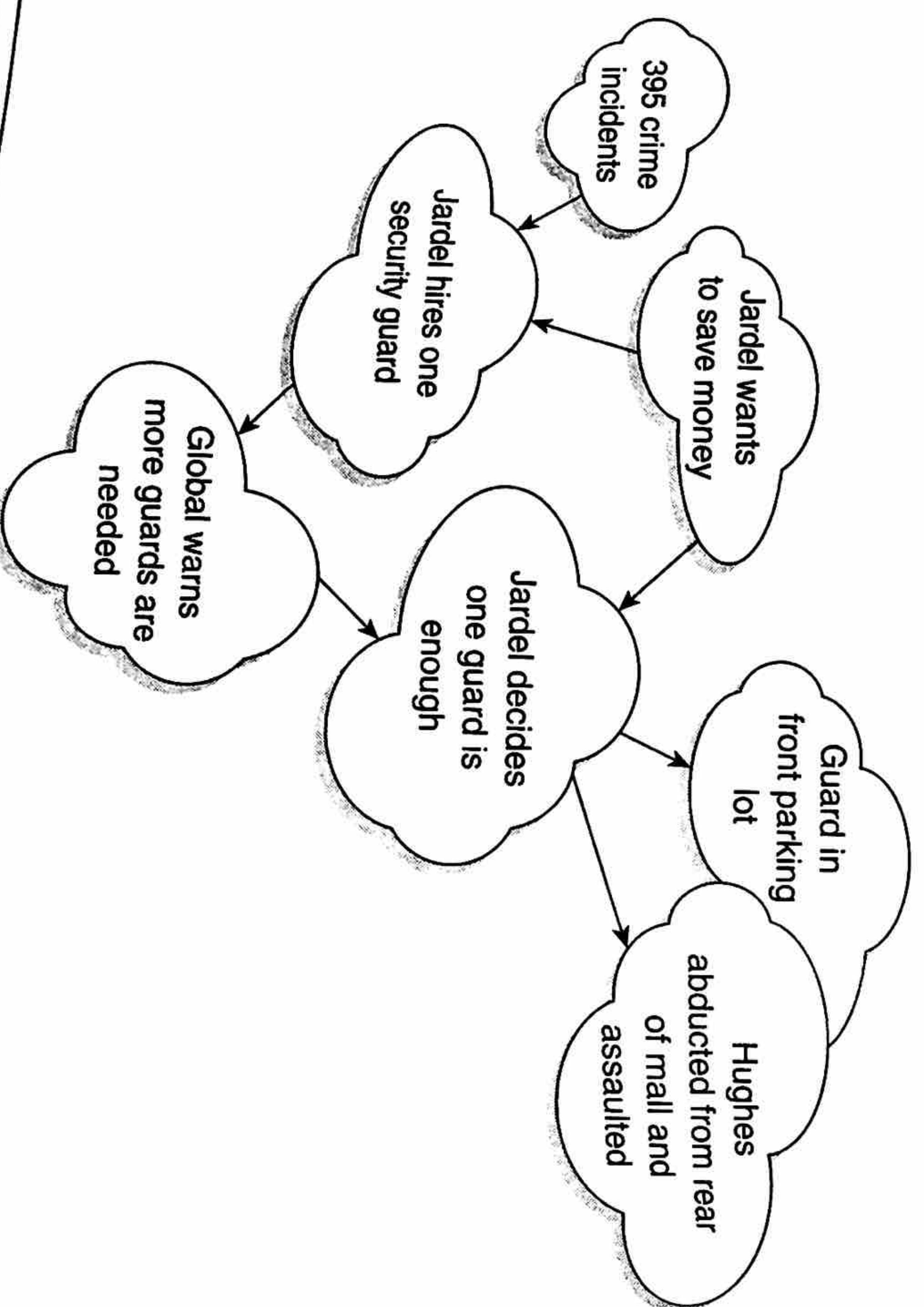


Figure 6.2 The schematic structure of a story constructed by a juror to comprehend (explain) the evidence (1987)

More important, though, is the finding that jurors who choose different verdicts have reliably different mental representations. Pennington and Hastie (1991) found that when jurors construct summaries of the evidence they are hearing and seeing in legal disputes, there are usually at least two competing interpretations (otherwise the dispute would not have gotten to court—over 90% of criminal cases and civil suits plea-bargain or settle before they get to court, presumably because one side or the other did not have the evidence to construct a plausible story). Different jurors are likely to construct different stories, and the stories lead to different verdicts. At least, after jurors reach different verdicts, they have different stories in mind. This situation is summarized in Figure 6.3 (for a criminal case): First, the juror constructs a story summary of the evidence (and there are usually only a few, two or three at most, alternate stories for any case); second, the juror learns something about the possible verdicts from the judge's instructions at the end of the trial; then the juror makes a decision by "classifying" the story into the best-fitting verdict category. Pennington and Hastie also found that jurors with more complete, more detailed, and more unique stories were more confident than those whose stories were less compelling.

An illustration of the power of story-based evidence summaries is provided by the dramatic differences between European American and African American citizens' reactions to the verdict in the O. J. Simpson murder trial. (There even appeared to be racial differences in response on the jury and within the defense team.) We believe that jurors' race made a difference in the acceptability of the defense story according to which a racist police detective (Mark Fuhrman) planted incriminating evidence. African Americans, compared with European Americans, have many more beliefs and experiences that support the plausibility of stories of police misconduct and police bigotry. Many African Americans and members of their immediate families have had negative, and probably racist, encounters with justice system authorities. African Americans know of many more stories of police racism and police brutality directed against members of their race (some apocryphal, some veridical) than do European Americans. This background of experience, beliefs, and relevant stories made it easy for African Americans to construct and believe a story in which a police officer manufactured and planted key incriminating evidence. (In an effort to find a European American version of the "racist cop" stereotyped scenario, one of the authors asked his colleagues if they knew, through personal experience, of any examples of biased or unfair authorities. The resounding answer? Internal Revenue Service officials! Almost everyone in his predominantly white, middle-class sample had had, or claimed to know someone who had, a bad experience with overzealous income tax auditors.)

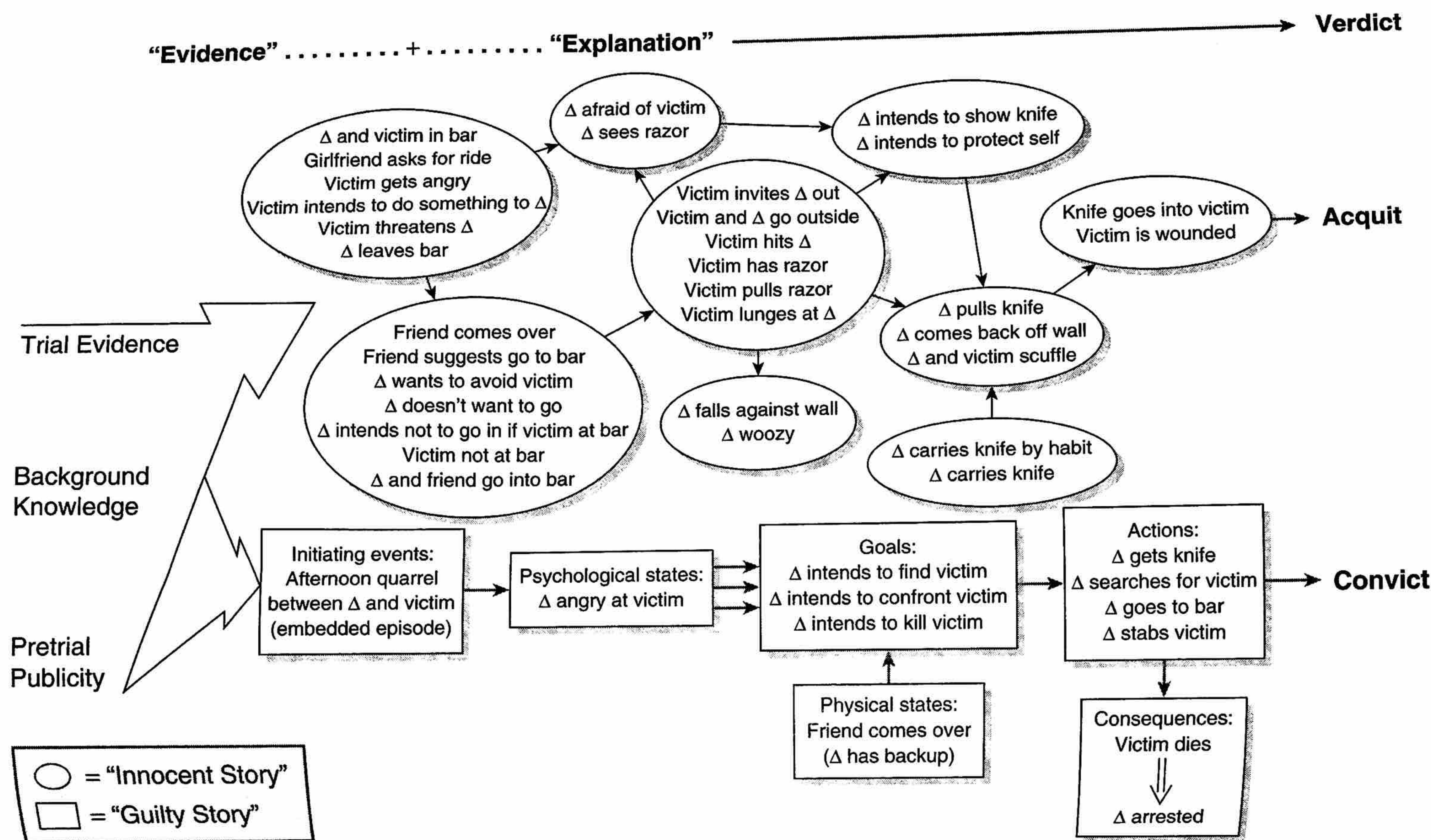


Figure 6.3 Innocent versus guilty stories constructed by jurors who rendered different verdicts in a criminal trial

One of the most dramatic demonstrations that jurors' stories of the evidence cause their verdicts is a study by Nancy Pennington (Pennington & Hastie, 1991) of the effects of variations in the order of evidence presentation on judgments. Stories were expected to be easy to construct when the evidence was presented in a temporal sequence that matched the occurrence of the original events (Story Order). Stories would be more difficult to construct when the presentation order did not match the sequence of the original events. (This non-story Witness Order matched the sequence of evidence presented by witnesses in the original trial.) As predicted, jurors were likeliest to convict the defendant when the prosecution evidence was presented in Story Order and the defense evidence was presented in Witness Order (78% of the jurors judged the defendant guilty), and they were least likely to convict when the prosecution evidence was in Witness Order and the defense was in Story Order (31% said guilty). The difference in conviction rates is huge, over 40 percentage points. (We do not claim that the *order of proof* effect will be this large in actual trials, although we do believe the effect generalizes and advise attorneys to tell good stories, when they can, as do winning trial attorneys like Gerry Spence, "Racehorse" Haynes, and Johnnie Cochran.)

A more subtle aspect of scenario-based judgment occurs because stories tend to exist, *sui generis*, without multiple interpretations or versions. In the Pennington and Hastie (1988) studies of juror decision making, the perceived strength of one side of the case depended on the order of evidence both for that side *and for the other side* of the case. This finding implies that the jurors attempted to construct more than one story summary of the evidence and that the *uniqueness* or relative goodness of the best-fitting story is one basis for confidence in their judgment. The construction of multiple stories is almost forced on the decision maker by the traditions of our adversarial trial system. However, we suspect that in most everyday situations, when story construction is the basis for decisions, people stop after they have constructed one story.

During construction and evaluation of a story, people do consider alternative versions of *parts* of the stories. (This form of reasoning is called *counterfactual thinking*, because it involves imagining alternatives to "factual" reality that might have occurred—what we have referred to as Piagetian "scientific reasoning" elsewhere in this book.) For example, in the *Jardel Co. v. Hughes* case, the crucial inference that appeared to distinguish between jurors who decided the mall owners were liable versus those who concluded they were not decided the possible effects of adding extra patrol guards to the mall security staff. Jurors who reasoned, "If there had been more guards, the rape would have been prevented," went on to conclude the mall was liable. After all, if the owners had not been so greedy, if they'd paid a little more to add

extra guards, then the assault would not have occurred. On the other hand, jurors who reasoned, "If there had been more guards, the rape would still have occurred" (i.e., in a large mall, full protection would require an impossibly large security force), concluded the owners were not liable. In legal contexts, this kind of reasoning is called the "but for" test of causality; a philosopher would probably describe it as testing if a candidate cause (few security guards) is a *necessary condition* for an effect (the assault on Kathleen Hughes) to occur. So, although there is a tendency for one story to dominate our mental representation of any situation, the construction of that story usually involves the consideration of alternative parts or episodes within the story. When there is uncertainty about those parts (e.g., a juror can't make up his or her mind about whether the rape would have been prevented by adding security guards), that local uncertainty is generalized to lower confidence in the whole story.

Follow-up research has addressed some practical questions about trial tactics in adversarial trials. For example, many criminal cases involve the presentation of only one story, by the prosecution, and the defense tactic is to "raise reasonable doubts" by attacking the plausibility of that story. (Some cynical attorneys describe this defense strategy as "creating a cloud of confusion in the juror's mind and then labeling that cloud 'reasonable doubt.'") In these one-sided cases, jurors construct only one story, and confidence in the verdict is determined by coherence and fit of that single story to the verdict category. In this situation, a weak defense story is worse than no story at all; in fact, a weak prosecution story is bolstered and more guilty verdicts are rendered when a weak defense story is presented. Again, this result implicates the importance of the comparative *uniqueness* factor when more than one story has been constructed.

Another observation, which reinforces the lore of trial tactics, is that when a narrative strategy is used to argue a case, the attorney should set up the story in his or her opening statement to the jury. The chance of obtaining a verdict consistent with a story is increased when the story is primed in advance and is ready in the juror's mind to interpret the evidence. But, as Gerry Spence (1994) warns, "When I make an opening statement, I always do it as a story. But, you'd better be able to prove your story, because if jurors who believed you find out you haven't told the whole story, then they turn against you."

6.5 Scenarios About Ourselves

It is widely believed among psychoanalytic clinicians that clients of Freudian analysts have Freudian dreams and clients of Jungian analysts have Jungian dreams (and clients of behavioral therapists have *rapid eye movements*, but

nothing else worth mentioning). The extension that clients of Freudian and Jungian analysts have led Freudian and Jungian lives, respectively, is a bit more disconcerting, for it implies that the dearly gained insights of these clients may be joint inventions of the clients and analysts (inventions of unknown and unknowable validity). Research on the nature of retrospective and even allegedly repressed memory has reinforced this possibility, for the malleability of such memory implies that mere agreement with the therapist is a poor basis for judging accuracy (Campbell, 1998). Could the therapy process be partly, or even primarily, one of inventing a good story about the client's life? If so, could this "story" hinder as well as help to foster free and responsible choice?

This notion of *narrative truth* is consistent with the rationales behind many forms of psychotherapy. These therapies assume that clients' (narrative) representation of their lives is the key to understanding their maladaptive behaviors. The therapist's reconstruction of the client's life story into a more coherent and adaptive narrative is the primary goal of therapy. Freud himself originally believed that maladaptive behaviors were caused by actual events, but after discovering that several of his clients had manufactured memories that were impossible, he acknowledged that the crucial causal events might never have occurred. Thus, the goal of therapy is not solely to recall actual events, but to reconstruct a more adaptive life story, one that may not agree perfectly with actual, historical truth. These more adaptive life stories are aimed at helping the clients to accept their past distressed behavior as a normal consequence of what had previously occurred in order to make the decision to abandon this behavior. (Paul van den Broek and his colleague Richard Thurlow [1991] provide a thoughtful discussion of the role of narrative autobiographical reconstruction in psychotherapy from the point of view of laboratory-based cognitive psychology.)

The problem with therapies based on reconstructing life stories was pointed out by James March (1972), in discussing the problem with "discovering" that one's adult years flow naturally—as part of a good story—from childhood:

[B]elief in the model seems likely to create a static basis in personal self-analysis. Individuals who believe the "formative years" hypothesis seem quite likely to consider the problem of personal identity to be a problem of "discovering" a pre-existing "real" self rather than of "creating" an "interesting" self. The notion of discovery is biased against adult change.

Such discoveries can become verbal straitjackets through the attributions they create—for example, "I have come to accept the fact that I suffer from a narcissistic character disorder" can lead to self-indulgence ("What can I do? After all, I'm a narcissist, and that's it.") and unrealistic projection onto

others. The art of this form of cognitively oriented therapy is to construct *adaptive* life stories. (The psychotherapist who has developed this theme most fully is Donald Spence, whose book *Narrative Truth and Historical Truth* [1982] is a landmark in modern psychoanalytic theory.)

A hint of the potentially detrimental side effects of our habit of creating and reconstructing consistent life stories is given in studies of people's biased reconstruction of what they used to be like. As we will show at the end of this chapter, autobiographical memories tend to be dominated by our current attitudes, beliefs, and feelings about ourselves.

All of the elements needed for belief in the high probability of personal scenarios are there when we view our lives. These include stereotypes derived from family myths, cultural beliefs, literature, plays, movies, and television—and in the case of professional psychotherapists and psychiatrists, prototypical case histories communicated in textbooks or through contact with others who have an interest or a professional commitment. These sources all provide prepackaged, believable, complex sequences of events for our entertainment, education, *and use*. No wonder some pop psychologists have achieved great fame through arguing that we often act out preselected life scripts (e.g., Eric Berne's popular exegesis, *Games People Play* [1964]).

6.6 Scenarios About the Unthinkable

What do you think is the probability that there will be a massive flood somewhere in North America, in the next 12 months, in which more than 1,000 people drown? Now, what about the probability that there will be an earthquake in California, in the next 12 months, causing a flood in which more than 1,000 people drown? Or a tropical storm in the Gulf of Mexico, in the next 12 months, causing a flood on the Gulf Coast, in which more than 1,000 people drown? The more specific, causal stories somehow seem more compelling, and more likely. There are many reasons that a catastrophic flood could occur, but providing one vivid scenario ups the probability. But, of course, this is our old friend the conjunction error—a more specific category, that logically must have a smaller extent, is judged more probable than the larger, more abstract, and more likely class of events.

Several small countries are working on the development of nuclear weapons. Iran, North Korea, and Pakistan are obvious examples. One or more of these countries may be run by a fanatic who incites suicide missions such as the 9/11 terrorist attack on the World Trade Center. Given that H-bombs are now the size of a child's sled, it should be possible to smuggle one into New York or Los Angeles. Say that the suicidal fanatics all agree to

die in the blast so that they cannot be traced. The city is annihilated, and there were no missiles, no early warning, no warning of any sort. The city is simply gone, and various terrorist groups claim responsibility. (The group actually responsible will make sure there are bogus calls as well.) The civil liberties of the U.S. citizens disappear soon after the city does, and international nuclear war is not far behind.

Vivid? Yes. The terrorists are thin, swarthy, excitable young men of Arab or Asian extraction, with moustaches. (Indeed, this scenario, originally sketched out by Daves in 1988, in the first edition of this book, is also the basis for the screenplay of the 1998 movie *The Siege*.)

Likely? No, but not impossible. The point is that there are literally thousands of scenarios leading to nuclear destruction. The *real* availability, accuracy, and delivery speed of nuclear weapons increase year by year, yet we concentrate on a few scenarios. For example, roughly 60% of the university students in one of our decision-making classes believed it was "more likely that there would be a Mideast crisis leading to nuclear war between the United States and an Arab nation in the next 25 years than that such a war would occur for *any* reason." Furthermore, when we concentrate on a few scenarios, we develop a false sense of security by taking precautions against (only) them. If the first event of a scenario (perhaps an incident that leads to a confrontation between the United States and North Korea) does not occur, we believe the rest of the scenario will not occur either (just as we were [too] sure the tennis star must join Alcoholics Anonymous and quit drinking to win the tournament). Believing events such as nuclear war can occur only in the context of specific scenarios is thinking myopically and irrationally.

How high is the probability for a nuclear war each year? We are not claiming that it is a constant, merely that it can be approximated with a single value *given no additional information*. Let us suppose, for the sake of analysis, that the probability of nuclear destruction (which did not occur) between 1960 and 2000 was 1/3. That means, assuming a constant probability p and independence between years (as rough approximations to reality), that $(1 - p)^4 = 2/3$, or $p = .01$ per year. Thus, if p remains constant, the probability of having a nuclear war sometime in the next century is $2/3$ ($1 - .99^4$). But p does not remain constant. If, for example, it were to become twice as likely in each of the next 40 years as the last—and if we accept the 1/3 figure—then the probability of surviving the next 40 years without a nuclear war is only .44.

The probabilistic approach to nuclear war also contains a positive message: *Whatever can decrease the probability of a war, by even a small amount, is valuable*. Assume, for example, the probability of .02 per year. As pointed out earlier, the probability of no war in the next 40 years is only .44 (assuming constancy and yearly independence). Now suppose some international agreement is reached that

reduces that probability by $1/3$ —that is, to .0133. The probability of no war in the next 40 years would then be .58.

If that decrease does not appear important, consider this situation:

A barrel contains 100 balls, 44 of which are green, 14 of which are blue, and 42 of which are red. A single ball is drawn at random. Choose between two options:

- If a green ball is chosen, you receive \$10,000. If a blue or red ball is chosen, you die.
- If a green or blue is chosen, you receive \$10,000. If a red ball is chosen, you die.

Which option would you prefer? When the difference between .58 and .44 is viewed in this manner, the much greater desirability at .58 is evident. (Unfortunately, people tend to assess the magnitude of a probability difference in terms of *ratios*—for example, the “mortality ratio” for smokers versus nonsmokers—rather than in terms of actual differences.)

Our colleague Paul Slovic has emphasized the probabilistic approach to reducing the danger of nuclear war and other societal and personal risks. Small differences in probability for small intervals can yield large differences in broad ones. As Slovic points out, scenario thinking can once again get in the way of a probabilistic assessment. The desirable scenario for most of us would be an agreement among all countries capable of producing nuclear weapons resulting in technological control of such weapons to the point that they could not be used in haste or by accident. The least desirable scenario is an international confrontation followed by war. As mental images of what could occur in the next few decades, these scenarios are understandable, vivid, and compelling. Thus, we exaggerate the probability of confrontation and of total agreement while we neglect policies that would reduce the probability of nuclear war each year by some small amount.

The first step in resolving a problem is to think clearly about it. The big problem with scenario thinking is that it focuses the thinker on one, or a few, causal stories and diverts the decision maker from a broader, more systematic representation of the decision situation. Scenario thinking grossly overestimates the probability of the decision situation. Scenario thinking grossly overestimates long-term probabilities of events occurring one way *or another*. Furthermore, there is a general tendency for memories and inferences to be biased so as to be consistent with the themes and theories underlying the scenarios. One of the main messages of this book is that rational analysis requires a systematic, comprehensive representation of situations and alternative outcomes, in order to assess the important underlying probabilities of events.

We believe that probabilities (and some other statistics) are the best tools our civilization has developed to deal with uncertainty and other sources of confusion in decision making. In contrast to immersion in the seductive details of a few vivid scenarios, probabilistic assessments tend to be more valid. Moreover, probabilistic thinking indicates that “small” changes in likelihood can have “large” long-term effects. For example, if we must continue to play nuclear Russian roulette, putting more empty chambers into the gun is preferable to trying to (vividly) imagine which chamber the bullet is in. In Chapter 8, we will return to the question of how to think more clearly and rationally in uncertain situations.

6.7 Hindsight: Reconstructing the Past

Memory for complex events is basically a reconstructive process. As the novelist Alain Robbe-Grillet put it, “Memory belongs to the imagination. Human memory is not like a computer which records things; it is part of the imaginative process, on the same terms as invention.” Our recall is organized in ways that make sense of the present. We thus reinforce our belief in the conclusions we have reached about how the past has determined the present. We quite literally make up stories about our lives, the world, and reality in general. The fit between our memories and the stories we make up enhances our belief in them. Often, it is the story that creates the memory, rather than vice versa.

In a series of ingenious demonstrations, Baruch Fischhoff showed that people who know the nature of events *falsely* overestimate the probability with which they *would have* predicted them. (See Hawkins & Hastie, 1990, for a comprehensive review of the research on hindsight effects.) In his initial studies, Fischhoff simply asked people to predict what would happen before particular events occurred (e.g., U.S. President Nixon’s visits to Russia and China in 1972) and then to later recall what they had predicted. Their recall was biased in the direction of having predicted what actually happened. It follows, as Fischhoff points out, that we are “insufficiently surprised” by experience. One result is that we do not learn effectively from it.

A study by David Wasserman, Richard Lempert, and Hastie demonstrates the role of causality in producing reconstructive hindsight effects. These researchers followed the Fischhoff procedure of comparing foresight judgments from one group of experimental participants with informed, *hindsightful* judgments from a second group. They presented their subjects with short vignettes describing historical or fictional events (the outcome of a military conflict between the British colonials and native Churkas in India, a

gold-prospecting venture) and asked them to estimate the probability of various outcomes (British victory, success in the prospecting enterprise), either with or without knowledge of the "true" outcomes. (They employed an experimental method so that all possible outcomes could be presented as "true" to different groups of participants in the hindsight condition for purposes of experimental control.) Like Fischhoff, they obtained substantial hindsight effects, even when subjects were instructed to estimate the probabilities that would be given *by other people like themselves*. But, more important, Wasserman et al. manipulated the nature of the cause that was described as primarily responsible for the reported outcome. In half of the hindsight conditions, the outcome was attributed to a causally potent event (the better equipped and trained British troops, the superior knowledge of the battle terrain by indigenous guerrilla forces, etc.) or to a surprising "act of God" event (an unseasonal monsoon rainstorm disabled the British weapons and tactics, the rainstorm prevented the guerrilla forces from utilizing their superior knowledge of the terrain, etc.). The results were clear: Hindsight effects only occurred under conditions where persuasive causal explanations could be generated by the participants to "glue" the causes to the outcomes.

This hindsight bias is not always reducible to a knew-it-all-along attempt to appear more omniscient than we are. Sometimes motivational factors probably apply, as when that irritating friend claims to have predicted that the home team was going to lose the football game or that the dark horse candidate was going to win the election. But people actually *make mistakes* in their recall of what they thought would happen, even when they are motivated to be as accurate as possible. A classic example was provided by the natural experiment in which President Nixon's former aide John Dean attempted to recall, before congressional investigating committees, as truthfully as possible events that occurred during the Watergate scandal. (Dean tried to recall events that occurred between June of 1972 and March of 1973 in testimony given in June of 1973.) Dean exhibited detailed memory of countless events during meetings in which Nixon discussed the Watergate events and many other political matters. But subsequent to the testimony it was discovered that many of the same conversations had been secretly tape-recorded by the president. Comparisons between the Nixon tapes and Dean's testimony revealed his memory was exceptionally accurate, but the testimony was still peppered with memory errors and illusions, almost all biased to be consistent with Dean's knowledge of the situations *at the time he testified*, not at the time the original events occurred (Ulric Neisser [1981] conducted this analysis). "Creeping determinism"—to use Fischhoff's phrase—is well-documented, and the major determinant of hindsight effects

is our proclivity to summarize experiences as coherent narratives, after we know how they turn out.

Sometimes, when we believe in change, we recall change even when it has not occurred. In order to make our recollection compatible with this belief, we resort (again not consciously) to changing our memory of the earlier state. We can, for example, reinforce our belief in a nonexistent change for the better by simply exaggerating how bad things were before the change. Certainly there have been times, for example, before a religious or psychiatric conversion, when a person was badly off (we all are at times), and memories of those periods persist; recall can be organized around the traces of these memories. A dieter who has not succeeded in losing a single pound can certainly recall periods of time prior to embarking on a diet when he or she was heavier than when the person completed the ineffective diet; by carefully not recording his or her weight before starting the diet, those times can be (mis-)recalled as evidence of its success.

Experimental evidence shows that when we believe a change has occurred, we are apt to distort the past to be consistent with the change. Michael Conway and Michael Ross (1984) randomly selected participants for a university program designed to improve study skills and created a control group of students who had volunteered for the program and were on the waiting list. Participants and controls were questioned before the study skills program began and at its conclusion. At both times, they were asked to assess their study skills (How much of your study time is well spent? How satisfactory are your note-taking skills?) and the amount of time they studied. At the second interview they were also asked to recall what they reported during the first session concerning their skills and study time.

At the initial interview, participants and controls did not differ significantly on any measure of skill, study time, or other variables. Both groups performed equally well and—most important to the study—the program itself was *not* found to improve study skills. Nor did it improve grades. When asked to recall their situations before the program started (or before they were put on the waiting list), however, the subjects did differ. There was no difference between the two groups in their memory of the amount of time they spent studying, but their recall of their skills was markedly different. Program participants recalled their study skills as being significantly *worse* than they had initially reported, while waiting-list control subjects recalled their skills as being approximately the same as they had reported initially. Thus, program participants exaggerated their improvement in a direction consistent with their beliefs of what *ought* to be (improved skills due to taking the course), not by exaggerating their current skills, but rather by reconstructing their memories to fit with the expectation that they should have

improved. In short, they rewrote their autobiographical memories to be consistent with their current beliefs. There was not such distortion on the part of the subjects who had been put on the waiting list.

Moods also affect recall (see Chapter 5). Does the same principle apply to our recall of our own lives? It is a basic precept in many psychotherapies, from Freud on, that current misery is caused by unfortunate experiences in childhood, especially bad relationships with our parents. But what if current misery hindsightfully selects and reconstructs memories of childhood to be consistent with a miserable state today? Peter Lewinsohn and Michael Rosenbaum (1987) set out to answer this question with a rare prospective study of over a thousand citizen volunteers. The participants were recruited from the general population (not from a selected sample of clinical depressives) and asked to recall their parents' behavior. They were classified, during a 3-year follow-up, into four groups: nondepressives (people who had never been depressed), predepressives (people who were to become depressed during the 3-year study), acute depressives, and remitted depressives (that is, people who had once been depressed and were no longer). The researchers studied the relationship between current mood states and parental memories. Theories that say depression follows from childhood problems would predict that the childhoods of those of us who are depression-prone are different from those who are not and hence would be recalled differently, while theories about the effect of current mood on past recall predict that the difference in recall should be between people who are *currently* depressed and those who are not. Perhaps recollections of one's parents are influenced by a current state of depression or non-depression, or it could be that people who are prone to depression recall their parents differently from those who are not (the non-depressives). The results were consistent with the hypothesis that recollection of one's parents as rejecting and unloving is strongly influenced by current moods; negative recollections were not a stable characteristic of depression-prone people.

Whereas the currently depressed subjects recalled their parents as having been more rejecting and as having used more negative control than the normal controls, the remitted depressives did not differ from the never depressed control in their recall of parental behavior. Similarly, the subjects who were about to become depressed shortly after the initial testing did not differ from the controls in their recollections of the degree to which their parents used negative control methods. (Lewinsohn & Rosenbaum, 1987, p. 617)

This study of depression is important in that it casts doubt on the degree to which adult problems are caused by childhood ones. Given a biasing effect

of mood on memory, people who are distressed as adults tend to remember distressing incidents in their childhood. And, if a person also believes that current problems have their roots in early life (perhaps because their therapist told them so), this view itself may serve as an organizing principle to produce even greater distortion of recall (remember the Conway & Ross [1984] study above). Hindsightfully biased recollections reinforce the "child is father to the man" theory of life span development.

6.8 Sometimes It's Better to Forget

One primary function of our minds is to create a model of the current situation in which we are located. When a car changes lanes in front of us, we update our mental model of the traffic situation so as not to ram into it; when a person we once thought was reliable demonstrates that he or she is not, we adjust our mental model of that person and do not rely on him or her to come through for us in difficult circumstances. The maintenance of up-to-date situation models requires us to constantly refresh our beliefs about where we are and what is about to happen. This process is adaptive when we must make decisions about the future. Indeed, remember the fundamental tenet of decision theory that we should ignore *sunk costs* and focus only on future probabilities and utilities to make rational choices (see Chapter 1). But as we engage in this constant adjustment process, we lose the past and find it is difficult to recover what we used to think and sometimes even what we did. Usually, that's a good thing.

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7

Chance and Cause

Say you're thinking about a plate of shrimp. Suddenly someone says plate, or shrimp, or plate of shrimp. Out of the blue. No use looking for one either. It's part of the lattice of coincidence that lays on top of everything.

—From the film *Repo Man*, written and directed by Alex Cox, 1984

7.1 Misconceptions About Chance

On January 26, 1972, Vesna Vulovic, a 22-year-old Yugoslavian flight attendant, was serving drinks to passengers on JAT Flight 367 when the plane was demolished by a bomb planted by a Croatian nationalist group. Most people would think she was extremely unlucky—first, to be on a rare flight destroyed by a terrorist bomb and second, because of a name confusion, she had been assigned to work the wrong flight. Definitely the wrong flight. But there is a positive side to this story. Ms. Vulovic lived and now holds the world record for surviving the highest fall without a parachute—33,000 feet (10,000 meters). Just a little more than a year after the fall, she declared herself ready to return to work, a self-described “optimist” with a newfound belief in God. So, many people would describe her as exceptionally lucky. Ms. Vulovic goes with our first assessment, “I’m not lucky. Everybody thinks I am lucky, but they are mistaken. If I were lucky I would never have had this accident” (Bilefsky, 2008).