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Belief Formation, Organization, and Change: Cognitive and Motivational Influences

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This chapter is concerned with the representation of beliefs in memory and the factors that influence their formation and change. After discussing the nature of beliefs and their relation to other cognitions (e.g., attitudes, opinions, and other types of judgments), we review alternative conceptualizations of the way in which belief-relevant knowledge is organized in memory and the processes that underlie its retrieval and use. Then, we discuss factors that influence the computation of beliefs on the basis of criteria other than the knowledge to which they directly pertain. Finally, we consider motivational factors that affect responses to belief-relevant information and the change in beliefs that can result from these responses.

BASIC CONCEPTS

Beliefs are typically conceptualized as estimates of the likelihood that the knowledge one has acquired about a referent is correct or, alternatively, that an event or state of affairs has or will occur (Eagly & Chaiken, 1998; Fishbein & Ajzen, 1975). In much social psychological research (for a review, see Wood, 2000), the referent of a belief is a proposition (e.g., the assertion that the United States will become involved in a nuclear war within the next 10 years, or that one's secretary is having an affair with the department head). Beliefs can refer to subjective experiences as well. We are often uncertain about whether we actually saw or heard something, or whether the food we are eating at a local restaurant tastes as good as it did the last time. These uncertainties, like uncertainties about the validity of verbal information, also constitute beliefs.

Beliefs obviously vary in strength. We are completely confident that some things are true (e.g., that Abraham Lincoln was president of the United States) and confident that other things are not true (e.g., that Abraham Lincoln was tsar of Russia), but are relatively uncertain about still other things (e.g., that Abraham Lincoln had brown eyes). These beliefs can often be expressed in units of subjective probability ranging from 0 to 1. They can also be expressed in units of confidence or certainty. To this extent, beliefs could potentially pertain to virtually all

concepts and knowledge we have accumulated, including the definitions of semantic concepts, mathematical relations (e.g., $2 + 2 = 4$) and truisms (e.g., honesty is the best policy).

Beliefs can refer to a specific event or situation or a general one. Moreover, they can be about the present, the past, or the future. Beliefs about the future are often equated with *expectations* (Olson, Roese, & Zanna, 1996). The processes that underlie these different types of beliefs could differ. However, such differences are matters of theoretical and empirical inquiry and are not inherent in the conceptualization of beliefs per se.

Fishbein and Ajzen (1975) distinguished between *beliefs in* something and *beliefs about* it. Thus, I might believe in God, or in the principle of free speech. I might also believe that God is not all-powerful, and that free speech is guaranteed by the U.S. Constitution. However, a belief in God is equivalent to the belief in the proposition that God exists, and a belief in the principle of free speech is equivalent to the belief that free speech is desirable. In each case, therefore, the belief can be conceptualized as an estimate of subjective probability, or alternatively, of the certainty that a proposition is true.

Beliefs and Knowledge

As the preceding discussion indicates, beliefs pertain to knowledge. That is, they concern the likelihood that one's knowledge about a referent is correct or, alternatively, that this knowledge has implications for a past or future state of affairs. Beliefs can also concern the likelihood that new information one receives about a referent is true. But to say that beliefs *refer* to knowledge is not necessarily to say that beliefs are *part of* knowledge and are stored in memory as such. Rather, beliefs could simply be viewed as subjective probability estimates that are computed online at the time they become necessary to attain a goal to which they are relevant (e.g., to communicate information to others, or to make a behavioral decision). Once a belief is reported, this judgment might often be stored in memory and consequently might be recalled and used as a basis for judgments that are made at a later point in time. (For evidence of the effects of previously reported judgments on subsequent ones, see Carlston, 1980; Higgins & Lurie, 1983; Lingle & Ostrom, 1979; Sherman, Ahlm, Berman, & Lynn, 1978.) Of course, they may not be the *only* criterion that is brought to bear on these latter beliefs. Other concepts and knowledge one has accumulated could be retrieved and used in addition to, or instead of, these prior judgments. Schwarz and Bohner (2001; see also Wyer, 2004; Wyer & Srull, 1989) have argued that all judgments are computed online, and that the consistency of judgments over time simply reflects the fact that similar bodies of knowledge are involved in their computation. This possibility has obvious implications for the processes that underlie belief formation and change. For example, differences in the beliefs reported at different points in time may not indicate a conscious change in these beliefs, but rather, may only reflect the fact that different subsets of previously acquired knowledge have been used to compute them.

Be that as it may, a conceptualization of belief formation and change requires an understanding of how knowledge about the referents of beliefs is organized in memory, and of which aspects of this knowledge are actually considered in computing these beliefs. We begin by reviewing briefly the types of social knowledge that people acquire. We then discuss the distinction between the beliefs that are based on this knowledge and other knowledge-related constructs (e.g., attitudes, opinions, and judgments).

Referents of Knowledge

Knowledge can be about oneself, other persons, places, objects or events. It can also concern the relations among these entities. Thus, we know our name and where we live, that we like

to go to movies, and that we ate dinner at Jaspa's Restaurant yesterday evening. Similarly, we know that Jimmy Carter won the Nobel Peace Prize, that Marilyn Monroe was blonde, that Chicago is west of New York, that the World Trade Center collapsed on September 11, 2001, and that drinking too much wine can make you sick. Knowledge can also describe procedures for performing a function or attaining a goal. Thus, for example, we know how to get a meal at a restaurant and how to drive a car.

Knowledge can often be statistical. For example, we might know that less than 50% of Americans voted for George W. Bush in the 2000 election, that there is a 90% chance of rain tomorrow, and that 51% of first marriages end in divorce. Beliefs, defined as subjective probabilities, can be directly influenced by this type of information. Nevertheless, beliefs do not always correspond to objective probabilities. For one thing, objective probabilities can be subjectively ambiguous and, therefore, the beliefs on which they are based can vary with the context in which they are evaluated. Windschitl, Martin, and Flugstad (2002) presented participants with information about two diseases. The diseases were described as equally prevalent among women but as differing in prevalence among men. Participants estimated the chances of a female target's having each disease to be lower than the objective probability they were given when the disease was highly prevalent among men, but to be higher than the objective probability when the disease was less common among men.

Sources of Knowledge

Knowledge is often acquired through direct experience with its referents. It can also be internally generated. That is, it can result from performing cognitive operations on information one has already acquired. Thus, for example, we might infer that a person is sadistic from evidence that he set fire to a cat's tail, and we might conclude that smoking is bad for the health from statistical evidence of its association with lung cancer and heart disease. Or, we could form a mental image from the description of a character in a novel, and we might experience a positive or negative affective reaction to a U.S. President's plan to permit logging in national forests. Cognitions about these subjective reactions could be stored as knowledge about their referents and could later be retrieved for use in making a judgment or decision.

The information that serves as a basis for beliefs is often conveyed verbally, in the form of propositions. It can also be transmitted in other sense modalities (auditory, visual, olfactory, etc.). However, there is clearly not an isomorphic relation between the modality of stimulus information and the modality of its representation in memory. Verbal information can often elicit visual images in the course of comprehending it (Black, Turner, & Bower, 1979; Garnham, 1981; Glenberg, Meyer, & Lindem, 1987; Reyes, Thompson, & Bower, 1980; Wyer & Radvansky, 1999). Moreover, nonverbal information is sometimes recoded verbally in the course of communicating about it to others. Note that when linguistically coded information is represented in memory as a mental image, features that were not specified in the information are likely to be added to the image in the course of constructing it. Correspondingly, many details of visually or acoustically coded information are likely to be lost when it is recoded verbally.

Specificity of Knowledge

Some of the knowledge we acquire refers to specific events that occurred at a particular time and place. This knowledge can often have the form of stories about a sequence of events that we learn about and later describe to others. Other knowledge can refer to more general types of persons and situations. Thus, for example, I may have a detailed memory of last night's dinner at Timpone's, when a waiter tripped over a chair and spilled wine on my new suit. At the same time, I also know the general sequence of events that occurs in restaurants (being shown to a table, ordering the meal, eating, paying, etc.). Many generalized sequences of

events can constitute implicit theories about the causal relatedness of these events that can be used to comprehend and explain specific experiences and to predict their consequences. The construction and use of these theories and their role in belief formation are discussed in some detail in later sections of this chapter.

Distinguishing Beliefs From Other Constructs

The conceptualization of a belief as an estimate of subjective probability seems straightforward. However, its relation to other theoretical constructs is not as clear as one might like. Several ambiguities concerning these distinctions are worth noting.

Beliefs Versus Perceptions, Inferences, and Judgments

Three constructs—perceptions, inferences, and judgments—are often used interchangeably in social psychological research. It is useful to define them more precisely, however, as they are related to beliefs in different ways.

Although *perception* has a more technical meaning in research on psychophysics, we use the term in this chapter to refer to the interpretation of stimulus information in terms of concepts the information exemplifies. An *inference* refers to the construal of the implications of information or knowledge for an unspecified characteristic, based on cognitive rules of the sort we describe in later sections of this chapter. A *judgment* is the overt or implicit expression of an inference and can be either a verbal utterance (“ridiculous,” “exciting,” “nice”) or a rating along a scale. Thus, for example, if we hear a man chew out his secretary for being late, we might perceive this behavior to be hostile. Based on this perception, we might infer that the man is generally mean and insensitive. This inference, in turn, could later provide the basis for describing the person to someone else or for rating his eligibility for a position as personnel director. Beliefs, as we have conceptualized them, are estimates that an inference is correct. As such, they may be influenced by perceptions and have consequences for judgments.

Beliefs Versus Attitudes and Opinions

Measurement Ambiguities. Beliefs, attitudes, and opinions are obviously central constructs in social psychological theory and research. Nevertheless, there is a surprising lack of consensus about their meaning and the manner in which they are expressed. Agreement with a descriptive statement (e.g., “Cigarette smoking will be declared illegal”), for example, is often interpreted as a belief, whereas agreement with a prescriptive statement (e.g., “Cigarette smoking should be declared illegal”) is assumed to reflect an opinion. To the extent that agreement with a statement is based on one’s estimate of the likelihood that the statement is true, however, this distinction is illusory. The only difference might lie in the fact that the validity of a descriptive (belief) statement can often be verified empirically, whereas the validity of a prescriptive (opinion) statement cannot.

The fuzziness of the distinction between belief and opinion statements is further illustrated by comparing the belief statement, “Cigarette smoking is unhealthy,” and the opinion statement, “Cigarette smoking is detestable.” The statements are structurally similar, and both concern an association of a concept—cigarette smoking—with an undesirable attribute. Similarly, the assertion, “most Americans detest cigarette smoking,” is often assumed to reflect a belief, whereas the assertion, “I detest cigarette smoking” is assumed to express an attitude. However, agreement with each of these propositions might be based on the subjective probability that the proposition is true. To this extent, responses to all of these statements would reflect beliefs. Whether individuals who make these various statements see differences in their implications or, alternatively, use the statements interchangeably, is of course an empirical question.

Theoretical Considerations.   Theoretical formulations of the relations among beliefs, attitudes, and opinions do not help much to clarify matters. For instance, tripartite conceptions of attitudes (Katz & Stotland, 1959; Krech & Crutchfield, 1948; for reviews, see Breckler, 1984a, 1984b) have assumed that attitudes have an affective component (feelings toward the attitude object), a cognitive component (beliefs and opinions), and a conative (behavioral) component. In this view, beliefs and opinions are both components of an attitude by definition.

A definition of attitude in terms of beliefs and opinions is also implied by Thurstone's (1959; see also Edwards, 1957) attitude scaling procedures. That is, people's attitudes toward a referent is based on their agreement with a set of statements that have been scaled on the basis of independent judges' beliefs about the favorableness of the statements' implications for the referent. A different conceptualization with similar implications was proposed by Wyer (1973). He found evidence that people's evaluation of an object along a category scale of liking (which is conceptually similar to scales along which attitudes are often measured) was the subjective expected value of a distribution of beliefs that the object belonged to each of the categories that compose the scale. Furthermore, people's subjective uncertainty about their evaluation of the object was predictable from the dispersion of their beliefs that it belonged to these categories. To the extent that an attitude is simply an expression of liking, this conceptualization also suggests that there is little conceptual difference between beliefs and attitudes. Moreover, it recognizes that people can be uncertain of their attitudes as well as the validity of statements that bear on them (beliefs).

Fishbein (1963; Fishbein & Ajzen, 1975) made a much clearer distinction between attitudes and beliefs. Borrowing largely from a subjective expected utility conceptualization (Peak, 1955; but see Fishbein, 1967, for a conceptualization in terms of social learning theory), he assumed that an attitude toward an object, A_O, can be predicted from the equation

$$A_O = \Sigma b_i e_i, \qquad [1]$$

where e_i is the evaluation of the ith attribute of the object and b_i is the belief that the object possesses the attribute. (Alternatively, if the attitude object is a behavior, e_i and b_i represent the evaluation of the ith consequence of the behavior and the belief that the consequence will occur, respectively.) According to this conception, beliefs about an object are theoretically determinants of an attitude toward the object but are not themselves an attitude.

Other conceptualizations also make distinctions. For example, Albarracín and Wyer (2001; see also Wyer, Clore, & Isbell, 1999) conceptualized attitudes toward an object as expressions of the affective reactions that people experience and attribute to their feelings about this object. According to them, attitudes can potentially be influenced by both (a) reactions that have actually become conditioned to the object through learning and are elicited by thoughts about it (e.g., b_i and e_i; see Equation 1), and (b) the affect that one happens to be experiencing for reasons that have nothing to do with the object being evaluated (e.g., moods) but is misattributed to one's feelings about the object (Schwarz & Clore, 1983, 1996). Along similar lines, Zanna and Rempel (1988) distinguished between evaluations that are based on feelings and evaluations that are based on other, nonaffective criteria (for empirical evidence of this difference, see Adaval, 2001; Pham, 1998; Yeung & Wyer, in press). To this extent, evaluations of an object along a scale of favorableness could sometimes be based on affect, sometimes on beliefs, and sometimes on both.

The controversy surrounding the relation between beliefs and attitudes cannot be fully resolved. To the extent that beliefs and attitudes are conceptually distinct, however, the relation between them is a matter of theoretical and empirical interest and does not exist by definition. In this chapter, we retain our conceptualization of beliefs as estimates of subjective probability which, in the case of propositions, are reflected in either (a) estimates of the likelihood that a

proposition is true, (b) expressions of confidence or certainty that the proposition is valid, or, in some cases, (c) agreement with the proposition. In contrast, we reserve the term *attitude* for responses to an object along a continuum of favorableness. Many of the factors that underlie belief formation and change could govern attitude processes as well. In this chapter, however, we will generally restrict our review of the literature to research and theory in which beliefs, as we conceptualize them, have been the primary focus of attention.

THEORIES OF KNOWLEDGE BELIEF ORGANIZATION

As noted earlier, a question arises as to whether beliefs (i.e., estimates of certainty or subjective probability) are part of knowledge and are represented as such in memory, or alternatively, they are the result of cognitive operations that are performed on this knowledge at the time the beliefs are reported. Suppose a woman is asked her belief in the proposition that comprehensive examinations increase the quality of undergraduate education. On one hand, she could retrieve and use a previously formed estimate of the likelihood that the proposition is true. On the other hand, she might never have thought about the issue before. In this case, she might compute her estimate on the spot, based on previously acquired knowledge that appears to be relevant. Moreover, these possibilities are not mutually exclusive. Even when a previously formed belief (or the report of this belief) exists in memory, it might be only one of several pieces of knowledge that might be drawn on in computing one's belief at a later point in time.

These alternative possibilities have seldom been articulated. Some conceptualizations (e.g., McGuire, 1960, 1981; Wyer & Goldberg, 1970) implicitly assume that beliefs are themselves elements of a stable memory system that is organized according to certain a priori rules (see also Slovic & Lichtenstein, 1971). Theories of belief change, such as Fishbein and Ajzen's (1975), operate under similar assumptions. Other conceptions, however (see Bem, 1972; Hasher, Goldstein, & Toppin, 1977), suggest that beliefs are situation-specific expressions of certainty that people do not estimate until they are called on to do so, and that they compute on the basis of whatever criteria happen to come to mind at the time.

To the extent that beliefs are computed online on the basis of criteria that are accessible in memory at the time, a conceptualization of these computational processes requires an understanding of both (a) the manner in which belief-relevant knowledge is organized in memory (and consequently is likely to be activated and applied) and (b) the cognitive processes that underlie the use of this knowledge to make an estimate. The next sections of this chapter concern these matters. We first describe how knowledge might be organized in memory and then review how people compute beliefs on the basis of this knowledge.

General Theories of Knowledge Organization

Numerous theories of memory organization have been proposed, details of which are beyond the scope of this chapter (for a summary, see Carlston & Smith, 1996; Smith, 1994). Four general conceptualizations that provide the bases for more specific theories of belief organization are worth describing briefly. The theories differ in terms of the assumptions they make about the degree of interrelatedness of different units of knowledge and the processes that surround their retrieval.

Independent-Trace Theories

Hintzman (1986) assumed that information in memory is not organized at all. That is, each experience is stored in memory as a separate trace, independently of others. When information

about a referent is required, a set of features, or *retrieval cues*, are compiled that specify the nature of the information being sought, and all existing representations that contain these features are activated. The features that are most frequently contained in the activated set of representations are weighted most heavily and, consequently, have the predominant influence on any judgment or decision that is made. Thus, for example, suppose someone is asked about war. The use of "war" as a retrieval cue might activate all of the knowledge that includes war as an element. The features common to this knowledge may be abstract and few in number, leading to a general description of war that is very nonspecific. "Vietnamese war" might activate only those representations that pertain to this more specific event, leading to a more detailed description whose implications could differ from those of war in general. As this example suggests, the more specific the retrieval cues, the fewer preexisting memory traces are likely to be identified and, therefore, the more detailed the memory.

Another implication of this conceptualization is that the more frequently a particular type of experience is encountered, the more representations containing the features of this experience are likely to be stored in memory and, therefore, the more likely it is that these features will have an influence on judgments and decisions. Moreover, each time information is retrieved, the features that are extracted from it form a new representation that is stored in memory along with the other representations on which it is based (Hintzman, 1986). Thus, abstract memory representations can come to function independently of the specific representations that were used to construct them.

Associative Network Theories

A second conceptualization has its roots in Collins and Loftus' (1975) spreading activation model of memory (see also Anderson & Bower, 1973; for a direct application to social memory, see Wyer & Carlston, 1979). This conceptualization assumes that concepts and knowledge units are represented in memory by *nodes* and that associations between them are denoted by *pathways*. Associations are presumably formed by thinking about one concept or knowledge unit in relation to another. The more often the two elements are thought about in combination, the stronger the association becomes.

The model assumes that when a particular unit of knowledge is thought about (i.e., activated), excitation spreads to other units along the pathways connecting them. When excitation that accumulates at a node reaches a minimum activation threshold, the knowledge stored at this node is activated, leading it to come to mind as well. Once a unit of knowledge is deactivated (no longer thought about), however, the excitation at the node does not dissipate immediately but decays gradually over time. Consequently, the unit is more likely to be reactivated by additional excitation that is transmitted from other sources. In effect, this assumption implies a recency effect of activating a concept or unit of knowledge on its later recall and use.

An associative network model contrasts with an independent-trace conceptualization in the emphasis it places on the associations that are formed between different units of knowledge as a result of the cognitive activities that surround their use. Moreover, it assumes that once two units of knowledge become associated as a result of thinking about them in relation to one another, the subsequent activation of one will stimulate the activation of the other as well. Many specific conceptualizations of belief organization and change are implicitly based on this assumption.

Schema Theories

Associative network theories of knowledge organization assume that different pieces of knowledge are discrete and are stored at different memory locations. A somewhat different conceptualization (Brewer & Nakamura, 1984; Rumelhart, 1984) assumes that many knowledge

structures are organized in memory schematically, or configurally, as a set of interrelated features. In social psychology, the term *schema* has often been used to refer to any cluster of features that have become associated with a referent and stored in memory as a unit (Fiske & Taylor, 1991). However, it is useful to distinguish between *categorical* representations, which consist of a list of features without any inherent organization, and *schematic* representations whose features are interrelated according to a set of rules that can be specified a priori (see Bobrow & Norman, 1975; Brewer & Lichtenstein, 1981; Mandler, 1979; Wyer & Carlston, 1994). These relations can be spatial, temporal, or logical. A spatially organized schema is exemplified by a human face whose eyes, nose, and mouth are in specified positions in relation to one another. A temporally organized schema might be composed of the events that occur in a restaurant. The features of many event representations can be organized both spatially and temporally. For example, a mental representation of "The boy threw the ball to the girl" could consist of a mental image of the boy and the ball positioned in relation to one another, but might also depict the ball in the air and the girl waiting to catch it, and her actually doing so.

In contrast, a categorical representation might simply consist of a central concept denoting its referent along with a number of unrelated features that have no particular order. A lawyer, for example, might be represented as someone who prepares briefs, questions witnesses, and is both mercenary and articulate. However, the description would be equally meaningful if the attributes were conveyed in a different order (e.g., "is articulate, questions witnesses, is mercenary, and prepares briefs"). In contrast, order is critical is a schematic representation. For example, a description of a restaurant visit in which the person ate a meal, looked at the menu, paid the bill and was shown to a table would appear to make little sense.

The most important distinction between schematic and categorical representations arises when they are brought to bear on the comprehension of new information. That is, all of the features that are necessary to construct a schematic representation are not always specified. To this extent, they must be implicitly added in order to make the representation meaningful. Thus, the description of someone as having a big nose and a beard does not specify the nature of the eyes and hair color. Similarly, the statement "John went to a Chinese restaurant, ordered fried rice and paid $14" does not indicate that John actually ate the meal. These features may nevertheless be added spontaneously in the course of comprehending the information. These additions can often occur spontaneously (Graesser, Singer, & Trabasso, 1994). When this occurs, there may often be little distinction between the added features and those that were actually specified in the information presented.

This latter possibility is important. We noted earlier that when people have formed a representation on the basis of new information, they later use the representation as a basis for judgments and decisions without consulting the information on which it was based. To this extent, the added features, although not specified, may be recalled as actually having been mentioned. (For empirical evidence of these intrusions in a variety of domains, see Bransford, Barclay, & Franks, 1972; Graesser, Gordon, & Sawyer, 1979; Loken & Wyer, 1983; Spiro, 1977. Formal accounts of such intrusions are implied by connectionist and distributed processing models; see Smith, 1996). The implications of these intrusions for an understanding of belief formation and change are elaborated presently.

"Storage Bin" Models

A fourth conceptualization combines features of other approaches. This conceptualization assumes that information about a particular referent is stored in memory at a particular location, thereby constituting a *memory organization packet* (Schank, 1972) or, in terms of Wyer and Srull's (1986, 1989) conceptualization, a *referent bin*. The knowledge representations that are stored in a particular location can depend on the type of information being represented. Thus,

they can include propositions, schemas, visual images, clusters of traits and behaviors, and sequences of temporally related events. Once each representation is formed, it is stored as a separate unit of knowledge and can later be retrieved independently of others for a purpose to which it is relevant.

Wyer and Srull (1989) assume that knowledge is stored in a bin in the order it is acquired, with the most recently formed representation on top. Moreover, when information about a referent is needed, a bin pertaining to the referent is identified and a probabilistic top-down search is performed for knowledge of the type required. If a knowledge representation is identified, a copy of it is formed and, once it has been used, is returned to the top of the bin. This means that knowledge representations that have been formed and used most recently (i.e., ones near the top of a bin) and frequently (that are represented in multiple copies) are most likely to be used again. In evaluating this possibility, note that the assumption that recently formed knowledge representations are most likely to be retrieved and used does not negate the influence of information acquired earlier. The first information one receives about a person or object may often influence the interpretation of later information and may provide a central concept around which later information is organized. In such instances, the first information obtained about a referent may have a disproportionate impact on judgments. (For a more detailed discussion of primacy vs. recency effects within the framework of this model, see Wyer & Srull, 1989.)

Summary

The four conceptualizations outlined are metaphorical and should be evaluated in terms of their utility in conceptualizing and predicting empirical findings rather than in their validity as a description of the physiology of the brain. The assumptions underlying the conceptualizations are implicit in many more specific formulations of belief formation and change to be discussed in this chapter. Moreover, the conceptualizations provide a basis for postulating four factors that are often assumed to underlie the retrieval and use of belief-relevant knowledge. The implications of these theories can be summarized in four postulates:

P1: (Recency). The likelihood of retrieving and using a piece of belief-relevant knowledge is a positive function of the recency with which the knowledge has been acquired or used in the past.

P2: (Frequency). The likelihood of retrieving and using a piece of belief-relevant knowledge is a positive function of the frequency with which it has been encountered and used in the past.

P3: (Strength of Association). The likelihood that exposure to one unit of knowledge stimulates the retrieval and use of a second unit increases with the extent to which the two units of knowledge have been thought about in relation to one another.

P4: (Schematic processing). If a configuration of information is comprehended in terms of a more general schema, features that are not mentioned in the information but instantiate features of the schema will be spontaneously added to the representation as it is formed and, therefore, will later be recalled as actually having been mentioned.

The implications of these postulates for belief formation and change become important in light of research and theory on knowledge accessibility (Bargh, 1994, 1997; Bargh, Chen, & Burrows, 1996; Bargh & Pietromonaco, 1982; Higgins, 1996; Wyer, 2003). As Taylor and Fiske (1978) pointed out, people typically do not bring all of the relevant knowledge they have available to bear on a judgment or decision. Rather, they rely on only a small amount of this information that comes to mind easily at the time. Chaiken (1987) provides a particularly

clear theoretical analysis of this possibility. That is, when people are required to make a judgment or decision, they first apply the criterion that is quickest and easiest to use and assess their confidence that the implications of this criterion are valid. If their confidence is above a minimum threshold, they base their response on this criterion without further consideration. If, however, their confidence is below the threshold, they apply additional criteria, and continue in this manner until either their threshold is reached or, alternatively, they do not have the time to engage in further processing. Situational and individual difference factors that influence participants' confidence threshold will consequently determine the number of criteria they employ. In general, however, only a small amount of knowledge will be involved.

In the present context, these considerations suggest that the knowledge that people use as a basis for the beliefs they report is likely to be a function of the recency and frequency with which it has been encountered or thought about in the past (Postulates 1 and 2), or the strength of its association with other belief-relevant knowledge that happens to be accessible in memory (Postulate 3). For example, evidence that more extensively processed information is easier to recall (Craik & Lockhart, 1972; see also Wyer & Hartwick, 1980) could be partly a reflection of the effects of frequency and strength of association implied by Postulates 2 and 3. Knowledge accessibility may also depend on the information's relatedness to a more general schema that is brought to bear on the referent of the beliefs being reported. Theory and research that are based on these assumptions are described in the pages to follow.

Associative Theories of Belief Organization and Change

Some theoretical formulations of belief formation and change are based on assumptions similar to those of a general associative network conceptualization, whereas others exemplify schema-based conceptions of knowledge organization. Still other theories make minimal assumptions about the organization of knowledge in memory and, therefore, are more akin to independent-trace models. In this section of the chapter, we focus on network types of representations, giving primary emphasis to McGuire's (1960, 1981; McGuire & McGuire, 1991) formulations of knowledge organization.

The Content and Structure of Thought Systems

Perhaps the most extensive and far-reaching analysis of the organization of belief-relevant knowledge is embodied in William and Claire McGuire's (1991) conceptualization of the content, structure, and operation of thought systems. They proposed that in order to cope effectively with the situations and events they encounter in daily life, people attempt to explain events that have occurred in the past and to predict their occurrence in the future. This disposition stimulates them both to identify the antecedents of the events they encounter and to construe the consequences of these events. To confirm this assumption, the McGuires asked participants to free associate to propositions that described the possible occurrence of an event such as increasing admission prices to university sporting events. As they expected, over 65% of the responses to these propositions pertained to either reasons why the event might occur or to potential consequences of its occurrence.

McGuire and McGuire (1991) postulated four more specific strategies that people can use to cope with life experiences. These strategies take into account both people's desire to see the world in a favorable light and their desire to have an accurate perception of reality.

1. (Utility maximization) Events stimulate thoughts about consequences that are similar to the events in desirability. That is, desirable (undesirable) events stimulate thoughts about possible consequences that are also desirable (undesirable).

2. (Congruent origins) Events stimulate thoughts about antecedents that are similar to them in desirability. That is, desirable (undesirable) events stimulate thoughts about desirable (undesirable) causes.

3. (Wishful thinking) Desirable events stimulate thoughts about why the events are likely to occur, whereas undesirable events stimulate thoughts about why they will not occur.

4. (Rationalization) Events that appear likely to occur stimulate thoughts about desirable consequences, whereas events that are considered unlikely stimulate thoughts about undesirable consequences.

The first two of these hypotheses—utility maximization and congruent origins—received strong support in McGuire & McGuire's (1991) research. Although the other postulates were less convincingly supported on the basis of participants' spontaneous free responses in the McGuires' work, they have received confirmation in other paradigms. For example, participants who have formed a favorable attitude toward a behavior on the basis of the affect they are experiencing for objectively irrelevant reasons tend both (a) to increase their beliefs that the behavior will have consequences they consider to be desirable, and (b) to increase their liking for consequences of the behaviors that they believe are likely to occur (Albarracín & Wyer, 2001).

Empirical Evidence

According to an associative network conception of knowledge organization, thinking about two entities in relation to one another should increase their association in memory and, therefore, should increase the likelihood that calling attention to one of the events will stimulate thoughts about the other as well (Postulate 3). To this extent, the McGuires' research provides insight into the sort of associations that are formed spontaneously between causally related events in the absence of explicit requests to do so. As noted earlier, people who are called on to explain an event or construe its desirability may bring only a small amount of knowledge to bear on these judgments. Thus, people who are motivated to estimate the likelihood of the event described in a proposition may search for antecedents of it, whereas those who are motivated to construe the event's desirability may search for possible consequences of it. In each case, however, they are likely to identify and use the first relevant piece of previously acquired knowledge that comes to mind rather than searching for all of the information that might be relevant (Higgins, 1996). Therefore, the number of associations that are actually formed as a result of this activity may be limited.

Evidence that these associations are formed was obtained by Wyer and Hartwick (1984). Participants first read a list of randomly ordered propositions with instructions to indicate if they understood them. Some of the propositions were causally related; that is, the event that was described in one proposition, A (e.g., "Trucks carrying heavy cargo destroy highway paving") was the antecedent of the event that was described in a second, C (e.g., "the weight limit on truck cargo may be decreased"). After this familiarization task, some participants reported their belief in either the antecedent (A) or the consequence (C). Others reported the desirability of either A or C. Finally, in a second session several days later, participants recalled the propositions they had encountered in the earlier session.

The authors reasoned that if a judgment-relevant proposition had been made salient during the familiarization task, participants would identify and use it, thereby forming an association between this proposition and the one they were asked to judge. Thus, they should form an association between A and C if they are asked to report either their belief in C (which stimulates them to search for an antecedent) or the desirability of A (which leads them to search for a consequence). This association should be reflected in their recall of the propositions later.

Specifically, if *A* and *C* are associated in memory, thoughts about one proposition (e.g., *C*) should cue the recall of the second (*A*). Consequently, the likelihood of recalling *A* should be greater if *C* has been recalled than if it has not. This possibility was, in fact, the case when participants had reported either their beliefs in *C* or the desirability of *A*. When they had reported the desirability of *C* or their belief in *A*, however, no association between the two propositions was formed, and so the recall of *A* had no impact on the recall of *C*.

Implications for Belief Salience

Associations of the sort postulated by the McGuires (1991) and Wyer and Hartwick (1984) have implications for the sort of knowledge that is likely to be used as a basis for not only beliefs but attitudes as well. Fishbein and Ajzen (1975) assume that people's attitudes toward an object or behavior are determined by the subset of beliefs about the attributes of the referent that are *salient* (i.e., accessible) in memory. These attributes, and the beliefs pertaining to them, can vary over both individuals and situations. For example, a person might believe both that using condoms prevents AIDS and that using condoms decreases unwanted pregnancies. However, these beliefs may differ in the strength of their association with the notion that using contraceptives is desirable and, therefore, the likelihood that they come to mind when the possibility of using condoms is thought about.

As implied by Postulates 1 to 4, however, other situational factors can influence the retrieval of belief-relevant propositions from memory as well, including the frequency and recency with which the propositions have been thought about or the amount of thought that has been devoted to them in the past (Craik & Lockhart, 1972). To this extent, people are likely to report different attitudes, depending on which subset of belief-relevant cognitions happens to come to mind at the time (for a review of relevant evidence, see Albarracín, Wallace, & Glasman, in press). These considerations suggest that attitudes, like other judgments, are not always stable, but rather, can depend on the time they are requested or become necessary for attaining a goal to which they are relevant (Schwarz & Bohner, 2001; but see Krosnick & Petty, 1995, for a different view).

Au: Pls. provide year.

Further Considerations

Although the associative processes postulated by McGuire and others have typically focused on small numbers of related propositions, these processes can potentially govern the relations among substantial bodies of knowledge. Several attempts have been made to assess individual differences in the differentiation and interrelatedness of persons' belief systems and to examine their implications (see Gruenfeld, 1995; Linville, 1982; Rokeach, 1954; Schroeder, Driver, & Streufert, 1967; Scott, 1969; Scott, Osgood, & Peterson, 1979). As Wyer (1964) showed, however, alternative measures of cognitive differentiation and integration are often uncorrelated and, therefore, may be tapping different underlying constructs. This makes general conclusions based on this research difficult to draw.

Probabilogical Models of Belief Organization and Change

The conceptualization of knowledge organization developed by the McGuires (1991) provides an indication of how different pieces of belief-relevant knowledge can become associated in memory. However, it does not describe the way in which beliefs themselves are related, or how beliefs in one piece of information can affect beliefs about others to which it is related. A conceptualization proposed by McGuire (1960, 1981) and extended by Wyer and Goldberg (1970; see also Wyer, 1974, 2003) addressed this matter. McGuire (1960) noted that the causal relatedness of two cognitions, A and C, can be described in a syllogism of the form "*A*;

if A, then C; C." To this extent, beliefs in C should be a function of the beliefs that these premises are true (that is, the beliefs that A is true *and* if A is true, C is true). Wyer (1970; Wyer & Goldberg, 1970) further noted that C might be true for reasons other than those embodied in these premises, and that beliefs in these reasons could be reflected in beliefs in the mutually exclusive set of premises, "not A; if not A, then C." If this is so, and if beliefs in the premises are in units of subjective probability (i.e., along a scale from 0 to 1), the belief that C is true, $P(C)$ should be a function of the beliefs in these two mutually exclusive sets of premises, or:

$$P(C) = P(A)P(C/A) + P(\sim A)P(C/\sim A), \qquad [2]$$

where $P(A)$ and $P(\sim A)$ $[= 1 - P(A)]$ are beliefs that A is and is not true, respectively, and $P(C/A)$ and $P(C/\sim A)$ are conditional beliefs that C is true if A is and is not true, respectively.

Several studies (Wyer, 1970, 1975) show that experimental manipulations of the beliefs composing the right side of Equation 2 confirm the multiplicative and additive effects of these beliefs on beliefs in the conclusion. Moreover, if people's estimates of the likelihood of each proposition are reported along a 0 to 10 scale and then divided by 10 to convert them to units of probability, the equation provides a quantitative description of the relations among the beliefs composing it that is typically accurate to within a half of a scale unit (.05) without requiring ad hoc curve-fitting parameters. This is true regardless of whether the beliefs involved pertain to abstract entities (e.g., genes and person attributes) that are described by the experimenter (Wyer, 1975), events described in stories about hypothetical events (Wyer, 1970), or events that might occur in the real world (Wyer & Goldberg, 1970).

Several studies (see Dillehay, Insko, & Smith, 1966; Holt, 1970; Watts & Holt, 1970) support the assumption that people attempt to maintain logical consistency among their beliefs and opinions. McGuire (1960) suggested one particularly interesting implication of this assumption. He noted that people's beliefs are not always consistent because they do not think about them in relation to one another. However, asking people to report syllogistically related beliefs in temporal proximity should call their attention to any inconsistency that exists and, therefore, should stimulate them to reduce or eliminate the inconsistency by changing one or more of the beliefs involved. If this is true, the beliefs that people report after engaging in this cognitive activity should be more consistent than they were at first. McGuire (1960) denoted this phenomenon to *Socratic effect*. Therefore, if Equation 2 provides a valid description of the relationship among syllogistically related beliefs, the accuracy of this equation in describing people's beliefs should increase over time once the beliefs to which the equation pertains have been made salient.

Rosen and Wyer (1972) confirmed this hypothesis. That is, participants reported their beliefs in propositions of the sort to which Equation 2 pertains in two sessions a week apart. These beliefs, converted to units of probability, were more consistent in the second session than the first. That is, participants appeared to revise their beliefs to eliminate inconsistencies among them once these inconsistencies were called to their attention.

Two contingencies in this conclusion are noteworthy. First, individual differences may exist in the disposition to eliminate logical inconsistencies of the sort that Equation 2 describes. For example, Norenzayan and Kim (2000) found evidence that the Socratic effect occurs only among representatives of Western cultures and is not evident among Asians. Easterners, who appear to have a less analytic thinking style than Westerners do (Choi, Nisbett, & Norenzayan, 1999), are apparently less motivated to engage in the syllogistic reasoning processes that underlie the Socratic effect.

Second, Henninger and Wyer (1976) found that the Socratic effect was only apparent when participants in the first administration of the questionnaire reported their beliefs in the

conclusion, $P(C)$, before reporting their beliefs in the premises. When participants encountered the premises first, the consistency of their beliefs was high in the first session and did not increase further over time. People may find it easier to change their belief in a conclusion to make it consistent with their beliefs in premises than to change their beliefs in premises to make them consistent with their belief in the conclusion. Therefore, participants who encountered the conclusion at the time their beliefs in the premises were salient to them were able to modify their belief in it online to make it consistent with their beliefs in these premises. However, participants who encountered the premises after reporting their beliefs in the conclusion could not easily engage in this online inconsistency resolution. Alternatively, they might have eliminated the inconsistency by altering their beliefs in the conclusion, but this change (and, therefore, the reduction in inconsistency that resulted from it) was not evident until they reported this belief again in the second session.

To the extent that the Socratic effect generalizes beyond the situations in which it has been traditionally investigated, it has further implications. For one thing, it suggests that changes in people's beliefs can be induced simply by calling their attention to preexisting knowledge that bears on the beliefs rather than by providing new information. Moreover, to the extent that calling people's attention to an inconsistency among their beliefs stimulates cognitive work to eliminate it, the increased coherence of these beliefs might make them more resistant to change in the future. McGuire's (1964) research on resistance to persuasion is worth noting in this regard. He found that exposing people to a communication that attacked a previously formed belief increased their resistance to subsequent attacks. Furthermore, this increased resistance was true even when the arguments presented in the initial attack differed from those in the later one. McGuire suggests that the initial attack made participants aware of their vulnerability, leading them to bolster their defenses by counterarguing, and that the practice they had in performing this activity increased their ability to refute the attack they encountered subsequently. Another possibility, however, is that the initial attack made them aware of the inconsistency in their beliefs associated with the target proposition and stimulated inconsistency resolution processes similar to those that underlie the Socratic effect. This increased coherence of the beliefs increased resistance to influence by subsequent messages.

SCHEMATIC THEORIES OF KNOWLEDGE ORGANIZATION AND INFERENCE: IMPLICATIONAL MOLECULES

Wyer and Hartwick's (1984) research suggests that the associations that people form between propositions can sometimes be fortuitous, depending on the knowledge that happens to be accessible in memory at the time the events are contemplated. However, many causally related events or states of affairs may be encountered frequently in the course of daily life, leading to the formation of strong associations between the propositions and the events or states they describe (Postulate 3). As a result, the configuration of causally related propositions may come to function as a schema, being activated and applied as a unit in comprehending information and drawing inferences about states or events to which it is applicable. To this extent, the application of such a schema could have effects of the sort suggested by Postulate 4.

Implicational Molecules

Abelson and Reich (1969) formalized this possibility (see also Bear & Hodun, 1975; Kruglanski, 1989; Wyer, 2004; Wyer & Carlston, 1994). They postulated the existence of *implicational molecules*, or sets of psychologically related propositions that are bound together by psychological implication. These molecules, which can function as schemas (Wyer & Carlston, 1979,

1994), reflect generalizations about events that occur frequently in the real world. Thus, for example, the general conviction that smoking causes lung cancer might be embodied in the molecule:

[*P* smokes; *P* has (will get) lung cancer].

Alternatively, a person might have a *just desserts molecule* exemplifying the notion that people get what they deserve, composed of the propositions:

[*P* does something bad (good); bad (good) things befall *P*].

Or, a *similarity-attraction molecule*, exemplifying the generalization that people who like the same thing like one another, might be:

[P_1 likes *X*; P_2 likes X; P_1 and P_2 like one another].

The schematic character of implicational molecules is exemplified by their use in comprehending new experiences. This comprehension is governed by a *completion principle* whose implications are similar to those implied by Postulate 4. That is, if a specific experience or set of experiences instantiates all but one proposition in a molecule, an instantiation of the other is inferred to be true as well. The principle applies regardless of which propositions are instantiated by the experiences and which are not. Thus, the just desserts molecule could be used to infer that a particular person who has done a bad deed will be punished or otherwise experience misfortune. However, it could also be used to infer that a person who has encountered misfortune has done something bad or is, for other reasons, a bad person (for evidence supporting this possibility, see Lerner & Miller, 1978; Lerner & Simmons, 1966; Walster, 1966).

The completion principle, which is consistent with processes that presumably occur in the construction of schemas, has extremely broad implications. Several more specific conceptualizations of belief formation and change can be viewed as special cases of the more general theory proposed by Abelson and Reich (1969). Two particularly well-known phenomena—cognitive balance and social attribution—are particularly worth discussing in this context. From different perspectives, each conceptualization calls attention to a more general question, concerning which of several alternative implicational molecules are activated and applied at any given time. The aforementioned principles of knowledge organization could potentially provide answers to this question.

Cognitive Balance Theory

According to Heider (1946, 1958), people's perceptions of interpersonal relationships are guided by the assumptions that people get along well with one another if they have similar interests, values, or attitudes; if they belong to the same group, organization, or social category; or if they have other characteristics in common. Correspondingly, they are not expected to get along well if their attitudes and values conflict, or if the individuals are dissimilar in terms of personality, group membership, or other characteristics. Note that these implications are very similar to those of the similarity-attraction molecule we described earlier.

One implication of balance theory is that balanced relations may be represented schematically in memory, whereas unbalanced relations may be stored as individual pieces of information. This possibility was confirmed on the basis of two criteria. First, if people comprehend new information they receive according to a balance principle, they are likely to spontaneously add unmentioned features to the representation they form that are consistent with these principles. Consistent with this prediction, Picek, Sherman, and Shiffrin (1975) gave participants

sets of relations among four hypothetical persons. In some cases, some relations were unspecified but, if inferred, would produce balanced triads of relations (e.g., *A* likes *B*; *B* likes *C*; *C* dislikes *D*; *D* dislikes *A*). In other cases, the missing relations would not produce perfect balance (e.g., *A* likes *B*; *B* likes *C*; *C* likes *D*; *D* dislikes *A*). Later, participants recalled the relations they had learned. Participants who were exposed to the first sets of relations tended to recall the unspecified balance-producing relations as actually having been presented. When the unspecified relations could not produce balance, however, intrusion errors were not evident.

Second, if people organize sets of relations in memory according to balance principles, they should later respond to the information as a single unit of knowledge rather than in terms of its constituent elements. Sentis and Burnstein (1979) provided compelling evidence of this possibility. Participants were exposed to sets of three relations that were either balanced (e.g., "Al likes Bob; Al dislikes *X*; Bob dislikes *X*") or imbalanced (e.g., "George likes Peter; George dislikes *X*; Peter likes *X*"). Then, they were shown sets of either 1, 2, or 3 of the relations in each set and asked to verify that the relations were among the ones they had previously seen. When the original set of relations was imbalanced, the time that participants took to perform this task increased with the number of relations they were asked to verify. When the relations were balanced, however, the opposite was true; participants took less time to verify all three relations in combination than they took to verify any one of the relations when presented in isolation. In the latter case, participants had apparently stored the relations in memory as a unit, and so they could verify a configuration that matched this unit very quickly. However, more time was required to "unpack" the configuration in order to verify any given component.

Numerous applications of cognitive balance exist in the literature (for summaries, see Eagly & Chaiken, 1993). Moreover, the theory has been extended to larger configurations of cognitions (Abelson & Rosenberg, 1958; Cartwright & Harary, 1956; see also Gollob, 1974, for an interesting extension of the theory). In most successful tests of the conceptualization's utility in describing comprehension and inference, however, the persons and objects involved in the relations have been described abstractly, and the relations do not reflect the social context in which they occurred. When the information pertains to specific types of people and relations, the applicability of the principle is often unclear (see Wyer & Lyon, 1970).

Several of these contingencies are suggested by an implicational molecule conceptualization. In addition to a similarity-attraction molecule, for example, people are likely to have a *competitiveness molecule* that exemplifies the generalization that people who want the same thing dislike one another:

$$[P \text{ wants } X; O \text{ wants } X; P \text{ and } O \text{ dislike one another}]$$

In addition, they might have a *jealousy molecule* exemplifying the generalization that people dislike others who have what they want:

$$[P \text{ wants } X; O \text{ has } X; P \text{ dislikes } O]$$

The applicability of these molecules are likely to depend on the types of elements involved in the relations being described as well as the relations themselves. A similarity-attraction molecule is likely to be applied when *P*'s and *O*'s sentiment relations to the referent do not create interpersonal conflict. Thus, for example, two men, Bob and Alan, may both be believed to like one another if they have similar sentiments about George W. Bush. If Bob and Alan are both in love with the same woman, however, or if Bob covets Alan's wife, the competitiveness and jealousy molecules are more likely to be applied. To this extent, the beliefs may be governed by the completion principle in much the same way described earlier. However, the effects of applying the principle would not produce balance.

Beliefs About Causality

Several motives could potentially underlie a person's behavior. For example, people do things (a) because they like doing them, (b) because they are forced to do them, or (c) because their actions will attain some external objective that they consider desirable. These generalizations could be exemplified in three different molecules, which have a proposition in common:

1. [*P* enjoys *B*; *P* performs *B*]
2. [*O* controls *P*; *O* likes *B*; *P* performs *B*]
3. [*P* wants *X*; *B* facilitates *X*; *P* performs *B*]

Thus, suppose people hear a man express a favorable opinion of abortion, which exemplifies the proposition "*P* performs *B*." In the absence of any other information, only the first of the aforementioned molecules would stimulate an application of the completion principle. Thus, observers should infer that the man favors abortion (or, at least, likes to advocate it publicly). However, suppose observers learn that the person's employer favors abortion (an instantiation of "*O* likes *B*") or that the person is getting paid to advocate the position (an instantiation of "*B* facilitates *X*"). In these cases, the completion principle could be applied to the second and third molecules as well as the first. Assuming that all three molecules are equally accessible, therefore, people should be less likely to infer that the man personally favors abortion (or the behavior of advocating it) in this case than when only the first molecule applies.

This conclusion, of course, is consistent with correspondent inference theory (Jones & Davis, 1965). Moreover, note that the molecules are potentially applicable in comprehending and making inferences about one's own behavior as well as others'. To this extent, a similar analysis would suggest that a person would infer his/her own liking for abortion to be less when the second two molecules are potentially applicable than when they are not (see Bem, 1967, 1972).

Our analysis of attribution phenomena in terms of implicational molecule theory assumes that these phenomena occur spontaneously in the course of comprehending the information one receives. As such, it clearly does not capture all of the phenomena to which theory and research on social attribution is relevant. Many attributions are made deliberately to comply with social demands, or are stimulated by personal motives (e.g., the desire to maintain self-esteem). We consider these possibilities in a later section of this chapter.

Stereotypes as Implicational Molecules

People may form generalizations about the characteristics of individuals who belong to certain social groups or categories. These generalizations, which are typically viewed as *stereotypes*, can be conceptualized as implicational molecules of the form:

[*P* belongs to group *G*; Members of *G* have attribute *X*; *P* has attribute *X*].

Thus, if members of a group are believed to be aggressive, an individual member of the group may be inferred to have this attribute, and this inference may be made independently of other information available.

Research on stereotype-based beliefs and inferences is extensive (for reviews, see Fiske, 1998; Hamilton & J. Sherman, 1994), and a detailed review is beyond the scope of this chapter. To give but one example, Bodenhausen and Wyer (1985) found that individuals who read the transcript of a criminal case in which the defendant was accused of assault in a bar were more likely to believe that the defendant was guilty if his name was Carlos Ramirez than if his name was nondescript, and this effect occurred independently of the implications of the evidence contained in the transcript. The name of the defendant apparently activated a stereotype of Latinos as aggressive, and this stereotype influenced judgments independently

of other considerations (but see Bodenhausen & Lichtenstein, 1987, for qualifications on this conclusion).

The conceptualization of stereotype-based representations of knowledge as implicational molecules has further implications. According to the completion principle, people should not only infer that a person has a stereotype-related attribute on the basis of information about his group membership, but should infer the individual's group membership on the basis of information that he has stereotype-consistent attributes. This prediction is essentially a recognition of the *representativeness* heuristic identified by Kahneman and Tversky (1972). That is, American college students who are told that a person is short, has black hair, and reads poetry infer that the individual is more likely to be a Chinese studies professor than to be an engineering professor despite the fact that few if any American university faculty members are Chinese studies professors and that the description is characteristic of many individuals who were not Chinese.

The Role of Implicit Theories in Belief Formation and Change

The implicational molecules we have described consist of only a few causally related propositions. Much more extensive scenarios can be constructed to describe entire sequences of events that occur over a period of time. These scenarios, which have the form of a narrative, theoretically exist in memory as a single unit of knowledge (Schank & Abelson, 1995; Wyer, 2004; Wyer, Adaval, & Colcombe, 2002). As such, they can function as *implicit theories* about the sequence of temporally and thematically related events that occur in situations of the sort to which they refer. Once these narrative-based theories are constructed, they can potentially be used to comprehend new experiences that exemplify them. To this extent, they can influence beliefs about unmentioned events and states of affairs through processes similar to those implied by Postulate 4.

The narrative representations that constitute implicit theories can be of several types (Wyer, 2004). Some representations may be mental simulations of situational- and temporally specific sequences of events (e.g., episode models; see Wyer & Radvansky, 1999). Others may have the character of stories about real or hypothetical experiences involving themselves and others that people communicate to one another for the purpose of informing, entertaining, or illustrating a point. More general representations (e.g., scripts; see Schank & Abelson, 1977; Todorov, 1973) can depict prototypic sequences of events that occur routinely in certain general types of situations (e.g., a restaurant). Still other generalized representations could resemble *story skeletons* (Schank & Abelson, 1995) that people use to comprehend the events that occur in a series of thematically related situations. A common example might be the romantic scenario of the sort that pervades movies and television shows—for example, a boy meets a girl, they fall in love, an unexpected event creates conflict, the boy and girl argue and break up, the misunderstanding is resolved, and the boy and girl make up and live happily ever after.

Comprehension and Memory Processes

The influence of implicit theories on beliefs could often be guided by a completion principle similar to that postulated to underlie the use of an implicational molecule. That is, once a preexisting representation is activated and used to comprehend new information, instantiations of unmentioned features that are required in order to comprehend the information may be added spontaneously to the representation that is formed of the information. Consequently, these features may be later recalled as actually having been presented. Thus, people who read that "John pounded a nail into the wall" might later recall that he used a hammer (Bransford, Barclay, & Franks, 1972). Similarly, people who are told that Bob went to an Italian restaurant,

ordered chicken cacciatore, and paid $21.95 might later recall that he ate there (see Graesser et al., 1979), although he might actually have been picking up some food for a sick friend. These intrusions occur spontaneously at the time the information is comprehended (Wyer & Radvansky, 1999; but see Colcombe & Wyer, 2002, for a qualification on this conclusion).

Other intrusions can occur as a result of more deliberative processing. This processing may be stimulated by an attempt to explain an unexpected event, or could result from the need to comply with external demands. A study by Spiro (1977) exemplifies the former possibility. Participants in an initial experimental session read an ostensibly true story about an engaged couple. In some versions of the story, the man revealed that he did not want children, the woman objected, and a serious argument ensued. After reading the story, the participants were asked to perform an ostensibly unrelated task. While they were doing so, however, the experimenter incidentally remarked that the couple had gotten married and were still happily together.

Participants were then dismissed but returned for a second experimental session several weeks later, at which time they were asked to recall the story they had read earlier. They were explicitly cautioned to report only things that were mentioned in the story and not inferences they had made. Nevertheless, many participants recalled behaviors that had not been described but were consistent with the romantic relationship story skeleton described earlier. For example, one person recalled that the woman found she couldn't have children. Another recalled that the man changed his mind. Apparently, persons who heard the experimenter's incidental remark during the first session spontaneously speculated about how it might be true despite the serious conflict described in the story they had read, and made inferences about unstated events, based on the implications of the story skeleton. These inferences then became part of the representation that they stored in memory and later used as a basis of their recall (Postulate 4).

Similar effects can result from external demands. In a well-known demonstration by Loftus and Palmer (1974), participants who had been shown a picture of a traffic accident were asked either how fast the car was going when it "smashed into" the tree or, alternatively, how fast the car was going when it "hit" the tree. Participants estimated a faster speed in the first case than the second. In doing so, however, they reconstructed the picture they had seen, adding features to it that were consistent with implications of the question. Thus, they reported seeing broken glass at the scene of the accident, although it was not actually shown in the picture.

Loftus (1975) provides numerous other examples of this phenomena in her analysis of the questionable validity of eye-witness testimony. In other contexts (Loftus, 2000), she notes that similar phenomena can underlie adults' post-hoc memories of sexual abuse that occurred in early childhood. That is, individuals who have a very vague memory of an event that occurred in early life may be stimulated to apply an implicit theory of sexual abuse in reconstructing a story about it, adding features that they later remember as actually having taken place.

Reconstructing the Past

Loftus' (2000) examples of reconstructive memory for sexual abuse may exemplify a more general influence of implicit theories on people's beliefs about the past that occurs very frequently in daily life. That is, when people have only a vague recollection of specific events, they may use implicit theories as a basis for reconstructing these events instead of relying on their memory for what actually occurred. Research summarized by Michael Ross (1989) provides examples. In one study, female participants who had previously reported their typical emotional reactions during the period of their menstrual cycle were asked to keep a daily diary of their moods over the course of a month. At the end of the month, they were asked to recall the moods they had experienced during this period. Participants' recall was better predicted by their implicit theories about their emotional reactions during the time of their menstrual cycle than by the actual feelings they had reported experiencing at this time.

Students in a second study (Conway & Ross, 1984) participated in a program that they believed would increase their study skills. After participating, they were asked to recall their preprogram estimates of their ability. Their recall was governed primarily by their implicit theories that the program would be effective. Thus, participants whose skills after participating did not actually change over the course of the program recalled their preprogram ability as lower than it actually was, consistent with their theory that they had improved.

In a study by Goethals and Reckman (1973), students participated in a group discussion of bussing. The discussion was dominated by a confederate whose position contrasted with the opinion that participants had reported in an earlier session. The confederate's view had a substantial influence on not only participants' postdiscussion opinions but also their recall of the opinions they had reported earlier. Thus, participants apparently employed an implicit theory that their position on the issue was stable over time and, therefore, used their postdiscussion opinions to infer what their earlier position must have been before the discussion took place. This interpretation was confirmed by Ross (1989). Specifically, participants, after reporting their agreement with the position advocated in a persuasive message, were asked to list the thoughts they had had in the course of trying to recall the opinion they had reported 1 month earlier. Responses of over 50% of the participants suggested the use of an implicit *temporal consistency theory* (e.g., "I answered the question now and assumed that my opinion probably hadn't changed month in a month or so.").

Research conducted in the context of self-perception theory (Bem, 1967, 1972) provides further examples. Bem argued that when people are asked to report their stand on a social issue, they do not perform an exhaustive review of the large amount of self-knowledge they have stored in memory that bears on this position. Rather, they retrieve the judgment-relevant information that comes most easily to mind and base their response on the implications of this information alone. In many instances, this information is a behavior they have recently performed. Under these circumstances, people construe the implications of this behavior for the judgment they are asked to make and resort to additional information only if they consider its implications to be unclear or unreliable (see Chaiken, 1987).

In an interesting demonstration of this possibility, Bem and McConnell (1970) induced participants to advocate a position with which they had reported disagreement during an earlier experimental session. Some participants were given the opportunity to refuse to advocate the position, whereas others were not given a choice. Later, participants were asked to recall the belief they had reported in the earlier session. Participants who had voluntarily agreed to advocate the position recalled their beliefs as consistent with the position they had advocated, whereas those who were forced to advocate the position did not. Thus, the former participants appeared to invoke a theory that people believe in the positions they voluntarily agree to advocate publicly and used this theory to infer their prebehavior position on the issue they endorsed rather than recalling the position they had actually reported.

Spontaneous Versus Deliberative Processes of Belief Formation

The impact of implicational molecules and implicit theories on beliefs is due in part to their schematic character. That is, unmentioned features of information that instantiate elements of the molecule or theory that is used to comprehend it may be added spontaneously to the mental representation of the information's referent that is formed and stored in memory. As a consequence, these elements may later be recalled as actually having been mentioned (Postulate 4). As the research by Ross and his colleagues testifies, however, implicit theories are also used deliberately to make inferences about events to which they pertain. In these latter cases, the implicit theories might not be invoked unless participants are confronted with a task that

requires them. In this regard, it is generally important to distinguish between beliefs that are formed spontaneously in the course of receiving information and beliefs that are only constructed on demand, or in the service of a goal to which they are relevant.

The Spontaneous Identification of True and False Statements

A theoretical discussion of the conditions that give rise to spontaneous and deliberative inferences in the course of comprehension is provided by Graesser, Singer, and Trabasso (1994). Two conceptualizations developed in social psychological research have implications for this question. Gilbert (1991; Gilbert, Krull, & Malone, 1990) postulated that people must entertain the possibility that an assertion is true in order to comprehend it. However, a second stage of processing is required to identify the statement as false. To demonstrate this two-stage process, participants in one study (Gilbert, 1991) received a series of stimulus statements along with indications that the statements were either true or false. Then, they were asked to verify the truth of these statements while performing either a simple or a distracting cognitive task. Participants who were distracted were presumably able to perform the first, comprehension stage of processing. Therefore, they were unlikely to misidentify true statements as false despite the distraction. In contrast, distraction significantly disrupted the second, falsification stage of processing, as evidenced by an increase in the tendency to misidentify false statements as true.

A somewhat different conceptualization proposed by Wyer and Radvansky (1999; see also Wyer, 2004). According to this theory, people who encounter a proposition comprehend it by forming a mental simulation of the situation it depicts (e.g., a situation model), based on a comparison of its features to those of a previously formed knowledge representation in memory. If the similarity of the statement to the representation they use to comprehend it exceeds a certain threshold, people not only comprehend the information but spontaneously recognize it as true. Correspondingly, if the similarity is below some minimal threshold, they spontaneously identify it as false. If the similarity falls in between these extremes, however, participants comprehend and store the proposition in memory without assessing its validity.

Wyer and Radvansky (1999) obtained support for this conceptualization. Participants were exposed to propositions about actual people and events about which they had prior knowledge. Some of the propositions were true (e.g., Jane Fonda acted in a movie), others were false (e.g., Jane Fonda played professional basketball) and others were of uncertain validity (e.g., Jane Fonda rode a motorcycle). Some participants were asked to indicate whether or not they understood each statement, whereas others were told to indicate whether the statements were likely to be true or false. The time required to verify true and false statements was very similar to the time required to comprehend them, suggesting that verification occurred spontaneously in the course of comprehension. In contrast, statements of unknown validity took much longer to validate than to comprehend.

Implications of Spontaneous Validation Processes

Wyer and Radvansky's (1999) theory has additional implications. Grice (1975) and others (e.g., Green, 1989; Higgins, 1981; Sperber & Wilson, 1986) note that social communication is often governed by certain normative principles (e.g., to be informative, to tell the truth, to be polite, etc.). Consequently, when a message that is conveyed in a social context appears to violate these principles, recipients may attempt to reinterpret its implications in a way that conforms to their expectations. For example, if people perceive that a statement's literal meaning is obviously true or obviously false, they may infer that the communicator intends the statement to be ironic and, therefore, to express the opposite point of view. Thus, the assertion "Central Illinois is a wonderful place to spend the summer—I simply love all that heat and high humidity" is likely

to be interpreted by residents of the area as sarcastic (that is, as a disparagement of Illinois and not a true description of its virtues).

The effects of communication norms on responses to information have been discussed in detail elsewhere (Higgins, 1981; Schwarz, 1994, 1998b; Strack, 1994; Wyer, 2004; Wyer & Gruenfeld, 1995). Gruenfeld and Wyer (1992; see also Wegner, Wenzlaff, Kerker, & Beattie, 1981) provided an application of the effect of norm violations in a study of reactions to news. Participants read a series of statements that had ostensibly been taken from newspaper headlines. In one condition, some of the headlines affirmed the validity of propositions that participants in the study were unlikely to believe to be true (e.g., "Members of the U.S. Senate belong to the Ku Klux Klan"). In another condition, the headlines denied the propositions' validity ("Members of the U.S. Senate do *not* belong to the Ku Klux Klan") and therefore were consistent with participants' a priori beliefs. After reading the statements, participants estimated the likelihood that they were true.

Relative to control conditions, participants who read affirmations increased their beliefs in the propositions. However, participants who had read denials *also* increased their beliefs in the propositions' validity. In fact, this effect was similar in magnitude to the effect of affirmations. Statements that denied the validity of a proposition that participants already believed to be false appeared to violate the norm that communications are intended to convey new information. Consequently, participants questioned the reason why the statement was made and, in doing so, speculated that there might be some reason (albeit unknown to them) that the statement might in fact be true and, therefore, was actually intended to be informative. As a result of this speculation, however, they increased their belief in the proposition being denied. Aside from its specific implications, this research calls attention to the fact that the influence of information on beliefs is likely to depend on not only the nature of the information itself, but also the social context in which it is conveyed.

The attempt to reconcile information that violates normative principles of communication can have other effects as well. For example, favorable statements about oneself often violate norms to be modest, and unfavorable statements about others, at least in the others' presence, violate norms to be polite. Therefore, these statements can stimulate attempts to understand why the statements were made, and this additional processing can increase the accessibility of the statements in memory (Wyer, Budesheim, Lambert, & Swan, 1994). This heightened accessibility, in turn, could increase the likelihood of using the statements as bases for beliefs that are reported later.

FORMAL MODELS OF BELIEF FORMATION AND CHANGE

The effects of information on beliefs of the sort described in the previous section occur in the course of comprehension. However, belief formation and change can also depend on computational processes that surround the assessment and integration of the information's implications after it has been comprehended. In this section, we review formal models of the cognitive activities that occur in the course of construing the implications of information for one's beliefs. In the next section, we focus on the role of heuristic criteria that often do not involve a detailed analysis of the information or knowledge that is relevant to them.

Conditional Inference Processes

A model of belief formation proposed by Wyer and Hartwick (1980) is similar to the probabi-logical conceptualization developed by McGuire (1960) and described earlier in this chapter. These authors assumed that when people are asked to estimate the likelihood that a target

proposition (*C*) is true, they search their memory for a second, informational proposition (*A*) that has implications for its validity. Once this proposition is identified, they estimate both (a) the likelihood that the target proposition would be true if the informational proposition were true and (b) the likelihood that the target would be true if the informational proposition were false. Then, if their estimates of these two probabilities differ, people average them, weighting each by the likelihood that the informational proposition is true and false, respectively. This process can be described by Equation 2. That is, the equation essentially implies that the belief in *C* is a weighted average of the two conditional beliefs, with the beliefs that *A* is and is not true serving as estimates of the relative weights attached to these conditionals.

As indicated earlier, Equation 2 provides a surprisingly accurate description of the effect of information bearing on an informational proposition, *A*, on beliefs in a related proposition, *C*. This accuracy is maintained even when the latter proposition is not mentioned in the information bearing on *A*. Thus, the formulation potentially describes the impact of information bearing directly on one proposition on beliefs in other, unmentioned propositions to which the first is related. The formulation applies both when the propositions involved are descriptive such as "George Bush will not be reelected", and when they are evaluative such as "I dislike George Bush" (Wyer, 1972, 1973).

The conditional inference model can be applied in a number of content domains. For instance, Jaccard and King (1977) observed that perceptions of likelihood that an outcome will occur can function as the premise of a syllogism (e.g., "outcome *X* will occur; if *X* will occur, I will perform behavior *B*"). Thus, people may construe the probability that buying a new computer will allow them to run more programs simultaneously, and might then infer a high likelihood that they will buy the computer (Jaccard & King, 1977).

In applying the model, however, it is important to keep in mind that the accuracy of the equation does not in itself validate the cognitive processes that underlie it. That is, the equation's accuracy could be the product of syllogistic inference processes of the sort postulated by McGuire (1960) as well as the algebraic computations assumed by Wyer and Hartwick (1980). Moreover, if components of the equation were true probabilities, the equation would be a mathematical tautology. To this extent, the model's accuracy could reflect a more general tendency for subjective probabilities (beliefs) to combine in a manner consistent with the laws of mathematical probability (Wyer & Goldberg, 1970). Because other inference rules implied by this assumption are less effective in describing human inference processes (Wyer, 1976), this latter interpretation seems unlikely to be valid. Be that as it may, Equation 2 provides a clear illustration of an instance in which the quantitative accuracy of a model is not a sufficient basis for evaluating the assumptions that underlie its validity.

Linear Models of Belief Formation

A limitation of the conditional inference model described by Equation 2 is its focus on the implications of a single proposition that happens to come to mind at the time. Although the implications of other criteria are taken into account, these implications are lumped together in the value of $P(C/\sim A)$, or the belief that the conclusion is true for reasons other than *A*. Other formulations consider more directly the possibility that multiple factors are considered. Slovic and Lichtenstein (1971), for example, postulated that people who predict an unknown event from a set of cues are likely to combine these cues in an additive fashion. Therefore, regression procedures can be used to predict beliefs on the basis of the implications of several different pieces of information, with the regression weights assigned to each piece being used as an indication of its relative importance.

Multiple-regression approaches can be useful in identifying individual differences in the weights given to different types of cues (Wiggins, Hoffman, & Taber, 1969). Nevertheless,

the assumptions that underlie these approaches are often incorrect (Anderson, 1974, 1981; Fishbein & Ajzen, 1975; Tversky, 1969; Wiggins & Hoffman, 1968). Birnbaum and Stegner (1979), for example, found that participants' estimates of a car's value was an *average* of its Blue Book value and the opinion of another person, with the weight of each piece of information depending on the credibility of its source.

In many instances, however, neither summative nor averaging models may be applicable. Kahneman and Tversky (1982a) provide strong evidence that people's estimates of the conjunction of two features (e.g., the likelihood that a woman is a feminist bank teller) are not predictable from their estimates of each feature (i.e., being a feminist or being a bank teller) considered in isolation. In these instances, people appear to configurally process the information rather than construing the implications of each piece of information separately. The conditions in which different combinatorial processes underlie the beliefs that people report (as well as other judgments they make) require more detailed analyses than can be provided in this chapter (see Wyer & Carlston, 1979, for a general discussion of these matters).

Information Processing Models of Belief Formation and Change

The preceding models pertain primarily to the computation of beliefs once the implications of the available information have been identified. Other models have been developed to account for the cognitive activities that occur in the course of assessing these implications. These formulations have been stimulated in large part by evidence that people's responses to belief-relevant information are unlikely to be predicted from the objective implications of the information that they can recall at the time their beliefs are reported. Rather, these responses reflect the number and implications of the thoughts that recipients had about the message at the time they encountered it (cf. Greenwald, 1968; Osterhouse & Brock, 1970; Petty & Cacioppo, 1986). Two models, by McGuire (1968) and Fishbein and Ajzen (1975), provide examples.

McGuire (1968)

According to McGuire (1968), the likelihood of being influenced by a communication is a multiplicative function of (a) the likelihood of receiving and comprehending the implications of the message and (b) the cognitive elaboration of these implications that occurs subsequently. If the communication is counterattitudinal, this elaboration is likely to consist primarily of counterarguing. A simplified version of this conceptualization was proposed by Wyer (1974), namely,

$$P(I) = P(R)[1 - P(CA)], \quad\quad [3]$$

where $P(I)$ is the probability that the information bearing specifically on a proposition has an impact on beliefs in its validity, $P(R)$ is the probability of receiving and comprehending this information, and $P(CA)$ is the probability of refuting its validity. Thus, situational and individual difference factors that independently influence the likelihood of comprehending and effectively counterarguing a communication should have a multiplicative impact on the communication's influence. An interesting implication of the conceptualization arises from the observation that influence is greater when reception and counterarguing are both moderate (e.g., $P[R] = P[CA] = .5$) than when they are either both low ($= 0$) or both high ($= 1$). Thus, variables that simultaneously influence both reception and counterarguing (e.g., intelligence, knowledge of the topic, or situational distraction) can have a nonmonotonic effect on communication impact.

Several studies support implications of this formulation. For example, Festinger and Maccoby (1964) and Osterhouse and Brock (1970) both showed that distracting recipients from thinking carefully about a message that contradicted their beliefs and opinions (and, therefore, decreased $P[CA]$) increased the impact of the communication. Contingencies of these effects on the quality of the communication (e.g., the ease of comprehending the message and the cogency of the arguments; see Regan & Cheng, 1973) can also be interpreted in terms of their effects on the model's components (Wyer, 1974). Finally, McGuire's (1964) research on resistance to persuasion can be conceptualized in terms of its effects on the extent to which exposure to an initial attack on one's position increases the ability to counterargue effectively and, therefore, decreases the influence of subsequent attacks.

Fishbein and Ajzen (1975)

A somewhat different formalization of belief processes was proposed by Fishbein and Ajzen (1975). These authors distinguished between the acceptance of a communication's implications as valid and the change in beliefs that results from this acceptance. Specifically, they postulated that the acceptance of a communication is a function of the quantity

$$p(A) = (1 - D)^{1/f}, \tag{4}$$

where D is the discrepancy between the recipient's a priori belief in a proposition and the position advocated by a message ($0 < D < 1$), and f denotes facilitating factors that increase acceptability of a communication, such as a persuasive source. The actual change in the belief induced by the message, C, is given by the equation:

$$C = D(A) = D(1 - D)^{1/f} \tag{5}$$

Thus, change in the belief is greater when the discrepancy between the implications of the message and one's prior belief is moderate (e.g., $D = .5$) than when it is either large (e.g., $D = 1$) or small (e.g., $D = 0$). At the same time, the amount of change produced by a given discrepancy will be less when facilitation (f) is high (e.g., the source is highly credible). Evidence consistent with supporting this conceptualization was obtained by Hovland and Pritzker (1957). Although this conceptualization and McGuire's (1968) theory can both be brought to bear on the same phenomena, the different implications of the two conceptualizations have not been clearly articulated.

Belief–Attitude Relations

The aforementioned theories of belief formation and change could potentially be viewed as components of the more general theory of attitude formation and change proposed by Fishbein (1963; see also Fishbein & Ajzen, 1975). Fishbein postulated that people's attitude toward an object is an additive function of their evaluations of a set of attributes that happen to be salient at the time, each weighted by their belief that the object has the attribute (see Equation 1). To the extent that Equation 1 describes the process whereby people compute their attitudes on the basis of their beliefs and evaluations of individual features, situational and informational factors that influence people's beliefs about an object should have a predictable influence on their attitudes as well.

Implications of this possibility were confirmed by Albarracín and Wyer (2001; see also Albarracín, 2002). They concluded that people who receive a persuasive message first compute their beliefs in the arguments contained in it and then, if these beliefs are above a certain threshold of probability, assess the favorableness of their implications and increment their

attitudes accordingly. This conclusion is consistent with evidence that beliefs are often formed spontaneously in the course of comprehending information, whereas evaluations may require more deliberative processing (Gilbert, 1991; Wyer & Radvansky, 1999).

HEURISTIC BASES OF BELIEF FORMATION AND CHANGE

As we discussed in the previous section, the beliefs that people form about the world in which they live are partly a function of the knowledge they have accessible in memory and use as a basis for computing them. To this extent, beliefs are often unstable, depending on situational factors that make different subsets of knowledge accessible in memory at the time the beliefs are reported.

However, beliefs are not based on the knowledge people acquire alone. They can also be influenced by factors that have little to do with the persons, objects, or events to which they pertain. That is, people may employ heuristic criteria in estimating the likelihood of an event, or the truth of an assertion, independently of the body of acquired knowledge that might potentially be brought to bear on it.

The use of judgmental heuristics to make inferences about real and hypothetical events is very well established. Research bearing on the influence of heuristics has been reviewed in some detail elsewhere (Ajzen, 1996; Kahneman, Slovic, & Tversky, 1982; S. Sherman & Corty, 1984) and is unnecessary to elaborate in the present context. Many heuristics can be viewed as a subset of the implicit theories or implicational molecules noted in an earlier section. However, they normally pertain to more general criteria for judgment rather than to specific domains of knowledge. In this section, we consider three such criteria: the ease of retrieving belief-relevant knowledge, subjective familiarity, and the ease of imaging the situations to which a belief pertains.

Ease of Retrieval

One of the best-known and well-established criteria for belief formation was identified by Tversky and Kahneman (1973) and was labeled, somewhat misleadingly, an *availability heuristic*. It is more appropriately referred to as an *ease-of-retrieval* heuristic and can be viewed as an application of the following implicational molecule:

[*X* occurs frequently (infrequently); Instances of *X* come to mind easily (with difficulty)]

This molecule can be used to infer that if things occur frequently, they are easy to remember. As already noted, this proposition is not always true. That is, novel or unexpected events are often thought about more extensively than common ones and, therefore, are relatively more likely to come to mind more easily (Wyer & Hartwick, 1980). Thus, it may be the frequency with which something is thought about, and not the frequency of its occurrence per se, that determines the ease of retrieving it from memory.

Be that as it may, the most interesting applications of the ease-of-retrieval molecule concern the converse, namely, that if instances of an object or event come to mind easily, they are likely to have occurred frequently. Thus, to use Tversky and Kahneman's (1973) classic example, people are likely to infer that more English words begin with the letter *k* than have *k* as the third letter. This inference is actually incorrect. However, words that begin with *k* come to mind more easily than words with *k* as the third letter, and people's beliefs are based on this criterion. Three quite different bodies of research that exemplify the role of ease of retrieval in belief formation are worth discussing in some detail.

The Effect of Ease of Retrieval on Inferences About Oneself and Others

One of the more imaginative applications of the ease-of-retrieval heuristic was made by Norbert Schwarz and his colleagues (for a review, see Schwarz, 1998a). In a typical study (Schwarz et al., 1991), some participants were asked to generate 6 instances of assertive behavior they had performed recently, whereas others were asked to generate 12. Then, they were asked to estimate the likelihood that they were assertive. Not surprisingly, participants typically reported more instances of assertiveness when they were asked to generate 12 than when they were asked to generate 6. Nevertheless, they judged themselves to be less assertive when asked to generate 12 rather than 6 instances of assertiveness. Participants who were told to generate 6 instances of the attribute apparently found it easy to do so and, therefore, inferred that they possessed the attribute. In contrast, participants found it difficult to generate 12 instances and, therefore, concluded that they did not have the attribute. In other words, participants did not base their beliefs on the actual number of instances of the behavior they were able to remember. Rather, they used the difficulty of generating these instances as the criterion.

People do not always ignore the implications of their past knowledge, of course. However, their computation of a belief on the basis of these implications is cognitively effortful. Consequently, they may only perform these operations when ease of retrieval is likely to be an unreliable criterion. In other conditions of Schwarz et al.'s (1991) research, for example, participants generated instances of assertiveness in the presence of distracting background music. In this case, participants apparently attributed their difficulty of generating instances to the distraction and to their lack of knowledge. In these conditions, therefore, they judged themselves as more assertive when they had generated 12 instances rather than 6.

The use of an ease-of-retrieval heuristic as a basis for judgment is quite pervasive, having been identified in research on consumer judgments as well as beliefs about oneself (see Menon & Raghubir, 1998). Further examples are described later in this chapter. The heuristic's implications can be quite ironic. For example, people may be less likely to believe that a proposition is true if they have attempted to generate a large number of reasons for its validity than if they have thought about only a few. Research by Wänke, Bless, and Biller (1996) supports this speculation. Some participants were asked to generate either three or seven arguments that either favored or opposed a specific issue, after which they were asked to report their own position on the issue. Other, yoked participants read the arguments that individuals in the first group had written. The yoked participants reported themselves to be more in favor of the position advocated when they had read seven-argument responses than when they had read three-argument responses, confirming the assumption that the substantive implications of the seven-argument sets were relatively more persuasive. Nevertheless, the participants who had actually generated the arguments judged themselves to be *less* in favor of the position when they had generated seven arguments than when they had generated only three. Thus, the effects of ease of retrieval overrode the effects of actual knowledge.

Perceptions of Social Reality

A more direct application of the ease-of-retrieval heuristic is exemplified by research on the impact of television on beliefs and opinions (O'Guinn & Shrum, 1997; Shrum, O'Guinn, Semenik, & Faber, 1991; Shrum, Wyer, & O'Guinn, 1998). Much of our knowledge about people and events comes from watching television; people watch an average of over $4\frac{1}{2}$ hours of television daily (Nielsen, 1995). However, the information acquired in this manner obviously does not provide an accurate picture of the world in general. For one thing, television newscasts usually focus on events that are newsworthy, and, therefore, give priority to things that occur infrequently. Fictitious events that are shown on television are biased in other ways. Soap

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operas, for example, are prone to portray individuals with affluent life styles. Other shows are prone to convey aggression and the individuals involved in it (police, shady characters, etc.). In short, the people and events that are seen on television are not representative of those that occur in real life.

Effects of Exposure Frequency. People are likely to dissociate the information they receive from its source as time goes on (Cook, Gruder, Hennigan, & Flay, 1979; Hovland, Lumsdaine, & Sheffield, 1949: Moore & Hutchinson, 1995). This dissociation is partly a result of the fact that people think about the referents of information more extensively than they think about the context in which it was acquired. Consequently, people who are asked to infer the incidence of persons and events in the real world may draw on exemplars they have seen on television without considering where they encountered them. To this extent, they may tend to overestimate the incidence of events that are over-represented on television, particularly when they are frequent television viewers.

The *cultivation effect* of television is well documented (see Gerbner, Gross, Morgan, & Signorielli, 1994). Shrum and his colleagues provide strong support for an ease-of-retrieval interpretation of the effect. For example, frequent soap opera viewers are relatively more likely than infrequent viewers to overestimate the proportion of Americans who belong to a country club or who have a swimming pool in their back yard. Ironically, they are also more likely to overestimate the incidence of crime or the number of policemen (O'Guinn & Shrum, 1997). Moreover, they make these estimates more quickly than infrequent viewers do, confirming the assumption that frequent viewers have instances of the characteristics being judged relatively more accessible in memory. These effects are evident even when other factors that might intuitively account for the relation between television watching and perceptions (e.g., educational or socioeconomic level) are controlled.

It is worth noting, however, that the effects of viewing frequency on people's beliefs can be reduced or eliminated by calling their television watching habits to their attention (Shrum et al., 1998) or by increasing their motivation to make correct judgments (Shrum, 1999). These data suggest that people can distinguish between events they see on television and those they learn about through other sources if they motivated to do so. (Alternatively, they may apply other criteria than ease of retrieval.) Generally, however, this motivation does not exist.

Effects of Novelty. Shrum et al.'s (1998) findings are consistent with more general evidence of the effects of exposure frequency on knowledge accessibility (Higgins, 1996; Srull & Wyer, 1979, 1980; see Postulate 1). As we have noted, however, the frequency of exposure to instances of a given type may often not be as critical as the frequency of thinking about them or the time devoted to doing so (Craik & Lockhart, 1972; Wyer & Hartwick, 1980). Thus, novel or unexpected events are likely to be thought about more extensively than common ones (Wyer & Hartwick, 1980). They should, therefore, become more accessible in memory and, as a result, should be more likely to influence judgments. Wyer and Hartwick (1980) found that implausible propositions, which may be thought about extensively at the time they are first encountered, were relatively more likely than plausible propositions to be retrieved and used as bases for beliefs in other propositions to which they were syllogistically related.

Although these results do not contradict the findings obtained by Shrum and his colleagues (1998), they raise an additional consideration. That is, novel events that are encountered on television or elsewhere in the media could stimulate more cognitive activity than familiar ones and, therefore, might become more accessible in memory for this reason. Therefore, according to the ease-of-retrieval principle, the likelihood of these novel events should be overestimated, and this should be true regardless of the amount of television one watches. Experimental evidence of this hypothesis was reported by Hamilton and Gifford (1976). In

this research, participants were exposed to a set of behaviors that were ostensibly performed by different members of a social group. In some cases, 13 behaviors were presented, of which 4 were unfavorable. In other cases, 26 behaviors were presented, of which 8 were unfavorable. Therefore, the proportion of unfavorable behaviors was the same in each case, but the number of these behaviors was less in the first condition than in the second. After receiving the information, participants estimated the incidence of the unfavorable behaviors. They were more inclined to overestimate the incidence of the behaviors in the first condition than in the second. Moreover, they believed that members of the group were generally more likely to possess the trait implied by the behaviors. Analogous effects were observed when the favorableness of the minority and majority behaviors was reversed.

These findings have implications for an understanding of media effects on both beliefs and the behavior that is based on these beliefs. For example, airplane highjacking occurs very infrequently. Yet, instances of these events are often thought about extensively when they occur, and are, therefore, likely to be accessible in memory. Consequently, individuals are likely to overestimate the likelihood of the events' occurrence and, as a result, might be less willing to travel than they otherwise would.

The effects of exposure frequency identified by Shrum and his colleagues (1998) and the effects of novelty identified by Hamilton and Gifford (1976) could sometimes offset one another. However, the relative contributions of these factors can depend in part on the extent to which individuals are motivated to think about the information at the time they receive it. People are often passive recipients of the information transmitted in television sitcoms and are unlikely to think much about it. The effects of this information on perceptions of social reality may therefore increase with the frequency of exposure to it. In contrast, rare events of the sort that are seen in newscasts may stimulate substantial cognitive activity. In this case, the effects of this activity may influence frequency estimates despite the novelty of the event, thus overriding the cultivation effects observed by Shrum et al.

Contextual Influences on the Accessibility of Belief-Relevant Information

Perhaps a more general indication of the effect of ease of retrieval is found in the impact of knowledge accessibility on judgments. That is, people are likely to infer that the information that comes easily to mind is likely to be representative of the entire body of knowledge they have available. Consequently, they may often use this information as a basis for judgment without searching for other information that could also be relevant (Taylor & Fiske, 1978). This possibility is exemplified by research on the way that beliefs are influenced by the context in which they are solicited. Although this research has been summarized in detail elsewhere (e.g., Schwarz, 1994; Strack, 1994), two examples are particularly noteworthy.

The Effect of Prior Judgments on Subsequent Ones. The criteria that are used to answer a question in a belief questionnaire can be influenced by concepts that have been activated and used to answer earlier questions. This influence is most apparent when the two beliefs are normally based on similar criteria. For example, consider the proposition that the American Nazi Party should be allowed to speak on campuses and the more general proposition that members of social and political organizations should be allowed to express their views in public. Many considerations that underlie beliefs in the first proposition are relevant to the second as well. To this extent, people who report their belief in the first proposition may activate concepts and knowledge that, having become accessible in memory, influence the belief they report in the second one.

However, this effect may be contingent on whether respondents think that the questioner expects them to use similar or different criteria. Strack, Martin, and Schwarz (1988) point

out that when people encounter related items in a belief questionnaire, they often infer that the questioner considers the items to mean different things and, therefore, expects them to use different criteria for evaluating the items. (Otherwise, why is the questioner asking both questions?) Consequently, they may intentionally exclude the criteria they use in responding to the first item from consideration when computing their response to the second. To continue with our example, suppose people who have reported their belief that the American Nazi Party should be allowed to speak on campuses are likely to activate reasons why this should not be the case. Therefore, if they are subsequently asked their beliefs about groups in general, they might normally use these reasons as bases for reporting these beliefs as well, and, consequently, might report less strong beliefs in this proposition than they otherwise would. However, suppose participants assume that they are supposed to use different criteria in responding to the two questions. Then, they might intentionally exclude the criteria they used to answer the first question from consideration in responding to the second and, as a result, might report their belief in the second question to be stronger than they would otherwise.

A study by Ottati, Riggle, Wyer, Schwarz, and Kuklinski (1989) supports these possibilities. People reported their beliefs in a series of general propositions about free speech similar to that described in the preceding example. In some cases, however, a related proposition that referred to either a highly respected group (e.g., the American Civil Liberties Union) or a negatively regarded group (e.g., the American Nazi Party) was also included. When this group-specific item occurred six items before the general one, it had a positive effect on participants' responses to the second item; that is, participants reported stronger beliefs in the proposition if the earlier one had referred to the ACLU than if it had referred to the Nazi Party. When the group-specific item occurred immediately before the general one, however, it had a negative impact; that is, participants reported stronger beliefs in the general proposition if the preceding one had referred to the American Nazi Party.

The Effects of Comparative Judgments on Absolute Judgments.   A quite different effect of ease of retrieval on beliefs was identified in a series of studies by Mussweiler and Strack (1999a; 1999b; 2000a; 2000b; for a review, see Mussweiler, 2003). In a typical study, some participants might be asked to compare a target object to a high value (e.g., "Is the Nile longer or shorter than 3,000 miles?"). Others might be asked to compare it to a very low value ("Is the Nile longer or shorter than 50 miles?"). Then, after making this comparative judgment, participants are asked to estimate the actual value of the object in question (e.g., the actual length of the Nile). Participants typically make larger estimates in the first condition than in the second. Moreover, this is true regardless of the plausibility of the high and low values specified in the comparative items and occurs even when participants perceive these values to have been selected at random.

In accounting for these effects, Mussweiler and Strack (1999a, 1999b, 2000a, 2000b) assumed that in responding to the first question, participants activate concepts associated with the value assigned to the standard, and that once these concepts become accessible in memory, they influence the criteria that participants use to generate the absolute estimates they report later. (Support for this assumption was confirmed by evidence that making comparative judgments increases the speed of identifying standard-related concepts in a later lexical decision task; see Mussweiler & Strack, 1999a).

Familiarity

The effect of ease of retrieval is particularly evident when people's beliefs are a function of the frequency with which instances of an event or state of affairs occurred. However, many beliefs are not of this type. Many beliefs, for example, pertain to the occurrence of a single

object, event, or state of affairs (e.g., that George Washington had red hair, that the capital of Tanzania is Dar es Salaam, or that the Cleveland Indians won the 1920 World Series). Such beliefs are not based on estimates of frequency per se. Nevertheless, ease of retrieval may play a role in the computation of these beliefs as well.

Specifically, if the elements of a statement can be understood in terms of concepts or knowledge that come to mind quickly, the statement is likely to seem familiar and, therefore, to have been encountered at some time in the past. Therefore, it is assumed to be true. A well-known conceptualization of recognition memory by Gillund and Shiffrin (1984) supports this contention. They assumed that people's beliefs that an item was contained in a list they have encountered earlier are based on the item's subjective familiarity. They further predicted that although the item's familiarity is determined in part by its actual presence or absence in the original list, it could be influenced by a number of other factors as well, including the item's semantic or structural similarity to other, previously acquired concepts and knowledge and the similarity of the situational context in which the item being judged to situations the recipient has encountered in the past.

More generally, people's beliefs that they have encountered a piece of information in a particular situation may be a function of its similarity to other, previously formed concepts and knowledge that were acquired before this situation occurred. However, the reverse may also be true. That is, beliefs that an information item's familiarity is due to one's general knowledge about its referent could be influenced by exposure to the item in a particular, perhaps irrelevant situational context (e.g., an experiment). Two provocative demonstrations of this phenomenon were conducted by Hasher, Goldstein, and Toppin (1977) and Jacoby, Kelley, Brown, and Jasechko (1989). In Hasher et al.'s study, participants completed a belief questionnaire containing statements whose validity was likely to be unknown to college students (e.g., "The capital of Tanzania is Dar es Salaam"). Several days later, they completed a second questionnaire that contained some of the statements they had seen earlier. Participants reported stronger beliefs in these statements when they encountered them the second time than they had at first. Presumably, the statements seemed familiar to participants when they read them the second time, but they misattributed the statements' familiarity to their prior knowledge about the persons or events to which the statements referred rather than to the presence of the items in the questionnaire they had completed earlier. Consequently, they reported the statements as more likely to be true.

In a conceptually similar study, Jacoby et al. (1989) exposed participants to names of persons, some of whom were fictitious. Then, 24 hours later, participants were given a second list of names and asked to indicate which of them referred to well-known persons. The second list contained some of the same fictitious names that participants had encountered earlier. Participants were more likely to believe that these names referred to well-known persons than names they had not seen before. Thus, as Jacoby et al. (1989) suggested, the persons "became famous overnight."

Simulation: The Effects of Constructing Explanations for a Situation on Beliefs in its Occurrence

Ease of retrieval can influence beliefs in yet another way. In many cases, specific instances of a situation may not exist or, at least, may not easily come to mind. In this case, beliefs may be based on the plausibility of the antecedent conditions that might give rise to the situation at hand. The identification of these antecedents could often be based on an implicit theory of the causal relations among the events, as suggested earlier. However, when several alternative theory-based explanations of a situation might potentially be generated, the explanation that is easiest to construct is most likely to be applied. Moreover, the easier it is for someone to

construct a particular explanation of a hypothetical event or state of affairs, the more likely the person is to believe that the situation has occurred in the past or might occur in the future.

This possibility is captured by the *simulation* heuristic proposed by Kahneman and Tversky (1982b). However, the general conception that easy-to-explain events are believed more likely to occur has general implications for a wide variety of specific phenomena that bear on the effects of constructing explanations for a situation on beliefs in its occurrence.

Informational and Situational Effects of Explanation Generation on Belief Formation

Evidence that the ease of constructing an explanation of an event can increase beliefs in its occurrence is provided by Pennington and Hastie (1986, 1988, 1992). In one study (Pennington & Hastie, 1988), participants read the transcript of a court case containing testimony for both the prosecution and the defense. Although the content of the transcript was the same in all conditions, the order of conveying the testimony for each side varied. In *witness-order* conditions, the testimony for a given side was organized according to the witness who provided it, as it was conveyed in the original trial. In *story-order* conditions, the testimony was conveyed in the order it became relevant in constructing a narrative of the events that led up to the crime, the crime itself, and its aftermath. After reading the transcript, participants recommended a verdict and estimated their confidence that their judgment was correct. Findings indicated that when the testimonies for each side were presented in a different order, over 70% of the participants favored the verdict implied by the testimony that was conveyed in story order. In contrast, when both sets of testimony were conveyed in the same order, an equal proportion of participants favored each side. Moreover, participants were more confident of their judgments when the testimonies were both conveyed in story order rather than witness order.

The Effect of Generating an Explanation on Predictions

Pennington and Hastie's findings provide convincing evidence that information about an event stimulates stronger beliefs when it is conveyed in a way that makes an explanation for the event easy to construct. A corollary of this conclusion is that if individuals are induced to explain an event whose occurrence is uncertain, this activity should increase the ease with which this explanation will come to mind in the future and, therefore, should increase beliefs that the event has occurred or will occur. Three studies bear on this possibility. In a study by Ross, Lepper, Strack, and Steinmetz (1977), participants read a clinical case study with instructions to explain why the protagonist might have engaged in a particular behavior (e.g., committing suicide or donating a substantial sum of money to the Peace Corps). They later predicted that the event they had explained was more likely to have occurred than the events they had not explained, despite being told that there was no evidence that the protagonist had engaged in either act. Analogously, Sherman, Skov, Hervitz, and Stock (1981) found that people who were arbitrarily asked to explain why they might succeed or fail on an anagrams task later predicted that they would attain the outcome they had explained. Moreover, their actual task performance confirmed this prophecy. Participants apparently retrieved a selective subset of self-knowledge for use in generating their explanation that they later brought to bear on their prediction. Their prediction, in turn, was used as a standard at the time they actually performed the task, motivating them to attain the performance level it implied.

The selective retrieval of self-knowledge to explain one's own behavior may occur spontaneously. In a study by Ross, Lepper, and Hubbard (1975), participants received false feedback that they had done either well or poorly in distinguishing between actual and bogus suicide notes. Later, they were debriefed, being shown compelling evidence that the feedback they received bore no resemblance to their actual performance. Nevertheless, participants were more

likely to predict they would do well on a similar task in the future if they had been led to believe that they had performed well on the first task than if they had been led to believe they had done poorly. It seems reasonable to suppose that participants who received feedback that deviated from their expectations spontaneously attempted to explain it and, in doing so, selectively retrieved a body of self-knowledge about their past experiences that provided a plausible narrative-based causal account of it. Later, they used this representation as a basis for their predictions without considering the validity of the feedback that stimulated its construction.

The Effects of Generating Explanations on Hindsight Bias

The preceding studies suggest that individuals use the first explanation of a situation that comes to mind (e.g., the explanation they can generate most quickly and easily) as a basis for their belief that the situation will occur, and that they seldom consider other possibilities that, although plausible, could come to mind less easily. This tendency could underlie the hindsight bias identified by Fischoff (1975, 1982; for a review, see Hawkins & Hastie, 1990). That is, people who know that an event has occurred often overestimate the likelihood that they would have predicted it. This could occur because people who are told that the event has occurred attempt to generate a plausible explanation for it and, if this can be done easily, conclude that its occurrence was foreordained.

If this interpretation is correct, however, the magnitude of the hindsight bias should be altered by either increasing or decreasing participants' perceptions of the ease of explaining the event they are asked to consider. This was demonstrated using procedures similar to that employed by Schwarz (1998a) and his colleagues to investigate the effects of ease of retrieval. For example, Sanna, Schwarz, and Stocker (2002) told participants that an event had occurred and to generate either 2 or 10 thoughts about why the event happened. Participants who generated few thoughts increased their belief that the event was inevitable, thereby strengthening the hindsight bias. However, participants who generated 10 thoughts, which was difficult to do, decreased their belief that the event was foreordained. Correspondingly generating a large number of reasons why the event might not have occurred increased beliefs in its inevitability (Sanna & Schwarz, 2003).

Affective Influences on Beliefs

As exemplified by the impact of ease of retrieval on beliefs, people often base their judgments on their subjective reactions to the stimuli being judged. The use of positive and negative affect as information about one's feelings toward an object and, therefore, evaluations of the object, is widely recognized (for reviews, see Schwarz & Clore, 1996; Wyer, Clore, & Isbell, 1999). Although affect is primarily relevant to evaluative judgments (e.g., attitudes), it can sometimes influence beliefs as well.

For example, people may base their estimates of the likelihood of a negative event on the anxiety they experience when they think about it, based on the assumption that their feelings are due to their concern that the event is likely to occur. In a study by Johnson and Tversky (1983), for example, people were induced to feel anxious by reading descriptions of an emotion-evoking tragic event (e.g., a fatal accident). These participants reported stronger beliefs than control subjects in the likelihood that other, unrelated events (cancer, an earthquake, etc.) would occur. Moreover, this effect did not depend on the similarity of the event they had read about to the events being predicted. Thus, participants misattributed the anxiety they were experiencing as a result of reading about the first event to their feelings about other events as well, and used these feelings as a basis for their judgments. To this extent, one might expect the impact of these feelings to decrease when people's attention is explicitly called to the actual

source of their feelings. However, Gasper and Clore (1998) showed that this was the case only if the situation-induced anxiety that participants were experiencing was inconsistent with their chronic level of anxiety. Chronically anxious individuals were influenced by the anxiety they were experiencing in all cases.

The positive or negative affect that people experience can also have an indirect influence on their beliefs. Participants in a study by Albarracín and Wyer (2000) read a persuasive communication under conditions in which they were feeling happy or unhappy. When participants were able to concentrate on the message, they typically based their attitudes toward the position advocated on their beliefs in the arguments contained in the message, reporting more favorable attitudes when the arguments were strong than when they were weak. In some conditions, however, participants were distracted from thinking about the communication at the time it was presented (for a treatment of the role of distraction in this domain, see Albarracín & Kumkale, 2003). These individuals based their attitudes on the extraneous affect they were experiencing instead. Moreover, these attitudes, once formed, influenced their beliefs in the consequences of the policy being advocated independently of the quality of the arguments in the message they had read earlier.

MOTIVATIONAL BASES FOR BELIEFS

The research and theory we have described thus far has focused on the cognitive processes that underlie belief formation and change and the type of knowledge to which these processes are applied. In some cases, beliefs are formed spontaneously in the course of comprehension (Wyer & Radvansky, 1999). In other cases, however, beliefs can have motivational roots. That is, they are often formed for a purpose. Certain motives for belief formation and change have been implicit in our previous discussion. Others, however, are less apparent. An understanding of the role of motivation is complicated in part by the fact that people may often have more than one goal, and beliefs that satisfy one goal can conflict with the attainment of others. In this section, we review a number of these motives and describe representative research that bears on their influence.

Types of Motives

A comprehensive review of the motives that potentially influence the formation and change in beliefs, and the cognitive responses to information that bears on them, is provided by Kunda (1990). For example, people may be motivated to be accurate (Kruglanski, 1980), to be consistent (Festinger, 1957; Heider, 1946; McGuire, 1960), to maintain a positive self-image (Baumeister, 1997), to believe in a just world (Lerner, Miller, & Holmes, 1976), to gain closure (Kruglanski, 1980), to avoid uncertainty and ambiguity (Harvey, Hunt, & Schroder, 1961; Roney & Sorrentino, 1995), and to avoid engaging in excessive cognitive effort (Chaiken, 1987; Taylor & Fiske, 1978). A number of these motives, however, may be manifestations of a more general one: to construct a representation of oneself and the world that permits one to cope effectively with life situations and, therefore, to lead a happy and successful life. Effective coping presumably requires that perceptions of oneself and one's world are a sufficiently close approximation of reality to permit the consequences of social events to be predicted and interpreted. At the same time, it also requires personality characteristics and abilities that enable one to perform successfully in one's social and physical environment. Finally, it requires that one's efforts be rewarded, and that one does not encounter misfortune for circumstances beyond one's control. The beliefs that one constructs of oneself and the world may be partly motivated by a desire to believe that these conditions exist.

However, beliefs that satisfy one of these objectives may be incompatible with others. An accurate perception of oneself, for example, is not always favorable. Moreover, misfortunes do occur for fortuitous and uncontrollable reasons. Thus, the maintenance of favorable concepts about oneself and the world may often be at the expense of accuracy, and beliefs bearing on them can reflect a compromise between the implications of these motives (Kunda, 1990).

Responses to Belief Dilemmas

People often receive information that conflicts with the implications of the motive-based representation they have constructed of themselves and the world in general. For example, it might suggest that their previously formed beliefs are inaccurate. Alternatively, the information might imply that individuals do not have the personal qualities necessary to ensure a happy life, or that their pursuit of happiness might not be successful for reasons beyond their control. The acceptance of such information as valid might require a modification of not only the beliefs to which it is directly relevant, but also to others with which they are associated in the knowledge representation in which they are embedded. These modifications, however, not only could have negative implications for oneself and others but also might be cognitively effortful. For these reasons, people are often motivated to resist change in their beliefs or the adoption of new ones, if they can accommodate to information in other ways.

Several possible responses to belief-related information were postulated by Abelson (1959), and others have been identified elsewhere (e.g., Kunda, 1990). For example:

1. *Reinterpretation*. People might selectively activate concepts that permit them to interpret the information as either consistent rather than inconsistent with their prior beliefs and opinions or, alternatively, as irrelevant. For example, they might activate knowledge that calls into question the credibility of the information's source. Or, if the information pertains to their own behavior, people might attribute the behavior or its outcome to situational factors that minimize its implications for their previously formed beliefs.

2. *Counterarguing*. People might retrieve previously acquired knowledge that permits them to refute the validity of the information or its implications.

3. *Bolstering*. People might selectively retrieve and review information that implies that their existing beliefs are valid for other reasons, despite the implications of the new information presented.

4. *Compartmentalization*. People might attempt to divide the referent of the new information into components, with the information being relevant to one, relatively unimportant component.

5. *Transcendence*. People might attempt to view the implications of the information within a broader conceptual framework that renders its implications, although valid, to be relatively unimportant.

These various responses require different amounts of cognitive effort. Moreover, this effort might sometimes be greater than that required to accept the information's implications at face value. For example, information can often pertain to concepts or propositions that are remotely connected to other components of one's cognitive system. In this case, the acceptance of the information as valid is likely to require little modification of previously formed beliefs. However, if the beliefs that are implicated by the new information occupy a central position in one's cognitive network, acceptance of the information's implications might require a change in not only the beliefs to which it directly pertains but many others with which it is associated. To avoid this disruption, other responses to the information may be attempted.

More generally, responses to belief-discrepant information may be governed by a priority system in which the strategies that are easiest to apply are given priority, with more cognitively

demanding strategies attempted only if the initial attempts prove to be unsuccessful (Chaiken, 1987). The number of strategies that are attempted may depend in part on situational and individual difference factors that influence the need for closure (Kruglanski, 1980).

In this regard, it is obviously difficult if not impossible to construct a completely accurate perception of oneself and the world, or to accommodate the implications of the competing motives that may underlie information processing (e.g., the motive to be accurate and, at the same time, to maintain a positive self-image). Therefore, it seems likely that people do not attempt to attain this ideal. Rather, they have a *tolerance threshold*, below which they are willing to accept the implications of the information without further attempts to reconcile its inconsistency with other beliefs or the goals to which it is relevant. In an analysis of decision making, Simon (1957) postulated that people engage in *satisficing.* That is, they often do not attempt to attain the best solution possible, but rather, settle for one that is above some minimal threshold of acceptability and, therefore, is good enough. A similar strategy might be employed in responding to belief-relevant information. Kunda (1990) also notes that people might often strike some compromise between accuracy and desirability in responding to belief-relevant experiences. The nature of this compromise might depend on the tolerance threshold that they invoke.

With these considerations in mind, we will review briefly some of the literature that bears on the role of motivational factors on belief formation and change and the cognitive responses that are stimulated by belief-relevant information. Our review is not intended to be exhaustive, but rather, to be representative of the concerns addressed in the areas to be covered.

Accuracy and Efficiency

People are presumably motivated to construct an accurate perception of themselves and their environment (see Kruglanski, 1980; Kruglanski & Stroebe, this volume). This motive may derive in part from pragmatic considerations. That is, people are undoubtedly better able to cope effectively with daily life experiences if they have an accurate perception of themselves, other persons, and more generally, the world in which they live. However, the acquisition of knowledge that would be necessary in order to attain perfect accuracy is difficult if not impossible. Moreover, as Kruglanski (1980) also notes, people may often be motivated by the desire to make a quick judgment or decision and, therefore, may be unwilling or unable to devote the time and energy required to be completely accurate even if it were possible to do so. That is, they may be satisfied with a construction of the world that is *sufficient* to permit them to cope effectively, even if it is not perfectly correct.

Chaiken's (1980, 1987) formulation of belief and attitude formation and change is based on similar assumptions. To reiterate, people who are called on to estimate the likelihood that a proposition is true may engage in belief-relevant cognitive activity until their confidence that their estimate exceeds a certain threshold, after which they make the judgment and terminate further processing. This threshold might depend on a number of situational and individual difference factors that influence the importance of the estimate to be made. Thus, participants who are extrinsically or intrinsically motivated to be accurate may adopt a high threshold and, therefore, may expend more effort in computing their belief than they would otherwise. For example, they may be more inclined to think extensively about the implications of the information they have acquired, and may retrieve and bring more previously acquired knowledge to bear on it. Moreover, they may be correspondingly less inclined to base their belief on the first relevant criterion that comes to mind.

The effects of numerous situational and individual difference factors on the impact of information can potentially be conceptualized in terms of their impact on the threshold that people adopt. For example, this threshold, and consequently the amount of cognitive activity

they expend in the processing of this information, may increase with their need for cognition (Cacioppo & Petty, 1982; Petty & Cacioppo, 1986) or with their intolerance of ambiguity (Webster & Kruglanski, 1994). It could also vary with the importance of the belief to the information recipient. Transitory situational factors, such as the affect that people experience at the time they receive information, can also influence this threshold and, therefore, can affect the amount of effort they expend in using the information to form beliefs to which it is relevant (Bless, Bohner, Schwarz, & Strack, 1990; Bodenhausen, 1993; Clore & Schnall, this volume).

Desirability

People are frequently motivated to think well of themselves and the individuals they care about and to believe that neither they nor others will come to harm (see Weinstein, 1980; but see Chang, Asakawa, & Sanna, 2001; Heine & Lehmen, 1995; Shepperd, Ouellette, & Fernandez, 1996). This state of affairs, however, does not always exist in actuality; people are not always admirable, and the world is not always benevolent. Thus, beliefs that convey an accurate picture of reality can have unfavorable implications, and beliefs with favorable implications are not always correct. Under these conditions, the results of people's cognitive activity may reflect a compromise between accuracy and desirability.

McGuire (1960, 1981; McGuire & McGuire, 1991) postulated that individuals' beliefs are guided in part by wishful thinking. That is, people usually wish to maintain a positive view of themselves and the world in which they live. Therefore, they may be disposed to believe that desirable events or states of affairs are likely to occur and that undesirable events and states are unlikely. He further assumed that when beliefs that result from wishful thinking are inaccurate, they can become inconsistent with other beliefs (see Equation 2), and that when this occurs, calling attention to the inconsistency disposes people to eliminate it (McGuire, 1960; Rosen & Wyer, 1972). In fact, the evidence for wishful thinking within the paradigm used to test implications of McGuire's probabilogical model is very limited (McGuire & McGuire, 1991; Wyer, 1974). However, research in other paradigms provides much stronger confirmation of the tendency and the processes that underlie it.

For example, people appear to be motivated to maintain favorable conceptions of themselves and the attributes they possess. Consequently, they may selectively process new information and previously acquired knowledge that permits them to construct beliefs that are consistent with these conceptions (see Pyszcynski & Greenberg, 1987). This selective processing may be reflected in both their attention to new self-relevant information and their retrieval of previously acquired self-knowledge.

A compelling example of selective processing was reported by Arkin, Gleason, and Johnston (1976). Participants in this study received feedback that they had either succeeded or failed on a task under conditions that suggested that either they were personally responsible for this outcome or, alternatively, the outcome could have been due to external, situational factors. Participants who failed on the task accepted responsibility for this outcome only if no other plausible explanations existed. Conversely, participants who succeeded took responsibility regardless of whether extraneous factors could have accounted for the outcome or not.

Arkin et al.'s findings would be consistent with the priority system described earlier. That is, the implications of successful performance are quite consistent with the favorable self-concept that participants attempt to maintain of themselves and therefore could be easily assimilated into the beliefs that pertain to this concept. Therefore, participants did not bother to engage in more extensive processing. In contrast, the implications of failure, which were less consistent with their beliefs about themselves, stimulated them to seek information that would permit them to interpret this outcome as irrelevant, and so they accepted the implications of this outcome only if this information was not available.

Results of a study by Wyer and Frey (1983) can be viewed similarly. In this study, participants who had ostensibly done either well or poorly on an intelligence test read a passage that conveyed both positive and negative arguments concerning the validity of intelligence tests in general. As one might expect, participants were more likely to disparage the validity of intelligence test when they had done badly than when they had not. At the same time, however, they recalled a greater proportion of arguments that supported the validity of intelligence test than other participants. The participants who did poorly apparently found it difficult to reconcile the implications of their poor performance with their previously formed beliefs about themselves, and so they attempted to refute the arguments that the intelligence tests were valid. However, their more extensive processing of this belief-discrepant information increased its accessibility in memory (Craik & Lockhart, 1972) and, therefore, increased their ability to recall it later.

Bolstering can come into play as well. This is particularly true when people receive information that a personal characteristic is important for success and well-being. In this event, people may selectively search for information that supports their belief that they have this characteristic. A study by Sanitioso, Kunda, and Fong (1990) suggests this possibility. Some participants were told that extroversion was conducive to success after leaving college, whereas others were told that introversion was conducive to success. Then, in an ostensibly unrelated study, they were asked to list behaviors they had performed in the past along a related trait dimension (shy vs. outgoing). Participants listed more behaviors that were congruent with the trait that was ostensibly conducive to success than behaviors that were incongruent with this trait. This and other studies suggested that people who have been told that a particular trait is associated with success selectively searched memory for personal experiences that confirmed their possession of the trait. Consequently, these experiences came to mind more quickly when they were called on to report instances of their behavior at a later point in time. Research in other paradigms has similar implications. For example, people are less likely to report engaging in a particular behavior (drinking coffee, brushing one's teeth) if they are told that the activity is bad for the health than if they are told it is healthy (Ross, McFarland, & Fletcher, 1981; B. Sherman & Kunda, 1989).

The information that people retrieve and use to bolster their belief that they will have a successful or happy life can also stimulate the construction of implicit theories about themselves and others that imply that they will be successful or will otherwise have desirable consequences. Kunda (1987), for example, found that college students are typically convinced that they will remain married to their first spouse for life despite knowledge that 50% of all marriages end in divorce. This belief is likely to result from their attempts to convince themselves that they personally have qualities that are uniquely conducive to marital happiness. To demonstrate this hypothesis, Kunda (1987) gave participants information about a target person who was either happily married or divorced, and whose demographic and personality characteristics either matched or did not match those of the participants themselves. Then, they asked the participants to indicate which of the target's attributes were most likely to contribute to his or her marital situation. Participants were more inclined to attribute the success of happily married targets to characteristics that matched their own than to characteristics that differed. Correspondingly, they were more likely to attribute the failure of divorced targets to traits that differed from their own than to traits that were similar. Studies in other domains yielded similar conclusions.

In combination, therefore, the series of studies described in this section suggest that despite the failure for wishful thinking to be identified in research performed by McGuire (1960, McGuire & McGuire, 1991), it seems clear that cognitive activities implied by this motive do, in fact, operate.

Beliefs in a Just World

The preceding studies suggest that people are motivated to believe that they personally have favorable attributes and, therefore, are able to cope effectively with the world in which they live. A byproduct of this motivation may be a desire to believe that the world is just and, therefore, that they (who presumably have desirable qualities) will not encounter adversity for reasons beyond their control. The just desserts molecule described in an earlier section may be partly a result of this desire. That is, people may be motivated to believe that people not only get what they deserve but also deserve what they get (Lerner & Miller, 1978; Lerner et al., 1976).

If this prediction is the case, experiences that threaten people's perceptions that the world as just may increase their motivation to adopt beliefs that bolster this perception. Wyer, Bodenhausen, and Gorman (1985) reported evidence of this tendency. Participants read a series of scenarios describing rape incidents and, in each case, reported both their belief that the defendant was convicted and their belief that the victim was partly responsible for the incident. Before doing so, however, participants (as part of a different experiment) were exposed to pictures showing acts of extreme nonsexual aggression (e.g., a lynching, a dead soldier with his skull torn apart by a bullet, a gory hit-and-run accident, etc.) that presumably called attention to injustice. These participants not only increased their belief that the defendant in the rape scenarios was convicted (that is, he got what he deserved) but also their belief that the victim was partly responsible for the incident (i.e., she deserved what she got). This pattern was true even when the defendant was a stranger and the victim vigorously resisted the attack.

Consistency

An additional motive that appears to guide belief formation and change is the desire to maintain an initial consistency among one's beliefs and opinions. This motive could be partly the result of a more general desire to construct an accurate representation of the world. The criterion for cognitive consistency, which has been studied extensively in social psychological research for decades (Heider, 1946, 1958; Festinger, 1957; for reviews, see Abelson et al., 1968), may vary. It may be conceptualized in terms of the compatibility of beliefs with the propositions that compose an implicational molecule or implicit theory. Alternatively, it might be defined in terms of Equation 2. Finally, it could be conceptualized in terms of a discrepancy between the implications of one's behavior and previously formed beliefs about the target of this behavior (Cooper & Fazio, 1984; Festinger, 1957; Wicklund & Brehm, 1976).

As noted earlier, some conceptualizations (e.g., McGuire, 1960) assume that the modification of beliefs to eliminate cognitive inconsistency occurs spontaneously once people become aware that the inconsistency exists. Other conceptualizations, however, assume that the awareness of inconsistency induces an unpleasant state of arousal or discomfort, and that changes in beliefs are motivated by a desire to eliminate this discomfort. The validity of this assumption has been convincingly established in research on cognitive dissonance theory (Festinger, 1957). This theory has typically been applied to inconsistencies between a person's behavior (e.g., publicly advocating a particular position on an issue, or a decision to perform a particular activity) and previously formed beliefs concerning the behavior's desirability (for a review, see Cooper & Fazio, 1984). In this context, Zanna and Cooper (1976), for example, showed that under conditions in which participants were led to believe that the arousal they were experiencing as a result of their belief-inconsistent behavior was attributable to other factors (e.g., to the effects of taking an arousal-inducing pill), the attempt to eliminate inconsistency through belief change is not evident.

Moreover, in a direct test of the assumption, Croyle and Cooper (1983) obtained physiological measures of participants' arousal while they voluntarily engaged in belief-discrepant behavior. Performing the behavior in these conditions induced arousal, as expected. Under conditions in which the measures of arousal were taken, however, participants' beliefs were not affected by their behavior. Apparently participants experienced arousal as a result of their dissonant behavior, but attributed it to their concern about the elaborate apparatus that was used to measure it rather than to their belief-discrepant behavior per se and, therefore, did not change these beliefs. The effects of belief-inconsistent behavior on beliefs is also eliminated by the presence of other situational factors that might account for this behavior, such as a lack of choice concerning whether or not to engage in the behavior, a high monetary incentive for performing it, or an unpleasant experimental room (for reviews, see Cooper & Fazio, 1984; Olson & Stone, this volume).

However, the arousal induced by belief-discrepant behavior and, therefore, the change in beliefs that results from it, could more fundamentally result from the implications of the behavior for one's self esteem (Cooper & Fazio, 1984). Thus, dissonance-induced belief change is most evident when one voluntarily engages in behavior that has negative consequences. Such behavior may be particularly threatening to one's concept of oneself as an intelligent person who engages in desirable activities, the outcome of which is under one's control. Thus, situational factors that permit one to preserve one's self-esteem without engaging in the cognitive activities required to change previously formed beliefs may decrease the likelihood of modifying these beliefs. (For more direct evidence that people do not engage in dissonance-induced belief change if they can bolster their self image in other ways, see Steele, 1988; Steele & Liu, 1983.)

In summary, the motivation underlying many belief-change phenomena can be conceptualized in terms of attempts to preserve a favorable self-concept and a view of the world as a place in which one's abilities and virtues are likely to be rewarded. As Kunda (1990) notes, however, the change in beliefs that results from this motivation may not always override the motive to be accurate. Thus, for example, people who voluntarily perform a behavior that is incompatible with their previously formed belief in a position may change this belief in a direction that is more consistent with the position they advocated, but they do not completely reverse it. That is, they do not totally ignore their prebehavior beliefs or the knowledge that bears on them. Rather, their beliefs appear to be a compromise between the implications of these conflicting criteria.

Other Motivational Determinants of Selective Information Processing

The motivation to cope effectively with life events can be manifested in selective information seeking of a different sort. Higgins (1998) has noted that people often have two different motivational orientations. One, *promotion* focus, disposes individuals to emphasize the desirable aspects of a present or future event to the exclusion of its negative aspects. The second, *prevention* focus, results from a desire to avoid negative features of a situation and stimulates attention to the undesirable features of an event without considering the desirable ones. These different orientations may bias the aspects of the information that one acquires in a situation and, consequently, beliefs that are based on it.

Chronic individual differences in prevention or promotion focus may exist as a result of social learning. Asians, for example, are more inclined to have a prevention focus than European-Americans are. This difference is manifested in both their attention to negative aspects of a situation in which they imagine themselves (Aaker & Lee, 2001) and their choices in multiple-attribute decision situations (Briley, Morris, & Simonson, 2000). Briley et al. (2000), for

example, found that when participants were confronted with a choice between (a) a product with both extremely favorable and extremely unfavorable attributes and (b) a product with only moderately favorable and unfavorable features, European Americans typically preferred the former alternative, suggesting that they focused their attention on the potential benefits of having the products they considered without considering their potential costs. In contrast, Asians were more inclined to choose the second alternative, suggesting that they were concerned about avoiding negative attributes of the products without considering their advantages.

These different motivational orientations can be influenced by situational factors as well (see Higgins, 1998). Briley and Wyer (2002), for example, found that calling individuals' attention to their cultural identity, which made them conscious of their group membership, induced a prevention focus that influenced their choice behavior, and this was true of both Asians and Americans. These findings do not bear directly on belief formation and change. However, to the extent differences in prevention and promotion focus bias the attention that people pay to positive and negative aspects of a situation, it seems reasonable to suppose that this focus influences beliefs about this situation as well as what people choose to perform.

CONCLUDING REMARKS

This chapter has covered a lot of ground. After conceptualizing beliefs and distinguishing them from other types of cognitions, we discussed the content and organization of the knowledge in memory and the processes that lead a particular subset of knowledge to be brought to bear on the beliefs to which it is relevant. We then considered several more specific formulations of the way in which beliefs are formed both spontaneously in the course of comprehending new information and deliberately, in construing and evaluating the information's implications. In this discussion, the role of implicational molecules and implicit theories was emphasized. We then discussed heuristic bases for computing beliefs on the basis of criteria that do not involve a detailed analysis of belief-relevant knowledge. Finally, we considered the role of motivation in belief formation and change.

Despite the extensiveness of this discussion one ambiguity was not completely resolved. It remains unclear whether beliefs per se are organized and stored in memory, or whether they are computed online, based on the knowledge that happens to come to mind at the time. With few exceptions (e.g., the probabilogical model of belief organization proposed by McGuire, 1960; see also Wyer, 1974), the bulk of the research and theorizing we have discussed is compatible with the latter, constructivist point of view. It nevertheless seems reasonable to assume that beliefs, or judgments based on them, are often stored in memory as part of the knowledge people acquire and are, therefore, often available, along with other knowledge, for use as a basis for computing new beliefs. It, therefore, makes more sense to ask, not whether previously formed beliefs are formed and stored in memory, but rather, when these beliefs are stored and retrieved for use in making judgments to which they are relevant (see Albarracín, Wallace, & Glasman, in press). Future research and theorizing should address this matter.

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