

## 8

# Metacognition

## *Methods to Assess Primary versus Secondary Cognition*

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Evaluation processes play a major role in directing human behavior, and thought processes have a fundamental impact on people's evaluations (e.g., Fiske & Taylor, 1991). Specifically, individuals' thoughts, along with their emotions (and their thoughts about their emotions) influence attitudes toward an array of objects that in turn have an impact on behavior (Petty & Wegener, 1998). Two distinctions made with respect to thinking are whether thinking is deliberative or more automatic (Chaiken & Trope, 1999), and whether thinking is relatively objective or biased (Wegener & Petty, 1997).

A third distinction, and the one of most importance for this chapter, is whether thinking involves *primary* or *secondary* cognition. A clear example of primary cognition is our initial associations of an object with an attribute or a projection of some object on a dimension of judgment. Examples of primary thoughts are "That product is high in quality," "I like Sally," or "I am too tired to climb that wall." Primary thoughts can be accompanied by thoughts that occur at a secondary and reflective level of thinking (e.g., "Is that product truly high in quality?" and "I am uncertain

whether I like Sally"). *Metacognition* refers to these second order thoughts, or thoughts about our thoughts or thought processes, and is important, because what we think about our thoughts is consequential in guiding the formation of attitudes and subsequent action (see Petty, Briñol, Tormala, & Wegener, 2007).

We have organized this chapter into four major sections in an effort to delineate primary and secondary cognition. Across sections, we focus on the domain of attitudes and persuasion because it is the area we know best, and because it is a very active domain in metacognition research. Furthermore, the primary and secondary processes relevant to understanding evaluative judgments are also likely to be important in understanding other judgments. In the first two sections we familiarize the reader with the primary and secondary processes relevant to attitude change. Next, we describe measures that can be taken to confirm or disconfirm whether a particular process underlies an observed effect. Finally, we walk the reader through a concrete example, or case study, to illustrate clearly the nuts and bolts of empirically separating various primary versus secondary processes.

### Processes of Primary Cognition

The notion and importance of primary thoughts in evaluation processes grew out of the cognitive response approach to persuasion (Greenwald, 1968; Petty, Ostrom, & Brock, 1981) and the inoculation theory approach to resistance (McGuire, 1964). Early theories of influence assumed that producing attitude change required learning of the message, and lack of change stemmed from a failure to learn (e.g., Hovland, Janis, & Kelley, 1953). In contrast, the cognitive response and inoculation approaches contended that persuasion (or resistance) depended not on the extent of rote learning but on individuals' own idiosyncratic thoughts about the information presented. According to these frameworks, an appeal that elicits predominantly favorable, issue-relevant thoughts toward a particular recommendation fosters attitude change, whereas an appeal that elicits predominantly unfavorable, issue-relevant thoughts leads to resistance.

Although these approaches offered a number of important insights into the persuasion process, they focused only on those situations in which people were active processors of the information provided to them. The theory did not account very well for persuasion or resistance in situations where people were not actively thinking about the message content. The elaboration likelihood model of persuasion (ELM; Petty & Cacioppo, 1986) was proposed to correct this deficit by arguing that persuasion or resistance can occur when people's thinking is at a high level or low level, but the processes and consequences of these outcomes are different in each situation (see Petty & Cacioppo, 1986; Petty & Wegener, 1999; Petty & Briñol, in press).

According to the ELM (Petty & Cacioppo, 1986), variables can affect persuasion through a finite number of distinct processes, many of which involve primary cognition in the form of individuals' thoughts. A core postulate of the ELM is that a key determinant of what processes operate is the amount of thinking or elaboration people engage in. Individuals can invest a modicum of thought (i.e., low elaboration) to a modest amount of thought (i.e., moderate elaboration) to due diligence (i.e., high elaboration). Evidence has accumulated suggesting that the amount of thinking engaged in can affect persuasion at the primary level of cognition through several different processes. We review the various primary cognition processes known before moving to discuss the importance of secondary processes in persuasion (see also Figure 8.1).

### Low Extent of Message-Related Thinking

To begin, variables can affect persuasion, as well as beliefs more generally, at the primary level of cognition by serving as a simple cue or by invoking a decision heuristic (e.g., Chen & Chaiken, 1999; Petty & Cacioppo, 1986). Many variables can prompt a simple response regardless of whether the variable has a logical relation to the outcome. This typically occurs when the amount of message-related thinking is very low. Thus, methodologies oriented to assess individuals' primary message-related thoughts, which we will discuss, yield few differences. Indeed, Petty and colleagues (1981) found that under low-level thinking conditions, people were more persuaded by experts versus nonexperts, regardless of whether the message was compelling or specious. Similarly, Razran (1940) placed participants in a negative affective state by exposing them to noxious odors or in a positive affective state by providing them with a free lunch. Razran found that individuals had more favorable attitudes toward subsequent political slogans when they had been placed in a positive versus negative affective state. This work is consistent with a simple associative process in which the positive state becomes attached to the attitude object or a heuristic process in which people reason, "If I feel good, I must like it."

### Amount of Thinking

One of the most fundamental things a variable can do to influence people's judgments is to affect the amount of thinking they do about an object. The more people think about something, the more their judgments are determined by their thoughts relative to the message (see Petty et al., 1981). And judgments based on high amounts of thinking are postulated to be more accessible, stable, resistant, and predictive of behavior (i.e., "stronger"; see Petty, Haugtvedt, & Smith, 1995). In the domain of persuasion, if the natural response to the message is to generate positive thoughts (e.g., because the arguments are compelling), the more an

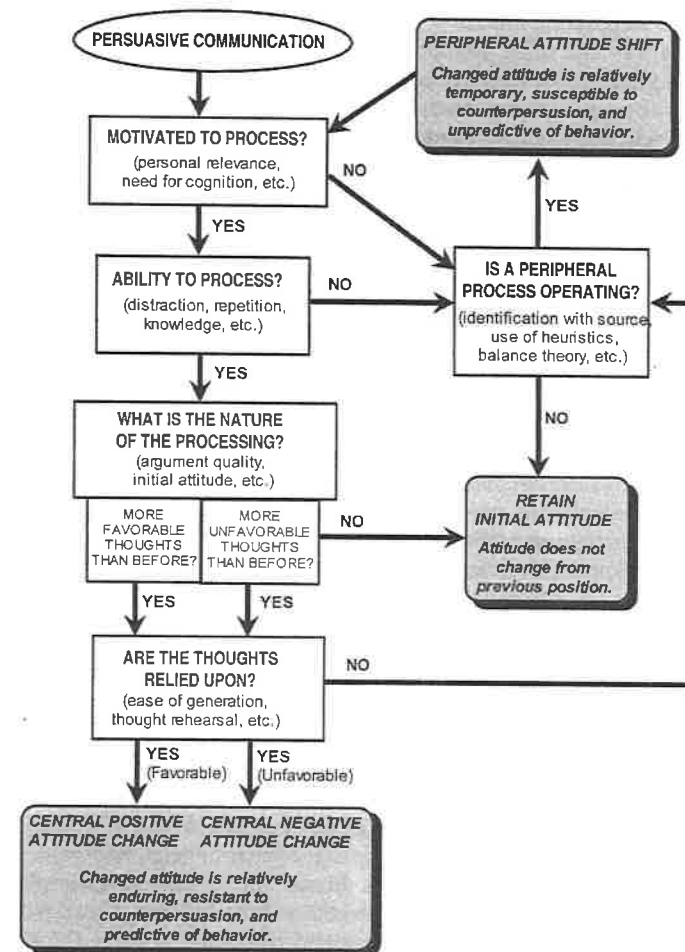


FIGURE 8.1. Schematic depiction of the elaboration likelihood model.

individual attends to the message, the more likely that he or she realizes the strength of the arguments and generates and uses positive thoughts. For example, Wegener, Petty, and Smith (1995) suggested that people in a positive mood process information more when they believe that information will maintain their mood. Indeed, participants induced to feel happy were more likely to generate message-relevant thoughts and to rely on the content of their thoughts when a message was framed as maintain-

ing their happiness, but they were less likely to generate thoughts if the message was said to be disruptive of their current mood. And, relying on their thoughts increased persuasion when the message naturally elicited positive thoughts from participants, but it decreased persuasion when the message elicited negative thoughts.

### Content of Thinking

Under high-elaboration conditions, people are more persuaded when information viewed as relevant to the object generates positive thoughts (see reviews by Eagly & Chaiken, 1993; Petty & Cacioppo, 1986). Consequently, variables also affect the content of people's thinking by serving as arguments. For instance, when people are thinking carefully, the attractiveness of the hair of a person using a shampoo might be seen as an important argument in accepting the proposition that the shampoo makes one's hair look good (e.g., Petty & Cacioppo, 1981; Petty, Cacioppo, & Schumann, 1983) but the same variable might serve as a simple valence cue for an irrelevant product (e.g., a bank loan) when people are not thinking much. In one study, Martin, Abend, Sedikides, and Green (1997) placed participants in a happy or sad mood, then asked them to read and evaluate a story designed to bring about a happy or sad mood. Because evoking a mood was a core objective of the story, participants placed in a mood (e.g., sad) were more favorable toward the story that intended to evoke that mood (i.e., sad) than one that intended to evoke the opposite mood (i.e., happy).

### Direction of Thinking

Under high thinking conditions, variables can also lead individuals to be biased in their processing of evidence or information (e.g., Killea & Johnson, 1998; Rucker & Petty, 2004). Biased processing of information is most likely to be observed when information is ambiguous, because clearly strong or weak arguments reduce the opportunity for a bias in thinking to occur. As an example, Chaiken and Maheswaran (1994) found that when ambiguous arguments were presented in a message individuals were more likely to generate positive thoughts, and form favorable attitudes, when the message came from an expert versus a nonexpert. Similarly, Petty, Schumann, Richman, and Strathman (1993) found that under high thinking conditions, placing participants in a positive mood enhanced the likelihood of generating positive thoughts, whereas placing participants in a negative mood enhanced the likelihood of generating negative thoughts. As a result, positive mood enhanced persuasion relative to negative mood. In both of these examples, a variable influenced persuasion by biasing the type of primary cognitions generated.

## Processes of Secondary Cognition

Although early research focused on the importance of primary cognition in persuasion, variables can also affect attitudes through various secondary thoughts that are generated. For example, a primary thought (e.g., "That car looks safe") might be accompanied by a secondary thought that assesses the validity of the primary thought (e.g., "That thought came to mind easily, so it must be correct"). These secondary cognitions are metacognitive in nature because they reflect a cognitive assessment of an existing cognition. Furthermore, such secondary thoughts are important, because when people's thoughts are held with greater confidence (Petty, Briñol, & Tormala, 2002), they are more likely to use them to form their judgments. However, if people doubt the validity of their thoughts, then their thoughts will be less likely to affect their judgments. Because secondary cognition operates off of primary cognition, such processes occur under conditions of high-levels of thinking (see Petty et al., 2002). High-level thinking is thought to be required for metacognition because individuals must first have put enough effort and thought into generating the primary cognitions, and they must further be motivated to reflect on their primary thoughts. Two prominent, well-studied secondary processes in the persuasion literature involve assessing the validity of thoughts and corrections for biases in thinking.

### Validity of Thinking

As we noted earlier, an individual's thoughts might be accompanied by a great deal of confidence or a great deal of doubt. Although thought confidence is a secondary cognition, it can be as important as the primary cognition, because when thoughts are held with greater confidence, people are more likely to use them in forming their attitudes. Conversely, if people doubt the validity of their thoughts, they are less likely to use them in forming their attitudes. The process of evaluating thoughts for validity is referred to as *self-validation* (see Petty et al., 2002).<sup>1</sup>

As an example, Tormala, Briñol, and Petty (2007) instructed participants to read a message. After participants had read the message, they were informed that the message came from a source either low or high in credibility. Tormala and colleagues found that individuals had greater confidence in their thoughts when they learned those thoughts were based on a message from a credible versus a noncredible source. In addition, the difference in thought confidence affected the degree to which participants were persuaded.

<sup>1</sup>We acknowledge that other metacognitive features of thoughts might affect persuasion (e.g., perceived importance of thoughts). We limit discussion here to thought confidence and bias accompanying thoughts. These two metacognitive processes have received the bulk of the treatment in the literature to date.

Participants were more persuaded by the credible than by the noncredible source when their thoughts were favorable, but the opposite was true (more persuasion for noncredible sources) when their thoughts were unfavorable.

Later in this chapter we describe how to assess this process of metacognitive validation with specific experimental predictions, measurement, and moderation approaches.

### Correction for Bias

If people believe that their judgments have been biased in some way, then they may adjust or correct their judgments in a direction opposite to the presumed biasing impact (Petty & Wegener, 1993; Wegener & Petty, 1997; Wilson & Brekke, 1994). Correction involves a secondary cognition that identifies the primary cognition as biased and, as a result, leads people to adjust their attitudes in an effort to offset the bias. For example, an individual seeing a car commercial might think, "That girl next to the car is very attractive," but also realize a possible biasing influence: "I probably like that car more than I should, because I'm being biased by the woman's attractiveness." As a result, individuals might be more likely to intentionally reduce the favorability of their attitudes than if they had relied only on their primary cognition (i.e., that the girl was attractive).

As one example of correction effects, Petty, Wegener, and White (1998) showed that individuals were more persuaded when a message came from a likable versus an unlikable source if a bias was not salient. However, when participants were explicitly asked to remove any bias from their judgments, the impact of source likability disappeared (i.e., people were equally persuaded by likable and unlikable sources); that is, individuals were able to engage in a metacognitive process whereby they presumed that the likability of the source was influencing their judgment and were able to adjust their attitudes in a manner that addressed the bias. Of course, just because people are aware of a bias does not mean that they will accurately correct it. Individuals might fail to correct sufficiently, overcorrect, or even correct in the wrong direction (see Wegener & Petty, 1997, for further discussion). As was the case with self-validation processes, theory-driven correction processes are metacognitive in nature and require a number of (measurable) conditions to operate that we examine later in this chapter.<sup>2</sup>

### Consequences of Different Processes

The presence of multiple processes is important because different processes can produce different results. For example, in the case of mood, if mood

<sup>2</sup>There are other metacognitive processes of correction, such as thought suppression, suppression of one's judgments or behaviors, and subtraction. We focus on theory-driven processes in this chapter, since they best represent the research on persuasion. For further discussion of these processes see Petty and colleagues (2007).

biases people's thinking (influence at the primary level of cognition), then a positive mood is likely to lead to more positive attitudes for ambiguous arguments but to relatively small effects for clearly strong or weak arguments (see Chaiken & Maheswaran, 1994). In contrast, if mood validates people's thoughts (influence at the secondary level of cognition), then a positive mood is likely to lead to more positive attitudes when arguments are strong but to more negative attitudes when arguments are weak, but mood may have little influence on ambiguous arguments. However, sometimes, a metacognitive process leads to the same outcome as a primary cognitive process. For example, increasing the self-relevance of a message recipient may lead to larger argument quality effects both when it enhances thinking about a message and validates thoughts (for a discussion of this possibility, see Briñol, DeMarree, & Petty, 2010). Later we demonstrate how these mechanisms can be teased apart.

In summary, primary and secondary processes can lead to similar or different outcomes. Furthermore, the same process (regardless of the level of cognition) can lead to different outcomes (e.g., happy mood can increase or decrease persuasion by affecting the amount of thinking). Finally, different processes can also lead to outcomes that are similar in appearance. However, even when attitudes are the same, attitudes formed through processes operating under high levels of thinking tend to be more persistent, resistant to change, and influential in determining behavior compared to attitudes formed by low elaboration processes (see Petty et al., 1995). Thus, knowing the situations under which various mechanisms operate, and the consequences associated with these processes, allows for differential predictions regarding the effect of a variable on persuasion.

### Empirical Means to Identify and Separate Processes

Given the importance of understanding the processes underlying persuasion, it seems critical to have precise methods and recommendations to identify empirically various cognitive and metacognitive processes. Fortunately, a finite set of methods can be used in conjunction to elucidate the nature of the process underlying the effect a variable has on persuasion. Next, we talk about each previously described process and introduce the empirical methods that test whether that process is likely to explain an observed effect. We introduce measures as they become relevant and explain further as needed.

#### Processes Operating at Low Levels of Thinking: Identifying Variables as Simple Cues

A defining feature of variables serving as simple cues is that this process is most likely to operate under low-elaboration conditions. As such, there are

a number of indicators to examine to determine whether a variable serves as a simple cue.

### *Measuring Amount of Thinking*

**Elaboration**—or the amount of thinking—can be assessed using questions about perceived cognitive effort. For example, individuals can be asked to rate the extent of their thinking, attention, or interest as relatively high or low (e.g., Petty et al., 2002). Furthermore, there are individual differences in the extent to which people naturally elaborate upon information. Specifically, participants of a study can be asked to complete the Need for Cognition Scale (Cacioppo, Petty, & Kao, 1984). Need for cognition (NC; Cacioppo & Petty, 1982) refers to the tendency to engage in and enjoy effortful thought. Individuals high in NC tend to form judgments on the basis of an effortful analysis of the quality of relevant information (i.e., high thinking processes), whereas people low in NC tend to be more reliant on simple cues (i.e., low thinking processes).

If a variable serves as a simple cue, then the effect should be most pronounced when measured elaboration—either self-reported or NC—is low. If the effect is strongest when elaboration is moderate or high, such an outcome would suggest that a simple cue is unlikely to be the primary process at work. Of course, in addition to measuring elaboration, elaboration can also be manipulated through a variety of factors (e.g., message relevance, task importance) that provide an alternative means of convergence (see Petty & Wegener, 1998).

### *Thought Valence*

At the primary level of cognition, individuals can report the cognitive responses or thoughts they have in response to a persuasive attempt. In the persuasion literature, participants are often instructed to list the thoughts that went through their minds as they read a proposal. A number of boxes or spaces can be provided to segment easily the number of thoughts participants have and asking participants to list one thought per box or space provided. Alternatively, individuals can be asked to list all thoughts that come to mind (see Cacioppo & Petty, 1981, for details on the thought listing procedure). These thoughts can be coded as positive, negative, or neutral with regard to the message presented.

Message-relevant thoughts can then be used to form an index by subtracting the number of negative thoughts from the number of positive thoughts, and dividing by the number of positive and negative thoughts (see Cacioppo & Petty, 1979). Notably, thoughts unrelated to the message (e.g., “I’m tired”) are not coded for this index of favorability. Most of the research in the last three decades has relied on this type of index, because it reports *relative* valence and controls for the total number of valenced

thoughts listed. Of course, other indices are also possible (e.g., positive divided by total number; positive minus negative), and tend to correlate highly with each other, but the measure described earlier is the most common because it considers the number of thoughts listed (reflecting participants’ verbal skills).

Thought valence can either be assessed by external judges exposed to what participants have written (and therefore treated as a dimension of primary cognition) or rated by the same person who generates the thought. Interestingly, when participants are asked to judge their own thoughts in persuasion research, they are in essence being asked to engage in metacognition, because they are asked for their thoughts about their own thoughts (e.g., “How *favorable* toward the issue is your thought?”). There is no presumption in the literature on primary cognition, however, that people necessarily think about their thoughts in this way at the time of thought generation—only that these post hoc categorizations are useful for predicting what attitudes people will adopt.

Importantly, if a variable (e.g., source credibility) affects persuasion through a simple cue, there should also be little influence on message-related thoughts (i.e., low thought–attitude correlations), because attitude change would not occur through scrutiny of message arguments. If there are strong differences in message-related thoughts that further mediate observed effects on attitudes, such an outcome suggests that simple cue-based processes are not at play.

### *Measuring Attitude Strength*

Another tool for identifying simple cue processes is attitude strength. Attitudes formed under greater degrees of thought are more likely to be persistent across time, resistant to efforts to change them, and to influence judgments and behavior. The measures of attitude strength can be broken down into both objective and subjective measures.

Objective measures of attitude strength refer to observable properties of an attitude, such as attitude–behavior correspondence. A large, positive correlation between an attitude (e.g., “Do you like that political candidate?”) and some behavior related to the attitude (e.g., “For whom did you vote?”) is an indicator of a strong attitude, whereas a nonsignificant correlation between these two measures would be an indicator of a weaker attitude. In a similar vein, the stronger the correlation between two attitude measures separated by time (e.g., 6 months) or the less change observed when an attitude is challenged, the stronger the attitude. Another objective measure of attitude strength is attitude accessibility (Fazio, 1995), which can be assessed in a number of fashions. A typical measurement in the literature is simply to record the length of time it takes for individuals to report their attitudes. If attitudes are assessed with multiple items, typically, the first item is used, since after answering the first item, the attitude becomes

accessible and subsequent reports are faster, regardless of initial differences in activation (see Petrocelli, Tormala, & Rucker, 2007).

Wegener, Downing, Krosnick, and Petty (1995) noted that for virtually every postulated objective indicator of an attitude's strength, such as the actual speed with which an attitude comes to mind (accessibility; see Fazio, 1995) or the amount of information persons can generate regarding their attitudes (knowledge; see Wood, Rhodes, & Biek, 1995), or the amount of thinking they have done about their attitude (Petty et al., 1995), there is a parallel measure of the *perceived* accessibility of the attitude, or amount of knowledge or thought. However, there are some subjective perceptions, such as attitude certainty and importance, for which there are no objective counterparts (for further discussion, see Petty & Krosnick, 1995; Petty et al., 2007). As a practical illustration of these metacognitive indicators, one might first be asked, "How much do you like the new university president?" Subsequently, individuals can be asked, "How certain are you that your attitude toward the new university president is correct?"; "How important is your attitude toward the new university president?"; and "How much knowledge is your attitude toward the university president based upon?" The more thought that individuals have put into forming their attitudes, the stronger the attitudes typically are on one or more of these dimensions (Petty et al., 1995; see also Bassili, 1996).

If a variable served as a simple cue, one can expect that there would be nonsignificant or weak correlations between attitudes and behaviors. Of course, attitude strength indicators, such as attitude accessibility and attitude certainty, can change as a consequence of factors other than the amount of thinking (see, DeMarree, Petty, & Briñol, 2007). Therefore, like all measures, these indicators should be taken into consideration in combination with other measures and procedures also designed to assess elaboration.

### Argument Quality

An *argument quality manipulation* typically consists of varying the persuasiveness of the advocacy in a message between groups (i.e., individuals are randomly assigned to receive either the strong or the weak version; Petty & Cacioppo, 1986). For example, consider a message urging people to eat more vegetables. A strong argument might be "Eating more vegetables will make you healthy and help prevent cancer." A weak argument might be "Eating more vegetables will add color and variety to your meal." These kinds of arguments need to be pretested to ensure that they elicit the appropriate pattern of thoughts; that is, the strong arguments should elicit predominantly favorable thoughts about the object or the proposal, whereas the weak arguments should provoke predominantly unfavorable thoughts, or counterarguments. At the same time, the strong and weak messages are expected to be equivalent on other relevant characteristics,

such as believability, plausibility, comprehensibility, complexity, and familiarity. Although consideration of what makes arguments strong or weak is an interesting area of investigation (e.g., see Petty & Wegener, 1998), persuasion research uses argument quality typically as a methodological tool to assess the psychological process by which persuasion occurs.

When using argument quality for methodological purposes, it is important to clarify further that both the strong and weak messages argue *in favor* of a proposal (e.g., eating more vegetables), but the strong arguments provide more compelling reasons than the weak arguments. Because both sets of arguments are in favor of the issue, they may be equally persuasive if people do not think about their implications. Individuals who do not think about the message carefully may respond simply to the number of arguments presented, or to their initial gut reaction to the proposal. The more attention paid to the information provided, however, the greater the difference in subsequent attitudes in response to strong versus weak arguments.

For a simple cue effect, a variable is likely to produce a similar main effect across argument quality conditions, with a relatively small argument quality effect, due to the lack of careful processing. An argument quality manipulation can be used to help distinguish among several different processes. Figure 8.2 provides sample interactions based on weak, strong, and ambiguous arguments.

### Processes Operating at Moderate Levels of Thinking: Identifying Variables Affecting Amount of Thinking

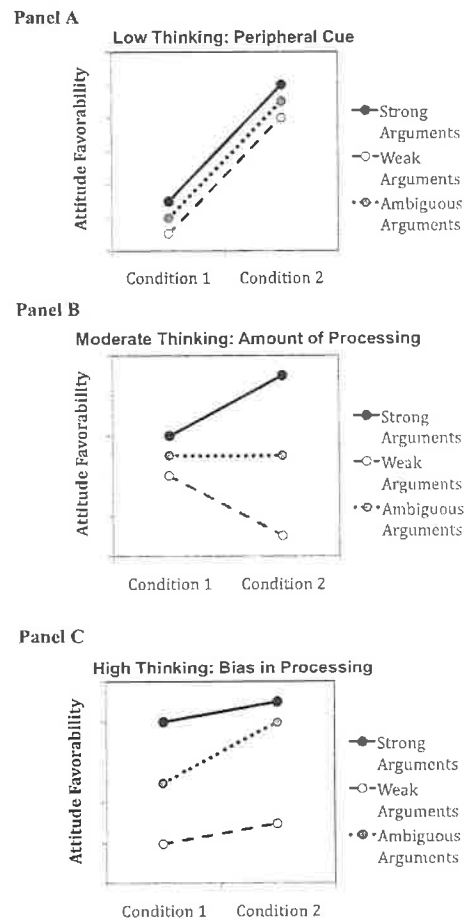
Testing whether variables influence the amount of thinking can also be accomplished using several of the measures already described in the case of simple cues. However, overall patterns of results one looks for in assessing whether differences in the amount of thinking account for an effect may differ.

### Measuring Amount of Thinking

When an obtained effect is observed most often when amount of thinking is not constrained to be low or high, this outcome suggests the variable is likely to influence the amount of thinking. Thus, if a measure of elaboration shows the effect for individuals who process a message a modest amount (e.g., individuals moderate in NC), then this initial evidence would be consistent with a variable affecting the amount of thinking.

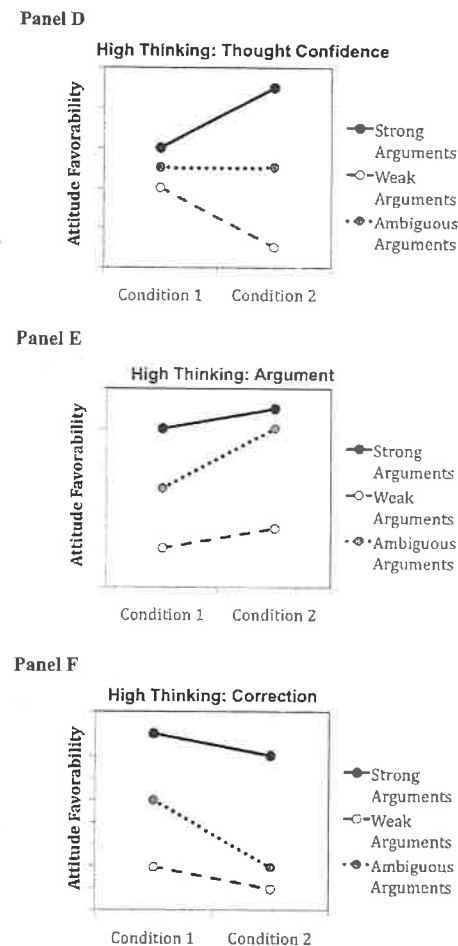
### Argument Quality

Perhaps the most dominant means of testing whether a variable influences the amount of thinking is manipulating argument quality and measuring thought valence. For argument quality, a difference in amount of thinking



**FIGURE 8.2.** Illustrating different psychological processes at varying levels of thinking as a function of a variable and argument quality. In these graphs, the variable is predicted to have a positive effect on persuasion in the second condition.

should produce a larger difference between weak and strong arguments in one condition versus another. This is based on the notion that the more one pays attention to the actual content of the message, as opposed to merely the position or number of arguments, the more differences between weak and strong arguments should become apparent. For example, if one expects that a variable increases (decreases) message processing, the difference between strong and weak arguments should be larger (smaller) in one



**FIGURE 8.2.** (continued)

condition than in another, producing a fan effect (as observed in Figure 8.2, Panel B).

### Thought Valence

Differences in amount of thinking also manifest themselves in the thought valence index. If message arguments are strong (weak), greater message processing will be accompanied by more (less) favorable thoughts. Indeed, such a measure is typically combined with the argument quality measure. As will be noted, differences in thought valence are important in sepa-



rating out cognitive processes of amount of thinking from metacognitive processes involving self-validation, since both produce similar patterns on argument quality.

### *Measuring Attitude Strength*

If a variable affects the amount of thinking, then attitude strength should be stronger under conditions of greater thinking. Thus, observing a shift in the strength of the attitude, on whatever measure is chosen, would be consistent with a change in the depth of thinking, with more thinking occurring wherever attitude strength is greater.

### **Processes Operating at High Levels of Thinking: Overview**

Because multiple cognitive and metacognitive processes can occur under high-level thinking conditions, some of the measures previously described are not effective in disentangling or discriminating these different processes. For example, each of the processes to be discussed most likely appear with high levels of thinking (e.g., individuals high in NC), and such processes tend to produce stronger attitudes. Although such measures can document that a process is occurring under high elaboration, they do little in the way of distinguish among various high-elaboration processes. We focus our discussion here on measures that go beyond identifying that a process is occurring at high levels of thinking, and point to a particular process at play.

### **Processes Operating at High Levels of Thinking: Identifying Variables Affecting Direction of Thinking**

#### *Argument Quality*

Argument quality can be useful in identifying a variable influencing or "biasing" the direction of thinking. Specifically, a bias in thinking should be most likely to produce a main effect when arguments are ambiguous. This main effect should be attenuated when arguments are clearly strong or weak (see Figure 8.2, Panel C); that is, it is easier for people to be biased when arguments are ambiguous than when they are clear, and it is easier for one additional argument to sway opinions when the other arguments are not already clearly strong or weak.<sup>3</sup>

<sup>3</sup>Of course, the bias may be so strong that it actually eliminates any effect of argument quality (e.g., people are strong advocates regardless of the message). Or the argument quality manipulation may be so strong that the effects of bias are asymmetrical, if it is not possible to be biased in one direction (for a discussion, see Petty et al., 1993). Thus, the figures are most useful in a relative fashion, when evaluating data, rather than in an absolute fashion.

### *Thought Valence*

A bias in thinking should also show up in individuals' message-related thoughts. Specifically, individuals should generate more thoughts of a valence consistent with the direction of a bias that, in turn, should mediate the observed effects on judgments or attitudes. When used in conjunction with an argument quality manipulation, a bias in thoughts should be most prevalent under conditions where the arguments are ambiguous in quality.

### **Processes Operating at High Levels of Thinking: Variables as an Argument**

When a variable serves as an argument, the variable is viewed as informative to the attitude object. As such, the variable should produce a main effect on thought valence across argument quality conditions, but especially when arguments are ambiguous. In this sense, the empirical methods for determining that a variable is an argument (e.g., thought measures) are the same as determining whether a variable is biased thinking. The primary difference is whether the information is relevant or irrelevant to the attitude object being judged. If individuals view information as relevant, then an observed difference can be attributed to using the information as an argument, whereas if information is irrelevant, then it can be attributed to a bias in thinking. For example, consider a situation in which a boss is evaluating a job applicant for a computer programming positioning. The boss is thinking very carefully about the candidate who happens both to have a PhD from MIT in computer science and to be very physically attractive. Although the individual's overall interview is mediocre (i.e., ambiguous in quality), his PhD and attractiveness might enhance his likelihood of being hired. However, whereas a PhD from MIT in computer science is likely to serve as an argument due to its relevance to the question at hand (i.e., Does this person know about computer programming?), the physical attractiveness is not relevant and would be more a manner of biased thinking.

### **Processes Operating at High Levels of Thinking: Variables Affecting Validity of Thinking**

Variables affecting the validity of one's thinking operate through a metacognitive process. Evidence for variables affecting the validity of one's thinking can be amassed through measures of thought confidence, argument quality, and thought valence.

### *Thought Confidence*

Thought confidence is a secondary cognition attached to or that qualifies individuals' thoughts; that is, individuals might have generally favorable or



unfavorable thoughts but differ in how confident they are of those thoughts (Briñol & Petty, 2003; Briñol, Petty, & Barden, 2007; Petty et al., 2002). Thought confidence can be assessed by asking individuals about their overall confidence in their thoughts or how confident they are in each thought they listed (e.g., see Briñol, Petty, & Tormala, 2004; Briñol et al., 2007; Tormala et al., 2007). For example, participants in any given study can be asked to think back to the thoughts they generated and to rate their overall confidence by responding to how “confident,” “secure,” “certain,” and “valid” they perceive their thoughts to be. Responses to these items tend to be highly intercorrelated and are often averaged to create a composite measure of confidence in thoughts. Thought confidence can also be measured individually for each thought rather than as a global assessment of the whole group of thoughts, by presenting to participants each of their thoughts (e.g., entered previously in the computer or written in a paper thought listing) and asking them to rate the confidence they have in the validity of each thought. If a variable is validating one’s thinking, then there should be an effect on thought confidence that should mediate differences in attitudes.

### Argument Quality

Because enhancing the validity of people’s thoughts increases people’s reliance on their thoughts (Petty et al., 2002), argument quality can also provide evidence for a variable affecting the validity of thinking. Specifically, individuals who have confidence in their thoughts should rely on those thoughts more, thus showing a stronger differentiation between weak and strong arguments than if they doubt their thoughts (see Figure 8.2, Panel D).

### Thought Valence

If a variable is exerting its influence through the validity of one’s thinking, there should be little effect on thought valence. Indeed, differences in amount of thinking are diagnosed by differences in thought valence (see Figure 8.3, top panel), whereas differences in validity of thinking are diagnosed by differences in thought confidence (see Figure 8.3, bottom panel).

### Processes Operating at High Levels of Thinking: Variables Producing a Correction for Bias

Because individuals are motivated to hold correct attitudes (Petty & Cacioppo, 1986), they make efforts to correct their attitudes when they perceive there is a bias. Results that are due to bias correction should increase as individuals’ awareness of the bias becomes more salient. A way to accomplish this is to instruct individuals explicitly to consider and

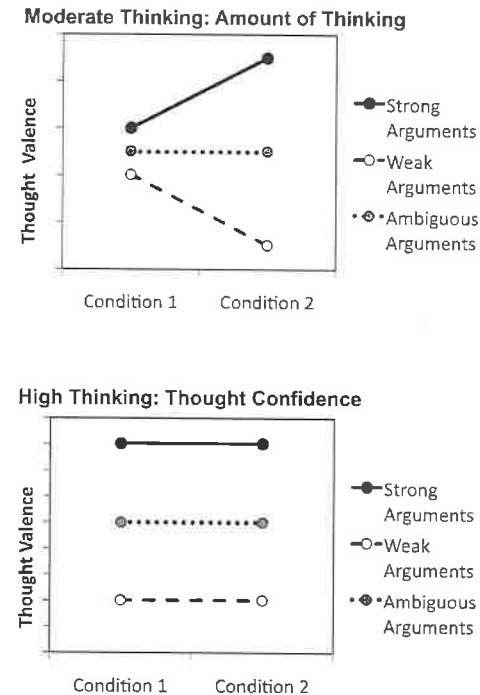


FIGURE 8.3. Illustrating patterns of thoughts as a result of a process linked to amount of thinking (cognitive) versus thought confidence (metacognitive).

correct for any biases. Of course, in using correction instructions to tease apart these processes, individuals must be motivated and able to correct (see Petty & Wegener, 1993). Another means to examine whether a variable is the result of individuals’ attempts to correct for a bias is to measure and assess individuals’ naive theory and ask whether they corrected. If individuals indicate that they have corrected in some capacity, then this could provide evidence of correction, especially if they can articulate the direction and magnitude of a bias.

### Summary of Disentangling Processes

As seen in this discussion, there are a variety of means to disentangle different processes. For example, a researcher might begin with a manipulation of argument quality as a starting point to narrow down the process. Or a researcher might start by examining whether an effect is stronger at low versus high levels of elaboration. Of importance, regardless of where

the process is started, the methods described here, used across a program of research, allow the researcher to converge on the underlying mechanism at play.

### Control Groups to Disentangling Processes

The issue of control groups comes up often in persuasion research. For example, when testing the effects of high-versus low-expert sources, is it important to have a no-source control group to determine the locus of the effect? The answer in virtually all such cases of which we are aware (in the persuasion domain at least) is that relative to a control condition, the locus of *any* effect can be produced depending on various background features of the study. For example, if the message is well written and uses statistics, people might assume a highly credible source in the no-source control group; thus, the less credible source is shown to have the most effect compared to a control. Or if the message uses mostly strong arguments, baseline persuasion might be set at a high level, again leading the less credible source to show more of a difference from the control. A large number of such background variables may affect whether the more or the less credible source differs more from the control in any given study.

This discussion suggests that a control group is not needed if one's goal is to establish the locus of the effect, since the findings of the control group vary depending on how they are devised. However, control groups can be valuable for very specific applications. For example, if a health campaign wants to determine whether adding a credible spokesperson lifts persuasion compared to execution without a spokesperson, then this could be relevant, since the relative value of such a person is of practical importance.

### Case Study: Testing Different Underlying Processes Involving Mood

Given the available set of tools, we now provide concrete examples of how these various tools have been used in past research to rule out, or provide evidence for, each of the different processes discussed. Given the organizing value of elaboration previously discussed, we structure our example around testing for low-, moderate-, and high-elaboration processes.

As just one example of the multiple roles a variable can play in persuasion situations, consider how a person's incidental emotions can affect evaluative judgments according to the ELM. First and most simply, when thinking is constrained to be low (e.g., due to many distractions), then emotions tend to serve as simple associative cues and produce evaluations consistent with their valence (e.g., Petty et al., 1993). When the likelihood of thinking is not constrained to be high or low by other variables, then emotions can affect the extent of thinking. For example, people may think

about messages more when in a sad than in a happy state because sadness either signals a problem to be solved (Schwarz, Bless, & Bohner, 1991) or conveys a sense of uncertainty (Tiedens & Linton, 2001). If people process a message more when in a sad than in a happy state, this means that they would be more persuaded by cogent arguments when sad than when happy, but less persuaded by specious arguments. When thinking is at a high level, one's emotions serve other roles. First, emotions can be evaluated as evidence (negative emotions such as sadness or fear can lead you to like a movie if these are the intended states; e.g., see Martin, 2000). Also, when thinking is at a high level, emotions can bias the ongoing thoughts (positive consequences seem more likely when people are in a happy state; e.g., DeSteno, Petty, Wegener, & Rucker, 2000). Finally, when thinking is at a high level, emotions can affect confidence in one's thoughts (Briñol et al., 2007). Because of the importance of understanding the process by which variables such as emotions can produce persuasion, we describe each of these possibilities in the next sections in some detail.<sup>4</sup>

### Processes Operating at Low Levels of Thinking: Mood as a Cue

Petty and colleagues (1993) provided evidence for mood as a simple cue, such that a positive mood led to more favorable attitudes than did a neutral mood. In one experiment, mood was manipulated to be positive by assigning participants to watch a comedy program (*The Cosby Show*) or neutral program (i.e., *Cardiology Update*). Subsequently, the researchers manipulated involvement by telling participants they would select among various pens or instant coffees after participants had completed the experiment. Participants then saw a variety of ads. Of critical importance, one of the ads was for the Maestro pen. This ad was relevant to those who had been informed they would receive a pen (high involvement) but not relevant for those who had been told they would receive instant coffee (low involvement). Participants were asked to indicate their attitude on three 9-point bipolar scales (*good–bad*, *satisfactory–unsatisfactory*, *favorable–unfavorable*). Finally, participants were provided with seven spaces in which to list thoughts they had while viewing the commercial for the Maestro pen. Two judges, blind to condition, coded the thoughts with respect to whether participants expressed positive, negative, or neutral statements. A thought index based on the proportion of positive thoughts was then computed.

Despite the lack of personal relevance, Petty and colleagues (1993) found that even under low-involvement conditions individuals evaluated the pen more favorably when induced to be in a positive mood than a nega-

<sup>4</sup>Notably, in the ELM, these processes apply not only to emotion but also to a plethora of other variables. For example, the credibility of the message source and other variables has been shown to serve the same multiple roles as emotion.

tive mood. In addition, in another experiment, Petty and colleagues (1993) found a similar pattern among measured differences in elaboration in the form of individuals low in NC (i.e., individuals predisposed not to think as carefully and to rely instead on heuristics). Furthermore, there were no differences in measured thoughts for individuals in low-elaboration conditions. This finding suggests that the effect was cue-based because it could not be explained by differences in message-relevant thinking. As we discuss in greater detail later, Petty and colleagues also found that although a similar pattern occurred under high-elaboration conditions (i.e., a more favorable attitude under positive than neutral moods), this effect was mediated by people's thoughts relative to a message. In short, the work by Petty and colleagues suggested that mood could serve as a simple cue by (1) manipulating and measuring elaboration, and (2) measuring thought valence.

### **Processes Operating at Moderate Levels of Thinking: Mood Affecting the Amount of Thinking**

Work by Wegener and colleagues (Wegener & Petty, 1995; Wegener, Petty, & Smith, 1995) suggested that mood can affect persuasion by affecting the amount of thinking (see also Mackie & Worth, 1989; Schwarz et al., 1991) in which individuals engage. Specifically, the authors put forth the hypothesis that positive mood can increase the amount of thinking in situations where people believe that processing the information will not threaten or ruin their positive mood and, in fact, might preserve it.

To test this idea, Wegener, Petty, and Smith (1995) asked participants first to imagine events designed to elicit a positive mood (e.g., taking an all-expense-paid vacation to Hawaii) or a neutral mood (e.g., checking out a book from the library). Subsequently, participants received a message that contained weak or strong arguments. Importantly, the message was on a topic that was not threatening and, if anything, was rather agreeable to participants (i.e., improving a foster care program). In addition, the topic was selected to be neither highly involving nor uninvolved, suggesting that elaboration conditions were likely to be moderate. Wegener, Petty, and colleagues found that participants in a happy mood made a stronger differentiation between weak and strong arguments than did participants in a neutral mood. In fact, those in a neutral mood showed no significant difference. In a separate experiment, the authors found that differences in thought valence followed a similar pattern of results (i.e., an interaction of mood and argument quality), further supporting an information-processing account.

At the time of this work, the notion that variables could affect metacognitive elements such as one's thought confidence had not been proposed. However, as noted, Wegener and colleagues (1995) found a difference in thoughts, consistent with a cognitive information-processing account over a metacognitive validation account. Finally, given that there were no argu-

ment quality effects under the neutral mood condition, this result suggests that overall elaboration was not high, a necessary requirement for metacognitive processes.

This work thus teased apart processes by (1) using an argument quality condition, (2) constraining elaboration to be moderate, and (3) measuring individuals' thoughts.

### **Processes Operating at High Levels of Thinking: Mood Affecting Primary and Secondary Cognition**

Whereas variables are primarily likely to affect persuasion through primary cognitive processes under low elaboration (serving as a cue) or moderate elaboration (affecting the amount of thinking), both primary processes (direction of thinking, variables as arguments) and secondary processes (validity of thinking, correction) operate under high elaboration. Fortunately, several markers can separate the different processes occurring under high levels of thinking.

### **Processes Operating at High Levels of Thinking: Mood Affecting Direction of Thinking**

In the work already described by Petty and colleagues (1993), the authors also tested whether mood could influence the direction of one's thinking under high-elaboration conditions. Specifically, they found that when elaboration was high due to individual (i.e., individuals high in NC) or circumstantial factors (i.e., the advertisement was for a product category from which they would be choosing later in the experiment), a positive mood led to more favorable attitudes than did a neutral mood. Importantly, however, under these high-elaboration conditions, Petty and colleagues found that the effect of mood on attitudes was mediated by individuals' message-related thoughts. Positive mood led to a systematic biasing effect, such that individuals in a positive mood generated more favorable thoughts than those not in a good mood, and this difference in thoughts affected their attitudes.

Petty and colleagues (1993) also included an argument quality manipulation and found that mood did not interact with argument quality. In addition to elaboration being held at a high level, this suggests that an information-processing or thought confidence account does not explain these data. Finally, because mood in this case was incidental to the message itself, it was unlikely to serve as an argument. Thus, their research provided evidence consistent with a biased thinking account by (1) manipulating elaboration to be high, (2) showing mediation by message-related thoughts, and (3) finding that the outcome was not moderated by argument quality.

### Processes Operating at High Levels of Thinking: Mood as an Argument

Surprisingly, little research has systematically attempted to separate out mood as an argument from other processes. However, in one notable exception, Martin and colleagues (1997) made participants' mood central to the message. Specifically, they first induced participants to be in a happy or sad mood, then asked them to read and evaluate a story that was either happy or sad. Because evoking a mood was a core objective of the story, participant mood was a valid argument for assessing the story. Consistent with this notion, individuals evaluated the happy story more favorably when in a happy mood than in a sad mood, whereas individuals evaluated the sad story more favorably when in a sad mood than in a happy mood.

Although elaboration was not manipulated or measured in this research, the fact that individuals were explicitly asked to read and evaluate the story is consistent with relatively high-elaboration conditions. Furthermore, because mood did not exert a consistent main effect (i.e., positive mood did not lead to more favorable evaluations than negative mood) but was sensitive to the match between one's mood and the message suggests that the information was assessed with respect to its relevance as an argument rather than serving as a cue or biasing thinking.

### Processes Operating at High Levels of Thinking: Mood Affecting Validity of Thinking

Briñol, Petty, and Barden (2007) suggest that positive moods could affect persuasion through a metacognitive process whereby positive moods increase individuals' confidence in their thoughts. Arguing that positive mood might be associated with greater confidence than negative mood, Briñol and colleagues suggested that inducing a positive mood *after* a persuasive message should validate whatever thoughts individuals had about the message. As a consequence, individuals who generated primarily positive thoughts should be more favorable toward a message after being placed in a positive versus a negative mood, whereas individuals who generated primarily negative thoughts should be more unfavorable toward a message after being placed in a positive versus negative mood.

To test this hypothesis, Briñol and colleagues (2007) first instructed participants to read a message that consisted of either strong or weak arguments. The message advocated a new identification card policy relevant to the students, and students were further told to pay close attention, because the issue was important. Thus, the topic was designed to place participants into a high-elaboration situation that should produce either a positive thought profile, in the case of strong arguments, or a negative thought profile, in the case of weak arguments. After reading the message, participants listed the thoughts they had about the policy. Subsequently, to

induce mood, participants were asked to recall a time that they felt either happy or sad. Finally, participants were asked to indicate the confidence in the thoughts they listed toward the message and to provide their attitudes.

Briñol and colleagues (2007) found that individuals showed a strong differentiation between strong and weak arguments when induced into a happy mood versus a sad mood. This, in and of itself, suggests that the process at play was either a cognitive process linked to amount of thinking or a metacognitive process involving thought confidence. However, the authors also observed no differences in message-related thoughts as a function of mood. This outcome was expected given that the mood manipulation followed message processing, and individuals had been instructed to pay close attention to a relevant issue. Furthermore, the authors found that the argument quality by mood interaction was mediated by differences in thought confidence. Thus, the lack of effects on primary thoughts, along with significant mediation effects of thought confidence, provided evidence for a thought confidence account.

In another experiment, speaking further to the high-elaboration process involved in these effects, participants' NC was measured. The self-validation effect was only obtained among individuals with high NC. For individuals low in NC, Briñol (2007) found a simple main effect, such that those in a happy mood expressed more favorable attitudes than those in a negative mood, replicating the cue-based effect under low-elaboration conditions found by Petty et al. (1993). Thus, these findings discriminate among various processes using a variety of methods linked to (1) argument quality, (2) thought valence, (3) thought confidence, and (4) manipulations or assessments of the extent of elaboration.

### Processes Operating at High Levels of Thinking: Mood Producing a Correction for Bias

Given that mood is often decoupled from the message, in many cases people might view the effects of mood as an unwanted bias. As such, people should alter or adjust their evaluations to compensate, if alerted to the bias. Indeed, in a test of this, Schwarz and Clore (1983) found that although individuals report being more satisfied with their lives on sunny days (i.e., positive mood induction) than on rainy days (i.e., negative mood induction), this difference was completely eliminated when people were first asked about the weather. This suggested that mood was viewed as exerting a bias and corrected for when this bias became apparent.

Similarly, DeSteno and colleagues (2000) found that under high-elaboration conditions, experiencing a specific emotion produced a biasing effect on judgments; that is, the emotion (i.e., anger or sadness) increased people's perceived likelihood of negative events tied to those emotions (i.e., being stuck in traffic, losing a loved one). However, when people were alerted to the possible bias (i.e., by informing them the study was on emotional

experiences) and people had the motivation and ability to correct (i.e., were high in NC), this attenuated the observed effects. These results provide evidence for bias correction in the context of emotion by explicitly alerting individuals to the bias and demonstrating that they correct (Schwarz & Clore, 1983), provided they have the motivation and ability to do so (DeSteno et al., 2000).

### Testing for Multiple Processes in the Same Design

While the previous discussion is meant to illustrate how each of the various processes can be tested, using mood as one specific case, we are quick to note that different processes can be tested within the same experiment. Consider two cases already highlighted. First, Petty and colleagues (1993) found that under both low- and high-elaboration conditions, being placed in a positive mood enhanced persuasion relative to a neutral mood. However, they found that this effect was unmediated by thoughts in low-elaboration conditions, consistent with a cue effect, but mediated by thoughts in a high-elaboration condition, consistent with a biased thinking explanation. Second, Briñol and colleagues (2007) also varied elaboration and found evidence of a main effect of positive mood under low elaboration, consistent with mood as a simple cue, but an interaction with argument quality under high elaboration, consistent with a thought confidence account. By taking advantage of the elaboration manipulation and the measure of thoughts, these researchers were able to demonstrate two processes occurring at different levels of elaboration within the same experimental design.

### Conclusion

Although the ELM is a rather complex theory, it has been extremely useful for understanding fundamental processes (primary and secondary) underlying attitude change. It points to multiple processes that operate in different circumstances. As reviewed, according to the ELM any single variable can work in multiple ways and therefore produce different outcomes (e.g., source credibility leading to more persuasion when it serves as a cue, but to less persuasion when it enhances thinking about weak arguments). It indicates that any single outcome can be produced by different processes (e.g., source credibility leading to more persuasion both when it serves as a cue, and when it enhances thinking about strong arguments or serves as an argument itself). And the theory postulates that not all judgmental outcomes that look the same on the surface really are the same (e.g., the same attitude changes induced by high- versus low-level thinking are differentially persistent over time).

In closing, it is important to note that although we have focused on the role of metacognition in the domain of attitudes and persuasion, the

distinction between primary and secondary cognition has been useful in the study of other areas of social psychology, ranging from subjective feelings (Schwarz & Clore, 1983) and thoughts (Kruglanski, 1989) to the study of groups and organizations (Hinsz, Tindale, & Vollrath, 1997). For an updated review on social metacognition more generally, see Briñol and DeMarree (in press).

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## 9

## Peripheral Psychophysiological Methods

URSULA HESS

### The Use of Psychophysiological Measures in Psychology

*Psychophysiology*, the study of the interrelationships between the physiological and psychological aspects of behavior, has a long tradition in experimental psychology. Thus, in 1890, William James, in his *Principles of Psychology*, discusses the bodily changes that accompany mental processes. At the same time, early pioneers such as Vigoroux (1879), Féré (1888), and Tarchanoff (1890) studied electrodermal activity (EDA). Over the course of the first half of the 20th century, psychophysiological measures became a more common part of the scientific repertoire. However, the Society for Psychophysiological Research (SPR) was not formed until 1960, and its journal *Psychophysiology* not published until 1964; thus, psychophysiology as a formal discipline is only 50 years old.

These 50 years, however, have seen tremendous changes in both use of the measures and the ease of recording. Whereas early researchers had to build their own equipment and—once polygraphs were replaced with computers—write their own software, readily available commercial systems now allow easier access to these measures. It is therefore now possible for researchers from different disciplines within psychology to add