7

CONNECTING PSYCHOPHYSIOLOGY TO OTHER MEASURES OF MEDIATED MESSAGE PROCESSING

The previous six chapters of this book have provided knowledge of how psychophysiological measures can be an exciting addition to the media psychology researcher's toolbox for investigating mental processes engaged during media use. We have discussed well established psychophysiological indicators of cognitive and emotional processing as well as measures that have yet to be extensively applied in media psychology research but have tremendous potential to significantly increase our understanding of how the mind processes mediated messages. The goal of this chapter is to place psychophysiological measures of cognitive and emotional processing of mediated messages in the proper perspective by discussing the connection between physiological indicators of mental processes engaged during media use and other measures that provide valuable self-report and behavioral data. We begin by discussing how media psychology researchers can gain a proper perspective of the need for data obtained from multiple measures of mediated message processing. Relationships between psychophysiological and other measures of mediated message processing will then be discussed. This chapter concludes with a review of specific self-report and behavioral measures of mediated message processing, many of which were first covered in Annie Lang's (1994b) foundational book, *Measuring psychological responses to media*. This chapter expands upon and updates that resource by explicitly discussing important methodological issues that must be considered when studying mediated message processing through a combination of psychophysiological and self-report measures. The seminal volume edited by Lang, however, should be considered an important resource in the library of any media psychology researcher.

Such a researcher is dedicated to systematically investigating some of the most complex and dynamic social phenomena that exist—the human mind as it consumes and is influenced by media. The complexity of this phenomenon appears

on both the independent and dependent variable side of experiments on mediated message processing. The complexity of the stimulus being studied—mediated messages—has exponentially increased since the days of the first experiments on media effects. In addition to studying more traditional media content, media psychology researchers currently investigate independent variables that researchers involved in the birth of media effects research likely could not even imagine would exist, such as features of online avatars, social media, and multimedia platforms. Further, the dependent variables of interest in media psychology research—attention, emotion, memory, attitudes, decision-making, etc.—emerge from the operation of multiple dynamic, embodied mental processes that ultimately yield numerous forms of meaningful experiences reaching varying levels of consciousness. The entire set of conscious and unconscious mental processes and experiences engaged by media use contains data that reveals the impact of mediated messages on individuals. Thus, advancing knowledge in this area requires media psychology researchers to ground their research programs in conceptual and operational thinking that results in a coherent analysis of multiple forms of data obtained from a range of interconnected measures that are capable of indexing mental processes and experiences varying in the level to which they rise to consciousness. This will require clear understanding of the role of data obtained from multiple measures in providing insight into the mind "on" media.

Gaining a proper perspective on data obtained from multiple forms of measurement

The extent to which psychophysiological measures have already been used to gain insight into mediated message processing has helped create an extremely exciting research environment in which today's media psychology researchers can build upon the growing body of existing knowledge through data collected in their own experiments. The challenge is that in a research environment where some scholars emphasize understanding mental processes engaged across time during media use over documenting more static outcomes of media use, it can be easy for a media psychology researcher to become overly enthralled with psychophysiological measurement. After all, a primary strength of psychophysiological measures is the ability to index cognitive and emotional processes in real time during media exposure. However, failing to understand the unique insights that can be gained from specific forms of data—psychophysiological, self-report, and behavioral—and over-emphasizing one form of measurement over another is unlikely to lead to research capable of producing in-depth and thorough insights into mediated message processing.

Media psychology researchers who understand the unique insights that can be gained from specific forms of data have a proper perspective on the value of studying complex phenomena—like mediated message processing—through the combination of multiple forms of measurement. This perspective is grounded in

the realization that each specific measure provides data that yields a partial glimpse of dynamic mental processes and experiences. The ability to gain this proper perspective and understand the unique insights that can be gained from multiple measures of mediated message processing requires careful consideration of the nature of the phenomenon being studied—the mental experience of consuming and being influenced by media—as well as solid concept explication that includes a high degree of attention to operational strengths and weaknesses of specific measures.

Let's start by considering the phenomenon being studied—an embodied human mind consuming media—with an eye toward the challenge of measuring the functioning of representative constructs. The LC4MP—a model of mediated message processing presented in Chapter 4—describes all communication as a continuous, dynamic interaction between a message and a message recipient (Lang, 2009). In the context of mediated message processing it is the continuous interaction between a mediated message and a message recipient—an individual that dynamically acts, reacts, and interacts in a social environment across time—that is the catalyst for the mental experience of media consumption. It is important to note that labeling this phenomenon a "mental experience" is not meant to diminish or deny behavioral components of media consumption. Rather, behavioral components of media consumption can be viewed as reflecting motor responses enacted by the embodied human mind that produces mental experience.

A significant component of a motivated cognition theoretical perspective on mediated message processing is the assumption that physiological activity of the central and peripheral nervous system creates an embodied mind, from which the mental experience of consuming media emerges. A belief that central and peripheral nervous system activity underlies and produces mental experience is the core belief that allows a researcher to apply psychophysiological measures to the study of mediated message processing (Lang, Potter, & Bolls, 2009). It would be a mistake, however, to believe that embodied mental processes—as revealed by psychophysiological measures—fully describe or actually are the entirety of media-evoked mental experiences generated by the embodied mind. Our hearts slow down as we allocate more cognitive resources to encoding important news stories and our palms sweat when playing a particularly arousing online game; however, observing this physiological variance indicative of cognitive and emotional processing of media structure and content only allows researchers to scratch the surface of the complete dynamic experience of consuming and being influenced by media.

Media consumption clearly evokes engaging and gratifying conscious mental experiences that, while produced by specific patterns of nervous system activity constituting an embodied mind, are completely outside description provided by psychophysiological measures. For instance, playing a violent online game may be an extremely arousing experience as indicated by skin conductance data, however, psychophysiological data cannot describe conscious gratifications that

might be obtained from playing violent games such as those that might deal with escaping into a fantasy world. The embodied human mind as it interacts with mediated messages produces much more than just biological, physical activity reflective of the cognitive and emotional processes discussed earlier in this book. Our mental experience evoked by consuming media includes a host of discrete emotional feelings as well as sensations such as being entertained, informed, and fascinated. Therefore, the study of the embodied human mind interacting with mediated messages requires researchers to conceptually and operationally define a wide range of relevant constructs in practically every experiment.

In Chapter 1 we were critical of media effects research for not including mental processes as relevant constructs and taking a "black box" approach to studying how individuals consume and are influenced by media, an approach that was consistent with the dominant paradigm grounded in behaviorism. The shift away from behaviorism to considering mental processes as valid objects of study burst open the "black box" and was absolutely a catalyst for advancing knowledge of the experience of consuming and being influenced by media. This shift, however, in no way decreases the importance of measuring variables that appear to be outcomes of media exposure. Rather, the ability to study mental processes evoked by media exposure enables media psychology researchers to study the dynamic interaction between psychological processes and states representative of the entire mental milieu accompanying mediated message processing occurring across time. Under this approach, "outcome" measures—representative of beliefs, attitudes, feelings, and behaviors—should not be viewed as indexing stable and predictable "effects" of media exposure. The media psychology researcher should rather view self-report and behavioral measures of so-called "media effects" as indexing psychological states that dynamically interact with mental processes as well as other psychological states across time in a broad complex social environment that includes media use.

Figure 7.1 contrasts the early "black box" approach to studying media effects with a dynamic processes approach that is theoretically grounded in the LC4MP (Lang, 2009). A dynamic processes approach to understanding the media–mind interaction encapsulates multiple concepts representative of interacting psychological processes and states that operate and emerge into consciousness to varying degrees over time. A core epistemological assumption of a dynamic processes approach to understanding the media and mind interaction is that mediated message processing at any point in time is impacted by prior events and interactions as well as anticipated events and interactions (Lang, 2009). Thus, embodied mental processes and emerging psychological states are continuously fluid throughout time rather than static. Advancing knowledge of dynamic mental processes and emerging psychological states in the context of mediated message processing requires researchers to address the complexity of this phenomenon at both the conceptual and operational level in conducting research. This seems more likely to occur through a dynamic processes approach that provides a description of

this phenomenon that is more analogous to looking through a kaleidoscope than the traditional input/output model applied to early media effects research.

Taking a dynamic processes approach to investigating mediated message processing, grounded in a consideration of a wide range of relevant constructs

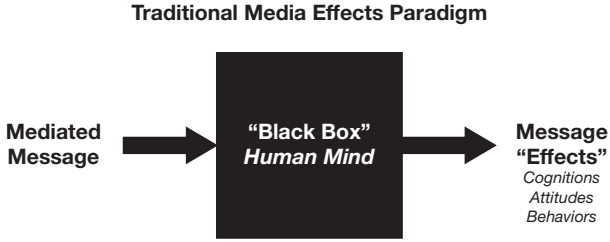

FIGURE 7.1a This diagram depicts the traditional media effects research paradigm in which mental processes are considered a form of "black box" phenomenon that researchers cannot validly observe.

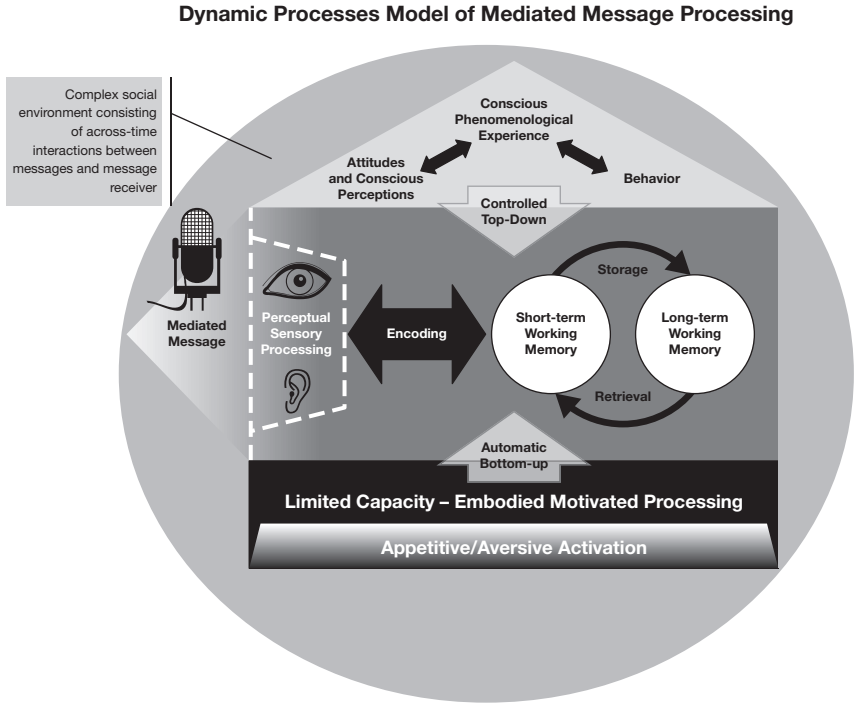

FIGURE 7.1b This diagram depicts a dynamic processes perspective for studying mental processes and states that operate and emerge into consciousness to varying degrees across time during interactions between mediated messages and message recipients.

in any given experiment, requires solid concept explication. Solid concept explication in this context requires going beyond conceptualizations rooted in the lowest, biological process level of the embodied human mind and returning to a higher level view of the phenomenon. The ultimate research objective of media psychology researchers is to draw conclusions about the interaction between mediated messages and message recipients—not merely the functioning of their embodied mind. Thus, the explication of multiple concepts relevant to the mental experience of a message recipient consuming and being influenced by media is needed. This fundamentally means connecting conceptual definitions of the relevant concepts to multiple measures of mediated message processing—in other words just good, plain, solid concept explication as described by Chaffee (1991). We will do that here in a general way, beginning with a discussion of conceptualizing "message recipient," ultimately teasing out concepts—relevant to mental experiences evoked by media use—to be explicated in a way that provides insight into the roles and interconnections of psychophysiological and other measures of mediated message processing.

The ability to connect multiple measures of mediated message processing in a way that provides a complete description of the mental experience of consuming and being influenced by media can only emerge through a strong connection between the conceptual definition of message recipient and specific measures indexing psychological processes and states engaged and experienced through media consumption. Message recipient has been conceptualized as an individual consisting of an embodied mind that dynamically acts, reacts, and interacts in a complex social environment across time (Lang, 2009). Measures of mediated message processing that are strongly connected to this conceptualization of message recipient must be capable of describing psychologically meaningful patterns of nervous system activity as well as phenomenological experiences occurring as a result of action, reaction, and interaction engaged by media use across time. These measures must be sensitive to change across time as well as a host of changing features of a complex social environment—including more than just specific content and structural features of mediated messages.

The psychophysiological measures of mediated message processing discussed in this book are sensitive measures of psychologically-meaningful patterns of nervous system activity that can be used as valid indicators of this dimension of cognitive and emotional processes engaged by media use. Self-report and behavioral measures—many of which have an extensive history of being applied to studying the mental experience of media consumption—have tremendous potential to be sensitive indicators of phenomenological experience constructing psychological states emerging from the interaction between message recipients and mediated messages. Thus, the unique role of psychophysiological measures in understanding the mental experience of consuming and being influenced by media is to describe the embodied processes of human cognition and emotion while the role of self-report and behavioral measures is to describe conscious

psychological states reflective of phenomenological experience and potential behavioral action that might emerge from media use.

It should be clear now that under the previously mentioned conceptual definition of "message recipient" any concept the media psychology researcher wishes to study represents a more specific explication of the broader concepts *embodied cognitive and emotional processes*, *phenomenological experience*, and *behavior*. Figure 7.2 illustrates this idea, listing specific examples of concepts media psychology researchers might need to explicate in their research that fall under each broader concept. This form of explication is consistent with a view of the phenomenon to be studied by media psychology researchers as a dynamic interaction between mediated messages and an individual with an embodied mind that produces emerging mental experiences that reflect and support action, reaction, and interaction across time. Thus, as required by solid concept explication, there is a tight relationship between concepts and their measurement.

The media psychology researcher who studies mediated message processing by connecting psychophysiological measures with self-report and behavioral measures—as we advocate here—needs to understand the relative strengths and weaknesses of each of these measures. Psychophysiological measures of mediated message processing are true process measures in that they can be used to observe embodied mental activity as it unfolds across time. Self-report measures reflect the output of a conscious state of a message recipient at a given moment in time. Thus, psychophysiological measures possess the relative strength of describing

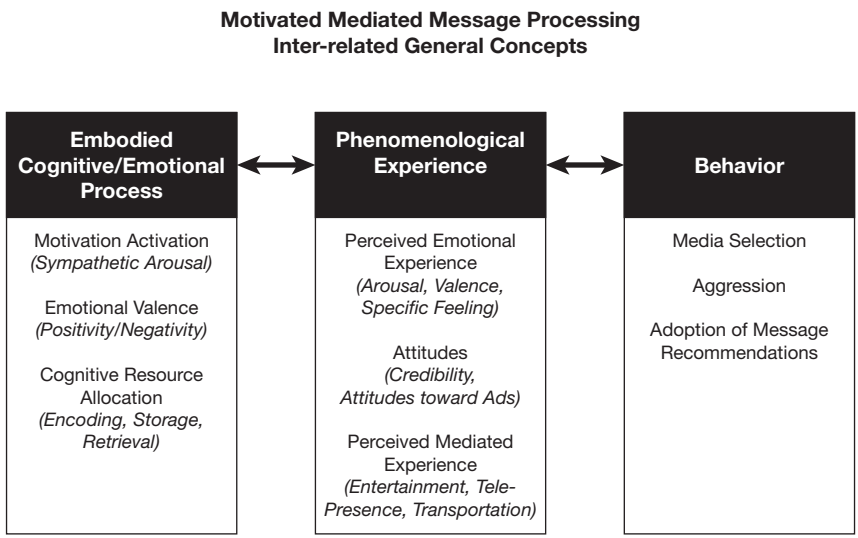

FIGURE 7.2 This diagram depicts examples of specific concepts that represent explication of the broader concepts, embodied processes, phenomenological experience, and behavior.

instant-by-instant fluctuations in the temporal dynamics of relevant concepts. Self-report and behavioral measures possess the relative strength of describing relevant concepts in a way that captures the experientially meaningful summation of mental activity over time that can be difficult to discern in psychophysiological data.

A significant amount of the mental activity and experience of individuals is unconscious, incapable of being reported by the individual (Cacioppo & Decety, 2009). Psychophysiological measures of mediated message processing are capable of capturing the less conscious dimensions of processes underlying the mental experience of consuming and being influenced by media. Alternatively, it is important to note that there are significant psychological states for which no meaningful, reliable, observable physiological footprint, as would be required for psychophysiological measurement, has been identified (Strube & Newman, 2007). The implication of this fact for the media psychology researcher is that psychologically-meaningful features of mediated messages may evoke patterns of mental processing that may be difficult or impossible to observe through psychophysiological measures. Researchers need to evaluate whether a construct under investigation can be validly distinguished according to a specific pattern of embodied mental activity reliably observable with a specific psychophysiological measure or response pattern. For instance, facial EMG may reliably distinguish between generally positive and negative attitudes evoked by an advertisement; however, there is not a psychophysiological measure that can distinguish whether those attitudes vary due to perceived attractiveness or perceived trustworthiness of a spokesperson.

A final consideration here concerns challenges to validly drawing conclusions based on data obtained with different measures of mediated message processing. Weaknesses of self-report and behavioral measures that can impact the validity of conclusions drawn from data include **social response bias** and the fact that responses on these measures are influenced by ease of memory retrieval. Psychophysiological measures are not as susceptible to these weaknesses but, as discussed in Chapter 1, are monstrosities—meaning that removing what should be considered physiological noise and isolating variance in physiological activity due to mental processing is difficult and poses a very real threat to the validity of conclusions drawn from data. Once equipped with an understanding of the role of data obtained from multiple measures of mediated message processing, researchers are ready to consider how psychophysiological measures are related to other measures of processing.

Understanding relationships between psychophysiological and other measures of processing

A discussion of relationships between psychophysiological and other measures of mediated message processing begins by considering the degree to which one ought to expect measures of embodied cognitive and emotional processes,

conscious phenomenological experience, and behavioral actions to be correlated with each other. This involves moving beyond a consideration of simple correlation to thinking more broadly about theoretical coherence between measures of mediated message processing in obtaining data that describes multiple processes and states emerging from media use. Researchers who do not fully understand the embodied motivated cognition theoretical framework and psychophysiological measurement—as described earlier in this book—can be tempted to limit their understanding of the relationship between psychophysiological and self-report measures to an analysis of the degree to which they are correlated. We would strongly caution against such a mindset because when these two types of measures are found to not be significantly correlated, an easy default is to assume that one of the measures must be invalid. Unfortunately, our experience suggests the physiological response measure is usually thought to be at fault. This kind of thinking reflects a rather shallow view of the relationships between measures of mediated message processing,

Limiting your consideration of relationships between measures of mediated message processing to the degree to which they are correlated is misguided for several reasons. First, simple correlation between these measures glosses over the temporal dynamics of the concepts being measured. Psychophysiological measures of mediated message processing are often employed to observe cognitive and emotional processes that unfold instant-by-instant during media use. Self-report measures, on the other hand, are obtained post hoc and often used to assess participants' conscious perception of cognitive and emotional processes that were engaged by a mediated message. Averaging across the dynamic activity indexed by psychophysiological measures yields data for which the degree of correlation with a conceptually related self-report scale of message processing will depend on specific patterns of temporal fluctuation in physiological activity. For instance, if the emotional intensity of a mediated message varies widely within the message skin conductance level recorded during exposure to the message will likely also show a high degree of variation across the message. This variation in the instant-by-instant recorded data will impact averaged skin conductance collapsed across the entire message but may or may not impact the average level of self-reported arousal for the same message. The fact that averaged psychophysiological data will be impacted by instant-by-instant variation in mental processes that are engaged during message exposure, but averaged ratings obtained on a related self-report measure may not, has implications for any observed correlation between these measures. Researchers should keep these temporal dynamics in mind particularly in cases where either no or very modest correlations between psychophysiological measures and self-report measures are found.

Second, the complexity of the phenomenon under study, the media–mind interaction, makes obtaining strong intuitive correlations between psychophysiological, self-report, and behavioral measures a chancy proposition. Mediated messages have a tremendously wide and complex range of both structural and

content features executed across multiple modalities that are capable of evoking widely varying patterns of embodied cognitive and emotional processing observed in psychophysiological measures. These defy expectations associated with simple correlational relationships between measures of mediated message processing. Finally, examining the relationship between these measures only through the lens of correlation at best severely limits theoretical development, and at worst can lead to rejection of psychophysiological measures as valid indicators of embodied cognitive and emotional processes evoked by media use.

There are theoretically interesting reasons why distinct measures of mediated message processing—that are believed to be conceptually related—may or may not be significantly correlated. Let's imagine you wanted to study arousal evoked by a specific feature of mediated message content—for the purpose of this example let's say it's the degree to which participants are able to customize an avatar that they use to play an online videogame. Two measures of arousal that you might obtain in such an experiment could be skin conductance (see Chapter 5) and a self-report measure which asks participants to rate how calm or exciting they perceived playing the game to be. There are interesting theoretical reasons why you may or may not expect these measures of arousal to be correlated. For one, previous research has indicated that arousal is not a unitary concept—there are distinct types of arousal that have been identified including autonomic, cortical, and behavioral (Stern, Ray, & Quigley, 2001). Skin conductance and a self-report measure of arousal could be indexing different forms of arousal while individuals play online video games and these distinct forms of arousal may or may not be correlated with each other. Further, specific features of mediated messages can easily have differential impact on these distinct forms of arousal, making the relationship between skin conductance and self-reported arousal much more dynamic and complicated than can be described by consideration of the simple correlation between these two measures. If you found only a very weak correlation between these measures or, more clearly, if the ability to customize an avatar was found to only significantly affect one of the measures of arousal, it would be misguided to conclude that one of the measures must be a poor measure of arousal. When considering the relationship between measures of mediated message processing obtained in specific experiments, media psychology researchers should find it quite fascinating to consider the theoretically exciting reasons why measures may or may not be correlated and reveal a consistent pattern of results. This requires thinking of measures of embodied cognitive and emotional processes, phenomenological conscious experience, and behavioral action associated with mediated message processing as measures of distinct concepts representative of, and emerging from, related but unique underlying mental processes.

The importance of viewing psychophysiological, self-report, and behavioral measures as indexing related yet distinct concepts can be illustrated by considering previous research that offers evidence that embodied motivated processing of a

mediated message—as reflected by cardiac activity—is a distinct phenomenon from the conscious experience of attending to a message—as measured on a self-report scale. According to previous research on radio advertising, individuals self-report paying more attention to high versus low imagery ads but high imagery ads evoke a pattern of cardiac acceleration rather than deceleration (Bolls, 2002, 2007; Bolls & Lang, 2003; Bolls & Potter, 1998). At face value this pattern of results suggests a lack of correlation between the self-report and psychophysiological data as—consistent with our discussion of heart rate in Chapter 4—one might expect an increase in self-reported attention paid to a message to be associated with cardiac deceleration. However, if one considers that the conscious perception of paying attention to an ad is a distinct concept from embodied motivated processing of the ad, then a very interesting theoretical explanation emerges. Bolls and colleagues interpreted cardiac acceleration during exposure to high imagery radio ads as reflecting an increase in cognitive resources allocated to retrieving information already stored in memory that is needed to support visual mental imagery. *This* mental process results in cardiac acceleration and is arguably evoked during exposure to high imagery ads. The fact that individuals report paying more attention to high imagery ads may indicate that the conscious perception of attending to a message is not sensitive to changes in the relative allocation of cognitive resources to encoding, retrieval, and storage. This kind of in-depth theorizing about how the mind processes media is more likely to come from researchers viewing psychophysiological and self-report measures as indexing distinct, independent concepts that are related in ways that go beyond simple correlation.

It is important to note that correlation between physiological activity and self-report measures of psychological states has played a critical role in the development of the psychophysiological measures media psychology researchers use to study mediated message processing. Psychophysiologists in validating the psychophysiological measures directly assess the correlation between physiological responses and psychological states within individuals. Cacioppo and colleagues provide a very good description of the process of validating psychophysiological measures by considering the correlation between physiological activity and other measures of psychological states (Cacioppo, Tassinary, & Berntson, 2007b).

The task of validating psychophysiological measures, however, is a completely different task than what media psychology researchers do in studying the media–mind interaction. Media psychology researchers are engaged in a unique activity that requires a more nuanced and in-depth theoretical analysis of possible relationships in experimental data obtained through various measures of mediated message processing than considering simple correlations among these measures. Media psychology researchers use psychophysiological and self-report measures to study an interaction between distinct concrete entities—mediated messages and individual human beings. This is a fundamentally different task than the task of

validating psychophysiological measures—which is properly based on a significant degree of correlation between specific patterns of physiological activity and self-report measures of psychological states.

Media psychology researchers use psychophysiological measures that have already been validated by psychophysiologists to conduct research on mediated message processing. The results of this research consist of data—ideally obtained by multiple measures of mediated message processing—reflecting processes and states that can exist in a wide, dynamic constellation of relationships depending on features of media messages and message recipients. When the relationship between measures of mediated message processing does not appear to make intuitive sense researchers simply need to roll up their sleeves and do the difficult theoretical work of figuring out what interactions between features of individuals and of the mediated messages under study may be responsible. This has certainly been the case in work on understanding cognitive processing of emotional radio content where research has found that cognitive resources allocated to encoding, as measured by cardiac deceleration, does not necessarily translate into better message recognition (Bolls, Lang, & Potter, 2001; Potter, Koruth, Bea, Weaver, Lee, Rubenking, & Kim, 2008).

Now that we have considered the nature of general roles of psychophysiological and other measures of mediated message processing, as well as the relationships between them, we turn to a more specific methodological discussion of combining psychophysiological and self-report measures in studying mediated message processing. An overview of several forms of measures commonly used to study mediated message processing will be provided: self-report, continuous response measurement, thought listing, secondary task reaction time, and measures of memory. While many reading this chapter will be already familiar with these measures, perhaps even having used them in their own research, we will point out some specific methodological considerations necessary when combining them with psychophysiological measures that may not have been thought about. Several studies will also be presented to highlight the usefulness of combining data from these measures with psychophysiological data in order to gain a better understanding of mediated message processing.

Combining self-report and psychophysiological measures of mediated message processing

Truly understanding the phenomenological experience of individuals when they consume mediated messages requires an assessment of how features of mediated messages impact well-established psychological states. Put more directly, there is no other way to capture psychologically meaningful aspects of the phenomenological experience evoked by mediated messages then having participants, themselves, describe—or self-report—that experience. Thus, reliable and valid self-report scales designed to measure meaningful psychological states, especially

when combined with psychophysiological measures of embodied cognitive and emotional processing, have tremendous value to the media psychology researcher.

A host of potentially valuable self-report scales exist. Rubin and colleagues have compiled a collection of validated scales for communication research (Rubin, Palmgreen, & Sypher, 1994). This book is a great source for the media psychology researcher looking for validated scales measuring potentially meaningful states that possess a high degree of theoretical relevance to understanding mediated message processing. Many of the measures in Rubin et al. (1994) could be combined with psychophysiological measures of mediated message processing with exciting results. Those interested in the impact of persuasive communications—such as advertisements and PSAs—might also find Bruner, Hensel, and James (2005) applicable. A discussion of each potential self-report scale that could be fruitfully combined with psychophysiological measures is far beyond the scope of this section. Rather, the purpose here is to list a few specific examples of self-report measures that represent distinct analytical directions a media researcher can take when connecting self-report measures to psychophysiological measures of mediated message processing.

Prior to this discussion, however, it is important to note two methodological issues that the researcher must be aware of when combining the collection of self-report and psychophysiological data in the same experiment. The first concerns the potential for collection of the self-report measure to introduce noise into the psychophysiological signal. A very simple form of noise that can significantly contaminate psychophysiological data comes from the motor movements required to fill out the self-report questionnaires themselves. Motor movements required to circle a number on a paper survey or even indicate a response with the click of a computer mouse can, for instance, contaminate the ECG signal. Similarly, movements such as these result in noticeable increases in skin conductance level recorded from the palm. The protocol for an experiment involving collection of psychophysiological data should instruct participants to sit as still as possible, while remaining comfortable, during exposure to stimulus messages. This is obviously not the case when they are completing self-report measures; therefore it is usually of little value to record psychophysiological data while participants complete them. A typical research protocol may have participants respond to self-report measures prior to the presentation of any stimuli, in between exposure to each stimulus message in the experiment itself, and then again after exposure to the last stimulus message.

The second general methodological consideration that researchers need to keep in mind is that completing a self-report measure is a cognitive and emotional task which will have some impact on psychophysiological measures being recorded. The act of completing questions that might be emotionally sensitive, or require a significant level of reflection on the part of the participants, is likely to engage cognitive and emotional processes which will then be reflected in psychophysiological data. It is important to design data collection protocols so that any

psychophysiological responses evoked by either the motor or cognitive/emotional effort associated with the self-report measures dissipate and activity returns to a resting baseline level prior to exposure to the next message during which psychophysiological data is being recorded. This can generally be easily accomplished by building in time in the experimental protocol where participants are simply instructed to sit and relax between completion of self-report measures and exposure to the next media message.

With these being the only two serious methodological considerations associated with combining self-report and psychophysiological measures, it is no wonder that they have often been used together to obtain data leading to theoretical insights into mediated message processing. The different ways self-report and psychophysiological measures have been combined in experiments on mediated message processing reflect distinct approaches to using data from these different forms of measurement to understand mediated message processing. There are three general ways self-report measures can be used in combination with psychophysiological measures of embodied mediated message processing that we believe have tremendous potential—based on existing research—to yield great insight. Self-report measures can be used to index psychological states that are conceptually related to the embodied mental processes psychophysiological measures index. Researchers can also collect self-report measures of psychological states that are believed to either moderate or emerge from variation in embodied mental processes recorded with psychophysiological measures. Finally, self-report measures can be used to index significant individual differences that might influence embodied mental processing of mediated messages. Each of these is addressed separately below, although they could also be used in combination within the same experimental design.

Self-report measures as indices conceptually related to embodied mental processes

One approach to combining self-report and psychophysiological measures is to include self-report measures of attention and dimensions of emotion in an experiment in order to gain insight into the participant's perception of the degree to which messages engage the embodied cognitive and emotional processes indexed with psychophysiological measures. As mentioned earlier, it is important to remember that the insight gained by combining self-report and psychophysiological measures in this way goes beyond the degree to which these measures may or may not be correlated with each other. Experiments in which psychophysiological measures of emotional processing have been combined with conceptually related self-report measures of arousal and valence are more common than experiments combining psychophysiological measures of cognitive processing with self-report measures of attention; however, there are established self-report scales worth discussing that enable the media psychology researcher to conduct both kinds of research.

One of the most common self-report scales used to assess the arousal and valence dimensions of human emotion is the **Self Assessment Manikin scale**, also known as the SAM scale (Bradley & Lang, 1994; Lang, 1980). The SAM scale is a nine-point pictorial scale consistent with the dimensional theory of human emotion (Lang, 1995). Participants are instructed to rate arousal on a continuum ranging from calm to extremely excited and valence on a continuum ranging from unpleasant to pleasant (see Figure 7.3).

Of particular interest to the media psychology researcher, the SAM scale has been extensively validated on and used to study individuals' responses to emotional pictures (Bradley, Cuthbert, & Lang, 1996; Codispoti, Ferrari, & Bradley, 2006; Lang, Greenwald, Bradley, & Hamm, 1993). The scale was used to produce and validate what has become known as the **International Affective Picture System (IAPS)**—a large collection of pictures with normed arousal and valence ratings (Bradley & Lang, 2007b). Selections from the IAPS have frequently been used in emotion research to elicit emotion using stimuli of a known emotional level of arousal and valence. This line of research has enabled psychophysiologists to study how stimuli of a given level of arousal and valence impact psychophysiological measures. Research in which individuals have viewed pictures from the IAPS has demonstrated that in the context of viewing emotional pictures, arousal ratings on the SAM scale are positively related to skin conductance and

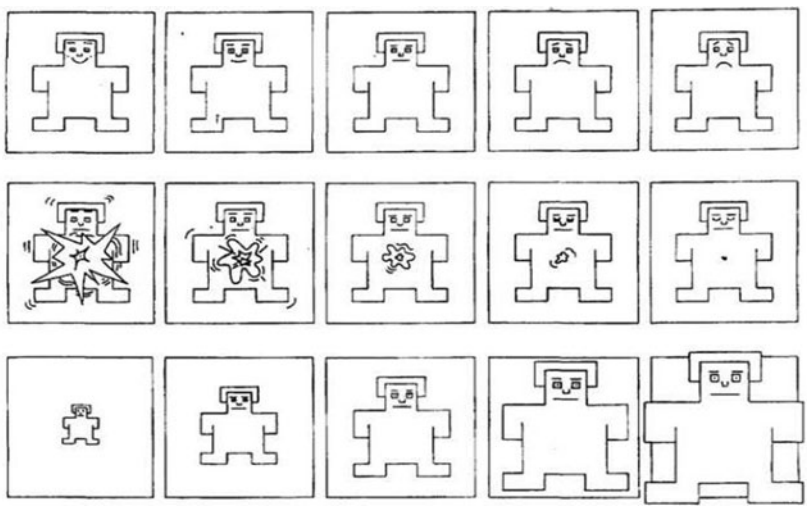

FIGURE 7.3 The Self Assessment Manikin (SAM) scale. The top row measures self-reported valence and the middle row self-reported arousal. The bottom row is a measure of dominance, a dimension of emotion that has proven to be less predictive across many fields and is not often used in media psychology research.

Source: Bradley & Lang, 1994, with permission from Elsevier.

valence ratings on the SAM scale are significantly related to patterns of positive and negative emotional responding in facial EMG (McManis, Bradley, Berg, Cuthbert, & Lang, 2003).

The SAM scale has proven to be extremely valuable in experiments on mediated message processing. It has been used in experiments where psychophysiological data has been combined with SAM scale ratings to study processing of features of media including the visual complexity of websites (Tuch, Bargas-Avila, Opwis, & Wilhelm, 2009), negative political advertising (Bradley, Angelini, & Lee, 2007), and avatar choice in multi-player computer games (Lim & Reeves, 2009). For instance, in a recent experiment on television advertisements, Morris and colleagues found distinct patterns of brain activation as revealed by fMRI that correlated well with the valence and arousal dimensions of the SAM scale (Morris et al., 2009). Research into cognitive emotional processing of audio messages has combined psychophysiological measures with the SAM scale to demonstrate that increasing the structural complexity of audio content increases skin conductance as well as perceived arousal (Potter & Choi, 2006). Lee and Lang (2009) combined psychophysiological data with self-report ratings of arousal and valence on the SAM scale in order to attempt to identify specific patterns of motivational activation underlying the experience of discrete feelings while viewing televised PSAs. They adapted the SAM scale by having participants separately rate pleasantness and unpleasantness in order to separately index appetitive and aversive activation evoked by the televised messages. The predicted pattern of appetitive and aversive activation for messages produced to evoke joy was only found in the self-reported ratings; however, the predicted pattern of appetitive and aversive activation for messages produced to evoke sadness was observed in both self-report and psychophysiological data.

The previous review barely scratches the surface of how media psychology researchers have used the SAM scale in combination with psychophysiological data to better understand emotional processing of mediated messages. However, from this brief review of recent research it should be clear that the SAM scale has become the most widely accepted, valid, and reliable scale for measuring perceptions of the arousal and valence related to emotional processing of mediated messages. This scale is easy to obtain and implement into experiments; therefore it is likely to remain a frequently used scale to provide insight into dimensions of emotional experience elicited during media use.

A significant amount of research has also been conducted utilizing self-report measures of attention to understand cognitive processing of mediated messages. Studies in this area contribute insight into understanding individuals' perception of their own mental effort allocated to perceiving, attending to, and making sense of media content. It is important to keep in mind, however, the limitations of self-report measures of attention when drawing conclusions about how individuals cognitively process media content. In addition to the fact that they are sometimes used in an attempt to measure concepts reflecting unconscious mental

processes, self-report measures of attention can often gloss over the functioning of distinct cognitive processes engaged during media use. That is why self-report measures of attention are likely best viewed as measuring the conscious perception of a very broad allocation of mental effort to processing mediated messages. That is not at all to say that insight into the conscious perception of mental effort invested in processing media messages lacks theoretical value. Data obtained from self-report measures of attention—despite the noted limitations—can add tremendous value to data obtained from psychophysiological measures of cognitive and emotional processing. For example, greater theoretical insight into how individuals process highly aversive health messages could be gained by exploring how extremely arousing and unpleasant images impact both actual cognitive resources allocated to encoding—as measured by heart rate or HRV—and conscious perception of mental effort invested in processing such messages indexed with a self-report measure of attention. It is possible that despite the fact that highly unpleasant and arousing images result in defensive withdrawal of resources from processing these kinds of messages, individuals still consciously perceive that they allocate a lot of mental effort to them. Such an interesting pattern of results would obviously only be obtained through the dual use of psychophysiological and self-report measures of cognitive processing.

Fortunately, for media psychology researchers who wish to wrestle with potentially very interesting patterns of results there are some established ways of obtaining a self-report measure of attention that can usefully be combined with psychophysiological measures. Involvement is a concept that has been extensively applied in research on cognitive processing of mediated messages and reflects levels of attention paid to different messages (Greenwald & Leavitt, 1984). Unfortunately, this concept has been defined and operationalized in many different ways (Roser, 1990), only some of which are useful for our purposes here. The concept of involvement has been extensively applied in the study of persuasion (Johnson & Eagly, 1990). Recognized as a multi-dimensional concept that includes two distinct categories, product/issue involvement and message involvement (Zaichkowsky, 1985), self-report scales of involvement can be easily found in the advertising literature (Andrews, Durvasula, & Akhter, 1990). The items from established involvement scales, however, that are clearly most relevant to investigating the direct relationship between conscious perception of mental effort allocated to a message and the embodied process of allocating cognitive resources to processing it are those that directly measure an individual's conscious perception of the level of attention or mental effort. For instance, Andrews and Shimp (1990) developed an index of message involvement that includes items assessing the amount of attention, degree of concentration, level of thought, degree of focus, and level of effort allocated to a message.

Several experiments have included self-report measures of attention that mirror established scales of message involvement to varying degrees while simultaneously including psychophysiological measures of cognitive processing. In an experiment

on structural complexity in radio messages, Potter and Choi (2006) measured attention allocated to processing the messages by recording heart rate during exposure to the content and by having participants reflectively self-report their perceived level of attention to each message. The items used on their self-report scale of attention are similar to message involvement scale items in that they asked participants to indicate how much they paid attention to, concentrated on, and thought about each message, as well as how interesting they perceived messages to be. Analysis of the individual items on their self-report attention scale indicated that participants perceived that they paid more attention and had to concentrate more while listening to radio messages with high structural complexity compared to low structural complexity. Interestingly, Potter and Choi observed significantly greater cardiac deceleration during exposure to low complexity radio messages indicating that—contrary to their perceptions—participants actually allocated more cognitive resources to encoding low complexity messages compared to high complexity messages. This study by Potter and Choi, once again, illustrates the theoretical value of combining both self-report and psychophysiological measures of cognitive processing in the same experiment, in that tremendous insight can be gained even when results from these different measures contradict each other.

Another interesting example of the combination of self-report measures of attention with psychophysiological data comes from Smith and Gevins (2004) who measured self-reported attention by asking participants how interesting they perceived television advertisements to be. They also collected EEG—a psychophysiological measure of cognitive processing discussed in Chapter 4—during exposure to the ads. The results indicated a significant relationship between alpha-wave blocking at prefrontal cortex and self-reported interest. This pattern of results led them to conclude that subjective interest in a television ad results in greater cortical activation associated with the control of attention and working memory.

Self-report measures as moderating or emerging from embodied mental processes

A second approach to combining self-report and psychophysiological measures is to obtain self-report measures of meaningful psychological states that might moderate or emerge from cognitive and emotional processing of messages. The ability to use psychophysiological measures to probe inside the black box of the human mind and study cognitive and emotional processes engaged by media use does not decrease the importance of also measuring pre-existing and/or emerging psychological states that may be both theoretically and practically important to truly understanding how the specific form of mediated messages being studied is processed. This brings us back full circle to exploring various kinds of perceptions, attitudes, and behaviors that would be considered "message effects" under a traditional media effects research paradigm but that the media psychology

researcher today conceptualizes as psychological states occurring through the dynamic, across time interaction between media messages and message receivers.

There are numerous perceptions, attitudes, and behaviors measured through validated self-report scales that could be potentially relevant to the processing of mediated messages. For instance one can easily find published studies on concepts such as perceived credibility of media messages, attitude toward advertisements, and frequency of various patterns of media use. Significant theoretical advancement in understanding mediated message processing, however, is to be gained by media psychology researchers combining psychophysiological measures with self-report measures to examine the interaction between these concepts and embodied motivated processing of mediated messages.

In designing experiments to investigate the interaction between psychological states and embodied motivated processing of mediated messages it is important for the media psychology researcher to consider how such states might both moderate and emerge from processing of a message. In the study of health campaign messages, for instance, it is likely both theoretically and practically important to consider how current health behaviors and beliefs impact processing of health messages as well as how processing of health messages leads to emerging patterns of health beliefs and behavioral intentions. Fortunately for the media psychology researcher who wishes to study health communication, well-established validated scales of important health concepts such as beliefs, efficacy, and behavioral intentions are found in the published literature. The same state of affairs exists for concepts representative of psychological states that are likely important to other areas of mediated message processing. Validated scales of such concepts—like perceived news credibility, aggressiveness, and perceived realism—are not only found in published articles but can also be located in handbooks such as Rubin et al. (1994).

Media psychology researchers have recently began to conduct more experiments on mediated message processing that utilize psychophysiological measures of cognitive and emotional processing along with self-report measures of relevant psychological states. In an interesting study on the impact of media content delivered over portable versus traditional television platforms Ivory and Magee (2009) measured skin conductance along with a self-reported index of media **flow experience**—a concept that is believed to be associated with a challenging yet entertaining media experience. Participants in their study experienced lower levels of arousal and less perceived flow experience for content delivered over portable handheld devices, leading Ivory and Magee to conclude that the convenience of portable media technology potentially results in a less entertaining mediated experience.

The area of health communication is arguably one of the most fascinating mediated message processing contexts in which to combine psychophysiological measures of cognitive and emotional processing with self-report measures of relevant psychological states. Researchers working in this area have developed

self-report measures of psychological states that seem likely to be significantly related to cognitive and emotional processing of a message like perceived threat, efficacy, and behavioral intentions (Witte, 1994). Ordonana, Gonzalez-Javier, Espin-Lopez, and Gomez-Amor (2009) examined the relationship between embodied motivated processing of a fear-appeal based message promoting the tetanus vaccine and psychological states particularly relevant to health persuasion. During the message they recorded heart rate and skin conductance as measures of attention and arousal respectively. After the message, participants completed self-report measures of perceived threat, perceived efficacy, and behavioral intention. The pattern of results obtained through their psychophysiological and self-report measures suggested that participants exposed to a high threat/high efficacy message displayed a pattern of autonomic responding reflective of more effective cognitive/emotional message processing and higher levels of self-reported intention to engage in the recommended behavior.

This discussion represents only a small fraction of the host of important psychological states that media researchers need to study in conjunction with embodied motivated processing of mediated messages. We hope that these brief examples spark research that combines psychophysiological and self-report measures in fascinating ways. Media psychology researchers who engage in this line of research are going to move beyond using psychophysiological and self-report measures to simply validate the existence of cognitive and emotional processes and develop rich theoretical models of mediated message processing that more fully describe the constellation of interacting processes and states underlying media influence.

Self-report measures of individual differences impacting embodied mental processes

A third approach to combining psychophysiological and self-report measures involves using the latter to index individual differences that might impact embodied motivated processing of mediated messages. The embodied human mind is anatomically structured such that individual differences on a host of variables representative of meaningful psychological states and traits could quite easily moderate embodied processes indexed by psychophysiological measures. Recall from the discussion in Chapter 4 that the human brain is biologically structured to process stimuli in both a bottom-up and top-down fashion. It seems plausible that individual differences in certain psychological traits could exert a top-down influence on embodied motivated processing of mediated messages.

Researchers who study the influence of media use on individuals have clearly moved beyond the simplistic powerful effects model to much more extensively considering individual differences in media use and effects (Krcmar, 2009). A theoretical approach to understanding individual differences in media effects that has been suggested categorizes individual differences into needs, readiness to

respond, and traits (Oliver & Krakowiak, 2009). Variables examined in media effects research that reflect individual differences in needs include sensation seeking (Zuckerman, 1979) and need for cognition (Cacioppo & Petty, 1982). Readiness to respond reflects an individual difference in the likely intensity of emotional responding to media content. Variables associated with traits traditionally reflect individual differences in established personality characteristics. Media psychology researchers can easily go to the research literature their colleagues studying media effects have generated in order to find validated scales that measure individual differences with a high probability of impacting how the human mind processes mediated messages. The following paragraphs provide examples of potentially interesting individual differences that could lead to different patterns of embodied motivated processing of mediated messages.

There are likely numerous personality traits that, dependent upon the nature of mediated messages being studied, could significantly impact cognitive and emotional processing of a message. The psychology literature contains examples of validated personality measures. Some predominant scales include the NEO Personality Inventory (Costa & McCrae, 2008), the Zuckerman-Kuhlman Personality Questionnaire (Zuckerman, 2008) and the Eysenck Personality Questionnaire (Furnham, Eysenck, & Saklofske, 2008). Some researchers have focused on a specific dimension of the Eysenck Personality Questionnaire—**psychoticism**—as a potential moderator of embodied motivated processing of mediated messages. Individuals who score high on this factor are generally described as aggressive and lacking empathy (Rawlings & Dawe, 2008). Bruggemann and Barry (2002) examined psychoticism as a possible moderator of how individuals emotionally respond to violent media content. They exposed participants to video clips of violence and comedy—measuring skin conductance level over a period of 10 presentations of each kind of video. High psychoticism participants self-reported higher levels of enjoyment and displayed a faster pattern of desensitization of skin conductance level in response to violent video clips in comparison to low psychoticism participants. In an interesting expansion on this study, Ravaja and colleagues examined how psychoticism might modulate psychophysiological measures of cognitive/emotional processing during specific violent video game events (Ravaja, Turpeinen, Saari, Puttonen, & Keitlkangas-Jarvinen, 2008). They concluded that high psychoticism participants appear to be less bothered by the killing and wounding of a video game opponent as evidenced by higher levels of zygomatic and orbicularis oculi muscle activity, indicative of positive emotion, in comparison to low psychoticism participants.

Another personality trait that has received substantial attention in media research is **sensation seeking**. Sensation seeking is believed to be a personality trait reflective of the degree to which an individual purposefully seeks out high-sensation experiences (Zuckerman, 1979). It makes sense to consider sensation seeking as an individual difference that could impact embodied motivated processing of mediated messages because this personality trait is manifested in

specific patterns of physiological activity. High sensation seekers have been found to display lower levels of resting physiological arousal in comparison to low sensation seekers (Zuckerman, 1990). It has also been reported that high sensation seekers exhibit lower levels of physiological arousal in comparison to low sensation seekers during exposure to televised substance-abuse public service announcements (Lang, Chung, Lee, Schwartz, & Shin, 2005).

A comparatively recent self-report measure of individual differences that arguably has an extremely strong theoretical connection to embodied motivated processing of mediated messages is known as the **Motivation Activation Measure** (MAM). The MAM has recently been developed and continues to be refined by Annie Lang and colleagues as a reliable and parsimonious measure of individual differences in resting level of activation within the appetitive and aversive motivational systems (Lang, Bradley, Sparks, & Lee, 2007a; Lang, Kurita, Rubenking, & Potter, in press; Lang, Shin, & Lee, 2005). This measure directly draws on the embodied motivated cognition theoretical perspective described in Chapters 4 and 5. In brief, this theoretical perspective proposes that human emotional response consists of activation in underlying appetitive and aversive motivational systems that determine how motivationally relevant stimuli—including mediated messages—are processed and evaluated. It is believed that there are significant individual differences in both the resting level of activation and the responsiveness of these systems to motivationally relevant stimuli (Ito & Cacioppo, 2005). This individual difference is likely rooted in the embodied nature of our motivational system that responds to motivationally relevant stimuli and supports cognitive/emotional processing leading to highly adaptive responses to appetitive and aversive stimuli (Berntson & Cacioppo, 2008). The MAM has been established to index these individual differences in responding to motivationally relevant information. Given this embodied connection between motivation activation and cognitive/emotional processing, there is a strong theoretical rationale for expecting individual differences in motivation activation—as indexed by the MAM—to moderate cognitive and emotional processing of mediated messages—as indexed by psychophysiological measures.

The MAM is a brief self-report measure that can easily be included in experiments on mediated message processing. Administering this measure to participants involves presenting a collection of specific images—of known arousal and valence ratings—selected from the IAPS (Bradley & Lang, 2007b) in a random order. The original MAM scale consists of 90 images—with an abbreviated version developed for children and adolescents. However, a shorter version consisting of 41 images has been developed and validated, allowing MAM to be more easily used in combination with other procedures (such as processing media messages) within a single experimental session (Lang, et al., in press). When taking the MAM, participants are instructed to view each image for as long as they would like and then rate how aroused, positive, negative, each makes them feel. Ratings are given on a modified version of the SAM scale, one that separates out positive and negative

ratings on two different valence scales. Participants' ratings of the pictures are used to calculate what A. Lang terms ***appetitive system activation (ASA)*** and ***defensive system activation (DSA)***. Participants' ASA and DSA scores—depending upon the research question being investigated—can be analyzed independently or crossed to create a typology of motivation activation. For instance, media psychology researchers might be interested only in how individual differences in DSA moderate embodied motivated processing of highly emotional media content; alternatively, the nature of the research question might lead to an analysis of how participants high on DSA and low on ASA process emotional media content differently than participants low on DSA and high on ASA.

Research using the MAM to index individual differences in motivation activation suggests that this is a very significant individual difference that moderates media selection as well as embodied motivated processing of mediated messages. Individuals who score high on ASA exhibit patterns of heart rate and skin conductance level indicating that they generally pay more attention to and are less aroused by media content compared to individuals low on ASA (Lang et al., 2007a). Further, it appears that DSA moderates processing of negative emotional media content in that individuals who score high on DSA exhibit patterns of heart rate and skin conductance level that suggests they pay less attention to and are more aroused by negative mediated messages (Lang et al., 2007a). Potter and colleagues have found MAM to be predictive of patterns of media use (Potter, Koruth, Bea, Weaver, Lee, Rubenking, & Kim, 2008). In their study, DSA was positively correlated with a preference for news and information. Given this finding, it would be particularly interesting for media psychology researchers interested in studying processing of news to combine the MAM and psychophysiological measures to examine how DSA might moderate embodied motivated processing evoked by specific message features involving the presentation of highly emotional news stories. The bottom line is that there is a growing body of knowledge indicating that researchers can develop fascinating hypotheses concerning how motivation activation—measured by MAM—might moderate embodied motivated processing of mediated messages.

MAM, SAM, psychoticism, need for cognition, and involvement are only a few of the multitude of self-report scales that can be found in the literature and we encourage you to contemplate the many interesting hypotheses and research questions that can result from using each in tandem with psychophysiological measures. The number of fascinating predictions increases exponentially when you consider that each of the self-reported scales mentioned up to this point measure a research subject's experiential response at a single point in time, and that perhaps there may be a way to more dynamically capture the self-reported experience. We now turn to a discussion of a measure which does just that. Continuous response measurement is an alternative way to index psychological states on a moment-by-moment basis and provides another way to connect experiential measures to psychophysiological ones.

Continuous Response Measurement: a dynamic alternative for measuring psychological states

Continuous Response Measurement (CRM) is a measure of mediated message processing that has not only been used by media psychology researchers to study mental processing of messages but has also achieved a high degree of visibility for its practical applications. Television news coverage of presidential candidate debates in the United States often includes CRM as a way of portraying to viewers how distinct groups of voters evaluate the performance of candidates during the debate. There are even specialized public opinion websites (www.mediacurves.com) that present online CRM data collected from large panel samples in response to various kinds of media content ranging from Super Bowl advertisements to celebrity news conferences and political speeches.

Biocca, David, and West (1994) provide a substantial discussion of methodological and technical considerations in using CRM to study mental processing of mediated messages. Therefore, in this section we will gloss over the specific methodological details in implementing continuous response measurement in experiments on mediated message processing and will instead focus on broader methodological and theoretical connections between CRM and psychophysiological measures.

Continuous response measurement is in essence a moment-by-moment electronic form of self-report measurement (Biocca et al., 1994). Usually subjects use a handheld dial or slider to continuously report their response along a scale of some sort. Scales usually take the form of semantic differentials (e.g., agree/disagree, calm/arousing, etc.) or numeric ratings of a single concept (e.g., "On a scale of 0–100, how funny is this message right now?") Nearly any concept that can be measured with traditional self-report measures can be indexed through CRM and doing so yields data reflective of momentary fluctuations in the psychological state being measured. Two primary areas of media psychology research in which CRM has been applied to study mental processing of mediated messages are advertising and political communication. This measure has been extensively used to study consumer reactions to advertisements, becoming a solidly established method of copy testing in the advertising industry in the early 1990s (Fenwick & Rice, 1991). Stayman and Aaker (1993) used data obtained from CRM during exposure to advertisements to tease out distinct dimensions of emotion from specific feelings evoked by ads. More recently CRM has been used to examine issue perception in order to study the degree to which individuals can be misled while viewing political candidate debates (Maurer & Reinemann, 2006).

Capturing moment-by-moment change in a higher-level psychological state reflective of mental interpretation of a message is the true strength of CRM. Traditional self-report measures, as discussed in the previous section, reflect a summative evaluation of the perception of a psychological state evoked by

messages in an experiment. Given that mental processing of mediated messages unfolds over time, it can be argued that the best measures of relevant psychological states should be sensitive to temporal fluctuation in the state being measured. CRM and psychophysiological measures share this distinct methodological strength, making it worthwhile to consider the conceptual and operational connections between these two measures. Furthermore, it is clear that the extensive application of this measure in the media industry potentially makes CRM a measure that media psychology researchers can use to bridge what are sometimes viewed as wide chasms between the theoretical and practical ramifications of their research on the media–mind interaction. It seems that there may be some unique theoretical and practical benefits to combining CRM with psychophysiological measures of cognitive/emotional processing of mediated messages. These two measures of mediated message processing share a common strength yet tap unique concepts that are important to how messages are mentally processed.

In considering how to productively combine continuous response measurement with psychophysiological measures, media psychology researchers must consider what CRM can be used to reliably index. We have already extensively discussed what psychophysiological measures describe in terms of embodied cognitive/emotional processing. It is possible to use CRM to index perceptions of arousal, emotional valence, and attention during exposure to mediated messages—similarly to what is done with psychophysiological measures. One potentially useful application of combining CRM with psychophysiological measures in this way would be to use CRM in pretesting stimulus messages for an experiment (Bradley, 2007a; Lee & Lang, 2009; Sparks & Lang, 2010). If messages to be included in an experiment are being selected by the researcher on the basis of presumed levels of evoked arousal, emotional valence, required attention, or any other psychological concept, then CRM can provide researchers an indication of the moment-by-moment fluctuation in these psychological processes from real subjects as a way of providing confirmatory data. The use of CRM to pretest messages in this manner represents a wise and efficient use of resources because it is less intrusive and expensive than psychophysiological measurement. The most meaningful difference in what can be validly measured through CRM compared to psychophysiological measures is that—similar to traditional self-report measures—CRM can be used to index higher-level mental states for which a reliable specific autonomic footprint has not been discovered.

Continuous response measurement engages a participant in introspective analysis of their mental states in order to report dynamic variation while they are exposed to a mediated message. Psychophysiological measures clearly do not require such introspection on the part of participants in an experiment. This is a significant difference in the measures in terms of the nature of real-time responses recorded. This also has implications for what mental states a researcher can expect CRM to validly index. Participants should easily be able to validly introspect and report dynamic variation in very simple psychological evaluations

of mediated messages, such as level of interest or simple favorable/unfavorable feelings. The more deliberative participants need to be in their introspection in order to report variation in the psychological state being measured the less valid CRM data is likely to be. Researchers need to keep in mind that the task of having to consciously evaluate and report variation in their mental state while simultaneously watching a message takes away cognitive resources from processing the message itself. This fact has significant implications for the selection of variables a media researcher should attempt to index with CRM and thereby places constraints on the kinds of higher-level interpretive states that could be usefully studied with CRM in conjunction with psychophysiological measures of embodied cognitive/emotional processing.

The fact that continuous response measurement and psychophysiological measures possess the strength of being able to index psychological processes and states in real time does not mean that there are not significant differences between these measures that must be kept in mind if data from these two measures are to be productively combined. The timescale on which these measures operate significantly varies. Specific evoked response potentials in the EEG signal, discussed in Chapter 4, have been found to be sensitive to general evaluative processes occurring within 300ms of the onset of a stimulus (Bartholow & Amodio, 2009). The process of a participant in an experiment consciously interpreting message content and then executing a motor response to dial in their reaction in completing a continuous response measure certainly operates on a much longer timescale. This means that the temporal mapping of psychological process or state to the continuous stream of sensory information in mediated messages is significantly tighter for psychophysiological measures than CRM. This temporal difference should be kept in mind, particularly when researchers are studying mental processes and states evoked by specific content or features occurring within mediated messages.

Researchers who use psychophysiological measures to study embodied motivated processing of mediated messages can combine psychophysiological data with data obtained from CRM to study the real time, moment-by-moment connection between embodied processes and emerging higher-level mental interpretation of mediated messages. The ability to do this has tremendous potential to significantly expand insights offered by media psychology researchers who have previously relied on the combination of psychophysiological measures and traditional self-report measures to make this link. For example, Wang, Lang, and Busemeyer (2011, p. 79) combined CRM ratings of positivity, negativity, and arousal with psychophysiological measures to study cognitive/emotional processing of video clips selected for their valence and arousal. One of the drawbacks of CRM is that only one dependent variable can be measured at a time, so each clip used in this experiment was rated for positivity, negativity, and arousal by multiple participants. Then, plotting the results against time, the final experimental stimuli were selected such that:

> [t]he 12 clips that were rated highest on the Positivity scale (means > 5) and stayed below 3 on the Negativity scale (means < 3) were selected as positive clips; the 12 that were rated highest on the Negativity scales (means > 5) but stayed below 3 on Positivity (means < 3) were defined as negative clips. Then within valence categories the 12 clips were ranked on Arousing Content and divided into three levels (arousing, moderately arousing, and calm), with 4 messages in each level.

Later, these 24 messages were systematically arranged across four different TV "channels" and viewed by another set of research subjects who could switch between each channel at will. Participants' heart rate, skin conductance, corrugator and zygomatic psychophysiological data were simultaneously collected and then *combined* with the CRM data to develop a mathematical model which mapped the dynamic relationships between the different variables. This study presents an indication of ways in which CRM and psychophysiological data can be combined beyond a more traditional pretest selection basis.

As all the examples provided where CRM and psychophysiology have been used in tandem suggest, it is complicated and likely invalid to collect both psychophysiological measures and CRM simultaneously within a single experiment. Motor movements required to input responses on a CRM interface will likely introduce significant artifact into physiological signals, not to mention the fact that this task takes away cognitive resources from the processing of a message being indexed with psychophysiological measures. A solution to this problem that could enable the collection of CRM and psychophysiological measures in the same experiment is to collect only psychophysiological measures or CRM during exposure to stimulus messages and vary the specific messages each measure is being collected for. This way, when data is averaged across participants, both forms of data have been collected for every message. Random assignment of participants to data collection conditions is obviously critical to this solution. It also may require a greater number of participants in the study because in essence two experiments are being combined into one. The other solution is to actually conduct two separate experiments, collecting psychophysiological measures in one and continuous response measurement in the other. The two separate experiments—to truly represent a combination of CRM and psychophysiological measures—should then be written up in one manuscript where the researcher draws general conclusions about mediated message processing by concurrently considering the results obtained from each measure in the two experiments. This is the kind of work that is presently missing in the published literature on mediated message processing. Our overall discussion of CRM as an alternative way to index psychological states should indicate several exciting ways that data from this measure can be combined with psychophysiological data with important implications for understanding mediated message processing.

Thought listing: capturing the qualitative experience of mediated message processing

Thought listing—often referred to as the think aloud procedure—is a measure that gives researchers a glimpse into the mental contents of individuals' minds including specific thoughts, feelings, ideas, expectations, appraisals, or mental images (Cacioppo, von Hippel, & Ernst, 1997; Shapiro, 1994b). Thought listing involves prompting participants to recall and then verbally state any thoughts brought to mind by specific stimuli in an experiment. Thought listing data obtained from participants in experiments on mediated message processing can give researchers a rich qualitative description of the mental experience of consuming media. Thought listing data can also be quantitatively coded for statistical analyses of specific categories of mental contents brought to mind by specific features of mediated messages. Researchers have used the thought listing technique to capture aspects of mental processing of media messages that cannot be richly described by purely quantitative measures. The data obtained by the thought listing technique is truly reflective of participants' phenomenological mental experience of consuming mediated messages as there is a high degree of correspondence between mental experiences and conscious thoughts.

Thought listing has been extensively used to study mental processing of persuasive media messages. Thoughts evoked by a persuasive message have been termed cognitive responses—a concept several researchers believe is highly relevant to attitude change that might result from exposure to a message (Chattopadhyay & Alba, 1988; Petty & Cacioppo, 1986). More recently persuasion researchers have used thought listing to study how the degree of confidence one has in specific thoughts evoked by a persuasive message impacts the influence of emotional appeals on evaluative judgments (Brinol, Petty, & Barden, 2007). Thought listing has also been used recently to study how humor might reduce critical scrutiny of arguments in a political message (Young, 2008). Outside of the context of persuasion, thought listing has been used to explore how exposure to verbally aggressive television sitcoms impacts the presence of aggressive thoughts (Chory-Assad, 2004). The extensive presence of this measure in the communication research literature is likely due to the appeal of being able to measure, in experiments, a more qualitative aspect of the mental experience of consuming media. Thought listing, however, has several unique considerations that researchers would do well to keep in mind in implementing and interpreting this measure of mediated message processing.

One methodological consideration has to do with what researchers can realistically expect individuals to validly report when they reflect on thoughts that might have been evoked by specific messages in a given experiment. Researchers should primarily rely on this measure to simply gain access to the content of thoughts and not have individuals attempt to explain, for instance, why they engaged in certain thought patterns. Research in social psychology has

demonstrated that individuals cannot be expected to explain why or how specific mental contents may have been produced by a stimulus (Wilson & Brekke, 1994). Thus, researchers should not rely on thought listing as a way to directly index the functioning of cognitive and emotional processes engaged by mediated messages. The mental contents captured through the thought listing technique describe the *output* of mental processes, or more specifically, reflect what has been described in this chapter as emerging psychological states. It therefore seems best to give participants as general a prompt as possible in instructing them to recall and state any thoughts that may have been evoked by a message (Shapiro, 1994b). A good prompt for thought listing could be as general and simple as "please describe any thoughts that came to mind during this message."

A second methodological concern in using thought listing data to study mediated message processing concerns sources of potential noise in the data. One such source has to do with the accuracy with which individuals can verbally describe relevant thoughts. The thought listing technique engages subjects in an introspective process where they attempt to recall the content of any thoughts they had. The validity of this data rests on the degree to which subjects in an experiment can accurately recall thoughts evoked during exposure to a message. A related issue is whether subjects are able to adequately describe their thoughts in such a manner as to provide the researcher with the insights they are looking for. For example, Stephens and Russo (1997) report that when subjects were asked to categorize their own thoughts as positive, neutral, or negative their results were significantly different from having trained coders categorize the same thought statements later. This would suggest that the subjects know something about the valence associated with their thoughts that they are unable to communicate to impartial readers of the data.

A couple of factors may impact subjects' ability to accurately recall thoughts they had during exposure to a message. One of the most obvious factors is the exact time that they are asked to recall and state their thoughts. Thoughts could be reported online while an individual is consuming media or in between mediated messages included in an experiment. Clearly, if participants are instructed to verbally state their thoughts as they are consuming media in an experiment then thoughts are being recorded nearly immediately as they are activated in working memory during mediated message processing. The accuracy of recorded thoughts under this instruction is not as dependent on memory retrieval processes as is the case when participants recall thoughts after exposure to a message. The weakness in this approach, however, is that the task of reporting one's thoughts while simultaneously processing mediated messages takes cognitive resources away from processing messages in a highly detailed manner—possibly causing participants to not thoroughly process a potentially important characteristic of mediated messages being studied in an experiment.

A second factor that could impact the accuracy of recall in completing a thought listing task is the repeated nature of the task in experiments that involve the

presentation of multiple messages. In an experiment that involves thought listing in response to several mediated stimuli, participants probably become increasingly diligent in consciously attempting to recall thoughts due to the anticipation of needing this information at the conclusion of a message. The likelihood of this happening not only points out the importance of randomizing the presentation of stimulus messages used in the study but also brings up the concern that simply instructing participants to recall their thoughts could change the way messages are cognitively and emotionally processed. This not only has implications for the level of noise in thought listing data but could also introduce noise in psychophysiological measures of cognitive and emotional processing. Researchers need to be aware that any part of an experimental protocol that shifts or changes the way individuals allocate cognitive resources to processing stimulus messages—such as informing participants that they are going to be prompted to recall their thoughts—has the potential to impact psychophysiological measures of cognitive and emotional processing that are also being collected in the study.

An additional source of noise in thought listing data is **social response bias**. Social response bias has the potential to contaminate many different measures of mediated message processing but it arguably deserves special consideration here. In asking an individual to describe their thoughts researchers are asking for disclosure of what can be considered one of the most private and personal aspects of an individual. It seems plausible that participants could even reasonably consider having to verbally describe potentially sensitive thoughts an even more invasive intrusion into their private mental life than having to complete quantitative self-report measures that index similarly sensitive attitudes and beliefs. It is therefore all the more critical for researchers to take specific steps to help make participants feel comfortable responding in a completely honest manner. This could include adding emphasis in instructions to subjects on the fact that their responses are generally anonymous and confidential, and perhaps even taking extra steps to increase the privacy of the environment in which thought listing data is collected.

The thought listing technique has been used to gain intriguing insight into mental processing of mediated messages. This qualitatively based measure of mediated message processing when combined with psychophysiological measures of mediated message processing seems likely to have tremendous potential to yield new insight. No study to date has purposefully drawn conclusions about mediated message processing by concurrently interpreting data obtained from psychophysiological measures of embodied motivated processing and thought listing. This could be due to the labor-intensive nature of data analysis for both kinds of measures. The thoughts expressed by subjects in an experiment have to be sorted and coded, with attention being paid to issues such as **inter-coder reliability**. Researchers who are willing to invest this level of work in data analysis could possibly gain the ability to simultaneously observe embodied motivated processing and the phenomenological mental experience of consuming media in theoretically valuable ways. For instance, media psychology researchers could investigate how

the degree to which cognitive resources are allocated to encoding a persuasive message—as indexed by heart rate—impacts the presence of thoughts in thought listing data reflective of message counter-arguing or discounting. Alternatively in the arena of new media, researchers might investigate how features of interactivity evoke differential patterns of arousal—indicated by skin conductance—and thoughts reflective of an entertaining and satisfying mediated experience. Thought listing could be combined with psychophysiological data in a slightly less labor-intensive manner by having the subjects themselves categorize their thoughts along a pre-determined typology (Stephens & Russo, 1997). The combination of these measures in experiments on mediated message processing will certainly involve work on the part of researchers and a high degree of attention to methodological considerations, but as should be clear from the above discussion, can also be used to tremendously enrich theoretical understanding of this phenomenon.

Secondary task reaction time: a behavioral measure of cognitive resources

Secondary task reaction time (STRT) is a measure of cognitive processing that has a rich history of being used by cognitive psychologists to study human attention. This measure is conceptually grounded in limited capacity theories of human attention that propose individuals have limited cognitive resources for performing the mental tasks involved in processing multiple sources of information in their environment (Kahneman, 1973; Shiffrin & Schneider, 1977). Operationally, STRT is grounded in a dual task processing research paradigm under which scholars working in cognitive psychology realized that they could operationally study human attention by having research participants engage in two separate mental tasks and assess the degree to which one task affects performance on the other (Pashler, 1998).

The collection of STRT data in an experiment involves instructing participants to pay the most attention to a primary task (e.g. reading a story) but to also behaviorally respond—typically by pressing a button—to a secondary task cue. The amount of time it takes a participant to respond to the secondary task cue (usually a brief audio tone or visual character) is the secondary task reaction time. This data, recorded in milliseconds, is submitted to statistical analysis in order to draw conclusions about cognitive resources. Researchers in cognitive psychology have utilized secondary task reaction time data to help them build basic models of human attention (Posner, 1978) as well as, more recently, in combination with brain imaging, to study the neural underpinnings of processes related to attention (e.g., Britta et al., 2008). Thus, STRT continues to be considered a useful measure in studying how the human mind attends to information.

Communication researchers working in the 1980s, when attention was just beginning to become widely studied in the field, adopted STRT as a useful measure of this concept (Thorson, Reeves, & Schleuder, 1987). Secondary task reaction

time data has appeared with growing frequency in the published communication literature since that time. Basil (1994a) described a basic theoretical foundation for applying STRT to the study of cognitive processing of mediated messages. He suggested that consuming media requires the allocation of limited cognitive resources; therefore, STRT ought to be just as useful to the study of attention paid to mediated messages as it had been for basic research on human attention in cognitive psychology. Initially the application of this measure to studying how the mind processes mediated messages produced some puzzling results that ran counter to the traditional interpretation in cognitive psychology of what STRT measures.

The traditional interpretation of STRT data is that as a primary task consumes more attention or mental effort, secondary task reaction time gets slower. Applied to mediated message processing, this interpretation leads to the general hypothesis that more complex messages should result in slower secondary task reaction time than messages that are less complex. Researchers who have used secondary task reaction time to study cognitive processing of mediated messages have noted how several of the early experiments incorporating STRT produced results that failed to support this general hypothesis (Fox, Park, & Lang, 2007; Reeves & Thorson, 1986). For instance, Thorson and colleagues manipulated the audio and visual complexity of commercials and found STRT to be faster when participants were exposed to high complexity compared to low complexity messages (Thorson, Reeves, & Schleuder, 1985). Counterintuitive findings have extended to the relationship between STRT and memory for message content. If, under the traditional interpretation, secondary task reaction time directly measures attention paid to a message, then slower secondary task reaction time—or higher levels of attention paid to a message—should be associated with better memory for message content. This has not always been the case. For example, experiments on the impact of news teasers (Cameron, Schleuder, & Thorson, 1991) and narrative structure (Lang, Sias, Chantrill, & Burek, 1995) in televised messages produced results where faster secondary task reaction time was associated with better memory for the messages being studied.

Counterintuitive results appeared with enough frequency in the published literature by the mid-1990s to lead some scholars to begin questioning exactly what secondary task reaction time measures (Basil, 1994b; Grimes & Meadowcroft, 1995). Lang and Basil (1998) offered a theoretical reinterpretation of the measure, arguing that conceptualizing secondary task reaction time data as directly indexing cognitive resources consumed in processing a mediated message is incorrect and overly simplistic when describing cognitive processing of mediated messages. They suggested that a distinction needs to be drawn between cognitive resources allocated to processing a message and cognitive resources required to process a message. Cognitive resources—as was discussed in Chapter 4—are allocated to processing messages through both controlled and automatic processes. Cognitive resources required to process a mediated message are determined by the content and structural

features of the message. Lang and Basil (1998) termed the difference between resources allocated and resources required as cognitive resources available for encoding and suggested that the latter is what STRT actually indexes. This represented a very specific conceptual definition of STRT, distinct from the other ways it had been conceptualized as an indicator of attention.

A real strength of this theoretical interpretation of STRT is that it reflects more accurately the nuanced and complex nature of the mental task of attending to and processing mediated messages. Conceptualizing secondary task reaction time as measuring cognitive resources available for encoding establishes a strong connection between this measure and what is presently the dominant theory of how the mind processes media, LC4MP (Lang, 2009). Recall from our discussion of LC4MP in Chapter 4 that encoding is one of the specific subprocesses involved in attending to and remembering mediated messages. Further, this theoretical model explicitly draws a distinction between cognitive resources allocated to encoding and cognitive resources required to encode a message. This distinction means that cognitive resources allocated to encoding a message can run the gamut from being too few resources to more resources than are actually required to process the message depending on both resources that are actually allocated to encoding by an individual and the degree to which content and structural features of messages require resources for encoding. Lang and Basil (1998) suggested that secondary task reaction time recorded during exposure to mediated messages will vary according to the difference between cognitive resources allocated to encoding and cognitive resources required by the message—in other words, cognitive resources available for encoding.

Recent experiments on cognitive processing of mediated messages have supported conceptualizing secondary task reaction time as measuring cognitive resources available for encoding (Fox et al., 2007; Lang, Bradley, Park, Shin, & Chung, 2006; Lang, Park, Sanders-Jackson, Wilson, & Wang, 2007b). This support has come through a combination of both secondary task reaction time and message recognition data. Lang and colleagues have proposed that faster secondary task reaction time and decreased message recognition indicates that cognitive processing of the primary task has become overloaded due to significantly fewer resources being allocated to a message than are actually required to encode the message (Lang et al., 2006; Lang et al., 2007b). As a result of this overload, the research subject disengages from the primary task of watching the mediated message. This causes recognition memory for content of the message to go down while leaving plenty of resources available for encoding for more rapid response to the secondary task probe and faster STRTs.

Armed with a much clearer conceptualization of the precise aspect of mediated message processing secondary task reaction time indexes, media psychology researchers can proceed to productively combine this measure with psychophysiological measures of mediated message processing. There are, however, significant obstacles to collecting secondary task reaction time and psychophysiological data

simultaneously during exposure to mediated messages. The STRT cue is a stimulus that will evoke specific psychophysiological responses in addition to patterns of physiological responding evoked by a message. These additional responses are noise in the data a media psychology researcher is typically most interested in—psychophysiological responses evoked by the message. The motor responses required to respond to the secondary task reaction time cue have the potential to introduce even more noise into psychophysiological measures. Thus—as was the case with continuous response measures—media psychology researchers who wish to combine STRT with psychophysiological measures of mediated message processing should either vary which measure is collected during exposure to each message in an experiment or conduct two entirely separate protocols on the same messages.

It is difficult to find published studies that enable conclusions to be drawn about mediated message processing based on the collection of secondary task reaction time and psychophysiological measures on the same messages. This represents yet another interesting line of future research for media psychology researchers to pursue. Leshner and colleagues studied the impact of fear appeal and disgust-related visual images in televised anti-tobacco ads on cognitive processing by collecting heart rate and secondary task reaction time data for the same messages in two different experiments (Leshner, Bolls, & Thomas, 2009; Leshner, Vultee, Bolls, & Moore, 2010). They found that the addition of disgusting images in fear appeal messages resulted in faster secondary task reaction time, momentary cardiac acceleration, and slightly decreased recognition. Leshner and colleagues interpreted this pattern of results as indicating that the combination of threatening, fear appeal-based content and disgust-related visual images in anti-tobacco messages creates emotionally intense messages capable of overloading cognitive processing. Again in this work, overload was indicated by the combination of faster reaction times and decreased recognition memory for the primary task. This not only illustrates insights to be gained by interpreting data from both STRT and psychophysiological measures but also points out the importance of yet another measure of cognitive processing of mediated messages—measures of memory.

Measures of memory: performance indicators of mediated message processing

Real-time measures of mediated message processing like heart rate and secondary task reaction time are clearly valuable but ultimately in-depth insight into mediated message processing also requires data that describes the impact of features of mediated messages on the content of memory. In the early days of research on attention paid to mediated messages, researchers made the mistaken assumption that memory for message content indicates levels of attention paid to a message (Lang et al., 2009). However, a more current and informed theoretical

perspective recognizes that cognitive resources allocated to processing a message and the memory for a message are completely distinct concepts. As mentioned in our discussion of this issue in Chapter 4, an increase in cognitive resources allocated to encoding a message doesn't automatically translate into better recognition of message content (Bolls et al., 2001). Memory for mediated messages seems to be driven by a dynamic interaction between cognitive resource allocation and specific characteristics of messages. It is therefore vitally important for media psychology researchers to measure both cognitive resource allocation and memory in order to draw valid conclusions about how specific forms of mediated messages are processed.

Given that cognitive processing of mediated messages involves the allocation of resources to the subprocesses of encoding, retrieval, and storage, performance at each of these subprocesses needs to be indexed through the use of distinct memory tests. Message **recognition** indexes performance at encoding, **cued recall** measures how well content was stored, and **free recall** indicates how easily message content is retrieved (Craik & Lockhart, 1972). A free recall test involves instructing participants to simply list or describe the messages they can remember being exposed to during an experiment. Testing cued recall involves giving participants a cue for each specific message (e.g., during this study you viewed a message about puppies) and asking them to describe all that they can remember from that specific message. Multiple-choice tests are a common way of testing recognition. Recognition can also be examined in a more nuanced way through speeded recognition tests. These involve the presentation of brief target snippets from messages in an experiment as well as foil snippets from media content that participants were not exposed to during the study. The instruction to participants is for them to indicate as quickly as possible whether or not they believe the snippet is from one of the messages they were exposed to during the study. Speeded recognition tests yield data that enables a signal detection analysis of recognition memory. This more detailed analysis of recognition data produces two parameters—**recognition sensitivity** and **criterion bias**—that allow much more detailed insight into message recognition than recognition accuracy. Recognition sensitivity is an index of a research subject's ability to discriminate between the targets and foils. Criterion bias quantifies how conservative or liberal the subject is when responding that they had been exposed to the snippet during the experiment. Shapiro (1994a) describes these in more detail, plus further discusses the application of signal detection analysis in experiments on mediated message processing.

The implementation of memory tests in experiments on mediated message processing typically involves the inclusion of a distraction task prior to the actual memory test. This is to clear the contents of short-term memory after exposure to the last message and activate neural memory networks corresponding to topics unrelated to the stimulus messages and independent variables of interest. Sometimes distraction tasks consist of watching an unrelated message. Another

possibility is to create distraction as part of a research protocol by removing all electrodes that were placed on participants prior to testing memory.

It is not only theoretically important but also methodologically convenient to collect psychophysiological and memory data for all messages in a single experiment. Many of the published studies involving the use of psychophysiological measures of mediated message processing also include memory data. A review of that published literature is beyond the scope of this chapter. Suffice it to say that strong theoretical models like the LC4MP could never have been built without an extensive amount of data obtained from both psychophysiological measures and memory tests.

Summary

This chapter has established the unique roles that various forms of measurement play in observing the mental experience of processing mediated messages. Several measures that can be productively combined with psychophysiological measures in the study of mediated message processing were also covered. It should be clear that psychophysiological measures—or any other measure for that matter—cannot provide meaningful insight into the highly complex and dynamic interaction between the human mind and mediated messages if used alone. Researchers, however, need to be diligent in addressing several unique methodological challenges in combining the collection of psychophysiological data with data obtained from other forms of measurement in the same experiment. We hope that this chapter has not only provided media psychology researchers with a better understanding of measures of mediated message processing but has also sparked ideas for future research in which multiple measures will be combined in exciting ways, to truly advance knowledge.