Theoretical Article

Bridging Media Psychology and Cognitive Neuroscience

Challenges and Opportunities

René Weber,[1] Allison Eden,[2] Richard Huskey,[1] J. Michael Mangus,[1] and Emily Falk[3]

[1]Media Neuroscience Lab, Department of Communication, University of California, Santa Barbara, CA, USA, [2]Communication Science, VU University Amsterdam, The Netherlands, [3]Communication Neuroscience Lab, Annenberg School for Communication, University of Pennsylvania, PA, USA

Abstract. Media neuroscience has emerged as a new area of study at the intersection of media psychology and cognitive neuroscience. In previous work, we have addressed this trend from a methodological perspective. In this paper, we outline the progression of scholarship in systematic investigations of mass communication phenomena over the past century, from behaviorism and environmental determinism to biological and evolutionary paradigms. These new paradigms are grounded in an emergentist perspective on the nature of psychological processes. We discuss what it means to ask valid research questions in media neuroscience studies and provide recent examples in the areas of interpersonal and intergroup processes, morality, and narratives as well as in persuasion and health communication. We conclude with a selection of innovative methodological avenues that have the potential to accelerate the integration of cognitive neuroscience into media psychology research.

Keywords: media psychology, cognitive neuroscience, media neuroscience, brain imaging, communication, theory

The science of mass communication began at a time when positivism and environmental determinism were the most widely accepted approaches to understanding human behavior (Anderson, 1996; Weber, Sherry, & Mathiak, 2008). The historical consensus is that scientific research on mediated messages evolved primarily from research in social psychology and sociology in the early 20th century (Bryant & Pribanic-Smith, 2010; Rogers, 1997). At that time, the renowned psychologist John Watson (1925) advocated for a causal modeling approach in studying human behavior that is based on the analysis of "stimulus-response" variables. Watson's behaviorist philosophy had a strong influence on the work of pioneers in mass communication research, such as Hovland's research program on propaganda at Yale University, as well as Lazarsfeld's commercial media research at Columbia University. As a consequence, the nomothetic-deductive approach became the standard epistemology in experimental communication research and media psychology (Anderson & Baym, 2004). In addition, Watson's philosophy explicitly privileges nonbiological causes over biological ones – a fact that is largely ignored in most histories. Indeed, Watson's foundational work on psychological behaviorism (Watson, 1925) unequivocally refuted William James's (1890/1950) notion of "instincts" or "inherited traits" as valid explanations of psychological phenomena and asserted that all human behavior can be explained in terms of environmental learning.

Today, Watson's positions seem outdated. Communication science would look quite different were the discipline born into today's scientific milieu (Weber et al., 2008). For instance, in the hard sciences, simplistic cause-and-effect perspectives have been largely supplanted by a dynamic-systems perspective (Strogatz, 1994). In the life sciences, there is no longer a nature/nurture dichotomy – environmental and genetic factors combine in dynamic interactions to produce human behavior, including communication (Plomin, DeFries, Knopik, & Neiderhiser, 2013). In psychology, the "cognitive revolution" in the mid-20th century (Miller, 2003) has been trumped by a "Decade of the Brain" (Jones & Mendell, 1999) and a "cognitive *neuroscience* revolution" in the 1990s which gave rise to numerous new journals and academic societies. Subsequently, neuropsychological research has rapidly expanded into almost all areas of modern psychology. That trend prompted several special journal issues on the intersection between psychology and cognitive neuroscience (e.g., Diener, 2010; Poldrack & Wagner, 2008). In media psychology, biologically grounded explanations for media effects date back more than 20 years (e.g., Cappella, 1996; Lang, 1994; Potter & Bolls, 2012; Ravaja, 2004; Sherry, 2004, 2015; Weber et al., 2008), and the field has seen a recent increase in research activity with a neuropsychological focus (Afifi & Floyd, 2014; Weber, 2015a, 2015b) as well as revised theories that align the discipline with the paradigm shifts outlined above (Lang, 2013, 2014). Yet tangible attempts (e.g., research teams and research projects) that bridge media psychology and cognitive neuroscience are still rare, and the acceptance of integrative media studies among media psychologists remains at a comparatively low level. Why?

Of course, there are many reasons, but two stand out: (1) skepticism about the explanatory potential of neuroscientific data, such as the belief that investigations at the level of brain mechanisms are not needed for theory development and accurate predictions in media psychology; (2) a lack of training in neuroscientific theory and methodology, which leads to uncertainties about what research questions can and cannot be tackled in a meaningful way with neuroscience. In our view, both lead to a tendency to ignore the latest developments and research findings in cognitive neuroscience, or the rejection of their relevance for advancing media psychology research.

This article is meant to address these issues and to stimulate both research and critical debate among media psychologists. Our discussions begin with the multilevel integration of neuroscience into media psychology, including what the generally valid questions are in a neuroscientific study. Subsequently, we discuss the numerous and multifaceted ways in which cognitive neuroscience is helping advance specific research topics in media psychology. We conclude with a selection of new methodological avenues that have the potential to accelerate the integration of cognitive neuroscience into media psychology research.

Before we begin, however, we would like to note some caveats regarding the scope of this article and its terminology. By no means do the research topics explored below represent a comprehensive list. Due to the sheer magnitude of research in the cognitive neurosciences, such a list would easily fill several books. Instead, we aim to provide readers with a flavor of the types of questions in media psychology that have been addressed with a neuroscientific framework. Our selection is subjective; another selection of research topics that represent good candidates for a cognitive neuroscience perspective can be found in Falk (2012). Furthermore, due to limited space, we focus in this article on neuroscience studies in a narrow sense – that is, on direct studies of the human brain. Consequently, we largely ignore a vast body of research in media psychology using measures such as electrocardiography, skin conductance, or facial electromyography, as well as endocrinological measures. Excellent integrations of physiological media psychology can be found in Lang (1994), Potter and Bolls (2012), and Ravaja (2004). Finally, throughout this article we strongly advocate for a media psychological neuroscience, or a neuroscientific media psychology, or a neuroscience of mass communication, or simply for a communication/media neuroscience. To be consistent and avoid confusion, we use the term *media neuroscience* from now on. This term represents research at the intersection of media psychology and cognitive neuroscience.

The Emergentist Perspective

State-of-the-art theories of the brain draw heavily from complexity science (e.g., Strogatz, 2003) and argue that the brain exhibits characteristics of a complex system (Bassett & Gazzaniga, 2011). From a complex systems perspective, different neural structures perform computational tasks that can be described by a set of simple rules. These structures can exert influence over one another, and the combined output of this joint computation is thought to be greater than the sum of the individual parts – an idea known as emergence. This conceptualization of the brain as a complex system has motivated entirely new methods for assessing how cognitive tasks modulate connectivity between neural regions and brain states (Davison et al., 2015; Friston, 2011), and it is embedded in emergentism, which treats the mind as an emergent property of the brain (Broad, 1925; Goodenough & Deacon, 2008; Morowitz, 2002).

Emergentism implies a multilevel view of nonliving systems and living organisms, with levels arranged in terms of increasing complexity. In terms of scientific disciplines, a multilevel system treats physics as the foundational level, on which chemistry, then biology, psychology, and finally the social sciences are built. This systematic and multilevel view fits nicely with state-of-the-art media psychology (e.g., Lang, 2014). To help make this perspective more concrete, Weber et al. (2008) offer a car-driving metaphor. Imagine a group of researchers interested in understanding the various factors that contribute to fuel consumption. The most accurate prediction demands an understanding of the organizational level (e.g., traffic patterns), the individual level (e.g., driver personalities), the environment (e.g., city driving), and the mechanical level (e.g., fuel injectors). Likewise, media psychological phenomena operate at diverse levels of scale, and each particular level of explanation produces only a partial account of the phenomenon.

Scholars in media psychology who contend that nothing can be learned from brain science have made an empirically testable proposition, and as the next sections demonstrate, the evidence seems to be mounting against them. On the other hand, scholars in media psychology who make the argument that media psychology operates at a level of investigation that does not inherently *require* cognitive neuroscience for useful predictions ignore the multilevel organization of media psychological phenomena, instead settling for the constrained prediction accuracy of black-box theories (see Lang, 2013).

At this point, it may help to clarify which general questions are valid in media neuroscience studies. These uestions can be broken down into three categories: localization, selectivity, and generalization (Weber, Mangus, & Huskey, 2015).

The first category of questions deals with localizing the neural structures involved in a specific cognitive construct or process (e.g., face recognition). Localization studies are a necessary precursor for theory testing (Falk, 2012), particularly for media neuroscientists. Early neuroscientific studies using functional magnetic resonance imaging (fMRI) extensively investigated the neural correlates of psychological processes such as attention, perception, memory, language, and so on (see Gazzaniga & Mangun, 2014). These brain-mapping studies provide an important foundation, although constructs that are specific to media psychological processes may still require mapping.

Selectivity questions investigate the neural structures recruited by different cognitive processes and deal with issues of dissociation. Testing if communication processes selectively engage dissociable neural systems has value, especially in instances where different cognitive processes are theorized to result in similar behavioral outcome (an issue common in the persuasion literature, see Weber, Westcott-Baker, & Anderson, 2013).

Finally, generalizability questions examine the extent to which the same mental process is involved in a variety of communication tasks. As examples, cognitive neuroscience has demonstrated that the same neural structures are engaged when experiencing pain or when observing others experiencing pain (Singer, 2006), or experiencing aggression in a nonvirtual and virtual world (Weber, Ritterfeld, & Mathiak, 2006). Given that audiences can feel a strong sense of attachment with mediated characters, especially in video games (Lewis, Weber, & Bowman, 2008), these findings have implications for the experience and effects of video game exposure.

When investigating these questions, it is important to remind ourselves of important principles of brain function from an emergentist perspective. Scholars should be wary of any results suggesting that a single brain structure is responsible for a given communication process. Few neural structures are so selective (Kanwisher, 2010), and the ones that are tend to be selective for a specific and narrowly constrained cognitive subprocess (e.g., face recognition; Kanwisher, McDermott, & Chun, 1997). Communication processes, on the other hand, are dynamic and are generally theorized to recruit a number of cognitive subprocesses (e.g., attention, memory, reward, emotion). Therefore, most if not all investigations into the neural substrates of media psychological phenomena must conceptualize the brain as a dynamic system that simultaneously engages multiple neural structures.

The notion of emergence in a dynamic system and its inherent many-to-many mapping of brain structures to cognitive processes is a common source of misconceptions and misinterpretations among media psychologists. One prominent misinterpretation is known as the *reverse inference problem* (Poldrack, 2006). Suppose that a researcher observes that a certain stimulus tends to yield activation in brain region r, and that prior studies have associated r with the well-known cognitive process p. A researcher who wishes to speculate may be drawn to assert that the stimulus engages p because it activates r. However, the available data can provide only very limited support for such a claim. Region r may also be activated by cognitive processes $q, s, t \ldots$, so the fact that the region was active does not guarantee that the purported cognitive process took place.

The problem of reverse inference can be ameliorated in two general ways (Poldrack, 2006). First, selectivity studies could demonstrate that r exhibits responses that are consistently associated with p but not q. Second, neuroimaging can be used in conjunction with other measures to triangulate relevant cognitive processes. Media psychologists can provide particular insight here, given their expertise in the development of behavioral measures of media experiences and media effects.

With this groundwork in mind, the following sections highlight several areas where either there is already considerable overlap between media psychology and cognitive neuroscience, or new insights from neuroscience have the potential to reframe research in media psychology.

Interpersonal and Intergroup Processes

All communication is mediated by a physical substrate; even face-to-face communication uses the atmosphere as a medium. At the same time, Reeves and Nass (1996) have demonstrated that humans often respond to electronically mediated information the same way they respond to face-to-face information. This response occurs because the evolved capacities of the human brain are not adapted to an environment that includes modern media technologies. Thus, a neurophysiological account of interpersonal and intergroup processes, particularly in reference to person perception, empathy, stereotypes, social comparison, and real-time social interaction is of interest to media psychologists.

For example, findings demonstrating that social and moral information about others affects person perception and intergroup processes in the brain support the basic tenets of disposition theories of drama (Zillmann, 2006), the role of understanding intentionality in attributions about individuals (Mar, 2011), the formation and maintenance of stereotypes (Amodio, 2014), and the interplay of social emotions and status central to social comparison processes (Fiske, 2012). In these areas, we see the biological processes validating existing theoretical and empirical work from media psychologists, which was the hope outlined in 2006 when Anderson et al. (2006) in their introduction to a special issue of *Media Psychology*, focused on neuroscience, stating that brain imaging's "greatest promise for media psychology … may lie in the exploration of emotional reactivity to mediated events at large" (p. 4).

Neurophysiological research may be most exciting for media psychologists when findings in social cognitive neuroscience can help reframe or refocus existing debates. We consider three examples: the discovery of distinct systems for mirroring and mentalizing (thinking about) the actions of others (Mar, 2011; Van Overwalle & Baetens, 2009); the importance of consistency in moral information in person-perception processes and stereotyping (Mende-Siedlecki, Cai, & Todorov, 2013); and the importance of neural synchronicity in comprehension of verbal versus mediated communication (Hari & Kujala, 2009; Jiang, Dai, Peng, Liu, & Lu, 2012).

Person Perception and Empathic Responses

One of the largest areas of overlap in terms of existing research in social cognitive neuroscience and media psychology is in understanding how we think about and discern the intentions of others, and the role of empathy and social emotions in dictating future behavior. Thinking about the social world and the intentions of others is central not just for interpersonal relations but also for how we process characters and interactions in narrative (Lee & Shapiro, 2014; Zillmann, 2006). Existing research suggests that there are dissociable and identifiable neural networks involved in person perception. One network, which is termed the *mirror system* consists of the anterior intraparietal sulcus and the premotor cortex, and is primarily involved when observing and executing biological motion. Relatedly, the *mentalizing system*, which consists of the precuneus, temporo-parietal junction (TPJ), and the medial prefrontal cortex (MPFC), is primarily involved when there is no observation of motion – for example, when reading about actions taking place (Van Overwalle & Baetens, 2009), thinking about the intentions of others in theory of mind (TOM) tasks, where viewers must infer what an actor was thinking when she took some action and the reasons she performed it.

Mar (2011) performed a meta-analysis of 180 studies on the role of the mentalizing system in narrative – those studies which used narrative or story-based stimuli, those which did not, and the overlap between the two. The results show that the MPFC, bilateral superior temporal sulcus (STS), the middle temporal gyrus (MTG), the posterior cingulate cortex (PCC), the precuneus, the inferior frontal gyrus, and the left amygdala showed overlap for both story- and non-story-based mentalizing networks. From this, Mar (2011) suggested that functions such as language and face processing, retrieving personally relevant memories, and imputing those memories to others, are central to the understanding of observed actions of others. While this study – and the distinction between mirroring and metalizing networks more generally – have been used in subsequent neuroscientific work detailing the relevance of fiction as stimuli for mentalizing networks, as well as the role of mentalizing in fiction comprehension (Jacobs, 2015), the role of the mentalizing network has been less emphasized to date.

Media psychological explorations into how viewers form dispositions toward characters and infer intentionality and culpability from character behavior (see Lee & Shapiro, 2014; Zillmann, 2006) can benefit from taking into account the differences between mirroring and metalizing networks. For example, recently Nijhof and Willems (2015) found that activation of the mentalizing network was associated with a reader's feelings of transportation and fictional engagement with characters' intentions and beliefs, whereas the mirror network was more active in readers who were focused on the actions of characters. This supports and extends media psychological notions of how transportation and engagement occur (i.e., via thinking about characters and their motives) versus considering the simple motor actions of characters.

With that said, there is considerable controversy surrounding mirror neurons, the mirror system, and related theories of motor simulation and embodied cognition (for critical assessments, see Caramazza, Anzellotti, Strnad, & Lingnau, 2014; Hickok, 2009, 2014). It is beyond the scope of this paper to provide a detailed review on this controversy. Instead, we urge readers to approach this literature with a healthy level of skepticism and to familiarize themselves with the numerous issues surrounding this topic.

Stereotypes and Social Comparison

An important aspect of person-perception judgments is the role of stereotype activation and social comparison. Stereotypes are generalized characteristics ascribed to a social group and are often associated with increased prejudice or preconceptions about groups based on social, racial, or ethnic origins (Amodio, 2014; Fiske, 2012). The study of stereotypes and their formation and maintenance via media, as well as possible media-based strategies for their reduction, has been an important focus of media psychology, particularly in areas of racial and ethnic stereotypes (Dixon and Williams, 2014) and sex stereotypes (Smith & Granados, 2009).

Recent imaging work has distinguished stereotypes from other types of social or semantic information and suggests they are specifically linked to the person-perception and social cognition networks identified above, including the MPFC, PCC, bilateral TPJ, and anterior temporal lobe (ATL) (see Amodio, 2014; Contreras, Banaji, & Mitchell, 2012; Fiske, 2012). For example, when examining neural responses to low-status groups (drug addicts, migrant workers, homeless individuals), there is a significant failure of activation in the MPFC, suggesting that these groups are perceived as "less than human agents" (Harris & Fiske, 2006). However, individualizing members of these outgroups can increase the activation in the MPFC (Harris & Fiske, 2007). This suggests that media psychological interventions focused on individuating members of low-status outgroups (e.g., Schiappa, Gregg, & Hewes, 2005) may be most successful in stereotype reduction via humanizing outgroup members. Beyond focusing solely on the individual, media portrayals should also focus on sociomoral emotional networks to change implicit stereotypes. Recent media psychological work on the role of elevation in reducing outgroup bias (Oliver et al., 2015) has shown that targeting moral emotions such as elevation and empathy may facilitate increased empathy toward outgroups and perhaps a reduction in stereotype activation.

In contrast to stereotypes, which are linked to higher order processing, prejudice has been more closely linked to fear and fight-or-flight responses in the amygdala. As Amodio (2014) suggests, this indicates that interventions for stereotyping and prejudice focus on different mechanics: prejudice may respond to fear extinction protocols, whereas stereotypes are dependent on shifts in long-term exposure to positive social information. A social cognitive neuroscience account suggests that the most useful approach would focus on separate interventions for each specific neural target with associated behaviors and cognitions.

Social Interaction

Understanding communication as a shared activity between sender and receiver has only recently been incorporated into social cognitive neuroscience studies. This is in part due to the relatively recent advances in brain imaging techniques that allow for the examination of direct social interactions during verbal communication (Hari & Kujala, 2009). Stephens, Silbert, and Hasson (2010) found that speaker–listener neural couplings (temporally correlated response patterns) were integral to communication comprehension. This means that as a speaker was communicating, the listener was simultaneously making sense of the communication, and that this coupling of communication and comprehension can be witnessed in real-time neural activation. However, Jiang, Dai, Peng, Liu, and Lu (2012) found that neural synchrony was only present during face-to-face conversation, and not other forms of communication such as back-to-back conversation or listening to monologues. As the authors discuss in their paper, this finding has important implications for the understanding of computer-mediated communication (CMC) in which there is often a lack of temporal synchrony among communicators. The lack of neural synchrony may offer a functional underlying reason for the differences between face-to-face and online communication that have been a focus of CMC researchers in communication.

Morality and Narratives

The role of morality in media narratives has been of growing interest for media psychologists (Tamborini, 2013) as social judgments about the appropriateness of others' behaviors dictate how we feel about characters (Zillmann, 2006) and how we learn right and wrong from viewing the behaviors of others (Bandura, 2001). Cognitive neuroscience can aid us in identifying the cognitive and emotional networks involved in judging and reacting to moral information (Zahn, de Olivera-Souza, & Moll, 2011). In a comprehensive review of research on the *moral judgment network*, Zahn et al. (2011) suggest that the frontopolar cortex, ventromedial prefrontal cortex, dorsolateral prefrontal cortex, ATL, posterior STS, amygdala, hypothalamus, and the basal ganglia are particularly recruited in moral judgment tasks when compared with other types of social information judgments.

These areas are not just associated with cognitive decision making and rationalizing but with moral emotions such as guilt, compassion, pride, and shame (Zahn et al., 2011). By identifying both cognitive and emotional components of moral judgment and decision making via the concurrent activation of these neural networks, findings from cognitive neuroscience studies support arguments for dual-process models of morality (e.g., Haidt, 2012) over strictly deliberate moral decision making. For media psychologists, these findings suggest that studies focusing exclusively on either emotions or rationalizations of character's morality are missing fundamental components of moral judgments. Additionally, neuroscience studies have shown that even brief information about morality (i.e., whether someone is trustworthy or untrustworthy) can shape subsequent judgments of individuals (Delgado, Frank, & Phelps, 2005). In this way, a media neuroscience perspective can help clarify how and when dispositions toward characters are formed.

As an example, consider the debate on how audiences develop and maintain perceptions of characters. Zillmann (2006) proposed that media viewers act as "continuous moral monitors" of characters who continually update their dispositions toward each character. By comparison, Raney (2004) suggests that we use schemas to form initial impressions of characters and then update our information as we watch or read about characters. Brain imaging studies support both views; we use quick, schematic, dimensional judgments to form initial impressions about characters (Todorov, 2008), yet we also update these impressions as we receive more information.

More precisely, Mende-Siedlecki, Cai, and Todorov (2013) found that when updated sociomoral information is inconsistent with previous impressions, it specifically activates a separate network of cognitive and inferential judgment including the dorsal medial prefrontal cortex (dmPFC), the inferior parietal lobule, STS, and PCC. These findings suggest that media psychologists should assess not just the type of information being updated, but also the consistency of this information with prior social character judgments. Particularly in terms of judging morally ambiguous characters and antiheroes, the incorporation of this type of temporally linked, affectively charged information in future empirical studies could help dissociate the different processes associated with appreciating and enjoying behaviorally inconsistent characters (Krakowiak & Oliver, 2012).

Persuasion Neuroscience and Health

One of the most developed areas in media neuroscience has focused on effects of persuasion (Cascio, Dal Cin, & Falk, 2013). Early research in this domain focused on neural underpinnings of classically observed effects in the persuasion literature. For example, Klucharev, Smidts, and Fernandez (2008) demonstrated that messages attributed to sources high (vs. low) in expertise produced greater neural activation in regions hypothesized to engage in semantic elaboration (lateral prefrontal cortex), as well as within regions of the medial temporal lobe associated with memory encoding, and striatal regions implicated in valuation. The authors suggest that these pathways modulate listener attention and subsequent valuation and retention of ideas. Media neuroscience studies have also mapped neural correlates of message features such as message sensation value (Langleben et al., 2009) and argument strength (Lang & Yegiyan, 2008; Ramsay, Yzer, Luciana, Vohs, & MacDonald, 2013; Weber, Huskey, Mangus, Westcott-Baker, & Turner, 2015). Interestingly, neural processes underpinning persuasion appear consistent across different media formats and cultures (Falk et al., 2009).

Neural activity can also be treated as a predictor variable to forecast later behavioral outcomes (Berkman & Falk, 2013; for a detailed description of *brain-as-predictor* approaches, see Falk, Cascio, & Coronel, 2015). For example, Falk and colleagues (2010) demonstrated that neural activity within brain regions associated with self-related processing and positive valuation predicts message-consistent behavior change. Specifically they found that neural activity within a subregion of the MPFC during exposure to public service announcements (PSAs) encouraging sunscreen use predicted changes in study participants' sunscreen use behavior over the subsequent week. They further demonstrated that the variance explained by the neural variables was distinct from that explained by participants' changes in self-reported attitudes toward sunscreen and intentions to use sunscreen in the following week.

Follow-up work has shown that neural activity within MPFC during exposure to antismoking PSAs also predicts reductions in smoking behavior over the month following the scan, predicting variance above and beyond participants' self-reported attitudes, intentions, self-efficacy, risk beliefs, and ability to relate to the ads (Falk, Berkman, Whalen, & Lieberman, 2011). In addition, neural activity within MPFC in relatively small groups of smokers has been shown to forecast population-level success of media campaigns (Falk, Berkman, & Lieberman, 2012). This work has also been extended to include manipulation of MPFC activity using self-affirmation in sedentary adults (Falk et al., 2015). Increased ability to processes messages as self-relevant led to increased MPFC activity in treatment versus control groups. This activity then went on to predict changes in sedentary behavior over the following month.

In line with the account of MPFC indexing a neural signal of self-relevance, Chua and colleagues (2009) examined neural responses to personally tailored and untailored health messages. They found that brain regions implicated in self-related processing, such as MPFC and PCC, were more active in response to tailored versus untailored health messages. Consistent with prior work demonstrating that neural activity within MPFC in response to health messages predicts behavior change, this group also found that the MPFC activity produced by tailored messages was associated with later reductions in smoking behavior (Chua et al., 2011). Specific gene variants of the serotonin transporter impact amygdala reactivity to antismoking messages, which is in turn associated with the success of interventions (Jasinska et al., 2012). The combination of media neuroscience and behavioral genetics to study persuasion and health campaigns may be especially promising for helping create a more complete picture of pathways from biology to media effects (Falk, Way, & Jasinska, 2012).

Recent work has also moved toward combining classic theories of persuasion and media effects with brain-as-predictor approaches. For example, Weber and colleagues (2013, 2015) built on the elaboration likelihood model (ELM; Petty & Cacioppo, 1986), the activation model of information exposure (AMIE; Donohew, Palmgreen, & Duncan, 1980), and the limited capacity model of motivated mediated message processing (LC4MP; Lang, 2009) in studies using neural responses to antidrug messages to predict large-scale evaluation of the messages in independent samples. They documented that an interaction between message sensation value (MSV) and argument strength (AS) predicts effectiveness ratings for low-drug-risk participants; however, high-risk participants rated all messages as ineffective, regardless of MSV or AS. This is likely due to counterarguing in the high-risk participants. Given the lack of variability in the high-risk participants' self-reports, these responses did not predict larger-scale outcomes relevant to the messages; however, neural response in the high-risk participants did. In particular, brain regions implicated in executive function, social cognition, and self-referencing were associated with perceived effectiveness of the messages in large independent samples. This demonstrates that neural signals provide insight into relevant message features that impact message effectiveness, even when defensive processing masks underlying variability.

New Methodological Avenues

Greenwald strongly advocates, "there is nothing so theoretical as a good method" (2012, p. 99) and provides convincing evidence that shifts in research paradigms, theoretical advancements, and methodological innovations are mutually dependent. When examining scientific awards, Greenwald observes a reciprocal relationship: Theory enables methodological advances, and new methods inspire new theories. It is in this spirit that this final section highlights a few interesting methodological innovations.

Network Science and Big Data

One promising new methodological innovation lies at the intersection of neuroscience and computational social science. Although neuroscience methods typically address mechanisms at the individual level, and so-called big data is often aggregated across many individuals, tools from neuroscience and computational social science can strongly complement one another (O'Donnell & Falk, 2015, in press). More specifically, neural methods can help unpack mechanisms that lead to observed behaviors at large scales, and methods from computational social science can help contextualize the environments that individuals inhabit. For instance, early work has demonstrated that neural connectivity between the amygdala and cortical regions covaries with the size of participants' social networks (Bickart, Wright, Dautoff, Dickerson, & Feldman-Barrett, 2011). Leveraging social network data, O'Donnell and Falk (in press) demonstrated that brain function during specific social decision making contexts (e.g., choosing to recommend different mobile game apps) varies in accordance with a metric of participants' opportunities for information brokerage within their social networks. This team also demonstrated that smokers' neural responses to antismoking messages vary as a function of the proportion of other smokers in their social networks and that this neural activity goes on to predict changes in intentions to quit following exposure to the messages.

Intersubject Synchrony and Narrative Engagement

A broad framework for understanding communication as interbrain coupling has emerged in recent years, most notably in the work of Hasson and colleagues (Hasson et al., 2004; Hasson et al., 2008; Hasson et al., 2012). As described above, interpersonal communication aligns brain activity across individuals (Stephens, Silbert, & Hasson, 2010), but the same process also operates on the level of audiences. Intersubject correlation (ISC) analysis is used in this body of research to evaluate between-subject voxel-wise correlations in fMRI data (Pajula, Kauppi, & Tohka, 2012). Whereas a standard general linear model analysis explicitly models the time course of theoretically relevant manipulations, ISC provides a model-free look at commonalities in brain response across individuals. This makes ISC especially well-suited for the low-control stimuli commonly used in media psychology (e.g., movies, music, video games), for which it is difficult to define a precise a priori model of brain responses.

Research indicates that different types of narrative content induce different levels of whole-brain ISCs. Hasson interprets ISCs as a measure of audience engagement – the extent to which viewers share a collective experience in response to a mediated narrative. For videos with limited narrative structure, ISCs are lower; for videos with archetypal and emotionally evocative narrative structures, ISCs are higher.

Using this framework as a guide, subsequent studies have treated ISCs as an indicator of the shared cognitive machinery activated by media narratives and, in turn, as a predictor of group-level effects. Dmochowski et al. (2014) found that ISCs in a relatively small sample of participants accurately predict ratings and social media mentions of television programs. In other words, the most popular narratives may be the ones that best activate shared responses across their audiences. Media psychologists can lend important theoretical insight to guide future research by developing well-founded predictions about the narrative features that might be most relevant for ISCs. For example, Weber, Eden, and Mathiak (2011) manipulated the valence (moral/immoral) and outcome (reward/punishment) of narratives and found evidence that ISC was highest in the immoral-punishment condition. The high ISCs produced by those narratives suggest that the punishment of immoral people evokes a shared response grounded in fundamental intuitions. But this research paradigm is relatively new, and it is not yet well-established how high-level narrative features – the conceptual building blocks of key theories in media psychology – modulate ISCs.

Hyperscanning

Media neuroscientists conceptualize communication as the interaction between two or more brains (Weber et al., 2008). Until recently, it was all but impossible to directly test this assumption. Hyperscanning (Montague et al., 2002) allows multiple participants' brains to be imaged simultaneously and has important implications for understanding the relationship between media and neural synchrony. In a review of the hyperscanning literature, Babiloni and Astolfi (2014) note that this methodology has been applied to address a number of empirical questions such as simultaneous motor action, gestural communication, and nonverbal facial expressions of emotion. Two notable examples are particularly relevant to media neuroscientists. Spiegelhalder and colleagues (2014) investigated verbal communication between dyadic pairs of friends and found that neural activity in speech production areas was associated with activation in listener's auditory cortex. In another study, participants had to communicate information about a target shape during a visual attention task (Bilek et al., 2015). Here, the message sender had unique information about the target stimulus, and the message receiver was tasked with selecting the target object from an array of objects by observing the message sender's eye movements. Two experiments demonstrated that the joint attention task synchronized message sender and receiver activity in the right TPJ, a region implicated in both TOM and attentional tasks. This ability to assess the neural activity of dyadic communicators has important implications for media neuroscientists, particularly those interested in interactive media that grant individuals considerable agency over the communicative context.

Conclusion

The neuroscientific turn in media psychology provides new, materially grounded understandings of historically studied phenomena. This level of scientific inquiry has the potential to revisit previous findings, offer convincing explanations of their mechanisms, and refocus theoretical debates when neuroscientific findings are in conflict with current theorizing. Conversely, neuroscience scholars benefit tremendously from an integration of media psychology through the use of more naturalistic – and thereby complex – stimuli, as well as a refined understanding and measurement of those stimuli. Crossing the bridges outlined in this article requires that media psychologists internalize state-of-the-science ontology and epistemology and connect with cognitive neuroscience scholars. Likewise, it will require that cognitive neuroscientists welcome media psychology's unique theoretical and methodological traditions as a valuable addition to their scientific inquiry. Given the current developments in media psychology and cognitive neuroscience outlined in this article, we encourage our fellow scholars to investigate media psychology from this rapidly developing perspective.

References

Afifi, T., & Floyd, K. (2014). Communication, biology, and physiology: An introduction to the special issue. *Communication Monographs, 82*(1), 1–3.

Amodio, D. M. (2014). The neuroscience of prejudice and stereotyping. *Nature Reviews Neuroscience, 15*, 670–682.

Anderson, D. R., Bryant, J., Murray, J. P., Rich, M., Rivkin, M. J., & Zillmann, D. (2006). Brain imaging: A new approach to studying media processes and effects. *Media Psychology, 8*, 1–6.

Anderson, J. A. (1996). *Communication theory. Epistemological foundations*. New York: Guilford Press.

Anderson, J. A., & Baym, G. (2004). Philosophies and philosophic issues in communication, 1995–2004. *Journal of Communication, 54*, 589–615.

Babiloni, F., & Astolfi, L. (2014). Social neuroscience and hyperscanning techniques: Past, present and future. *Neuroscience and Biobehavioral Reviews, 44*, 76–93.

Bandura, A. (2001). Social cognitive theory of mass communication. *Media Psychology, 3*(3), 265–299.

Bassett, D. S., & Gazzaniga, M. S. (2011). Understanding complexity in the human brain. *Trends in Cognitive Sciences, 15*(5), 200–209.

Berkman, E. T., & Falk, E. B. (2013). Beyond brain mapping: Using the brain to predict real-world outcomes. *Current Directions in Psychological Science, 22*(1), 45–55.

Bickart, K. C., Wright, C. I., Dautoff, R. J., Dickerson, B. C., & Feldman-Barrett, L. (2011). Amygdala volume and social network size in humans. *Nature Neuroscience, 14*(2), 163–164.

Bilek, E., Ruf, M., Schäfer, A., Akdeniz, C., Calhoun, V. D., Schmahl, C., . . . Meyer-Lindenberg, A. (2015). Information flow between interacting human brains: Identification, validation, and relationship to social expertise. *Proceedings of the National Academy of Sciences, 112*(16), 5207–5212.

Broad, C. D. (1925). *The mind and its place in nature*. New York: Harcourt, Brace.

Bryant, J., & Pribanic-Smith, E. J. (2010). A historical overview of research in communication science. In C. R. Berger, M. E. Roloff, & D. R. Roskos-Ewoldsen (Eds.), *The handbook of communication science* (pp. 21–36). Thousand Oaks, CA: Sage.

Cappella, J. (1996). Why biological explanation? *Journal of Communication, 46*, 4–7.

Caramazza, A., Anzellotti, S., Strnad, L., & Lingnau, A. (2014). Embodied cognition and mirror neurons: A critical assessment. *Annual Review of Neuroscience, 37*, 1–15.

Cascio, C. N., Dal Cin, S., & Falk, E. B. (2013). Health communications: Predicting behavior change from the brain. In P. Hall (Ed.), *Social neuroscience and public health: foundations of an emerging discipline* (pp. 57–61). New York: Springer.

Chua, H. F., Ho, S. S., Jasinska, A. J., Polk, T. A., Welsh, R. C., Liberzon, I., & Strecher, V. J. (2011). Self-related neural response to tailored smoking-cessation messages predicts quitting. *Nature Neuroscience, 14*(4), 426–427.

Chua, H. F., Liberzon, I., Welsh, R. C., & Strecher, V. J. (2009). Neural correlates of message tailoring and self-relatedness in smoking cessation programming. *Biological Psychiatry, 65*, 165–168.

Contreras, J. M., Banaji, M. R., & Mitchell, J. P. (2012). Dissociable neural correlates of stereotypes and other forms of semantic knowledge. *Social Cognitive and Affective Neuroscience, 7*(7), 764–770.

Davison, E. N., Schlesinger, K. J., Bassett, D. S., Lynall, M.-E., Miller, M. B., Grafton, S. T., & Carlson, J. M. (2015). Brain network adaptability across task states. *PLoS Computational Biology, 11*(1), e1004029.

Delgado, M. R., Frank, R. H., & Phelps, E. A. (2005). Perceptions of moral character modulate the neural systems of reward during the trust game. *Nature Neuroscience, 8*(11), 1611–1618.

Diener, E. (2010). Neuroimaging: Voodoo, new phrenology, or scientific breakthrough? [Special issue]. *Perspectives on Psychological Science, 5*(6).

Dixon, T. L., & Williams, C. L. (2014). The changing misrepresentation of race and crime on network and cable news. *Journal of Communication, 65*(1), 24–39.

Dmochowski, J. P., Bezdek, M. A., Abelson, B. P., Johnson, J. S., Schumacher, E. H., & Parra, L. C. (2014). Audience preferences are predicted by temporal reliability of neural processing. *Nature Communications, 5*, 45–67.

Donohew, L., Palmgreen, P., & Duncan, J. (1980). An activation model of information exposure. *Communication Monographs, 47*(4), 295–303.

Falk, E. B. (2012). Can neuroscience advance our understanding of core questions in communication studies? An overview of communication neuroscience. In S. Jones (Ed.), *Communication at the center* (pp. 77–94). New York: Hampton Press.

Falk, E. B., Berkman, E. T., & Lieberman, M. D. (2012). From neural responses to population behavior: neural focus group predicts population-level media effects. *Psychological Science, 23*(5), 439–445.

Falk, E. B., Berkman, E. T., Mann, T., Harrison, B., & Lieberman, M. D. (2010). Predicting persuasion-induced behavior change from the brain. *Journal of Neuroscience, 30*(25), 8421–8424.

Falk, E. B., Berkman, E. T., Whalen, D., & Lieberman, M. D. (2011). Neural activity during health messaging predicts reductions in smoking above and beyond self-report. *Health Psychology, 30*(2), 177–185.

Falk, E. B., Cascio, C. N., & Coronel, J. (2015). Neural prediction of communication-relevant outcomes. *Communication Methods and Measures, 9*(1–2), 30–54.

Falk, E. B., O'Donnell, M. B., Cascio, C. N., Tinney, F., Kang, Y., Lieberman, M. D., . . . Strecher, V. (2015). Self-affirmation alters the brain's response to health messages and subsequent behavior change. *Proceedings of the National Academy of Sciences, 112*(7), 1977–1982.

Falk, E. B., Rameson, L, Berkman, E. T., Liao, B, Kang, Y, Inagaki, T. K., & Lieberman, M. D. (2009). The neural correlates of persuasion: A common network across cultures and media. *Journal of Cognitive Neuroscience, 22*(11), 2447–2459.

Falk, E. B., Way, B. M., & Jasinska, A. J. (2012). An imaging genetics approach to understanding social influence. *Frontiers in Human Neuroscience, 6*, 1–13.

Fiske, S. T. (2012). Journey to the edges: Social structures and neural maps of inter-group processes. *British Journal of Social Psychology, 51*(1), 1–12.

Friston, K. J. (2011). Functional and effective connectivity: a review. *Brain Connectivity, 1*(1), 13–36.

Gazzaniga, M. S. & Mangun, G. R. (Eds.). (2014). *The cognitive neurosciences* (5th ed.). Cambridge, MA: MIT Press.

Goodenough, U., & Deacon, T. W. (2008). The sacred emergence of nature. In P. Clayton & Z. Simpson (Eds.), *The Oxford handbook of religion and science* (pp. 853–871). New York: Oxford University Press.

Greenwald, A. G. (2012). There is nothing so theoretical as a good method. *Perspectives on Psychological Science, 7*(2), 99–108.

Haidt, J. (2012). *The righteous mind: Why good people are divided by politics and religion*. New York: Pantheon Books.

Hari, R., & Kujala, M. V. (2009). Brain basis of human social interaction: from concepts to brain imaging. *Physiological Reviews, 89*(2), 453–479.

Harris, L. T., & Fiske, S. T. (2006). Dehumanizing the lowest of the low neuroimaging responses to extreme out-groups. *Psychological Science, 17*(10), 847–853.

Harris, L. T., & Fiske, S. T. (2007). Social groups that elicit disgust are differentially processed in mPFC. *Social Cognitive and Affective Neuroscience, 2*(1), 45–51.

Hasson, U., Ghazanfar, A. A., Galantucci, B., Garrod, S., & Keysers, C. (2012). Brain-to-brain coupling: a mechanism for creating and sharing a social world. *Trends in Cognitive Sciences, 16*(2), 114–121.

Hasson, U., Landesman, O., Knappmeyer, B., Vallines, I., Rubin, N., & Heeger, D. J. (2008). Neurocinematics: The neuroscience of film. *Projections, 2*(1), 1–26.

Hasson, U., Nir, Y., Levy, I., Fuhrmann, G., & Malach, R. (2004). Intersubject synchronization of cortical activity during natural vision. *Science, 303*, 1634–1640.

Hickok, G. (2009). Eight problems for the mirror neuron theory of action understanding in monkeys and humans. *Journal of Cognitive Neuroscience, 21*(7), 1229–1243.

Hickok, G. (2014). The myth of mirror neurons: The real neuroscience of communication and cognition. New York: Norton.

Jacobs, A. M. (2015). Neurocognitive poetics: methods and models for investigating the neuronal and cognitive-affective bases of literature reception. *Frontiers in Human Neuroscience, 9*, 1–22.

James, W. (1950). *The principles of psychology* (Vols. 1–2), Mineola, NY: Dover (Original work published 1890).

Jasinska, A. J., Chua, H. F., Ho, S. S., Polk, T. A., Rozek, L. S., & Strecher, V. J. (2012). Amygdala response to smoking-cessation messages mediates the effects of serotonin transporter gene variation on quitting. *Neuroimage, 60*(1), 766–773.

Jiang, J., Dai, B., Peng, D., Zhu, C., Liu, L., & Lu, C. (2012). Neural synchronization during face-to-face communication. *The Journal of Neuroscience, 32*(45), 16064–16069.

Jones, E. G., & Mendell, L. M. (1999). Assessing the decade of the brain. *Science, 284*(54), 739.

Kanwisher, N. (2010). Functional specificity in the human brain: A window into the functional architecture of the mind. *Proceedings of the National Academy of Sciences of the United States of America, 107*(25), 11163–11170.

Kanwisher, N., McDermott, J., & Chun, M. M. (1997). The fusiform face area: A module in human extrastriate cortex specialized for face perception. *The Journal of Neuroscience, 17*(11), 4302–4311.

Klucharev, V., Smidts, A., & Fernandez, G. (2008). Brain mechanisms of persuasion: how "expert power" modulates memory and attitudes. *Social Cognitive and Affective Neuroscience, 3*(4), 353–366.

Krakowiak, K. M., & Oliver, M. B. (2012). When good characters do bad things: Examining the effect of moral ambiguity on enjoyment. *Journal of Communication, 62*(1), 117–135.

Lang A. (Ed.). (1994). *Measuring psychological responses to media*. Hillsdale, NJ: Erlbaum.

Lang, A. (2009). The limited capacity model of motivated mediated message processing. In R. Nabi & M. Oliver (Eds.), *The Sage handbook of media effects and processes* (pp. 193–204). Thousand Oaks, CA: Sage.

Lang, A. (2013). Discipline in crisis? The shifting paradigm of mass communication research. *Communication Theory, 23*(1), 10–24.

Lang, A. (2014). Dynamic human-centered communication systems theory. *The Information Society: An International Journal, 30*(1), 60–70.

Lang, A., & Yegiyan, N. (2008). Understanding the interactive effects of emotional appeal and claim strength in health messages. *Journal of Broadcasting & Electronic Media, 52*(3), 432–447.

Langleben, D. D., Loughead, J. W., Ruparel, K., Hakun, J. G., Busch-Winokur, S., Holloway, M. B., ... Lerman, C. (2009). Reduced prefrontal and temporal processing and recall of high "sensation value" ads. *Neuroimage, 46*(1), 219–225.

Lee, T. K., & Shapiro, M. A. (2014). The interaction of affective dispositions, moral judgments, and intentionality in assessing narrative characters: Rationalist and intuitionist sequences. *Communication Theory, 24*(2), 146–164.

Lewis, M. L., Weber, R., & Bowman, N. D. (2008). "They may be pixels, but they're MY pixels:" developing a metric of character attachment in role-playing video games. *Cyberpsychology & Behavior, 11*(4), 515–518.

Mar, R. A. (2011). The neural bases of social cognition and story comprehension. *Annual Review of Psychology, 62*, 103–134.

Mende-Siedlecki, P., Cai, Y., & Todorov, A. (2013). The neural dynamics of updating person impressions. *Social Cognitive and Affective Neuroscience, 8*(6), 623–631.

Miller, G. A. (2003). The cognitive revolution: A historical perspective. *Trends in Cognitive Science, 3*, 141–144.

Montague P. R., Berns G. S., Cohen J. D., McClure S. M., Pagnoni G., Dhamala M., ... Fisher R. E. (2002). Hyperscanning: Simultaneous fMRI during linked social interactions. (2002). *NeuroImage, 16*(4), 1159–1164.

Morowitz, H. J. (2002). *The emergence of everything*. New York: Oxford University Press.

Nijhof, A. D., & Willems, R. M. (2015). Simulating fiction: Individual differences in literature comprehension revealed with fMRI. *PloS One, 10*(2), e0116492.

O'Donnell, M. B., & Falk, E. B. (2015). Linking neuroimaging with functional linguistic analysis to understand processes of successful communication. *Communication Methods and Measures, 9*(1–2), 55–77.

O'Donnell, M. B., & Falk, E. B. (in press). Big data under the microscope and brains in social context. Integrating methods from computational social science and neuroscience. *The Annals of the American Academy of Political and Social Science, 659*(1), 274–289.

Oliver, M. B., Kim, K., Hoewe, J., Chung, M. Y., Ash, E., Woolley, J. K., & Shade, D. D. (2015). Media induced

elevation as a means of enhancing feelings of intergroup connectedness. *Journal of Social Issues, 71*(1), 106–122.
Pajula, J., Kauppi, J. P., & Tohka, J. (2012). Inter-subject correlation in fMRI: Method validation against stimulus-model based analysis. *PLoS One, 8*(8), e41196.
Petty, R., & Cacioppo, J. (1986). The elaboration likelihood model of persuasion. In L. Berkowitz (Ed.), *Advances in experimental psychology* (Vol. 19, pp. 123–205). New York: Academic Press.
Plomin, R., DeFries, J. C., Knopik, V. S., & Neiderhiser, J. M. (2013). *Behavioral genetics*. New York: Worth.
Poldrack, R. A. (2006). Can cognitive processes be inferred from neuroimaging data? *Trends in Cognitive Sciences, 10*(2), 59–63.
Poldrack, R. A., & Wagner, A. D. (2008). The interface between neuroscience and psychological science [Special Issue]. *Current Directions in Psychological Science, 17*(2).
Potter, R. F., & Bolls, P. D. (2012). *Psychophysiological measurement and meaning: Cognitive and emotional control of media*. New York: Routledge.
Ramsay, I. S., Yzer, M. C., Luciana, M., Vohs, K. D., & MacDonald, A. W. 3rd. (2013). Affective and executive network processing associated with persuasive antidrug messages. *Journal of Cognitive Neuroscience, 25*(7), 1136–1147.
Raney, A. A. (2004). Expanding disposition theory: Reconsidering character liking, moral evaluations, and enjoyment. *Communication Theory, 14*(4), 348–369.
Ravaja, N. (2004). Contributions of psychophysiology to media research: Review and recommendations. *Media Psychology, 6*, 193–235.
Reeves, B., & Nass, C. (1996). *The media equation: How people treat computers, television, and new media like real people and places*. Stanford, CA: CSLI.
Rogers, E. M. (1997). *History of communication study.* New York: Free Press.
Schiappa, E., Gregg, P. B., & Hewes, D. E. (2005). The parasocial contact hypothesis. *Communication Monographs, 72*(1), 92–115.
Sherry, J. L. (2004). Media effects theory and the nature/nurture debate: A historical overview and implications for future research. *Media Psychology, 6*, 83–109.
Sherry, J. (2015). The complexity paradigm for studying human communication: A summary and integration of two fields. *Review of Communication Research, 3*(1), 22–54.
Singer, T. (2006). The neuronal basis and ontogeny of empathy and mind reading: review of literature and implications for future research. *Neuroscience & Biobehavioral Reviews, 30*(6), 855–863.
Smith, S. L., & Granados, A. D. (2009). Content patterns and effect surrounding sex-role stereotyping on television and film. In J. Bryant & M. B. Oliver (Eds.), *Media effects: Advances in theory and research* (pp. 342–362). New York: Routledge.
Spiegelhalder, K., Ohlendorf, S., Regen, W., Feige, B., Tebartz van Elst, L., Weiller, C., . . . Tüscher, O. (2014). Interindividual synchronization of brain activity during live verbal communication. *Behavioural Brain Research, 258*, 75–79.
Stephens, G. J., Silbert, L. J., & Hasson, U. (2010). Speaker-listener neural coupling underlies successful communication. *Proceedings of the National Academy of Sciences, 107*(32), 14425–14430.
Strogatz, S. (2003). *Sync: The emerging science of spontaneous order*. New York: Hyperion.
Strogatz, S. H. (1994). *Nonlinear dynamics and chaos: With applications to physics, biology, chemistry, and engineering*. Cambridge, MA: Perseus.
Tamborini, R. (2013). A model of intuitive morality and exemplars. In R. Tamborini (Ed.), *Media and the moral mind* (pp. 43–74). New York: Routledge.
Todorov, A. (2008). Evaluating faces on trustworthiness. *Annals of the New York Academy of Sciences, 1124*(1), 208–224.
Van Overwalle, F., & Baetens, K. (2009). Understanding others' actions and goals by mirror and mentalizing systems: a meta-analysis. *Neuroimage, 48*(3), 564–584.
Watson, J. B. (1925). *Behaviorism*. New York: Peoples Institute.
Weber, R. (2015a). Brain, mind, and media: Neuroscience meets media psychology [Introduction to the special issue]. *Journal of Media Psychology, 27*, 89–92.
Weber, R. (2015b). Biology and brains: Methodological innovations in communication science [Introduction to the special issue]. *Communication Methods and Measures, 9*(1), 1–4.
Weber, R., Eden, A., & Mathiak, K. (2011). *Seeing bad people punished makes us think alike: Social norm violations in television drama elicit cortical synchronization in viewers*. Boston, MA: Paper presented at the annual meeting of the International Communication Association.
Weber, R., Huskey, R., Mangus, J. M., Westcott-Baker, A., & Turner, B. (2015). Neural predictors of message effectiveness during counterarguing in antidrug campaigns. *Communication Monographs, 82*(1), 4–30.
Weber, R., Mangus, J. M., & Huskey, R. (2015). Brain imaging in communication research: A practical guide to understanding and evaluating fMRI studies. *Communication Methods and Measures, 9*(1–2), 5–29.
Weber, R., Ritterfeld, U., & Mathiak, K. (2006). Does playing violent video games induce aggression? Empirical evidence of a functional magnetic resonance imaging study. *Media Psychology, 8*(1), 39–60.
Weber, R., Sherry, J., & Mathiak, K. (2008). The neurophysiological perspective in mass communication research. Theoretical rationale, methods, and applications. In M. J. Beatty, J. C. McCroskey, & K. Floyd (Eds.), *Biological dimensions of communication: Perspectives, methods, and research* (pp. 41–71). Cresskill, NJ: Hampton Press.
Weber, R., Westcott-Baker, A., & Anderson, G. (2013). A multilevel analysis of anti-marijuana public service announcement effectiveness. *Communication Monographs, 80*(3), 302–330.
Zahn, R., de Olivera-Souza, R., & Moll, J. (2012). The neuroanatomical basis of moral cognition and emotion. In R. Ebstein, S. Shamay-Tsoory, & S. Chew (Eds.), *From DNA to social cognition* (pp. 123–138). Hoboken, NJ: Wiley-Blackwell.
Zillmann, D. (2006). Dramaturgy for emotions from fictional narration. In J. Bryant & P. Vorderer (Eds.), *Psychology of entertainment* (pp. 215–238). Mahwah, NJ: Erlbaum.

Date of acceptance: June 14, 2015
Published online: XX, 2015

René Weber (PhD, University of Technology Berlin; MD, University of Aachen) is professor in the Department of Communication at UC Santa Barbara and director of UCSB's Media Neuroscience Lab (http://medianeuroscience.org). His research investigates the cognitive responses to motivationally relevant narratives in traditional and new technology media.

René Weber
Department of Communication – Media Neuroscience Lab
University of California
4405 SSMS Building Room
Santa Barbara, CA 93106-4020
USA
Tel. +1 805 893-2156
Fax +1 805 893-7102
E-mail renew@comm.ucsb.edu

Allison L. Eden (PhD, Michigan State University) is an assistant professor of communication science at VU University Amsterdam. She identifies and tests the functional role of enjoyment in attention to and selection of media content, and the effects of media entertainment on moral attitudes and norms, well-being, and behavior.

Richard Huskey is a PhD candidate in the Department of Communication at UC Santa Barbara and the manager of UCSB's Media Neuroscience Lab. His research investigates mediated narratives with a focus on how individual differences and message features contribute to enjoyment, persuasion, and moral judgments.

Michael Mangus is a PhD candidate in the Department of Communication at UC Santa Barbara, where he works as a researcher and technology director for UCSB's Media Neuroscience Lab. His interests include group coordination and prosocial behavior in mediated contexts, evolutionary approaches to communication theory, and the philosophy of science.

Emily Falk (PhD, University of California Los Angeles) is an associate professor at the University of Pennsylvania's Annenberg School for Communication. Her Communication Neuroscience Lab studies social influence and how ideas spread (e.g., through social networks, through cultures), with particular focus on health communication.

