This chapter consists of three main sections: The first section discusses the basic ideas of the neurophysiological perspective in mass communication research and enumerate key distinctions. We further address the question of what communication science, and mass communication research in particular, would look like if it were to start fresh in today’s scientific milieu. We argue that the models and relationships discovered throughout the history of our field must continue to play an important role in our thinking, but those models must be updated to reflect current scientific thinking. In doing so, we follow the lead of communication scholars who have begun to explore biological and evolutionary explanations such as Cappella (1996), Beatty and McCroskey (2001), Greene (2000), Malamuth (1996), Shoemaker (1996), and others. Therefore, we argue for a paradigm shift to a new way of thinking about communication and mass communication that goes beyond the positivist nomothetic-deductive models of the past and embraces current scientific ontology and epistemology. Additionally, we argue that this new approach will help focus mass communication research and, for the first time, offers the possibility for theory that offers “why” explanation. By re-examining the theories in our field in this manner, communication scientists will be able to sort the wheat from the chaff.
of our historical legacy. Insight from a disciplinewide re-examination of our heritage will effectively focus our field on fewer and more powerful theories and variables.

The second section of this chapter provides an introduction to the specific concepts and methods within the neurophysiological perspective of mass communication research. We underline the central role of the human brain within the neurophysiological perspective and introduce to its relevant physiology and anatomy. We further explain how to study the human brain with state-of-the-art methodology that is specific to our perspective (i.e., we introduce functional neuroimaging and important analytical paradigms in brain imaging). Additionally, we briefly describe electrophysiological brain activity measurement and peripheral nervous system physiology measures as more commonly used methods. We further touch on another field that is believed to be neurophysiological in origin—the field of temperament research, which is particularly embraced by researchers who work in the communibiological paradigm. The second section concludes with a demonstration that research within the neurophysiological perspective does not necessarily require rather complicated brain imaging technology. Even with simple paper-and-pencil methods much can be accomplished within the neurophysiological perspective.

Finally, the third section demonstrates examples of past and ongoing research that are rooted within the neurophysiological perspective. Because our neurophysiological perspective is primarily focused on (but not limited to) mass media research the examples provided stem mainly from this research area.

Before we commence to explicate our neurophysiology perspective of mass communication research, we emphasize that one group of communication researchers has already begun a strong program of research in regard to biologically grounded explanations and predictions of communication behavior. Michael Beatty and James McCroskey, the editors of this book, and their students have introduced the communibiological paradigm (Beatty & McCroskey, 1998, 2001; Beatty, McCroskey, & Heisel, 1998; Horvath, 1998). This paradigm, in sharp contrast to Watson’s behaviorism and the dominant ontology of communication research, argues that human communication behavior can best be explained via inherited biological traits. Within the field of interpersonal communication these researchers argue that behaviors, such as communication apprehension for example, are not learned behaviors, but inherited tendencies. Although this is likely bad news for departments that teach “how to make a speech” classes, Beatty and McCroskey (2001) have shown that it is an explanation that accounts for more variance than prior environmentally determinist explanations.

Although the communibiological paradigm is closely aligned with our thinking, we think that it is narrower in focus than what we are proposing.
We agree with their key propositions that human behavior is neurally based and that an important component of that neural basis is inherited. They also suggest that it is not unreasonable to assume as much as 80% of communication behavior as inherited (Beatty & McCroskey, 2001); a position with which we would disagree. We argue that genetic influence, although important, is susceptible to environmental interference from conception through death. As such, following the dynamic systems tradition we see genetic influence as one of many factors predicting human communication behavior. Furthermore, the communibiological paradigm has chosen to focus on traits as principle determinants of behavior relegating social interaction and learning to a minor role. At this point, we are not ready to commit all the intellectual resources of our position to trait-based explanation and to discount environmental factors to the same degree that the communibioligists do. We acknowledge, however, that they may well be correct in the end and that the discussion must ultimately turn on results of high-quality studies. As such, we perceive our relationship to the communibiology researchers as highly familial and complementary, although, like siblings, we do not agree on everything.

WHAT IF COMMUNICATION SCIENCE WERE INVENTED TODAY?

The field of communication science was born at a time when positivism and environmental determinism were the two most substantial scientific approaches to understanding human behavior. Numerous histories of communication science argue that scientific research about the uses and effects of mass communication evolved from earlier investigations in psychology and sociology in the early to mid-20th century (Delia, 1987; Dennis & Wartella, 1996; Lowery & DeFleur, 1995; Rogers, 1997; Schramm, 1997; Sherry, 2003). In particular, the histories point out that the two main subfields of interpersonal and mass communication have both been powerfully influenced by social psychologists such as Hovland and his colleagues at Yale; whereas mass communication research has additionally been influenced by Yale-based social learning theory and social psychological approaches to violence research. Social constructionists contend that the branch of social psychology from which communication science evolved relies on an ontology modeled after the positivist philosophy that dominated leading thought in the hard sciences in the early 20th century. In the 1920s, psychologists such as John Watson (1925) attempted to replicate the causal modeling and variable analytic epistemology of physics in the study of humans. Thus, the nomothetic-deductive approach became and remains the standard philosophy of communication science (J. Anderson &
Baym, 2004). Receiving considerably less attention is the fact that Watson’s behaviorist philosophy, from which the research program at Yale took its primary inspiration, explicitly privileged environmental causes over biological ones (Sherry, 2004). In fact, his major treatise on psychology (Watson, 1925) begins with a long refutation of William James belief in “instincts” (what we now call in-born traits) and the assertion that all of human behavior can be explained in terms of environmental learning.

To 21st-century scientists, Watson’s position sounds naïve. Advances in biological science demonstrate that biology has a role in a number of human traits (Steinmetz, 1994). This begs the question of what communication science would look like if it was born during the current scientific intellectual milieu. Positivism has been replaced by variants of dynamic systems thinking in almost all the hard sciences. Medical and psychophysiological research has replaced environmental determinism with a philosophy that argues that nature and nurture interact to influence human behavior. The intellectual core of our field is a remnant of 20th-century scientific thought.

The Basic Idea

Simply, the model we advocate argues that any complete theory of human behavior in the mass communication context specify empirically observed relationships among variables, the neural substrates of those variables, and a sound (preferably evolutionary) explanation for those neural substrates. Most theories that are currently popular in mass communication research provide descriptive accounts of observed relationships among variables, sometimes with marginally explicated appeals to cognitive science or models of the mind (as opposed to models of brain function). For example, Berkowitz’s useful priming model of media effects posits an associated network of nodes in the mind, but does not explicate the biological substrates or structures of the nodes and networks.

The basic model we are advocating departs from the received version of mass communication theory in a number of important ways. First, it focuses on media use as primarily a biological function, rather than a social one. Biological function provides us with entry into explanatory mechanisms as opposed to explanatory description. Explanatory mechanism speaks to the characteristic processes of a system by which the system comes into existence and that only it and its kind can undergo (Bunge, 2004), whereas explanatory description simply provides a map for how variables may be related. Examples of explanatory mechanisms include: Descartes’ explanation of the rainbow in terms of the refraction of sunlight by the water droplets suspended in the air after a rainfall; Newton’s explanation of planetary orbits in terms of inertia and forces; and Marx and
Engels’ explanation of history by both economic change and class struggle (from Bunge, 2004). In the case of living systems, the most compelling mechanism to explain behavior is the drive toward equilibrium, or a steady state. Such an explanation is consistent with such mechanisms as discomfort avoidance (e.g., cognitive dissonance, uncertainty reduction), consistency theories (e.g., expectancy violation theory), or pleasure seeking (e.g., mood management).

Second, a focus on biology also situates human behavior along with complex animal behavioral systems as materially rooted actions. Thus, human behavior is united with all other biological systems science, rather than occupying a privileged place resulting from nonmaterial forces. Such a perspective invites learning theories, social system evolution, and communication as a function of our material animal needs rather than some vaguely defined “higher power.” Our mass communication behaviors and needs reflect a long process of evolution leaving us equipped for certain complex behaviors, but incapable of other complex behaviors. For example, Reeves and Nass (1996) argued that evolution has left us incapable of differentiating reality for mediated messages. Why? Evolution has not had time or pressure to select for neural mechanisms that differentiate reality from virtual. Instead, our brain’s initial (not final) reaction to mediated stimuli is to treat such stimuli as real.

This brings us to our third and final departure from traditional mass communication research—the primacy of neural processes in explanation. Following cognitive philosophers such as Dennet (2003), Pinker (1997), and Clark (2000), we contend that true understanding of human behavior lies with understanding of the organ that gives rise to these behaviors, the brain. Media selection and media effects occur first in the brain, either consciously or unconsciously. Media messages are produced in the brain to achieve perceived goals. Even the technology used to communicate is a function of the creativity and limitations of the human brain. This is clearly seen in both the original invention and the subsequent re-invention of technologies.

The “Engine Perspective”

In another paper (Sherry & Weber, 2006) we used the phenomenon “car driving” as an analogy for the position that we are advocating. Like communication, it is something that we both do and observe. Therefore, it is a process in which we have both endogenous and exogenous viewpoints. We detailed that interpersonal scholars typically work on the observable manifestations of the endogenous experience. How we make individual decisions about communication (e.g., message production) is analogous with the procedures involved in making a car move. The procedures are highly
personalized and individualized, although they work within a common set of constraints necessitated by the universal design of cars. Other types of communication research are analogous to the exogenous aspects of car driving. Organization communication scholars, in this analogy, study the patterns of traffic. How do people navigate the process of sharing the road? What role do rules (traffic laws) play? Cultural scholars inform our understanding of how driving differs in other countries (e.g., the British who drive on the “wrong” side of the road), by locality (e.g., the insanely fast drivers found on German autobahn), or subculture (e.g., taxi drivers). Communication economists study the decisions and trends in the auto industry (see Sherry & Weber, ibid.)

Although a great deal has been accomplished, we would like to add another level of understanding to our field; we would like to look under the hood of the car and better understand our field from an “engine perspective.” Historically, it has been impossible to look “under the hood” of communication—analogously, to take apart the engine, transmission, suspension, or other systems—and examine how they work. Yet these systems inform driving and traffic decisions. The decision to stay on a paved road or drive across a field is predicated on general observations about how the car typically handles rough terrain (the suspension). Whether one can pass another car is based on observed assumptions of the power of the car (engine torque in the middle ranges). Locations of freeway off ramps are predicated on the average driving range of vehicles (a ratio of gas consumption, transmission gearing, and fuel tank size to distance). One need not know about suspensions, torque, and transmission gearing to make a large number of accurate observations and theories about driving as detailed in Sherry and Weber (2006). However, we argue that an understanding of the underlying mechanics will both enrich our understanding/theory and correct some misperceptions that are based on the difficulty of observation and explanation without knowledge of underlying mechanics. In this sense, we believe that an “engine perspective” is meaningful to our field and to mass communication research in particular.

Note that in our analogy we also believe that no one area is superior to any other or can claim primacy. One cannot understand the totality of the driving phenomenon without understanding the mechanics, the individual driver, the patterns of traffic, the laws, and the industry. In fact, it is impossible to understand patterns of traffic without an understanding of the drivers and the laws that inform that pattern. Therefore, we argue that it is foolish for any one area to claim primacy or to separate itself from the entire system. Furthermore, the fact that these perspectives are informed by other disciplines (engineering, economics, city planning, etc.) does not minimize the importance of the focused endeavor to understand driving. To the extent that everyone is affected by driving, whether driver, passenger, or pedestrian that must navigate traffic, the importance of understand-
ing is self-evident and needs no apology. In the same way, the importance of studying communication, though informed by other disciplines, is self-evident and needs no apologia (e.g., Donsbach, 2005).

Key Distinctions

A neurophysiological perspective of mass communication research will help to align our research with the larger scientific project. As such, there are certain distinct requirements for research under this approach. Here, we detail those key distinctions.

**Emergence, Not Reduction.** The historical pull of behaviorism has been strong on communication science. Not only has it pulled us to environmental determinism (Sherry, 2002), it has drawn us deeply into the language of reductionism. Our theories speak of axiomatic statements, causal linkages, nomothetic-deductive hypothesizing. However, this is a place no longer inhabited by mainstream science. The Heisenberg Uncertainty Principle has led physics to a land of probabilities; an ontology of dynamic and contingent relationships. Heisenberg (1927) wrote: “In the sharp formulation of the law of causality—if we know the present exactly, we can calculate the future—it is not the conclusion that is wrong but the premise.” Biology is a science of systems; it speaks a language of structure and interdependent relationships. If psychology is the biological study of brains (Restak, 1995) then it too should be conceived of in systems language. We argue that communication science is the psychological study of interacting humans (interacting brains), by extension we have moved up a level in the system. Such an approach allows us to think comprehensively and interactionally.

Cognitive philosophers such as Daniel Dennett (2003) have showed us that human free will could emerge from evolutionary forces (a systems model). Complex emergent phenomena can result from simple mathematical formulae as in fractal geometry and chaos theory. At this point in communication science theory development, we no longer see an advantage to staying with reductionist thinking that was based on Newtonian physics. Instead, the reality of our animal nature and the complex interaction found at all levels of biological systems demands that we embrace a systems perspective to communication science (cf. Vorderer & Weber, 2003).

**Complement, Not Replacement.** Ultimately, we offer neither a new theory nor a new paradigm. We don’t seek to replace communication science with “programs of consilience” (Wilson, 1998) but to complement it with a new perspective. Over the past century, many fine scholars have done important work within the strictures of their time. We argue that a new time has dawned in communication science, offering us tools and per-
perspectives to which our forbearers did not have access. We welcome Celeste Michelle Condit’s (2006) “program of transilience” that recognizes both the biological and symbolic inputs to human behavior. With our new perspective and research program, we follow to some extent her conclusion in her excellent National Communication Association/Carroll C. Arnold Distinguished Lecture:

We can no longer afford the insularity of ignorance about the biological inputs to human beings. . . . A few of us may be up for the challenge of generating a new kind of human studies, which explores the places where biology interfaces with symbolics. . . . The ability to address these interfaces is enabled by new understandings of biology as interlocked circuits that change with environments rather than as simple deterministic objects. (Condit, 2006, p. 20).

**Explanation and Description.** Although communication researchers use the language of theory, our field does not have a theory that addresses the ultimate question of “why” we communicate the way that we do. Instead, our theories are collections of observed relationships between variables. For example, agenda setting notes a relationship between the media agenda and the issues that people believe are important without telling us why this happens. The elaboration likelihood model poses a process for consideration of persuasive messages, but is silent on the ultimate source of this process. The theory of reasoned action is descriptive of the constituent parts of attitudes and the relationship of attitudes to behavior, but says nothing about why attitudes might drive behavior. “Why explanations” tell us more than that the relationship exists; it grounds the relationship in materialist reality. As stated before, this is not a reductionist argument, but a grounding of emergent explanation in material reality. How do we account for the relationships that we see? These relationships occur because neural structures, neurochemicals (neurotransmitter), and hormones guide (not determine) behaviors. Why do we have these neural substrates? Because they evolved in response to environmental pressures over millions of years. Thus, an adequate explanation from our viewpoint specified the observed probabilistic relationships, the proximate neural substrates that are responsible for the relationships, and the distal evolutionary account of those neural substrates.

**The Role of Research in Theory Building.** Although we demand that our theory goes beyond the descriptive, we unashamedly advocate that, like all contemporary scientists, we engage in exploratory and descriptive research. We reject hypothetical-deductive model as a necessary and sole condition for the progress of science. We strongly advocate exploration: What happens if we do this or that? We want communication scientists to
act as biological bench scientists—look at your phenomenon, interact with it, see how it reacts to stimuli, understand it in relation to its context, play with it. The progress of science is enhanced by accidental observations made while playing with materials (Roberts, 1989). Galvani discovered the electric nature of animal tissue when a dead frog’s leg, hanging from a copper wire, accidentally touched an iron railing; German physicist Wilhelm Conrad Röntgen accidentally discovered X-rays when he was trying to capture cathode rays; we may not have penicillin if Sir Alexander Fleming didn’t have a drippy nose one day when he was working with bacteria. Even such everyday products as Velcro, super glue, and Post-It notes resulted from laboratory accidents. If we are not engaged in the process of descriptive research and respect its value in scientific progress, we will likely miss the forest for the trees. There is nothing wrong if a well-planned, creative, and methodologically sound research project is not grounded in current mass communication theory.

**The Foundational/Empirical Domain.** Thus, our approach is firmly rooted in the foundational/empirical domain explicated in J. Anderson and Baym’s (2004) excellent article on the domains of communication research. The authors define foundational ontology as, “the real is assumed to be constituted by material objects that display discernable boundaries and exist within relatively stable and observable patterns of relationships” (p. 590) Although there are social constructions, these constructions are a function of neural structures directly resulting from human adaptation to environment over evolutionary time. Thoughts, attitudes, and group dynamics, although not material in the same sense as found in hard sciences, are a function of material neural substrates. Consistent with the broader scientific world, we insist on empirical observation as the ultimate test of a theoretical proposition. Furthermore, we believe that there is a reality that can be accounted for. We take an objective axiology and a praxeology that demands to be based in observation.

The Pursuit of Fewer Variables and Theories; At first glance, it may seem that opening the field of communication to a new level of examination would lead to the addition of another theory and to an explosion of new variables. However, we hold that this is not necessarily the case. Instead, we believe that emergent material theories will decrease the number of theories and variables through parsing and combining variables under neural substrates. Drawing from S. Anderson and Baym’s (2004) article again, the current state of the communication discipline is characterized by too many theories that can be understood as an “overabundance of object value and an underabundance of use value. Discipline and scholar alike need theory for its intrinsic value as an emblem of our disciplinarity and scholarship” (J. Anderson & Baym, 2004, p. 607). We disclaim this idea of theory. For this reason, we don’t claim the status of a theory for the neu-
rophysiological perspective. What actually defines a theory? Does accumu-
lating isolated “subject–object–context” models or conceptual “individ-
ual–medium–situation” models and claiming that the models’ variables
stand in complex relationships constitutes a theory in the long run?

Essential functions of theory are explanation and prediction (Infante,
Rancer, Womack, 1993). Prediction describes how and which variables
should be related to each other and explanation helps to understand and
to interpret why these relationships result in good predictions. Thus, mod-
els which list variables and describe how they relate to each other must at
least result in good prediction, (i.e., effect sizes), in order to be of any use.
Good predictions are crucial. Unless findings suggested by a theory and
within a theory’s scope confirm predictions with considerable effect size
(not p value), explanations should be questioned regardless of their intu-
itve appeal.

**Complexity as a Matter of Course.** The claim of complexity neither
provides evidence for a reasonable theory nor provides excuses for inade-
quate predictions. In our view, the statement of complexity in whatever
form (e.g., dynamic, interdependence, transaction) should be the self-evi-
dent starting point of any communication research endeavor and not its
conclusion. A chemist, by analogy, would never find it worthwhile to assert
in a scientific publication that “protein folding,” for example, is complex
and settle with listing factors for this complexity. It is the researchers’ task
to explain and predict this complexity, at least in its details. Of course,
human beings are not proteins and are even more complex! Human beings
are not a “one cause—one effect” system like some physical systems.
Human beings are “multiple interactive causes—multiple interactive
effects” systems (cf. Condit, 2006). Those systems, however, may be com-
posed of multiple “one-cause—one effect” subsystems. We want to first
study and understand these subsystems and become enchanted by the fan-
tastic complexity that may arise rather than to simply make the self evi-
dent claim of theoretical complexity and throw up our hands in defeat.

**Interdisciplinary.** Because thinking in neurophysiological dimensions
is not yet common in communication research, and mass media research in
particular, it becomes important that we engage in true interdisciplinary sci-
entific work. Although we support collaborations with researchers in such
fields as education, psychology, or economics, this is not the interdiscipli-
nary collaboration we intend. Education, psychology, and economic
research and methodologies are not very different from what we do in com-
munication. By contrast, the knowledge base and the basic methodologies
of medical science, biology, genetics, endocrinology, and neuroscience are
quite different from what we do. The neurophysiological perspective
requires cooperation with faculty in medical schools and in radiology/MRI
departments in particular. This, in turn, requires that communication scholars must acquire a working education in mathematics, statistics, and in some of the natural science’s core theories and assumptions. Studying complex mass communication processes in this manner will require knowing and applying complex quantitative analysis (e.g. spectrum and time series analysis). This is important in order to understand neuroscientists, for example, and to effectively communicate with them. If we learn to think within the neurophysiological perspective, while not neglecting our scientific heritage, we enrich and expand the reach of our research field considerably.

Misunderstandings of Evolutionary Perspectives

Our perspective is partly rooted in evolutionary theory of human behavior. Therefore, there is a risk that some of our key distinctions might be misunderstood in the same way like evolutionary theory is frequently misinterpreted. Although scholars with closely held ideologies may choose to intentionally maintain certain misinterpretations, the parsimony and simplicity of evolutionary theory may serve as an explanation for unintentional misunderstandings. The most common of these misunderstandings are genetic determinism, evolutionary invariability, and the belief in presently optimal developed survival strategies.

Genetic determinism claims that human behavior is exclusively determined by genes, and that environmental influences play only a minor or no role. This, however, is simply wrong. Evolution provides us with mechanisms within which environmental influences may act. The long-term process of the evolution of neural mechanisms does not defeat the short-term influence of environment any more than the long-term influence of building a green house defeats the short-term process of painting that house white. The environment effects activation of adaptive mechanisms, but only over very long periods of time. Adaptive mechanisms delimit reactions to environmental stimuli, but do not absolutely determine reactions.

A logical consequent of the first misunderstanding—the assumption of evolutionary invariability—addresses the notion that our behavior is predetermined by evolution and, therefore, that there is no way to influence or change behavior. In addition to laboring under the same logical fallacy of the first assumption, this rather pessimistic interpretation limits human ability to play an active rather than a passive role in shaping our environment. Millennia of human progress in the arts and sciences contradict this conclusion. Furthermore, if we understand evolutionary concepts as a contribution to provide knowledge about why we behave like we behave, we can actively use this knowledge to change our behavior.

Finally, people often confuse time involved in environmental change with the time of evolutionary change. The systems theoretical idea of adap-
tation in evolutionary processes requires time—a lot of time. Our present adaptive mechanisms are a result of environmental factors thousands of years ago. We are currently a “product” of our past, but not optimally adapted. Our greed for food rich in fat or our preference for violence (as a survival-relevant theme) in entertaining media may serve as examples for a current suboptimal adaptation to environmental changes that occurred too recently for evolution to have effected. Furthermore, adaptation is always a function of its costs. It would certainly be a useful and directly survival relevant adaptive mechanism to avoid being exposed to injury due to traffic in our modern world. This, however, would “cost” us the limitation of real social interactions with friends at other places for example. Humans evaluate the cost–value ratio of behavior relative to environmental cues, not evolutionary ones. In fact, human experiments in evolutionary change resulted in one of the most tragic episodes in American and German history—the eugenics movement. These misunderstandings are often responsible for the opposition to evolutionary-based concepts. At times, researchers oversimplify evolutionary processes for a variety of informed and uniformed purposes, adding to the confusion. We can only hypothesize about the relevant environmental influences that required the activation (or non-activation) of an adaptive mechanism thousands of years ago and how our current survival strategies are well developed in the long run.

A final misunderstanding of evolutionary pressures is that they favor an optimal human type (e.g., the alpha male or Übermensch). In fact, evolutionary theory favors individual difference on almost every trait an organism may have. Differences in a species create the possibility of adaptation to a changing environment (e.g., an ice age). Take, as an example, regional differences in eumelanin levels in human skin resulting in a wide range of skin color from very dark to very light. Eumelanin (a type of melanin) protects DNA from damage and subsequent melanoma; one of the more deadly cancers. A radical loss of Ultraviolet (UV) protection in the earth’s atmosphere could lead to a melanoma plague among humans from northern climates who lack eumelanin. However, the human species can survive because the range of difference in skin color provides for humans who are resistant to increase UV rays. If there were not a large range of differences in eumelanin levels, the entire human population could be wiped out by one environmental change.

Our neurophysiology perspective neither supports genetic determinism in any way nor does it posit evolutionary invariability or cultivate the belief in presently optimal developed survival strategies. In our view, behavior is neither simply determined by genes, nor has anybody of us optimally adapted to our current environment. We believe that we do have various means to actively change our behavior provided we know the true reasons for our behavior. Genetic difference, spawned by evolution, simply provides the playground in which the environment can play on our behaviors.
CONCEPTS AND METHODS WITHIN THE NEUROPHYSIOLOGICAL PERSPECTIVE

The neurophysiological perspective is rooted in the neurosciences and in order to do research from a neurophysiological perspective communication researchers need a basic understanding of how neuroscientists think and understand their work.

The neurosciences include the study of brain development, sensation and perception, learning and memory, movement, sleep, stress, aging, and neurological, and psychiatric disorders. The neurosciences also cover research with natural sciences methods on molecules, cells, and genes involved in nervous system functioning (Society for Neuroscience, 2005). The notation “neuroscience,” however, is too general for our research perspective. “Cognitive neuroscience” (cf. Gazzaniga, 1984) supplemented by neural representations of human emotions is the subarea that has the highest relevance for the neurophysiological perspective in mass communication research. Cognitive neuroscientists study intensively language, semantic memory, visual recognition, working memory, episodic memory, and attention (cf. Cabeza & Kingstone, 2001). Compared with these classical cognitive domains, the neural correlates of emotions are still less understood and studied. It indeed appears more difficult to address affective and social processes since the underlying mechanisms are more complex and the involved neural structures are more difficult to access (e.g., Merboldt, Franson, Bruhn, & Frahm, 2001). However, research efforts in this area are intensifying (Damasio, 2003; Lane & Nadel, 2002) as documented by the emergence of two new journals in this area in 2006 (Social Neuroscience, Social Cognitive and Affective Neuroscience). To date, numerous research findings revealed brain regions that respond to specific types of emotions; such as happiness, fear, anger, sadness, and disgust (see the excellent meta-analysis of Phan, Wager, Taylor, & Liberzon, 2001). The importance of a better understanding of the neurological foundations of human emotions for various mass media phenomena should be obvious to mass media researchers (e.g. Zillmann’s research program on media entertainment, see Bryant & Miron, 2003; see also Andersen & Guerrero, 1997).

The Basics of Brain Function, Brain Physiology, and Brain Anatomy

Thinking within the neurophysiological perspective requires a basic knowledge of brain anatomy, brain physiology, and brain function. Brodmann (1909), an early south German neurologist, suggested that we have to understand the human brain as a distributed network of a large number of
suborgans that dynamically interact in order to complete a task. Localizing distinct mental activities to isolated cortical zones is, thus, a restricted view. The human brain should be modeled as a distributed network of highly interconnected neurons that dynamically process information. Therefore, the study and understanding of functional localization, brain dynamics, and brain connectivity during tasks relevant for media experiences (e.g., watching a movie or playing a video game) define the core elements of our neurophysiological perspective.

The “hardware” of our soul is composed of neurons (nervous cells) embedded in a matrix of so called “glial cells.” The main principle of information processing in our brains is based on neurons that are able to create electrical action potentials that are transmitted rapidly over their entire cell body and its extension—the so-called “axon.” The axons can connect with a high number of synapses to other neurons. These synaptic connections, however, are chemical in nature. Therefore, the synaptic connections are slower (in the area of milliseconds) but allow for modulation and plasticity of connections and a counterbalance of excitatory and inhibitory signals. This hybrid system in our brain enables us to simultaneously process information in distributed subsystems and, at the same time, ensures high cognitive plasticity to adapt flexibly to changing environments. Under most natural conditions, our brain with its complex and distributed information-processing capabilities is still outperforming artificial systems.

Anatomically, the human brain is characterized by a folded outside layer—the cerebral cortex. All higher cognitive functions are linked to activity in this structure which is organized in a modular fashion. For instance, visual recognition flows through a hierarchy of cortical areas that represent more and more complex features. Primary areas are sensitive to brightness changes and edges in small receptive fields. Higher order areas are responsive to the perception of faces in the entire visual field. This “principle of compartmentalization” is reflected by different cell structures of these areas and a rather consistent localization within the brain. Moreover, these different cortical patches are connected in a consistent way with each other and with other neuronal structures such as the midbrain and the brainstem, the cerebellum and sensory organs. Since all higher cognitive functions can be localized in the cerebral cortex (including all limbic/emotional structures) and many brain-imaging technologies—including functional neuroimaging (see Fig. 4.1)—target cortical structures, we concentrate in the following on this part of the human brain.

The cortex is separable into a left and a right hemisphere; each structured by almost symmetric gyri and sulci. Gyri can be imagined as ridges and sulci as fissures on the cerebral cortex. A gyrus is generally surrounded by one or more sulci. The gross anatomical brain structure allows distinguishing frontal, parietal, occipital, and temporal lobes in each hemisphere.
The central sulcus separates the frontal lobe from the parietal lobe. The sylvian fissure (also called lateral sulcus)—extending almost horizontally from front to back—separates the upper frontal and parietal lobes from the lower temporal lobe. The occipital lobe is located most back (posterior or caudal in the neuron anatomic nomenclature).

Best studied of all higher cognitive functions seems to be the visual system. The primary visual cortex is located in the calcarine sulcus between the left and the right occipital lobes. The most information flows from the eye’s retina via midbrain structures into the primary auditory cortex and from there to higher order centers. Interestingly, an exception to this flow of information seems to be the direct connections into the brain’s emotional system. These “short-cuts”—bypassing visual and auditory cortices—directly influence affective processing in limbic (emotional) areas and particularly in the amygdala. This might explain why subliminal visual stimuli in mass media messages cannot be consciously perceived because of their short presentation time (less than 50 ...) but are able to affect emotions and emotional learning (Morris, Ohman, & Dolan, 1998).

Other well-studied and important sensory systems are the auditory and the tactile systems. Both modalities measure mechanical effects—either sound waves in the ear or mechanical changes in the skin. The primary and secondary auditory cortices are located inside the temporal lobe hidden in the sylvian fissure. For humans (and for communication research), language processing is of special relevance and provides a clear example of hemispheric differences. In most humans, the left hemisphere is more proficient in processing speech sounds. Moreover, the primary lan-
guage areas (Wernicke’s and Broca’s areas) are localized inside the left hemisphere. The sense of touch is mediated by the somatosensory cortex. This area is localized in the post-central gyrus (i.e., inside the parietal lobe), directly behind the central sulcus. On the other side of the central sulcus—in the frontal lobe—the motor cortex can be found. From here, cortical neurons send axons to the spinal cord to control muscle movements. Similar to the sensory system a hierarchy of adjacent areas provide more and more abstract representation of movements, including areas like the supplemental motor area (SMA), which is located in front of the motor cortices and close to the midline of the brain. This area is significant for planning and anticipation of actions (including those that are presented through mass media).

Further rostral (toward the front of the head) prefrontal areas are considered central for the highest cognitive functions such as working memory and abstract thinking. From the supplemental motor area toward the lower brain areas is a brain region that is particularly interesting and important for the neurophysiological research perspective—the anterior cingulate cortex (ACC). This structure reaches into the lower mid-temporal or limbic areas, which mostly represent affective processing. Neuroscientists have shown that the dorsal ACC is primarily related to rational cognition whereas the rostral is more related to emotional cognition and, therefore, can be considered as an interface between cognitive and affective processing (Bush, Luu, & Posner, 2000). As such, the ACC is vital to decision making, error monitoring, reward anticipation, empathy, and plays a central role in a variety of human emotions.

The limbic system or emotional brain is not clearly defined anatomically. But some areas can be pragmatically considered as its central elements. These are lower parts of the prefrontal cortex—the orbitofrontal cortex—and lower medial parts of the temporal lobe such as the amygdala and the entorhinal cortex. The latter structure is directly interwoven with the olfactory system. As such smell is thought to directly affect the emotional system (Otto, Cousens, & Herzog, 2000). The amygdala—an almond shaped group of cortical and subcortical neurons—is considered most important for emotion processing, especially if a fast response to fear eliciting stimuli is required (cf. Aggleton & Young, 2000; Phan et al., 2002). More complex emotional and social behaviors seem to depend on functions of the orbitofrontal cortex. It has been shown that lesions in this area may result in one’s incapacity to behave in accordance with social rules (Bechara, Damasio, & Damasio, 2000).

Finally, the human brain’s motivation and reward system (also called the brain’s pleasure or hedonism center) is certainly worth mentioning in connection with the neurophysiological perspective in mass communication research, particularly when it comes to entertaining mass media formats. The motivational and reward system has been specifically linked to
the mesolimbic pathway, which connects the ventral tegmental area in the midbrain to the ventral striatum, including the nucleus accumbens in the brain’s limbic system. The mesolimbic pathway is one of four major pathways where the neurotransmitter dopamine has been found. Dopamine has been frequently discussed in connection with neurobiological theories of addiction, incentive motivation, and reinforcement. A review of the neurobehavioral mechanisms of reward and motivation with more detailed descriptions of the anatomical structures can be found in Robbins and Everitt (1996).

Taken all aspects together, the human brain is a complex and versatile biological structure. Although it is difficult to distinguish relevant from less-relevant brain regions in a networked structure, it is helpful for our research perspective to focus initially on brain regions that are most relevant for mass communication research. We believe that for basic research and basic understanding of mass communication phenomena, the link and interchange between cognitive and (conscious or unconscious) emotional processes are crucial. Therefore, we suggest that brain regions like the anterior cingulate cortex, the amygdala, the pre- and orbitofrontal cortex as well as structures that are involved in the motivational and reward system of the human brain are of special interest for the neurophysiological perspective in mass communication research.

Functional Neuroimaging—PET and fMRI

Functional neuroimaging through positron emission tomography (PET) and functional magnetic resonance imaging (fMRI) is the primary and most advanced methodological approach of researchers within the neurophysiological perspective. Simplified, PET and fMRI define a technology in which metabolic and blood property changes (hemodynamic responses) are used to measure brain activity. Both methods measure brain activity indirectly by taking advantage of the fact that the localized hemodynamic responses are closely correlated with neural activity in those areas (Logothetis & Pfeuffer, 2004). The measurements are therefore based on the assumption that (a) stimuli lead to (b) neural activity which, in turn, lead to (c) changes in metabolic properties.

After Step 3, PET and fMRI differ. PET uses radioactively labeled water (H$_2$O$^{15}$) to detect localized blood flow. This methodology is invasive, physically limited in its spatial resolution, and more expensive than fMRI. Therefore, application in neurophysiological-inspired mass communication

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1For more details on brain physiology and brain anatomy in general, we recommend the excellent book Principles of Neural Science by Eric Kandel (2006) as a primary source to learn about brain physiology and function.
research is and will be sparse. A more recent alternative that is available in most medical research centers is fMRI, which utilizes the “blood oxygenation-level-dependent” (BOLD) effect that is an intrinsic contrast mechanism and does not require the injection of potential harmful substances. The effect is based on the observation that increases in blood flow bring more oxygenated hemoglobin into locally active brain areas (cf. Buckner & Logan, 2001). If adequately applied (no intracorporal metals or other contraindications), no adverse side effects have to be expected apart from the very high noise level of the scanning unit and unpleasantly narrow space. As such, this neuroimaging methodology is very suitable for neurophysiological motivated mass communication research.

An excellent and accessible overview of PET and fMRI is provided by Buckner and Logan (2001). A very good online resource for fMRI can be found at http://www.cis.rit.edu/htbooks/mri/inside.htm. At http://www.cfn.upenn.edu/virtscan.htm one can even participate in a virtual tour to explore fMRI scanning. D. Bryant Anderson, et al. (2006) described potential pitfalls when media scholars are interested in using functional neuroimaging to studying media processes and effects. We strongly recommend reading this chapter before becoming involved in a neurophysiological grounded brain imaging study.

**Analytical Paradigms In Brain Imaging**

We can differentiate between two distinct analytical strategies in order to understand neuroscientific methodology within the neurophysiological perspective on a basic level. The more static strategy attempts to reveal the functional neuroanatomy of contrasting brain activities over possibly all volume elements of the entire brain; the corresponding analytical procedure was termed statistical parametric mapping (SPM). A more dynamic approach is called the region-of-interest (ROI) approach. Within this approach, ROIs have a static localization but researchers are more concerned with the dynamics and the connectivity of those regions than in their isolated activity pattern.

SPM explores brain areas that, based on a stimulus, show a statistically significant activation or deactivation. The brain is segmented into about 30,000 volume elements or voxels (volume pixels = voxels). The image intensity of each voxel after convolution with an expected hemodynamic response serves as a dependent variable in a general linear model. A cognitive task (e.g., watching aggressive faces vs. nonaggressive faces) is used as an independent variable. After correction for multiple testing, significant models indicate activated or deactivated brain areas.

ROI analysis usually relies on theoretically or empirically derived a priori assumptions about the involved brain structures. Relevant ROIs are usu-
ally localized in anatomical structures. Tests of hypotheses are mainly based on time-series methods.

Recently, an increasing number of neuroscience studies have departed from paradigms with simple stimulus–response designs. In particular, this applies to the few neuroscientific studies in the area of media perception and media effects (e.g., Bartels & Zeki, 2004, 2005; Hasson, Nir, Levy, Fuhrmann, & Malach, 2004; Weber, Ritterfeld, & Mathiak, 2006). In these studies, neural activity was tracked over time in response to typical media images. For example, Weber et al., as well as Mathiak and Weber (2006) examined fMRI scans taken every 2.23 seconds while research participants played a violent first-person shooter game. It was found that during violent playing phases, brain activity patterns occurred that are characteristic of aggressive cognition and affect. Hasson et al. (2004) introduced a cross-subject correlation analysis to describe brain structures that are dependent and independent of movie stimuli. Bartels and Zeki (2004, 2005) applied a ‘blind source analysis strategy’ (independent component analysis) to describe the involved structures during free viewing of a movie. They found similar networks as in standard paradigms of vision research, but the link with specific visual features was complicated. Those approaches show that it is possible in neuroimaging studies to investigate complex stimulus material such as movies, video games, and other media types with new analytical paradigms in brain imaging.

Electrophysiological Measurement

Noninvasive electrophysiological methods, such as electroencephalography (EEG) and magnetoencephalography (MEG), have also been used to study neurophysiological communication phenomena in humans. Krugman (1971) was probably one of the pioneers to use EEG in a media context. Since then, comparably few researchers have followed up this line of research (e.g., Reeves, Lang, Thorson, & Rothschild, 1989; Reeves, et al., 1985). A more recent example of electrophysiological measurement in the interpersonal/communicobiological context can be found in Heisel & Beatty (2006).

In EEG, electrical currents resulting from communicating brain cells in rather roughly localized brain regions are measured (cf. Evans & Abarbanel, 1999). Similarly, however less distorted, MEG measures faint magnetic fields that emanate from the head as a result of electric brain activity (Del Gratta, Pizzella, Tecchio, & Romani, 2001). EEG and MEG measurements provide the highest temporal resolution of neuronal activity (down to the millisecond) which may be important for some attention-related research questions in mass communication research. However, the spatial resolution of EEG and MEG measurements cannot yet compete with fMRI.
Innovative approaches in modern brain imaging combine fMRI and MEG technology to optimize both the temporal and spatial resolution of brain activity images (e.g., Dale et al., 1997; for a review see Mathiak & Fallgatter, 2005).

**Peripheral Nervous System Physiology Measures**

The most common measures of the peripheral nervous system are heart rate (HR) and skin conductance levels or skin conductance responses. Heart rate and blood volume are frequently measured using a photoplethysmograph, which uses laser light to monitor pressure changes on the skin resulting from pulse activity. Skin conductance is predominantly measured in one of two ways: endosomatic measures and exosomatic measures. Endosomatic measurement is used to detect changes in the potential of the electrical signal naturally given off by skin tissue. In exosomatic measurement, a small DC current is sent across the skin from one electrode to another. Changes in electronic resistance to the current are recorded. These measures are considered valid and reliable indicators for arousal and attention, but provide only little insights in neurophysiological concepts. These comparably simple and inexpensive measures, however, are important to monitor research participants and provide control variables in neurophysiological research designs or may be used to explore basic assumptions before investing money in expensive brain imaging studies. Ravaja (2004) provided an excellent summary of these measures and other physiological measures for media research.

**Temperament and Paper-and-Pencil Measures**

Recently, a great deal of attention has been directed at differences that are present from birth and are believed to be neurophysiological in origin. These differences are commonly referred to as temperament. Despite, or perhaps because of, the large amount of attention that temperament has received, researchers have not been able to reach a consensus definition (Bates, 1989). A review of the literature suggests that there are about as many conceptualizations of temperament as there are major researchers in the field (cf. Bates & Wach, 1994; Buss, 1995; Buss & Plomin, 1984). Bates (1989) advanced the most commonly cited definition of temperament, stating that temperament “consists of biologically rooted individual differences in behavior tendencies that are present early in life and are relatively stable across various kinds of situations and over the course of time” (p. 4). According to Bates, temperament is conceptualized at three levels: (a) temperament is expressed behaviorally; (b) temperament is related to indi-
individual differences in neurological function and anatomy; and (c) temperament is heritable.

Although there have been literally thousands of behavioral studies of temperament (Bates, 1989), researchers are still not fully clear about its genetic and neurophysiological etiology. It seems that the behavioral manifestations of temperament are rooted in the functioning of the limbic system brain structures including, but not limited to, the septo-hippocampal system, amygdala, hypothalamus, and brain stem areas (Gray, 1991; Rothbart, Derryberry, & Posner, 1994; Steinmetz, 1994).

Communication researchers are beginning to embrace temperament as an area of study. Prominent among these researchers are those who work in the communibiology paradigm. Studies have examined the relationship between temperament and interpersonal variables such as communication apprehension (Beatty & McCroskey, 1998) and communicator style (Horvath, 1998). In mass communication, Sherry (2001) found that temperament is a stronger predictor of television use motivations from uses and gratifications models than is personality.

Although the powerful imaging and physiological measures as described here are most often associated with neurophysiological research, a great deal of valuable research has been conducted with simple paper-and-pencil measures. Temperament measures have been greatly refined over the past 40 years and powerful valid and reliable measures exist for almost any age group under study (Windle, 1992; Windle & Lerner, 1986). Those measures come from a broad variety of methodological backgrounds, the best of which are derived from empirical observation of infants, children, and adult. Such methods reflect the essential ingredient of temperament; that it is expressed behaviorally. Prominent among these measures are those derived from Thomas and Chess’ (1977) New York Longitudinal Study. These measures began with careful qualitative observation of infants and then tracked the infants through adulthood. The observed differences among individual infant’s behaviors provide the explanation for the temperament traits. Over time, a number of paper-and-pencil measures were designed and tested using the Thomas and Chess explanation of temperament. The best known of these is the Dimensions of Temperament Scale (DOTS) and Dimensions of Temperament Scale-Revised (DOTS-R). The DOTS-R comes in three varieties: adult self-administration, child self-administration, and child adult-administration. Other scales include those from the work of Rothbart and Derryberry (Rothbart, et al., 1994), or Strelau (1983; see Bates, 1989).

There are also a number of scales available that purport to be temperament scales, but are actually personality scales. These are fairly easy to spot because they contain a large number of items that ask about feelings rather than behaviors. For example, H. Eyesenck has begun to refer to his Big Three personality factors as temperament traits. These items were created
by factor-analyzing responses to large lists of adjectives. Because newborns cannot fill out surveys, studies based on these traits cannot substantiate the claim of temperament to be present from birth. Furthermore, the Big Three are “super traits” or collections of a large number of subtraits. For example, the “super trait” psychoticism is made up of measures of impulsiveness, aggressiveness, poor memory, and creativity. This is likely the reason that reliabilities for psychoticism tend to be very low.

There is also a broad array of cognitive skill traits, each of which has a variety of paper-and-pencil measures. For example, three-dimensional rotation is commonly measured with either the Vandenberg and Kuse Mental Rotation Test or the Watson and Stefanatos’ Viewfinding Test. The Vandenberg and Kuse test presents a set of connected cubes and asks the respondent to identify identical versions that have been rotated on the x or y axis. The Viewfinding Test shows a doll from a variety of perspectives on a horizontal axis; respondents are asked to identify the location that the camera had to be in to generate the picture. Both tests have excellent reliability. Other cognitive tests include a variety of verbal fluency measures, object location memory, visual memory, word association, color mapping, induction, spatial scanning, visualization, and many others.

EXAMPLES OF RESEARCH WITHIN THE NEUROPHYSIOLOGICAL PERSPECTIVE

As stated before, we are not the first ones who propose media-related research programs that are grounded in biologically explanations and predictions. We mentioned earlier in this chapter the studies of various excellent researchers that share with us similar ideas and research interests. Because our perspective is strongly rooted in the cognitive neurosciences, however, and based on findings as a result of state-of-the-art brain-imaging technologies, we to “look beyond our own nose” and provide an overview about media-related studies with background in the cognitive neurosciences. Thereafter, we conclude this chapter by presenting distinct examples of research questions and ongoing studies that are inspired by mass media scholars and rooted in the neurophysiological perspective of mass communication research.

As mentioned earlier, neuroscientists have recently begun to diverge from traditional stimuli in their research (brain imaging) designs—stimuli are presently becoming more complex and more natural. One reason for this development is that ultimately neuroscientists are eager to understand brain-function under conditions that are as natural as possible. Because we do not have mobile and small brain imaging devices yet, media formats such as a movie or virtual reality in a video game provide an excellent tool
to expose research participants with complex, nonlinear, and seminatural stimuli within an MRI scanner (see Spiers & Maguire, 2006a, 2006b). Bartels and Zeki (2004, 2005), for example, acquired fMRI data while volunteers were just watching a movie and labeled this approach “free viewing condition.” They found that the perceptual experience while watching a movie varies linearly with the MRI signal in specific identifiable visual cortex areas. Based on their findings, they reasoned that the compartmentalization of the cerebral cortex with specialization to distinct perceptual features remains preserved under seminatural conditions. For the first time it was shown that the free viewing condition is a useful research design in understanding brain functions.

Parallel to Bartels and Zeki’s work, the group of Malach in Tel Aviv used the movie The Good, the Bad, and the Ugly by Sergio Leone as stimulus for collecting fMRI brain data (Golland et al., 2006; Hasson, et al., 2004); and for measuring intracranial electrophysiological responses (Nir et al., 2005). The researchers demonstrated that the movie stimulus was able to explain fluctuations of brain activity to a high degree. Golland et al. (2006) even found that with the movie stimulus it was possible to differentiate “extrinsic networks,” which reflect external events, from intrinsic networks whose activity is disassociated from the external media stimulation and might reflect (not yet fully understood) internal processes while watching a movie.

While neuroscientists discover various media formats as useful stimuli in their research designs to better understand brain function under natural conditions, communication scholars as well have begun to diverge from traditional research paths. This development was recently echoed in a special issue of the journal Media Psychology. In the issue’s introduction, a distinct group of specialists in developmental psychology, pediatrics, neurology, and mass communication argue for studying media processes and effects from a neurophysiological perspective by using brain imaging methodology (D. Anderson, Bryant et al., 2006).

A few interdisciplinary research projects in which media scholars and neuroscientists converge and primarily study media processes and effects by means of state-of-the-art brain imaging technology have emerged. D. Anderson, Fite, Petrovich, and Hirsch (2006) compared normal video sequences with random sequences of shots. Whereas both conditions led to wide-distributed neuronal activity, occipital areas of the cingulate cortex specifically reflected the meaningful combination of video segments. It seems that different kind of narratives correspond to different processing hierarchies in distinct regions of our brains, which may well explain in the future why certain narratives are more enjoyable to most viewers.

Murray et al. (2006) studied the brain activity patterns of eight children as they viewed violent and non-violent TV movie scenes. The researchers found the same brain regions activated as Anderson et al.
Moreover, virtual violence was reflected by networks involved in emotion processing and affective regulation (e.g. the right amygdala) as well as in episodic memory encoding and motor programming. Murray et al. (2006) concluded that this activity pattern may explain why frequent viewers of TV violence are more likely to develop and store aggressive scripts. Likewise, Mathews et al. (2005) investigated the brain activity patterns of 71 adolescents who differed in both media violence exposure and the extent to which disruptive behavior disorders with aggressive features was diagnosed. The study revealed a clear reduction of frontal lobe activation in aggressive participants compared with a control group. The researchers suggest that media violence exposure may be associated with alterations in brain functioning.

Those studies are excellent examples of research within the neurophysiological perspective of mass communication. Researchers—still predominantly neuroscientists and psychologists—have begun specifying empirically observed relationships among media-related variables and studying the neural substrates of those variables. Still missing, however, are sound explanations and interpretations of those neural substrates. In the future, it will become important to more rigorously investigate the neural correlates of mass media forms and content and to better explain why those neural correlates have evolved. More mass communication scholars should become involved in this line of research and inspire neurophysiological research designs with their specific perspectives and methodologies. Therefore, we conclude this chapter by presenting three areas in which research within the neurophysiological perspectives of mass communication is presently ongoing and primarily inspired by mass media scholars who teamed up with neuroscientists.

**Neurophysiology of Movie Entertainment**

Media entertainment experiences are ubiquitous in everyday life. We have all experienced various forms of media entertainment and can easily talk about them. *It’s all entertainment—sure. But what exactly is entertainment?* is both the title of Vorderer’s (2001) frequently cited paper on media entertainment experiences and the most controversial and discussed question in media entertainment research. Current research and theorizing is primarily focused on ontogenetic (developmental) and situational explanations. Phylogenetic (species-specific) reasoning, that is, a neurophysiological perspective, has much to offer, but is still extremely rare in this research field (see, Suckfuell, 2005).

Currently, an interdisciplinary research project is underway with collaborators from the United States and Germany. The project uses fMRI technology to study the neurophysiology of entertainment by analyzing
the dynamics and connectivity of the brain’s emotional circuits (see Weber, 2006). The research project has two basic goals: First, to define and explain the neurophysiological effects of entertaining media content, specifically dramatic narratives in TV drama shows, on the human brain’s emotional system, and second to better understand the dynamics and connectivity of the brain’s emotional circuits under seminaturalistic, mediated conditions.

**Neurophysiology of Emotional Responses to Video Game Playing**

Another ongoing project that is grounded in the neurophysiological perspective of mass communication research concentrates on emotional responses to video game playing. A research consortium of six European universities funded by the European Commission studies the “fun of gaming” and develops neurophysiological-grounded measures for the “human experience of media enjoyment” (Mathiak & Weber, 2006). This study continues prior work on video game playing in which fMRI scans were taken during video game play (See, Weber et al., 2006). Through a neurophysiological perspective Weber et al. (ibid.) demonstrated a specific neurological mechanism that is activated when playing a first-person shooter game. This mechanism helps to better understand a potential link between playing certain types of violent video games and aggressive cognitions and affects.

Nagamitsu, Nagano, Yanashita, Y., Takashimo, and Matsuishi (2006) as well as Matsuda and Hiraki (2006), also studied effects of video game playing on neural processes. In contrast to the aforementioned researchers, however, they applied functional near-infrared spectroscopy, which is by far more easily applicable even in children, but does not allow for a good spatial resolution, particularly in the emotional circuitries of the human brain.

**Cognitive Skill Studies**

Data collection was recently completed on a study showing that cognitive skill explains as much or more variance in game success and liking between male and female adults as does gender alone (Sherry, Rosaen, Bowman, & Huh, 2006). Prior survey research suggested that there were clear differences between the types of games that males and females enjoy (Lucas & Sherry, 2004). These patterns were consistent with well-established gender differences in cognitive skills. Therefore, the researchers measured subjects’ cognitive skills in four game-relevant domains as well as their scores on four games chosen to closely match the cognitive skill. Cognitive skill and
game score were highly correlated, even after controlling for gender and prior game play. The study suggests that game play may be a function of nature (native cognitive skills) as well as nurture (game play socialization).

**CONCLUSION**

The neurophysiological perspective of mass communication research provides communication scholars with the opportunity to tie the ephemeral variables they have historically studied to material neural substrates and offer a convincing “why” explanation for communication phenomena. To do so will require that communication scholars connect with scholars from distinctly different disciplines and internalize state-of-the-science ontology and epistemology. We see no reason why communication research cannot be more scientific in this sense and call on our fellow scholars to investigate this new way of understanding communication.

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