Consumer Neuroscience

Hilke Plassmann
Marketing Area, INSEAD
Fontainebleau
France

Carolyn Yoon
Ross School of Business, University of Michigan
Ann Arbor, MI
USA

Fred M. Feinberg
Ross School of Business, University of Michigan
Ann Arbor, MI
USA

Baba Shiv
Graduate School of Business, Stanford University
Stanford, CA
USA

Keywords: consumer neuroscience, decision neuroscience, neuromarketing, marketing,


Contact information:
Carolyn Yoon
Ross School of Business
University of Michigan
701 Tappan Street, R5347
Ann Arbor, MI 48109-1234
e-mail: yoonc@umich.edu
phone: (734) 764-6355
fax: (734) 936-8716
Abstract

Consumer Neuroscience is a new, burgeoning field comprising academic research at the intersection of neuroscience proper, psychology, economics, decision theory, and marketing. Its main goal is to shed light on basic questions of consumer behavior by coupling traditional experimental and statistical research techniques with those developed by neuroscientists. This article presents an overview of the basic precepts of consumer neuroscience, some of its important early findings, and suggests how the field might develop over the next decade. Particular attention is paid to the use of functional magnetic resonance imaging (fMRI) as part of a multi-methodology approach to resolving fundamental behavioral research questions. Specifically, the authors address three main topics: how neuroscience offers consumer researchers a powerful suite of methodological tools; ways in which neuroscience represents a source of theoretical insights in experimental behavioral research; and how consumer researchers, economists, and decision theorists can actively spur developments in the core discipline of neuroscience. The article concludes with a series of suggestions for future research directions in the discipline.
BACKGROUND

The past decade has seen tremendous progress in academic research at the nexus of neuroscience, psychology, business, and economics. Even five years prior to that, fewer than a half-dozen papers appeared with keywords “neuroscience” and “decision-making”. Presently, across these parent disciplines, the yearly count stands around 200, and is doubtless accelerating. The twin births of Neuroeconomics and Decision Neuroscience has generated wide-ranging, ongoing debates on whether these hybrid fields benefit their parent disciplines and, within them, what forms these benefits might take (Shiv et al., 2005). Their joint aim is to adapt tools and concepts from neuroscience – combined with theories, formal models, rich empirical data, and tested experimental designs from the decision sciences – to develop a neuropsychologically sound theory of how humans make decisions, one that can be applied to both the natural and social sciences.

A group of consumer psychologists is now dedicated to investigating consumer research questions with methodological and conceptual approaches from neuroscience. This emergent field, Consumer Neuroscience, is described in detail in this chapter. A primary, and critical, distinction is between “consumer neuroscience”, which refers to academic research at the intersection of neuroscience, psychology and marketing, and “Neuromarketing”, which refers to practitioner and popular interest in neurophysiological tools – such as eye tracking, skin conductance, electroencephalography (EEG), and functional magnetic resonance imaging (fMRI) – to conduct company-specific market research. This chapter briefly details recent methods in neuroscience used by consumer researchers, presents basic ideas in consumer neuroscience as demonstrated by a variety
of preliminary findings, and concludes with an outlook for the future of consumer neuroscience research.

**METHODOLOGICAL APPROACHES IN NEUROSCIENCE**

Many distinct methods are used in neuroscience to study neural processes underlying human behavior. Because each method has its own strengths and weaknesses, robust research findings typically arise from studies using several different techniques to shed light on the same question. A core defining precept is that neurophysiological methods measure either responses of the central or the peripheral nervous system. Most research in the nascent field of consumer neuroscience has availed of methods capturing changes, or manipulating activity, in the central nervous system, specifically, in the brain. However, physiological measures are hardly new to consumer research; even 30 years ago, researchers had measured skin conductance and eye movements to understand motivation and involvement in consumer behavior. Many peripheral physiological reactions can be readily measured, and used to make inferences about both neural functioning and correlated behavior. For example, pupil dilation is correlated with mental effort; blood pressure, skin conductance, and heart rate are correlated with anxiety, sexual arousal, mental concentration, and other motivational states; and emotional states can be reliably measured by coding facial expressions and recording movements of facial muscles.

Recent technological advances in measuring and manipulating brain activity allow us to observe in real-time the neural processes underlying consumer decision-making via functional brain imaging techniques. Most brain imaging research involves
within-subjects comparisons of people performing different tasks, an “experimental” task (A) and a “control” task (B). The difference between changes in brain activity measured during A and B indicates parts of the brain that are differentially activated by A (this is often referred to as the “subtraction approach”). One of the oldest imaging methods, EEG, measures electrical activity on the brain’s surface using electrodes attached to the skull. EEG records timing of activity very precisely (resolution about 1 millisecond), but spatial resolution is poor, so that localizations when recording brain activity in subcortical areas that are small (e.g., the amygdala) can be problematic.

Positron emission topography (PET) is a newer technique that records positron emissions after a weakly radioactive blood injection. It does not measure brain activity directly, but rather metabolic changes linked to differentials in brain activity. PET offers better spatial resolution than EEG, but poorer temporal resolution and, because of rapid radioactive decay, it is limited to shorter tasks. However, PET usually requires averaging over fewer trials than fMRI, the method most widely used in consumer neuroscience. fMRI measures local changes in the ratio of oxygenated to deoxygenated hemoglobin. This ratio tracks neural activity because the brain effectively “overshoots” in providing oxygenated blood to active parts of the brain. Oxygenated blood has different magnetic properties than deoxygenated blood, giving rise to the signal picked up by fMRI (the so-called blood-oxygen-dependent-level, or BOLD, signal). Unfortunately, the signal-to-noise ratio of fMRI is, to date, fairly poor, so drawing tight inferences requires repeated sampling and many trials.

Yet another approach is single neuron recording, which tracks smaller scale neural activity (by contrast, fMRI measures activity of circuits consisting of thousands of
neurons). In single neuron recordings, tiny electrodes are inserted into the brain, each measuring the firing of one specific neuron. Because these electrodes can damage neurons, the method is restricted to animal and special human populations, for therapeutic reasons (e.g., epileptic patients undergoing neurosurgery). Owing to its experimental use on animals, single neuron measurement has so far shed far more light on basic emotional and motivational processes than on higher-level ones, such as cognitive control.

Regardless, the great body of extant research in neurobiology based on animal work (e.g., in rats and nonhuman primates) can directly inform theorizing in consumer neuroscience. Due to functional and structural similarities in human and animal brains, the “animal model” has proved highly useful in the past, the main difference being a cortex enfolding the mammalian brain responsible for higher cognitive functions. Thus, due to partial functional overlaps in sub-cortical areas, studying lower level processes, such as motivational signals during simple decision-making, is also informative for understanding human decision-making. An advantage of animal work is the ability to perform manipulations (e.g., stimulation) to make causal inferences, and also to allow single neuron recordings as direct measures of neuronal activity, which are not possible with fMRI or PET.

The oldest neuroscientific approach applied to understand human decision-making, and among the cornerstones in decision neuroscience, is studying patient populations with brain lesions. Localized brain damage, often produced by accidents and strokes, and patients who underwent radical neurosurgical procedures, are an especially rich source of insights. If patients with known damage to area X perform a particular task more poorly than “normal” patients, this suggests that area X may be vital in performing
that task. “Virtual lesions” can also be created by Transcranial Magnetic Stimulation (TMS), which creates temporary local disruption to brain regions using magnetic field stimulations.

CONCEPTS AND PRELIMINARY FINDINGS

Consumer neuroscience evolved alongside wide-ranging developments in behavioral decision-making research and cognitive neuroscience, with the common goal to better understand various elements of consumers’ evaluation and purchase decision processes (for a recent review, see Kenning and Plassmann, 2008). In consumer behavior research, neuroscience has received considerable attention for at least two reasons. First, neuroscience can be viewed as a new methodological tool, a “finer scalpel” to dissect decision-making processes without asking consumers directly for their thoughts, evaluations, or strategies. Second, neuroscience can be viewed as a source of theory generation, supplementing traditional ones from psychology and economics proper. Most of the remainder of this chapter is devoted to discussing these two perspectives.

Neuroscience as Methodological Tool

Methodological approaches in consumer research have tended to make heavy use of qualitative methods and survey measures to assess and how experimental manipulations influence consumers’ attitudes and behavior. This has served the field well, having led to a rich body of empirical data and cohesive theoretical foundations. When relying on stimulus-organism-response models from psychology, consumer
researchers must, however, take certain “black-box” conceptualizations of brain processes on faith. This raises several caveats that neuroscience might help to address.

First, neuroscience measurements, though they may be intrinsically noisy, have a strong advantage over surveys and self-reports in regard to potential biases. Because neuroscientific methods measure brain activity and its correlates directly – rather than relying on what subjects tell us what they think of how they are thinking it – they may offer more reliable indices of certain variables important to consumer researchers. Consider research on emotions and their role in consumer decision-making. Emotions play an important role in consumer research, but are notorious for being difficult to induce via clever experimental manipulation, due to their partially unconscious nature and great response heterogeneity across subjects. Neuroscientific research suggests that we cleave the concept of emotion into two parts: emotional states that can be measured through physiological changes (such as autonomic and endocrine responses), and feelings, the subjective and largely ineffable experience of emotions (Bechara and Damasio, 2005). The emotional states themselves depend on basic (implicit) brain mechanisms, which are rarely available for conscious cognitive introspection. A similar division could well be made for motivational processes. Another general area where neuroscience may offer substantial measurement benefits concerns when consumers undertake rapid information processing (e.g., viewing a visually-dense TV ad) or enacting speedy habitual choices (e.g., selecting which sort of eggs or milk to buy at the supermarket). For example, prior research that used steady-state, visually evoked potentials (similar to EEG) to understand memory systems underlying ad recall found
that changes in brain activity in certain frontal brain regions, while viewing TV ads, predict long-term memory for those ads. Habitual choices were investigated by Milosavijevic et al. (2009), whose subjects engaged in a fast perceptual choice task between very familiar food items, during which eye positions were acquired with the help of an eye tracker. They found that subjects were able to make value-based choices (i.e., consistent with subjects’ preferences) within “a blink of an eye” (fastest at 400 msecs).

Second, some preliminary consumer research uses brain imaging to validate marketing scales. A guiding principle is that brain imaging is too costly a tool to squander on large scale surveys, but could be used to ask the “right” questions to get at the underlying (neuro)psychological phenomena. For example, a recent study by Dietvorst et al. (2009) used fMRI to investigate neural activity in brain regions associated with “theory-of-mind” abilities (i.e., medial prefrontal cortex, temporo-parietal junction, temporal pole) in salespeople, combining it with surveys and other traditional methodologies to develop a new scale for assessing salespeople’s interpersonal mentalizing skills.

Third, fortifying existing models of consumer decision-making with neuroscientific data may help them make better predictions about consumer behavior. An early effort in this direction is by Knutson et al. (2007), who combined neural and attitudinal measures to predict consumers’ purchases. The authors decomposed the purchasing process into three steps – (1) viewing a product, (2) viewing product and price information, (3) pressing buttons to indicate whether one wishes to buy the product at the end of the experiment – and investigated neural correlates of the preference formation stages (1, 2) and the price processing stage (2). They found that product preference
correlated positively with activity changes in, amongst other areas, the nucleus accumbens (NAcc), a region thought to be involved in reward prediction mechanisms, and that net value (WTP-price) correlated positively with activity changes in the medial prefrontal cortex (MPFC), anterior cingulate cortex (ACC), and frontopolar cortex. During the choice stage (3), purchasing correlated negatively with activation in the bilateral insula, a region known to be involved in risk and pain processing, and positively with activity changes in the ventromedial prefrontal cortex (VMPFC), a region shown to encode preference signals at the time of choice. When distinguishing purchased-item trials from non-purchased-item trials, the authors found significant differences in NAcc activation during preference formation, and both medial prefrontal cortex and insula deactivation during price processing, in line with their *a priori* hypotheses. They then estimated brain activity in these three regions of interests and entered them as covariates in a logistic regression, along with self-report measures of preference and net value, to predict subsequent purchasing decisions. Results indicated that the full model (i.e., including the neural measures) was a significantly better predictor than one including only self-report measures.

This idea has been further developed by recent work combining behavioral decision-making research with machine-learning algorithms used in computational neuroscience. Computational neuroscience attempts to understand mental processing so as to allow a computer to mimic the way the brain functions during these processes. It has been used extensively to model simple learning algorithms in humans, among other areas. A recent first attempt to follow this path in consumer neuroscience (Tusche and Haynes, 2009) investigated how implicit brain processes could predict hypothetical purchasing
decisions using multivariate decoding. They found that activity changes in the insula and the medial prefrontal cortex – specifically, while one group of subjects was exposed to various cars and asked how much they liked each (referred to by the authors as a condition where attention was shifted to cars, but not to purchasing) and while another group of subjects was asked to respond to a fixation cross that sometimes was displayed on a car background (referred to as condition with neither attention to cars nor to purchasing) – predicted at the end of the experiment whether or not subjects wished to purchase the cars in question.

A similar approach using eye-tracking data as physiological measures, coupled with models from computational neuroscience of vision, has started to be applied in advertising research; extensions relying on additional neurophysiological measures and more detailed computational models have recently been suggested by Milosavljevic and colleagues (e.g., Milosavljevic et al., 2009). Indeed, studies of which brain areas (and/or other physiological measures, such as eye-movements) are involved during certain tasks could well be enhanced by the use of machine learning algorithms for predictive analysis.

Fourth, consumer researchers have begun to apply neuroscientific methods to test the abilities of competing behavioral theories to explain various phenomena. Although this has been the most common application of neuroscientific methods in consumer research to date, space limitations allow for only a few selected studies to be discussed. An early example is Yoon et al. (2006), who used fMRI to test whether semantic judgments about products and persons are processed similarly, finding that, contrary to several extant theories in marketing, they tend not to be. Specifically, whereas judgments of persons activated the medial prefrontal cortex, a region that in prior studies had been
implicated in person processing, judgments of brands differentially activated the left inferior frontal cortex, an area known to be associated with object processing. Plassmann et al. (2008) used fMRI to study whether information that creates expectations about how good a product should taste (e.g., its price or brand) does so via post-consumption rationalizing or via changes in actual taste perceptions. The authors found the latter: that changing the prices of otherwise identical wines affected brain regions involved in interpreting taste pleasantness while the wines were being sampled. Hedgcock and Rao (2009) used fMRI to investigate different theories of how consumers make trade-offs between goods or services that differ on the utilities for single attribute, but whose overall utilities are similar, i.e., are judged as equally good or bad across multiple dimensions. Prior research had confirmed that “asymmetric dominance” can lead to consistent violations of the regularity axiom: that introducing an alternative that is normatively irrelevant (because it is dominated by the existing alternatives) to the choice set can increase the choice probability of a nearby, dominating option. The authors found activity patterns differed across conditions (e.g., higher in the dorsolateral part of the prefrontal cortex and the anterior cingulate cortex vs. higher in the amygdala, medial prefrontal cortex and parietal lobule), supporting the existence of tradeoff aversion.

Weber et al. (2009) investigated whether increased happiness, as opposed to alternative explanations consistent with rational choice theory, can explain why consumers judge the value of money based on the actual amount of currency (nominal value) and not on the bundle of goods it can buy (real value), the so-called “money illusion”. The authors found that brain areas thought to be involved in the anticipation and experience of reward, namely the ventral medial portions of the prefrontal cortex,
showed higher activity changes when subjects displayed the money illusion. These findings were interpreted to suggest that the money illusion is based on changes in reward- or happiness-related neural activity, and thus cannot be fully accounted for by standard “homo economicus” theories of rational choice.

Two other recent papers investigated the neural basis of the “endowment effect”: why we value goods we own more than (identical or equivalent) goods we don’t. Vast theorizing has attended the endowment effect, ranging from a higher attraction to goods in one’s possession (possibly due to familiarity, or overestimating positive and underestimating negative features) to an aversion of losing what one tangibly possesses. Knutson et al. (2008) compared situations where subjects sold various products, bought different products, and made purchasing decisions for yet other products, all while their brains were scanned using fMRI. They found that, in both the selling and buying conditions, product preferences correlated with activity changes in the striatum (more precisely, the nucleus accumbens, NAcc), a region known to be involved in reward prediction. The authors found no difference in NAcc activity in the selling vs. buying conditions during what they refer to as the “product preference formation stage” (i.e., the point when subjects were exposed to items and prices), evidence against the theory that owned goods are more attractive or ‘sticky’. In addition, the authors did not find activation in the insula (a region known to be involved in pain and risk processing, and so related to loss aversion) to correlate with product preference in selling versus buying trials. However, in “sell” trials specifically, individual differences in insula activity for preferred products did predict the extent to which subjects’ indifference points for selling differed from the mean indifference point of buying (referred to by the authors as
“endowment effect estimates”). The authors offer this as evidence of some role for insula activity, and thus for loss aversion as antecedent to the endowment effect. The second paper, De Martino et al. (2009), used fMRI to investigate the neural basis of within-subjects differences in WTA-WTP for lottery tickets, when subjects either owned (i.e., acted as seller) or did not own (i.e., acted as buyer of) the ticket. On a behavioral level, they found a systematic increase in the minimum selling prices, as compared to maximum buying prices, for a ticket with the same expected value. On a neural level, they found that the magnitude of WTP (in the buying condition) was encoded in the medial OFC, and the magnitude of WTA (in the selling condition) in the lateral OFC. As the medial OFC has been found to encode increases and decreases in WTP during purchasing decisions across several fMRI studies (Plassmann et al., 2007), and the lateral OFC was found to be responsive to the price (and thus the net value) of a good and to the anticipation of monetary losses, the authors suggest this finding as in line with the theory that, in the selling condition, transactions were perceived as a potential losses. Interestingly, Knutson et al. (2008) found a partly overlapping area to be involved in the value comparison portion of the preference formation stage (i.e., only that time interval when subjects are exposed to the buying / selling price, a moment when subjects potentially started to think of their WTP/WTA in monetary units, rather than overall product preference, and compare it to the price, thus computing utility of the offer, i.e., whether or not it is a “good deal”). They found that the subjects showed increased activity changes in the ventromedial prefrontal cortex (among other areas) when they perceived the offer to be a good deal. However, it seems that the lateral part of the PFC did not react in the same way as in De Martino et al. (2009), which could be due to the
fact De Martino et al. looked at neural correlates of within-subjects endowment effects, whereas Knutson et al. studied between-subject effects.

Of special note is that De Martino et al. (2009) also computed the difference between a ‘context-free’ subjective value measure and a (either buying or selling) ‘context–biased’ one, and found the bilateral ventral striatum to correlate with increasing deviations from the unbiased value in the selling condition and decreasing deviations in the buying condition. The authors interpret this finding as evidence for the fact that the ventral striatum tracks the magnitude to which the subject’s stated price deviated from the subject’s true, unbiased value of the ticket in the selling and buying condition (i.e., reference dependent values) similar to a reward prediction error signal. Taken together, the findings of these two studies suggest that the endowment effect is related to negative emotional signals in the brain before and during the actual experience of endowment effects, supporting the loss aversion hypothesis consistent with prospect theory.

**Neuroscience in Consumer Behavior Theory Generation**

Consumer researchers have now begun to base hypotheses directly on theories from neuroscience. A recent example is Wadhwa et al. (2008), who investigate the impact of food sampling on subsequent consumer behavior, and compare two a priori hypotheses: the first – concordant with marketing practitioners, health experts, and much folk wisdom – that sampling a food will lead to lower subsequent consumption, and a second, rival hypothesis based on physiological theories of “reverse-alliesthesia,” that as drive states affect the incentive value of relevant rewarding stimuli, a consumption cue high in incentive value (such as sampling a food) can strengthen drive states like hunger.
and, thereby, lead to an increase in the urge to engage in reward-seeking behaviors (such as eating more, or increasing other consumption-related behaviors). A series of behavioral experiments support predictions arising from the notion of reverse-allliesthesia: sampling a food or beverage items high in incentive value can in fact make individuals more likely to engage in reward-seeking behaviors, independently from specific reward type. Specifically, sampling a drink high in incentive value (e.g., Hawaiian Punch) not only leads to increased consumption of other drinks (e.g., Pepsi), but also to consumers giving higher desirability ratings for hedonic food, hedonic non-food, and on-sale items, compared with those who had not sampled the high-incentive drink. Subsequent studies by the same authors investigate how motivational behavior impacts goal striving. In particular, they argue that if experiencing a hedonic cue enhances subsequent reward seeking behaviors, then the induced motivational drive is also likely to enhance pursuit of a subsequent goal (defined as a representation of an internal state associated with a desirable outcome). For example, experiencing a hedonic cue (e.g., being exposed to romantic pictures) is likely to make one persist longer on a subsequently adopted intellectual goal of solving anagrams. Thus, unlike much of the extant research that has focused on how factors related to the goal state (e.g., desirability) can influence its pursuit, the focus here is on how factors unrelated to the goal state (e.g., incidental brief experiences with hedonic cues) can enhance subsequent goal pursuit. The authors’ hypotheses are based on neuroscientific evidence (in rats and humans) of how the dopamine system works, i.e., any hedonic cue that leads to enhanced dopamine activity could also motivate behaviors aimed in pursuit of a subsequently adopted goal associated with a desirable outcome.
Can Cognitive Neuroscience Benefit from Consumer Research?

Having detailed why consumer researchers are increasingly interested in joining forces with neuroscientists, let us briefly suggest how they might repay the debt, that is, “what’s in it for neuroscientists?” In neuroscience, a number of developments led to a “cognitive revolution” that set the stage for the field of cognitive neuroscience, specifically. One major concern in early neuroscientific work was that it was largely descriptive in nature, and led to multiple isolated theories resistant to integration into a general, normative theory. An important advance came via the introduction of Signal Detection Theory, a first attempt to relate neuronal activity directly to behavior in the field of vision science. We believe it is possible that sophisticated formal models from decision science and economics might help cognitive neuroscience establish a body of normative theory regarding how different types of decisions are enacted in the brain. A similar approach is currently used in so-called “model-based fMRI” studies, which investigate neural correlates of decision-making variables by integrating models from economics and behavioral decision to aid in statistical data modeling.

Several pioneering neuroscientific studies on emotion and decision-making were conducted using lesion patients, discovering impairments during simple economic decision-making tasks for patients with lesions specifically in the ventromedial portion of the prefrontal cortex (for a review, see Bechara et al., 2000). This represented something of a milestone for interdisciplinary work at the intersection of neuroscience, psychology and behavioral decision science, and stimulated a great deal of subsequent research. An opportunity for neuroscientists in this area is the possibility to combine the wealth of
empirical data and formal experimental design methods from decades of work in behavioral decision science and studies on lesion patients. Although tasks have to be adapted to the specific requirements of patient work, experimental and empirical findings about observed behavior can be readily transferred to patient studies. This potential of behavioral decision research for neuroscience becomes slightly more complicated for brain imaging studies using fMRI, due to the requirement for repeated measures. Nevertheless, behavioral protocols and empirical knowledge from behavioral decision science have greatly benefited the study of neural correlates of decision-making. A prime example is a study of Plassmann et al. (2007) that used a design from behavioral economics, the Becker-de-Groot-Marchack auction, to sample trial-by-trial incentive compatible and non-hypothetical psychometric measures (here, economic preferences in the form of willingness-to-pay bids) to correlate in real-time with repeated neurometric measures (here, changes in BOLD-signal). The authors found that activity in the medial orbitofrontal cortex and dorsolateral prefrontal cortex correlate with the magnitude of the subjects’ willingness-to-pay.

SUMMARY AND FUTURE DIRECTIONS

In this chapter we introduced the genesis, core concepts, and preliminary empirical findings of the nascent field of consumer neuroscience. The future of the field, and its eventual reception, will depend on the insights and benefits it can generate in concert with its parent disciplines. We believe it will be crucial that researchers within the field of consumer neuroscience adopt a multi-method approach, including not only different neuroscientific tools, but also traditional behavioral (laboratory) and field
experiments, to transcend the limitations of mere correlational results subject to inverse inference and causation. Ideally, consumer neuroscience research will be able to link hypotheses about specific brain mechanisms (location, activation, direction, connectivity) to both unobservable intermediate variables (utilities, beliefs, goals, etc.) and observable behavior (such as choices), using a variety of different methodological approaches from neuroscience, statistical modeling, and social science proper.

Two emergent trends deserve special mention. First, computational, model-based consumer neuroscience studies will become increasingly crucial, as statistical approaches themselves become ever more sophisticated, from mapping functional connectivity to the use of multivariate statistics to decoding algorithms from computational neuroscience for predictive analysis. Second, a recent development of clear relevance to consumer neuroscience is the study of individual differences based on genetic information (often referred to as “imaging genetics”). Imaging genetics is the study of how genetic differences lead to individual differences in the morphology and functions of the brain, and thereby differences in behavior. The rapid proliferation of inexpensive, personalized genetic information should make such studies increasingly accessible and informative for consumer researchers.

The old saw goes that prediction is difficult, especially about the future. And so it is with consumer neuroscience, whose large time, financial, and learning-curve costs may appear to place it beyond the current reach of many consumer behavior researchers. We anticipate that the inevitable waning of these barriers over the coming decade will produce a flowering of interest in understanding the neural bases and correlates of
consumer behavior, and encourage our fellow researchers to wade enthusiastically into this exciting, growing area of inquiry.
Bibliography


