# 12 How Expectancies Shape Consumption Experiences

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The act of consumption is a primal and important one, essential for the survival of virtually all species. However, human consumption differs from that of other species in many ways. We consume foods, goods, and experiences. Our consumption goes far beyond products that satisfy basic survival needs, and includes the satisfaction of such higher-order needs as the needs to think, believe, and belong (Cacioppo and Petty 1982; Maslow 1959). Multidisciplinary evidence suggests that important factors influencing the value or enjoyment derived from consumption are also based on psychological associations and cognitive concepts (for example, brand images, beliefs about the quality or efficacy of products and treatments, and nutritional information on food packaging) that can occur independent of, and in extreme cases can even override, mere "physical consumption" (Ariely and Norton 2009).

In this chapter, we focus on one important driver of the effects of cognitive concepts on consumption: expectancies. Expectancies are beliefs and predictions about future feelings, events, or outcomes. Whereas some researchers reserve the term *expectancies* for conscious, reportable experiences, here we use it in a more general sense, and include predictive brain processes that may or may not be reportable. Because predicting future states is a fundamental function of the nervous system, expectancies can play many roles. Among their best-known functions are preparatory processes and learning. For example, in what may be the most famous psychology experiment in history, the Russian physiologist Ivan Pavlov showed that after learning dogs began to salivate upon hearing a bell that predicted food delivery. The prediction and anticipation of food constitutes a kind of expectancy, likely with both conscious and unconscious aspects. More recently, expectancies have been quantitatively modeled in the form of expected value signals that drive learning. Along those lines, Schultz, Dayan, and Montague (1997) showed that after learning, dopaminergic neurons fire not when monkeys are receiving a food reward, but when they see or hear a signal that *predicts* receiving the food reward. Conditioning processes such as these lead to multiple kinds of predictions that appear to be implemented in different brain circuits. How diverse "expectancy" signals are and how conscious, reportable "expectancies" are qualitatively different from other kinds of predictions are open questions in the field. Here we are agnostic on these issues, and we focus mainly on the effects of expectancies on hedonic experience and choice. (Neural anticipation during consumption decisions is also discussed in the chapter by Knutson and Karmarkar, in the chapter by Kringelbach, and in the chapter by Whybrow.)

Human expectancies can be based on a variety of learned cognitive concepts and beliefs. For example, your decision to consume a rewarding food item, such as piece of chocolate, probably would depend on cognitions of several kinds, including the memory of what you ate before, what other options are available, your estimate of the chocolate's quality, how good you anticipate it will taste, how unhealthy you think it is, and what other people would think of you if you were to eat a chocolate of this brand rather than one of a lower-priced brand. For a nonhuman animal, however, the decision to consume a food reward would be a "no-brainer"—it would presumably be based largely on the predicted appetitive value of the chocolate, moderated by hunger and food-specific satiety signals. (See the chapter by Preston and Vickers and the chapter by Lea.)

From an economic perspective, the effect of expectancies on immediate valuation can be traced back to Bentham's concept of utility, which suggests that anticipation, like consumption itself, is an important source of pleasure and pain since it simulates the consumption experience (Kahneman, Wakker, and Sarin 1997; Loewenstein 1987). Indeed, our ability to construct "what if" scenarios and our ability to envision the future have received multidisciplinary attention (Bar 2009; Barrett 2006; Moulton and Kosslyn 2009; Roy, Shohamy, and Wager 2012; Schacter, Addis, and Buckner 2007). The chocolate example shows that expectancies are linked to multiple types of prior experiences, some linked to learning and conditioning (Bar 2011) and others to the context-dependent meaning of the stimulus (Roy et al. 2012), which depends on how we conceptualize the chocolate (Barrett 2006)—for example, perhaps you remember that a certain kind of chocolate tasted very good the last time you had it, or you remember that your spouse liked it and told you about it, but you also remember reading in a medical journal that chocolate in general is unhealthy.

Sometimes we even create false memories of our past consumption experiences. For example, falsely telling you that the last time you ate a certain kind of chocolate you felt sick afterward, or showing you commercials in which people report being overly happy after eating the chocolate, can change your memory and may indeed create the expectation that you will feel sick or happy after eating this chocolate (Braun, Ellis, and Loftus 2002; Laney, Morris, Bernstein, Wakefield, and Loftus 2008). In other words, expectancies can be based on recollection of or association with our own real or false prior consumption experiences or those of others. If we haven't had any previous experiences with a consumable good, generalizations of learned cue-to-value associations can serve as the basis for expectancies. In such cases, expectancies are based on factors such as the price of the good (Plassmann, O'Doherty, Shiv, and Rangel 2008; Shiv, Carmon, and Ariely 2005; Waber, Shiv, Carmon, and Ariely 2008), the information on the packaging (Chandon and Wansink 2007; L. Lee, Frederick, and Ariely 2006; W.-C. J. Lee, Shimizu, Kniffin, and Wansink 2013), and information provided by a salesperson, a medical doctor, or some other trusted authority.

Thus, cognitive concepts and learned values lead to expectancies that, in turn, influence consumption and the value derived from it (Ariely and Norton 2009; Berdik 2012). In this chapter, we outline the effect that expectations have on behavioral aspects of consumption. We then review the neuropsychological underpinnings of these effects. We conclude by proposing an interdisciplinary model of expectancy effects and highlighting open questions for future research.

## Expectations and Consumption Behavior

A large body of literature in consumer psychology has been dedicated to studying how people's expectancies shape consumption experiences with the physical properties of consumed goods kept constant. In one study, some consumers were informed about the brand of the beer they were consuming and some were not. Those who had the brand information reported to like the taste of their favorite brand the most, whereas those who did not liked the tastes of all beers about the same (Allison and Uhl 1964). This paper was among the first to show that advertising and branding can create expectations in a consumer's mind that can alter the enjoyment of physical consumption. Converging evidence for this idea has been shown in follow-up studies involving both products and services (Boulding, Kalra, Staelin, and Zeithaml 1993; Kopalle and Lehmann 2001; L. Lee et al. 2006; Raghunathan, Walker Naylor, and Hoyer 2006; Steenhuis et al. 2010; Wansink and Chandon 2006; Wilcox, Roggeveen, and Grewal 2011). In fact, evidence of how expectations shape consumption has been found in a variety of domains. Expectancies about how funny a cartoon will be changed the reported enjoyment of viewing the cartoon (Wilson, Lisle, Kraft, and Wetzel 1989), and the reported enjoyment of a film was influenced by expectations about its quality (Klaaren, Hodges, and Wilson 1994). In these cases, the higher the expectation of enjoyment, the more participants enjoyed the experience. Stereotypes also influence how people are perceived (Darley and Gross 1983; Klein and Snyder 2003). For example, strategically setting low expectations so as to later claim that a candidate for political office did better in a televised debate than had been expected actually results in lower ratings of the performance (Norton and Goethals 2004). In addition, ritualistic behavior potentiates the consumption of indulgent and healthy foods, and enhances their enjoyment (Vohs, Wang, Gino, and Norton 2013), and information about the calorie count of a milkshake alters reported fullness and satiation after consumption of identical milkshakes (Brunstrom, Brown, Hinton, Rogers, and Fay 2011; Brunstrom and Rogers 2009).

Expectancies also have strong influences on pain, providing an aversive counterpart to consumption experiences (e.g., Atlas and Wager 2012; Atlas, Bolger, Lindquist, and Wager 2010; Colloca and Benedetti 2005; Geuter, Eippert, Attar, and Bchel 2013). In one study, information about the price of a painkiller affected ratings of pain elicited by mild electric shocks (Waber et al. 2008). A "discounted" analgesic cream was reported to be less effective than an expensive one, even though the creams were identical. This effect was recently replicated by Geuter et al. (2013), who also showed related reductions in "pain-processing" centers in the brain with the expensive cream.

Interestingly, expectancy effects go beyond reported enjoyment and perception of the consumption experience. Expectations can also change subsequent behavior. Consumers who thought they were drinking a wine from California reported greater enjoyment of the wine than consumers who thought they were drinking a wine from North Dakota; in addition, they consumed more wine and more food (Wansink, Payne, and North 2007). In a study of dieters, calling a food by a "healthy" name (i.e., "salad" vs. "pasta") increased the reported tastiness of the food and the quantity consumed. This effect was not found for non-dieters (Irmak, Vallen, and Robinson 2011). It is possible that in these studies the change in consumption was driven by the change in perceived tastiness or liking of the food. A study by Morewedge et al. (2010), however, showed that people who had imagined eating cheese cubes many times subsequently consumed fewer cubes than did people who had imagined eating the cubes fewer times (Morewedge, Huh, and Vosgerau 2010). Morewedge et al. (2010) suggest that such effects are due to the fact that merely expecting or imagining eating a food results in hedonic satiation to this specific food, decreasing the "wanting" but not the liking of the food item. (For a discussion of this dissociation and its mechanisms in animal models, see the chapter by Robinson, Robinson, and Berridge.)

Other studies have demonstrated effects of expectations on cognitive performance, arousal, and physiological responses. For example, a study by Shiv et al. (2005) showed that expectations about the efficacy of an energy drink, as manipulated by its price tag, influences both the consumption experience and subsequent performance in mental tasks. In the study by Shiv et al., participants who had purchased the drink at a discounted price subsequently performed more poorly on a puzzle-solving task than participants who had purchased the drink at full price.

A growing literature suggests that placebo treatments can influence physiological responses as well (Meissner et al. 2011). In studies of placebo caffeine, participants' beliefs that they had consumed caffeine were found to increase motor performance and heart rate, although the subjects had not in fact consumed caffeine (Kirsch and Sapirstein 1998). Similarly, placebo treatment supported by conditioning has been shown to reduce autonomic responses to painful stimuli (Nakamura et al. 2012). As in other domains discussed here, it is an open question whether physiological effects can be elicited purely by "conceptual" information, or whether they require cues conditioned through experience. For example, Flaten and Blumenthal (1999) found that consumption of decaffeinated coffee increased skin conductance and arousal and reduced heart rate relative to consumption of orange juice. In a subsequent study (Flaten et al. 2004), however, information that participants were receiving either a stimulant or a relaxant (in separate conditions) had no effects on caffeine-induced physiological arousal. A related field study showed that hotel room attendants whose daily work was framed as physical exercise, in conformity with the Surgeon General's recommendations for an active lifestyle, perceived themselves to be getting significantly more exercise than before (Crum and Langer 2007). As a result, they showed a decrease in weight, blood pressure, body fat, waist-to-hip ratio, and body-mass index relative to a control group. In another study, participants who thought they had consumed a high-calorie milkshake rather than a low-calorie one showed elevated levels of the satiety-related gut peptide ghrelin (Crum, Corbin, Brownell, and Salovey 2011). Those who had consumed a milkshake labeled "high-calorie" rather than an identical milkshake labeled "low-calorie" showed both a steeper anticipatory increase in ghrelin and a steeper post-consumption decrease in ghrelin. No effect on hunger ratings was found. These effects are consistent with the notion that conditioned cues can trigger brain processes that regulate metabolism (Woods and Ramsay 2000), but go beyond this to suggest that conceptual information can activate metabolic regulatory circuits.

Taken together, these studies show that expectancies across a variety of different domains can trigger "placebo effects" that change consumption while physical properties of consumed goods are kept constant. They also suggest that expectancies not only change the perception of the consumption experience, but also change subsequent behavior and thus can create "self-fulfilling prophecies" (Merton 1948).

Why are expectations so powerful that they can override physical properties of goods? There are possible explanations at many levels, but theories from social psychology suggest that one reason is that people strive to overcome cognitive dissonance and seek confirmation for their beliefs (Festinger 1962; Lord, Ross, and Lepper 1979). Further findings in consumer psychology and neuroscience, which we review below, are extending this view by shedding light on what is actually happening in the "black box" of the consumer's brain.

## A Neuroscience Perspective on How Expectations Shape Consumption

Understanding the brain processes underlying expectancy, value, and learning is critical to understanding why expectations have such a powerful influence on consumption. Are these effects mere "reporting biases" based on post-consumption rationalization and cognitive dissonance, or do expectancies change how the consumption experience is actually encoded in the brain?

Placebo effects in pain are a classical example of how expectancy influences affective experience. A large body of medical and neuroscientific work has begun to increase our understanding of the neural mechanism underlying the effects of placebos on the perception of pain (Atlas and Wager 2012; Benedetti et al. 2003; Colloca and Benedetti 2005; Kirsch and Sapirstein 1998; Wager and Atlas 2013). In this section, we first review findings regarding how expectancy affects brain markers of pain processing and how expectations lead to changes in subjective pain. We then review findings of neural correlates of the effects of expectancy on other, positive, affective experiences that are closer to everyday consumption experiences.

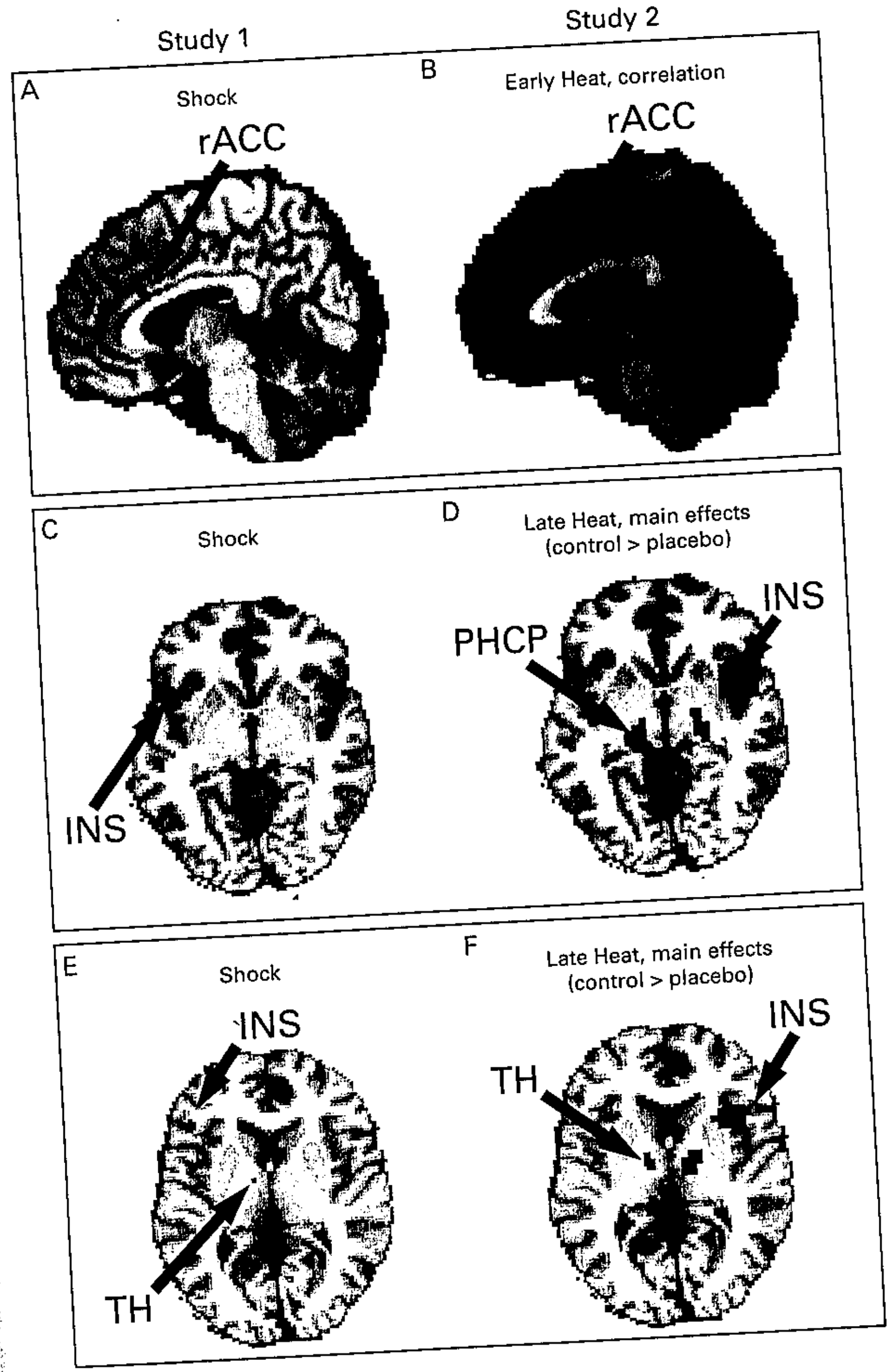
Traditionally, the term "placebo effect" refers to the pain-reducing or analgesic response caused by treatments that a patient believes will reduce pain but that in reality have no active ingredients. For example, if you take a starch pill believing that it is a painkiller, the belief about the efficacy of treatment causes you to lower your subjective ratings of pain (Colloca and Benedetti 2005). An important question is whether these effects truly affect pain-related processing or whether they simply reflect demand characteristics and reporting biases. The studies that provided the first evidence of placebo effects' altering pain processing via active neurochemical processes were conducted by Levine and colleagues. (See, for example, Levine 1978.) They found that placebo analgesia was attenuated when patients were given the opioid antagonist naloxone. Their findings suggest placebo effects depend on the release of opioids within the patient's brain, since the placebo effect was attenuated when opioid receptors were blocked. These initial findings have been complemented by brain imaging studies investigating the effect of placebo treatments (Bingel, Lorenz, Schoell, Weiller, and Büchel 2006; Meissner et al. 2011; Wager et al. 2004) and the effect of pain expectancy cues (Atlas et al. 2010; Koyama 2005) on neural signatures of pain processing.

Wager et al. (2004) used functional magnetic resonance imaging (fMRI) to test whether placebo effects caused reduced responses to painful stimuli in so-called pain-processing regions in the brain. After a placebo cream was administered, subjects' brains were imaged while they received mildly painful shocks or thermal pain. In a first step, we tested which brain regions were sensitive to stimulus intensity; in the second step, we tested whether any of these "pain regions" showed reduced neural activity in response to a placebo cream relative to an identical control cream. (The difference was in the instructions to participants and in their earlier experiences that the placebo was effective.) With placebo treatment, we found reduced responses in pain-responsive portions of the insula, the thalamus, and the anterior cingulate and correlations between the reductions in pain reports and reductions in brain activity, as shown in figure 12.1.

In related studies, Atlas et al. (2010), Koyama (2005), and Lorenz et al. (2005) investigated whether short-term expectations about pain intensity could also alter pain perception and pain-related responses in the brain. Atlas et al. (2010) used conditioning and verbal information to induce expectations about noxious heat intensity cued by auditory tones. They identified regions that predicted trial-by-trial variations in pain (i.e., medial and lateral pain systems), and found that many of these regions showed enhanced activity when cues predicted high rather than low pain, even though the stimulus intensity was identical for both cues. Interestingly, several recent studies (Eippert, Finsterbusch, Bingel, and Büchel 2009; Matre, Casey, and Knardahl 2006) suggest that expectancies can directly alter pain-related responses in the spinal cord. These studies complement the findings reviewed above by providing evidence that expectancies can change pain-related signals before they even reach the level of the brain, suggesting that expectancies have profound effects on stimulus processing that extend far beyond reporting biases.

Complementing research on placebo effects in the pain domain, a few studies also have investigated whether expectancies alter other, positive, affective experiences, such as taste, flavor, and visual pleasantness, in the

**Figure 12.1**
Pain regions showing correlations between placebo effects in reported pain (control-placebo) and placebo effects in neural pain (control-placebo) in two studies using electric shocks and thermal pain stimulation.


Study 1
Study 2
A
Shock
rACC
B
Early Heat, correlation
rACC
C
Shock
INS
D
Late Heat, main effects
(control > placebo)
PHCP
INS
E
Shock
INS
TH
F
Late Heat, main effects
(control > placebo)
TH
INS

brain. (For an overview, see Plassmann, Ramsøy, and Milosavljevic 2012.) McClure et al. (2004) investigated whether brand labels of colas (Pepsi vs. Coke) altered neural processing during consumption. They found that knowing vs. not knowing the brand name influenced neural activity in brain areas linked to cognitive regulation of affective responses and working memory (i.e., the dorsolateral prefrontal cortex) and also other memory structures (i.e., the bilateral hippocampus). De Araujo, Rolls, Velazco, Margot, and Cayeux (2005) investigated the influence of verbal labels of smells (cheese vs. body odor) on neural signatures of olfactory processing. They found that indeed when subjects were smelling identical odors, a positive or a negative description altered neural activity in ventromedial prefrontal cortex (vmPFC) and also in the bilateral amygdala, which are linked to olfactory processing and value construction more broadly. Nitschke et al. (2006) found that expecting an aversive taste to be less aversive reduces neural activity in regions of the insula associated with primary gustatory processes, although the intensity of the flavor itself was kept constant.

In another study (Plassmann et al. 2008), activity in the mOFC/vmPFC in response to the consumption of wine depended on quality beliefs about its price. Consuming identical wines with high vs. low price tags correlated with changes in neural activity in the mOFC/vmPFC, which has been considered "secondary taste cortex" and also responds to value-related signals and conceptual processes outside the gustatory realm (see, e.g., Plassmann et al. 2007, 2010; Roy, Shohamy, and Wager 2012). No such effects were found for taste-intensity ratings or when subjects did not know the wine's price, indicating that these effects were due to expectations induced by the price and that they were specific to the processing of taste pleasantness. Plassmann et al. also showed that behavioral pleasantness ratings across wines and control liquids correlated with brain activity in the same region of the mOFC/vmPFC. Kirk et al. (2009) found that pleasure derived from viewing art pieces, and accompanying engagement of the vmPFC, depended on whether the subjects believed that the pieces had been created by an expert (i.e., an artist) or by a non-expert (the experimenter).

Together, these findings suggest that, across domains, expectancy manipulations are associated with changes in neural processing linked to consumption-related processing in the brain, ruling out the hypothesis that expectancy effects simply reflect demand characteristics or report biases.

Expectations truly influence neurobiological responses to the experience of different stimuli. But which of these changes in "value-related" processes are related to decision processes that create reporting bias, and which of them influence pre-decision aspects of value? For example, conformity biases have been shown to influence signals in the medial prefrontal cortex (Klucharev, Hytönen, Rijpkema, Smidts, and Fernández 2009). Further studies are needed to identify brain regions and signals with different stages of the perception-decision-learning cycle.

## Underlying Neuropsychological Mechanisms of Expectancy Biases

The experiments reviewed above provide evidence that expectancies not only alter reported measures of pleasure or displeasure of consumption but also affect brain responses in consumption-related brain systems. Another crucial question, however, is how expectancies actually shape consumption. To shed light on the underlying neuropsychological mechanisms, we will review studies that have investigated individual differences correlated with the size of expectancy's effects on consumption. We will then review studies that have examined brain mediators of these effects.

Behavioral studies reveal correlations between increased placebo responsiveness and personality traits linked to increased dopaminergic functioning, such as behavioral activation and optimism (Geers, Helfer, Kosbab, Weiland, and Landry 2005; Morton, Watson, El-Deredy, and Jones 2009; Schweinhardt, Seminowicz, Jaeger, Duncan, and Bushnell 2009). Also, subjects who are more suggestible show greater responsiveness to a placebo (De Pascalis, Chiaradia, and Carotenuto 2002). Subjects who showed stronger neural markers of reward responsiveness, lower levels of dopamine and opioid binding during pain stimulation (Scott et al. 2007; Wager, Scott, and Zubieta 2007; Zubieta 2005), and greater gray-matter density in mesolimbic brain regions (e.g., ventral striatum, insula, and prefrontal cortex; see Schweinhardt et al. 2009) also showed stronger expectancy effects.

Another approach to testing for underlying mechanisms of expectancy effects is to test for correlations between such effects on brain *and* behavior. For example, in the study by Plassmann et al. (2008), the extent to which a high vs. a low price tag of an identical wine altered ratings of taste pleasantness correlated significantly with the difference in neural activity in the mOFC/vmPFC during consumption of high-priced wine (see figure 12.2).

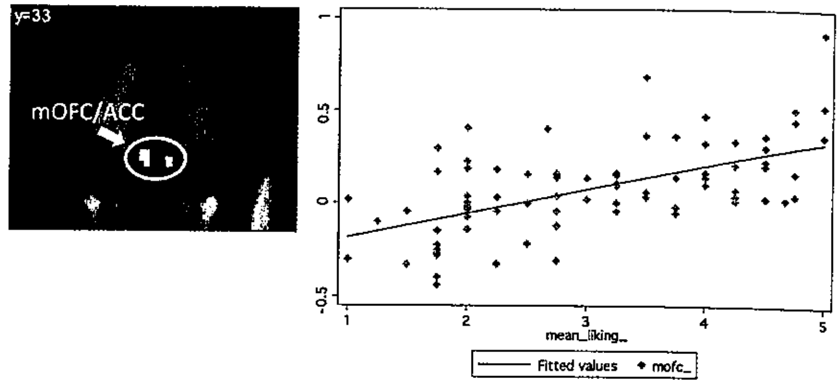



**Figure 12.2**
The effect of price on the enjoyment of wines. Left: Conjunction analysis. Activity in the medial OFC/rACC was higher in the high-price condition than in the low-price condition for both wine 1 and wine 2. Right: Correlation of behavioral and BOLD responses. Each point denotes an individual wine pair. The horizontal axis measures the change in reported pleasantness between the high-price and the low-price conditions. The vertical axis computes an analogous measure using the betas from the general linear model in a 5-millimeter spherical volume surrounding the area depicted at left. Reprinted from Plassmann et al. 2008.

Wager et al. (2004) found correlations between the magnitude of placebo effects on reported pain and the magnitude of heat-evoked responses in the insula, the thalamus, and the rostral anterior cingulate cortex. However, the brain's pain regions were not the only regions to correlate with placebo effects. During pain anticipation, brain regions that are also involved in cognitive control and in working memory (i.e., the dorsolateral prefrontal cortex) and in predicted value encoding (i.e., the orbitofrontal cortex) showed significant correlations between placebos' effects and reported pain. In fact, a new analysis of data from studies by Wager et al. (2011) in which machine learning and pattern analysis were used showed that anticipatory responses in brain systems involved in emotion regulation and emotional appraisal were more predictive than activity in the brain's pain-processing regions.

Taken together, expectancies might affect consumption-related circuitry not only because they simulate the consumption experience prior to consumption, but also because expectancies influence intervening processes such as emotion and attention. Indeed, although most of the studies reviewed above suggest that expectations modulate responses in consumption-related brain regions, some studies on placebo analgesia (e.g., Kong 2006) found expectancy effects primarily on prefrontal and subcortical regions that are not uniquely associated with pain processing, including the lateral prefrontal cortex, the orbitofrontal cortex, the parahippocampus, and the striatum. It also should be noted that a particular brain region is rarely *specifically* involved in a single mental process, such as encoding painful or pleasurable experiences (Poldrack 2006, 2011). In other words, expectancy effects in these regions may be associated with other intervening processes. Since the regions of the brain that are most frequently influenced by expectancy can be shaped by emotion, attention, and other processes that are likely to be affected by expectations, mediating mechanisms should also be investigated (Atlas et al. 2010; Atlas and Wager 2012).

Atlas et al. (2010) were the first to use multilevel mediation analysis to investigate the underlying neural mechanisms of expectancy's effects on pain experience. They used formal mediation analysis to identify the regions that link expectancy's effects on pain-related responses with its effects on subjective pain reports. In their study, cue-based expectations and pain reports varied from trial to trial, and they tested whether responses in the brain on a particular trial contributed to the link between cue-based expectation for high vs. low pain and changes in the pain experience. Mediation implies that expectancy's effects on a particular brain region explain more variability in pain reports than the expectancy effects themselves. They found that a subset of pain-responsive regions (including the insula, the cingulate, and the thalamus) formally mediated expectancy's effects on pain trial by trial, and that expectancy's effects on these regions were, in turn, mediated by expectancy-induced anticipatory responses in the ventral striatum and the vmPFC. These regions have been widely studied in the context of conditioning and value-based economic decision making in humans and animals (Rangel, Camerer, and Montague 2008), suggesting a link between these fields and expectancy's effects on pain experience. (On the role of these regions in valuation across species, see also the introduction to this volume, the chapter by Knutson and Karmarkar, the chapter by Kringelbach, the chapter by Preston and Vickers, and the chapter by Robinson, Robinson, and Berridge.) These findings are also consistent with the fact that anticipatory responses in emotion networks predict expectancy effects across individuals, as reviewed above. Expectancy's effects on consumption may be mediated by emotional responses during the experience of consumption *and* during anticipation of it.

## Conclusions and Open Questions

In this chapter, we have integrated research from different disciplines, including psychology, marketing, neuroscience, and medicine, that all investigate the effects of expectancy on affective experiences. Most of the works in this area find evidence for assimilation effects—that is, influences of a context (such as a high vs. a low price) on a judgment (such as experienced utility derived from consumption of a wine) such that judgments and contextual information are correlated positively, a higher price resulting in a higher experienced utility and a lower price in a lower experienced utility (Sherif, Taub, and Hovland 1958). In the pain domain, most research has focused on placebo (i.e., positive expectations that an inert treatment will relieve pain) and "nocebo" (i.e., negative expectations that an inert treatment will result in more pain) effects (Atlas and Wager 2012; Benedetti, Amanzio, Vighetti, and Asteggiano 2006; Scott et al. 2008; Wager and Atlas 2013). In all of these streams of the literature, however, there is little evidence for contrast effects (i.e., a negative correlation between judgments and contextual information such that a high price tag would lead to a lower experienced utility).

In one prominent paper in the placebo literature, Benedetti et al. (2003) reported evidence for contrast effects on a lower cognitive level measuring hormone secretion, whereas they reported assimilation effects on a higher cognitive level using ratings and motor performance. A group of healthy subjects and a group of Parkinson's patients went through different conditioning phases (i.e., pre-treatment with a painkiller for pain conditioning in the healthy subject group, subthalamic nucleus stimulation for Parkinson's patients), then were treated with sumatriptan for cortisol and growth hormone secretion, and then received verbal information that induced expectations that were either consistent or inconsistent with the conditioned response, i.e., the prior physical experience. Benedetti et al. found that placebo effects on pain ratings and motor performance reversed with different verbal instructions and thus depended upon the conscious belief, whereas effects on biophysical and hormonal responses did not reverse with instructions and thus followed the conditioned response. Gneezy and List (2013) varied the price *and* the quality (physical and perceived) of wines, and found the typical assimilation effect for the high-quality wine but not for the low-quality wine. For the low-quality wine, they found evidence for a contrast effect. It is important to note that Plassmann et al. (2008) also varied the physical quality levels of the wines. They administered one wine that received 80 points and one that received 92 points (on a range from 50 to 100 in an expert quality point system) at a high and a low price level. However, in contrast to the study by Gneezy and List, in a blind tasting no effect of the quality points on subjects' liking ratings (i.e., perceived quality) was found. This suggests possible boundaries for expectancy's effects on consumption. If the affective experience falls within a certain "latitude of acceptance" (Sherif 1963), expectancy effects may result in assimilation; if the affective experience falls outside this range of acceptable experiences, contrast effects may be observed. More research is needed to better understand the role of learning and its effect on physical consumption for contrast vs. assimilation effects of expectancy biases on a behavioral and a neurobiological level.

Research on the relationship between expectations and consumption shows that expectations about specific expectations—for example, verbal suggestions about the efficacy of a drug, a white lab coat, the price of a drug, or the price or brand name of a product—can profoundly influence neural and behavioral measures of consumption. The various types of expectations studied across different domains, from pain to flavor and visual experiences, not only influence reported consumption-related measures; they also influence the known brain markers of consumption experiences. Interestingly, each type of expectation seems to be related not only to sensory specific processing, but also to more general affective processing and regulation: brain mediators of expectancy's effects on pain also involve responses in brain networks encoding more general affective processes that are not specific to pain processing, and individual differences in placebo analgesia are best predicted by responses in such affective brain systems. More systematic research is needed to understand the underlying neuropsychological mechanisms of expectancy's effects not only in the pain domain but also in everyday consumption experiences.

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