

Affect-Gating

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Abstract

Neural theories of affective processes suggest that people may be more attuned to certain sensory channels during certain affective states. Experiment 1 shows that consumers in a negative affective state are more sensitive to tactile information, whereas consumers in a positive affective state are more sensitive to visual information. Experiment 2 shows that consumers in a negative affective state generate a more positive hedonic response toward tactile qualities of a product. Experiment 3 shows that consumers in a negative affective state are more sensitive to changes in product quality involving tactile attributes. Experiment 4 shows that the tactile quality of a product has more influence on hedonic response when the visual sensory channel is blocked. Experiment 5A shows that negative affect induces a physiological response of coldness, and Experiment 5B shows that a consumer under negative affective state is more sensitive to tactile warmth. The implication of these results is that the affective circuits operate like gates that manage the flow of information from specific sensory channels, leading consumers to become more (or less) sensitive to this information. This affect-gating account may explain certain consumer phenomena, such as the increased use of tactile and warming products (i.e., “comfort products”) when sad, or the closing of eyes when receiving tactile stimulation (e.g., a kiss, a massage).

Extant models of affect and cognition assume that affect can play three different roles in information processing (Cohen, Pham, and Andrade 2008; Patrick and MacInnis 2006; Shiv 2007). First, affect can be an input into decision making. Affect can exert a direct influence (affect as information, e.g., Schwarz and Clore 2007) or an indirect influence (e.g., mood congruency, Bower 1981) on a judgment. Second, affect can influence the quality of decision making. For example, positive affect leads to greater creativity (Greene and Noice 1988), better preference transitivity (Lee, Amir, and Ariely, forthcoming), better problem solving (Isen, Daubman, and Nowicki 1987), a reliance on heuristic processing (Adaval 2003), and greater risk taking (Kahn and Isen 1993), but can decrease judgment accuracy (Keller, Lipkus, and Rimer 2002). In contrast, negative affect decreases the ability to cope with feedback (Agrawal, Menon, and Aaker 2007), increases sub-optimal choice switching (Ratner and Herbst 2005), increases inaccurate attributions (Small, Lerner, and Fischhoff 2006), increases a focus on rewarding stimuli (Fishbach and Labroo 2007), increases a focus on concrete attributes (Labroo and Patrick 2009), and induces a bias toward positively framed information (Keller, Lipkus, and Rimer 2003; Trope and Pomerantz 1998). Affect can also influence the categorization of brands via clustering (Lee and Sternthal 1999). Third, affect can be the focus of decision making. People try to repair their negative moods (Patrick and MacInnis 2006; Zillmann 1988) and maintain their positive moods (Andrade 2005; Clark and Isen 1982), and will try to attend to information that will regulate their long-term affect (Keller, Lipkus, and Rimer 2003). Common to all of these research streams is the assumption that cognitive processes dictate the use, influence, and management of affective experience.

Neural models of affective processing argue that the affective system and the cognitive system collectively control information processing and hedonic response (Barbano and Cador

2007; Berridge 2009; Berridge and Robinson 1998). These models assume that affective processes manage perceptual experience in order to achieve hedonic goals. One such model, the opioid mediation model, assumes that there are hedonic circuits that are the target of affective regulation (Pecina, Smith, and Berridge 2006). Affective regulation is accomplished by *affect-gating* wherein the prevailing affective state gates the information processing system's access to the most relevant sensory information (Carr and Bak 1987; Panksepp and Moskal 2008). For example, experiments on animals show that negative affective states increase sensitivity to information received by the tactile channel. This tactile information induces the release of opioids (chemicals that have morphine-like properties) that quell the negative affective state (Keeverne, Martensz, and Tuite 1989; Martel et al. 1993; Panksepp 1998). The sensory channel opened by affective gates is "privileged" in the sense that other sensory channels, such as the visual channel, cannot induce the release of the same opioids generated by social rewards (Panksepp 1998).

There are evolutionary and developmental reasons for affective gating. For example, a negative affective state is a visceral indication that the juvenile has been separated from its parent (Panksepp, Nelson, and Bekkedal 1997). Juveniles that return to their mothers when they experience negative affective states are comforted. Comfort (tactile stimulation) causes opioid release, thus returning the juvenile to affective and organismic homeostasis (Keeverne et al. 1989). Juveniles that are more sensitive to tactile stimulation return to homeostasis more quickly and are more likely to survive. Survival then allows these juveniles to sexually mature and pass on their gene codes (expressing the response pattern of high tactile sensitivity in negative affective states) to offspring. Over hundreds of thousands of years, this process of natural selection results in privileged sensory channels in the affective system. In contrast, a positive

affective state is a visceral indication that the juvenile is self-sufficient (at least temporarily) and should explore its environment. Juveniles that make visual explorations during positive affective states develop more predatory and foraging abilities, hence become better hunters or food gatherers. In the end, natural selection dictates that the mammal has to assign fluctuating value to sensory channel stimulation (i.e., it has to develop a tendency to emphasize different sensory channels in different affective states) in order to survive, reproduce, and pass on its genes. Affective gating helps the organism assign fluctuating value to sensory channel information without the participation of higher order cognition.

If current affect states act as gates on the perception of information from competing sensory channels, then this gating process should have implications for product experience and hedonic appreciation. First, products that are experienced in a positive or negative affective state should be perceived along the sensory channel dimensions that are gated by the state. Second, people should be more sensitive to the changes in the product that are most easily perceived by the gated sensory channels. Third, any consumer behavior that amplifies the primary sensory channel, or inhibits competing sensory channels, should increase the intensity of the sensory perception. This article provides evidence for these three processes using a common consumer product (hand lotion).

TWO TYPES OF AFFECT

Two distinct types of affect are relevant to consumer judgment and decision making: *state affect* and *hedonic affect* (Barbano and Cador 2007). State affect refers to the general, global affective state of the consumer (e.g., a mood). For example, consumers in a *positive state affect* (henceforth positive affect) experience a light, airy feeling that makes them feel alive and upbeat, although they do not necessarily know why they feel good (Ciompi and Panksepp 2005;

Panksepp 1998; Sacks et al. 1972). Consumers in a *negative state affect* (henceforth negative affect) experience a heavy feeling that makes them feel downcast and lethargic, a global state that is sometimes called “anergia” to indicate the lack of psychic and physical energy (Salamone, Cousins, and Bucher 1994). State affect has been shown to exert an assimilative influence on the evaluation of products (Gardner 1985), evaluations of brand extensions (Barone 2005), attitudes toward an ad (Goldberg and Gorn 1987), decisions about future consumption (Pham 1998), and judgments of life satisfaction (Schwarz and Clore 1983), and decision making (Drolet and Luce 2004). State affect exerts an influence on judgments by making valence-congruent information more accessible (Isen et al. 1978), by directly serving as information (Schwarz and Clore 1983), and by affect transfer (Morales and Fitzsimons 2007). In organisms with highly-developed prefrontal cortices, difficulty from making a decision (Luce, Payne, and Bettman 1999) can also lead to negative affect, which can lead to choosing options that minimize the negative affect generated by the choice difficulty (Drolet and Luce 2004). Neurologically, this choice difficulty is generated by CRF activation, so it still falls under *state affect*.

In contrast, *hedonic affect* refers to the affective experience (e.g., hedonic response) that is generated as a direct function of a product exposure or consumption experience. *Positive hedonic affect* is what consumers experience as “pleasure,” or a positive hedonic feeling that is attributed to sensory stimulation from an object that is consumed (Barbano and Cador 2007; Berridge and Robinson 1998). *Negative hedonic affect* is what consumers experience as aversion (Hoebel, Avena, and Rada 2008; Morales and Fitzsimons 2007) or, at a different level, “satiation,” “a loss of pleasure,” or a disinterested feeling in the object of interest, sometimes called “anhedonia” to indicate the lack of hedonic pleasure (Panksepp 1998; Rolls 2005; Salamone, Cousins, and Bucher 1994). There is evidence that hedonic affect can be separate

from the overall evaluation of a product, but that hedonic affect is a common antecedent to an attitude judgment (see Cohen et al. 2008). Hedonic affect has been shown to influence attitudes toward an ad (Batra and Ray 1986), the evaluation of products (e.g., Pham et al. 2001), behavioral intentions (Bodur, Brinberg, and Coupey 2000), choices (Shiv and Fedorikhin 1999), behavior (Allen, Machleit, and Kleine 1992), and satisfaction with product performance (Oliver 1993). Hedonic affect exerts an influence on judgments through the process of evaluative conditioning (De Houwer, Thomas, and Baeyens 2001), affect transfer (Mackenzie, Lutz, and Belch 1986), or by serving as information (Pham 1998; Schwartz and Clore 1983).

There is psychological and neurological evidence showing that state affect and hedonic affect are separate forms of affect. State affect is a nonspecific state that can impact a variety of unrelated judgments in an assimilative direction, as long as the source of the affective state is not salient (Schwarz and Clore 1983). In contrast, hedonic affect is a stimulus-specific, rapid response that is more likely to be integrated into a response when it is salient (Pham et al. 2001). Neurological evidence shows that destruction of the dopaminergic pathways that mediate state affect does not prevent the generation of hedonic affect (Berridge and Robinson 1998; Panksepp 1998; Rolls 2005). That is, an organism without intact dopaminergic pathways can become very sluggish, and not want to pursue food or sex, but once it receives tactile stimulation from intromission, it will show clear evidence of a positive hedonic response (anergia without anhedonia). Second, de-activating the opioidergic pathways that mediate hedonic affect does not prevent the generation of state affect (Berridge and Robinson 1998; Fantino, Hosotte, and Apfelbaum 1986; Panksepp 1998; Pecina et al. 2003). People in this second situation report “wanting to have sex” or “wanting to self-stimulate” but not actually enjoying the tactile stimulation once it is received (anhedonia without anergia).

AFFECTIVE GATING

Affective gating is a process whereby an organism's state affective state changes the kind of sensory input that is privileged to enter perception, subsequently influencing the ability to experience positive or negative hedonic affect (Carr and Bak 1987; Carr, Bonnet, and Simon 1982; Panksepp and Moskal 2008). This process can be described as "gating" because the various state affect circuits, through different neuromodulators (chemical neurotransmitters that increase or decrease the activation of other neurotransmitters), regulate information coming in from the sensory channels. More specifically, mammals in a negative or positive state affective state are differentially sensitive to opioids activated by specific sensory channels (i.e., the affective state has created sensory-specific needs that can only be fulfilled by the appropriate sensory information). In turn, this increased hedonic sensitivity makes the animal more responsive to information from that particular sensory channel.

Negative State Affect

Negative state affect (henceforth, negative affect) emerges from limbic circuits that respond to physical or social-psychological pain, indicating loss of physical health or loss of social support (Eisenberger, Lieberman, and Williams 2003; MacDonald and Kingsbury 2006; Panksepp 1998; Panksepp 2003; Zubieta et al. 2001). This visceral "loss" signal induces the organism to seek stimuli that restore physical or social resources (e.g, its mother and sources of social support). These restorative stimuli have been shown to be detected most reliably through tactile information (Panksepp et al. 1980; Panksepp 1998). In negative affective states such as pain or sadness, μ -receptors become highly sensitized and disproportionately available (Zubieta et al. 2003). μ -receptors have a molecular structure that is opened only by β -endorphins, the

primary opioid released during tactile stimulation. When β -endorphins bond to the μ -receptor, there is a subjective alleviation of the negative affective state (i.e., pain or sadness is reduced or eliminated) and a subsequent experience of hedonic pleasure is generated (Nelson and Panksepp 1998). In support of this hypothesis, Martel et al. (1993) showed that *prolonging* the negative affective state increases the motivation of rhesus monkeys to receive tactile stimulation from mothers or other conspecifics. In addition, the administration of morphine, which *removes* negative affect, actually removes the ability of tactile stimulation to generate hedonic pleasure (Martel et al. 1993; Panksepp, Najam, and Soares 1979). Negative state affective states thus have the surprising influence of increasing positive hedonic affective responses toward tactile stimulation.

Positive State Affect

Positive state affect (henceforth, positive affect) emerges from limbic circuits that induce the nonspecific searching for rewards and the learning of reward cues (Barbano and Cador 2007; Berridge and Robinson 1998; Panksepp 1998). In mammals, food and sexual rewards are located using the olfactory system (lower mammals) or visual system (higher mammals, including humans). The visual system helps the organism search for food, for example, by identifying colorful berries against a backdrop of foliage, and by identifying prey movement against a backdrop of other objects (visual motion detection and visual temporal resolution). Additionally, the visual system helps the organism safely perform “seeking-type” forward locomotion, one of the universal behavioral responses among mammals in a positive affective state (Panksepp’s “Search for nuts and knowledge” hypothesis, see Panksepp 1998; Ikemoto and Panksepp 1999). Positive affective states cause pupil dilation and an enlargement of the visual field (Partala and Surakka 2003), increase visuo-spatial breadth (Rowe, Hirsh, and Anderson 2007), modulates

visual temporal resolution (Mora-Ferrer and Gangluff 2002), and aids in visual motion detection (Mora-Ferrer and Gangluff 2000). The effects of positive affect on visual intake are generally adaptive, although in extreme cases, overproduction of dopamine (the main mediator of positive affect) can increase visual intake excessively, causing a failure of the affective-perceptual system to perform gating of irrelevant visual stimuli (Mansbach, Geyer, and Braff 1988).

Positive affective states are instrumental in the development of visual perception (Imanaka et al. 2008; Mora-Ferrer and Gangluff 2000; Rolls 2005). Positive affect indicates that the organism is self-sufficient and should search its environment for rewards and reward cues, hence, visual intake is enhanced through autonomic and non-autonomic processes. First, eye-tracking studies show that subjects in a positive affective state make more eye saccades than subjects in a neutral or negative affective state (Wadlinger and Isaacowitz 2006) and are better at visual motion detection (Mora-Ferrer and Gangluff 2000). Second, limited visual exploration inhibits perceptual development. For example, kittens that are prevented from visual exploration become deficient in judgments of visual depth and line orientation (Hubel and Wiesel 1963; Wiesel and Hubel 1963a; Wiesel and Hubel 1963b). Mammals that do not perform visual exploration are more likely to become developmentally challenged, and become less able to judge color contrast, stimulus depth, and stimulus movement (Findlay and Gilchrist 2003; Held and Hein 1963). Taken together, these results are consistent with the idea that organisms in a positive affective state are hard-wired to search, and this tendency leads to a greater sensitivity to visual sensory input.

Evidence for Affective Gating

Although the affective gating hypothesis has not been previously tested in humans, there are mammalian results that are consistent with the hypothesis. For example, Harlow (1958)

demonstrated that a rhesus monkey will attach to a terry-cloth “mother” when it is afraid, despite the terry-cloth mother's absence of food (and the presence of food in a steel wire-mother in an alternate location). With the benefit of neurological hindsight, it could be argued that Harlow’s results illustrated the privileged access of tactile channel information in a negative affective state. Similarly, Panksepp et al. (1980) demonstrated that chicks in a negative affective state (as measured by the number and intensity of separation distress calls) stop their separation distress calls and exhibit hedonic eye-closure when caressed by human hands. Hofer (1987) shows that even tactile stimulation from a flat strip of synthetic fur on the floor reduces distress vocalizations among distressed rats. The fact that tactile stimulation from human hands (as opposed to the chick’s mother) or flat synthetic fur was able to quell the animal’s negative affective state is consistent with the idea that *non-specific* tactile stimulation can alleviate a negative affective state (i.e., visual or olfactory recognition of the mother is not necessary).

Lewis (2000) makes an argument from a developmental perspective. Lewis posits that the response dynamics of affective-perceptual circuits iteratively develop in response to life events. It can be argued that the hedonic response to tactile stimulation in a negative affective state is an adaptation that promotes social bonding and cohesion, whereas the lack of a hedonic response (or aversion) to tactile stimulation in a positive affective state is an adaptation that promotes environmental exploration. Without the alternating increase and decrease of hedonic experience from tactile stimulation, social cohesion and exploration cannot be optimized to advance organismic survival. The organism needs to feel pleasure from tactile contact some of the time, and not feel pleasure from tactile contact at other times, in order to achieve both the social attachment and exploration needs that promote well-rounded development.

Hypotheses

If the affect-gating premise is true, then the experience of sensory stimulation should not simply be a function of the objective quality of stimulation (e.g., velvet is experienced as more pleasant than wood), but should also be a function of the specific fit between the current affective state and the sensory channel. In negative affective states, stimulation via tactile channels releases β -endorphins that bind with μ -receptors to generate hedonic pleasure. Hence, a consumer in a negative affective state will be more sensitive to tactile stimulation and should, paradoxically, experience a greater hedonic affective response from tactile stimulation compared to consumers in a positive or neutral affective state. In addition, the pleasurable hedonic experience will cause the consumer to impute higher perceived quality to the source of the tactile stimulation.

- H1:** Consumers in a negative affective state (as compared to consumers in a neutral or positive affective state) will
- a. experience a product in a more tactile way;
 - b. rate tactile product benefits more positively;
 - c. be more sensitive to changes in tactile product benefits;
 - d. experience an increased hedonic affective response to tactile stimulation.

In contrast, a consumer in a positive affective state should be more sensitive to visual product benefits. Because autonomic increases in visual sensory intake occur during positive affect states, the consumer will be more sensitive to visual product attributes (generally positive in valence for most products), and will thus rate visual product attributes more positively. Yet, visual stimulation in a positive affective state does not result in an increased hedonic response because visual channels do not have pathway access to brain opioids that activate μ -receptors.

- H2:** Consumers in a positive affective state (as compared to consumers in a neutral or negative affective state) will
- a. experience a product in a more visual way;
 - b. rate visual product benefits more positively;
 - c. be more sensitive to changes in visual product benefits;
 - d. not experience an increased hedonic affective response to tactile stimulation.

To the extent that negative and positive states induce a person to be more sensitive to tactile or visual information, respectively, and to the extent that this sensitivity leads to a more positive evaluation of product attributes, the consumer should value the product more. When in a negative affective state, this increased valuation of the product should be driven by the hedonic response that results from the tactile stimulation (i.e., mediated by hedonic affect). When in a positive affective state, this increased valuation of the product should be driven by the affective state itself (i.e., mediated by state affect).

- H3:** Consumers in a negative affective state (as compared to consumers in a neutral or positive affective state) will pay more for a product that is experienced tactilely. The increased product valuation will be mediated by the hedonic affective response to the tactile stimulation (hedonic affect).

- H4:** Consumers in a positive affective state (as compared to consumers in a neutral or negative affective state) will pay more for a product experienced visually. The

increased product valuation will be a direct consequence of the affective state of the consumer (state affect; i.e., a mood congruency effect).

EXPERIMENT 1

Experiment 1 tested the hypothesis that a current affective state can influence a person's sensitivity to information from competing sensory channels (hypotheses H1a and H2a). Participants were asked to experience a product (skin lotion) while in a negative, neutral, or positive affective state. Afterwards, participants were asked to describe the product experience in their own words. It was expected that participants in a negative affective state would be more sensitive to the tactile product experience, whereas participants in a positive affective state would be more sensitive to the visual product experience.

Design and Procedure

Design. Forty-eight undergraduate students participated in the study for course credit. The study used a between-subject manipulation of the affective state (negative, neutral, positive). Participants were induced into an affective state, tried a product (hand lotion), and recorded their perceptions of the product.

Procedure. Participants were invited into a behavioral lab and were told that the study investigated "how consumers experience products under different emotional states." It was explained that people in certain professions (health care, military) often experienced temporary and/or prolonged emotional states and that these moods could influence their appreciation for products. Participants were told, "your task is to help us design products by sincerely trying your best to feel the emotion that is suggested by the statements you are about to read."

Participants were then induced into a negative, neutral, or positive affective state using the Velten (1968) affect induction procedure. The Velten procedure involves reading a series of statements that get progressively more negative (negative affect condition), progressively more positive (positive affect condition), or remain consistently neutral (control condition).

Participants were told to read the statements into a microphone, and to take their time imagining how each statement applied to their lives. For example, the negative affective state manipulation starts with mildly negative statements such as “I feel a little bit low today” and ends with strongly negative statements such as “All of the unhappiness of my past life is taking possession of me.” The positive affective state manipulation starts with mildly positive statements such as “I feel light-hearted” and ends with strongly positive statements such as “God, I feel great!” The neutral affective state manipulation starts with affectively neutral statements such as “Oklahoma City is the largest city in the world in area, with 631.166 square miles” and ends with affectively neutral statements such as “At low tide the hulk of the old ship could be seen.” This Velten procedure has been found to reliably induce physiological changes corresponding to positive and negative affect (Brown et al. 1993; Gadea et al. 2005).

After the affective state induction, subjects were asked to try a hand lotion. The lotion was Crystal Waters™. The lotion was light blue in color and had a tropical lily scent, and was placed in an 8-ounce, clear plastic bottle with a pump top. Each participant had a bottle of lotion in their personal cubicle. After trying the lotion, participants were asked to describe the product using any of the five senses.

Product Description Coding. The product descriptions were coded by two judges who were blind to experimental condition, with disagreements resolved through negotiation. Judges coded perceptions in reference to tactile, visual, and olfactory dimensions. Perceptions related to

the tactile dimension included “feels smooth and silky,” “moisturizing,” and “cool to the touch.” Perceptions related to the visual dimension included “has a nice blue color,” “looks calming,” and “looks like the ocean.” Perceptions related to the olfactory dimension included “smells good,” “floral scented,” and “smells sweet.”

Velten Procedure Manipulation Check. The effectiveness of the Velten (1968) procedure in inducing affective states was confirmed using the Positive-Affect-Negative-Affect Scale (PANAS) first developed by Watson, Clark, and Tellegen (1988) in the psychology literature and subsequently adopted for marketing by Aaker, Drolet, and Griffin (2008). Eighty-three participants were induced into a negative, neutral, or positive affective state using the Velten procedure. Participants then used 11-point scales (0 = *not at all* and 10 = *extremely*) to report how unhappy, disappointed, depressed, bad, unfavorable, dissatisfied, happy, elated, upbeat, good, favorable, and satisfied they felt in real time. The six negative affect items were combined to form the negative affect index (Cronbach’s $\alpha = .97$), and the six positive affect items were combined to form the positive affect index (Cronbach’s $\alpha = .98$). The affective state manipulation had a significant main effect on both negative affect ($F(2, 80) = 41.64, p < .01$) and positive affect ($F(2,80) = 35.71, p < .01$) indices. Participants in the negative affect condition felt more negative ($M = 5.57$) than the participants in the neutral ($M = 2.60, F(1, 80) = 30.92, p < .01$) or positive ($M = 1.13, F(1, 80) = 67.72, p < .01$) affect conditions. Participants in the positive affect condition felt more positive ($M = 7.54$) than the participants in the neutral ($M = 3.96, F(1, 80) = 39.41, p < .01$) or negative ($M = 2.58, F(1, 80) = 79.69, p < .01$) affect conditions.

Results

The data were analyzed using a repeated-measure ANOVA with the number of tactile and visual product descriptions as the repeated measure and affective state as the between-subjects factor. The affective state by sensory channel perceptions interaction was significant ($F(2, 45) = 14.30, p < .05$). The number of tactile perceptions ($F(2, 45) = 6.43, p < .01$) and visual perceptions ($F(2, 45) = 12.57, p < .01$) varied by affective condition. Participants experiencing a negative affective state generated more tactile perceptions ($M = 2.07$) than participants experiencing a neutral ($M = 1.19; F(1, 45) = 10.19, p < .01$) or positive ($M = 1.24; F(1, 45) = 9.93, p < .01$) affective state. Participants experiencing a positive affective state generated more visual perceptions ($M = 1.06$) than participants experiencing a neutral ($M = .31; F(1, 45) = 16.17, p < .01$) or negative ($M = .20; F(1, 45) = 20.70, p < .01$) affective state. A supplemental analysis showed that olfactory perceptions did not vary by affective condition ($M_{\text{Negative}} = 1.07, M_{\text{Neutral}} = 1.31, M_{\text{Positive}} = 1.29; F(2, 45) = .82, p > .10$).

Discussion

Experiment 1 demonstrates that consumers in a negative affective state generated more tactile perceptions. In contrast, consumers in a positive affective state generated more visual perceptions. The affective state-specific response patterns provide preliminary evidence in support of hypotheses 1a and 2a. The competing pattern of results on the tactile and visual measures, and the null effect on the olfactory measure, suggest that the results are not a consequence of participants being more motivated to process information in certain affective states.

For the remaining studies, it is important to distinguish between two types of tactile perception (McGlone et al. 2007; Pecina, Smith and Berridge 2006). Discriminative touch is mediated by fast-conducting sensory pathways (McGlone et al. 2007). Discriminative touch

corresponds to “what is the tactile quality of this stimulus?” In contrast, hedonic touch is mediated by slow-conducting sensory-affective pathways (Vallbo, Olausson, and Wessberg 1999; Rolls 2005). Hedonic touch corresponds to phenomenological experiences such as “how good does this stimulus make you feel (McGlone et al. 2007)?” Hence, perceived tactile quality, and sensation in general, is independent from hedonic experience and can be separately measured and tested.

EXPERIMENT 2

Experiment 2 tested the hypothesis that a current affective state can influence a person’s appreciation for information from competing sensory channels. Consumers were asked to experience a product (skin lotion) while in a negative, neutral, or positive affective state. Afterwards, participants were asked to rate the tactile, visual, and olfactory quality of the product, the hedonic experience of using the product, and the amount they would pay for the product. It was expected that participants in a negative (positive) affective state would rate the tactile (visual) quality of the product more favorably (Hypothesis 1b and 2b). Additionally, it was expected that participants in a negative affective state should have a greater hedonic experience from using the product (Hypothesis 1d) and should be willing to pay more for the product because of this hedonic experience (Hypothesis 3). Participants in a positive affective state should not have a greater hedonic experience from using the product, but should be willing to pay more for the product because their state positive affective state generates a mood congruent response (Hypothesis 4).

Design and Procedure

Seventy undergraduate students participated in the study for course credit. The study used a between-subject manipulation of the affective state (negative, neutral, positive). The procedure was identical to the procedure used in experiment 1 except for the dependent measures. First, participants indicated their hedonic affect by rating how good the lotion made them feel from 0 (Does not feel good at all) to 10 (Feels very good). Then, participants rated the tactile (“silky feel”), visual (“visually appealing”), and olfactory (“sweet smelling”) quality of the product from 0 (“not silky”, “not visually appealing”, “not sweet smelling”) to 10 (“very silky”, “very visually appealing”, “very sweet smelling”). Finally, participants stated the dollar amount they would be willing to pay for a 10-ounce bottle of the lotion.

Results

Primary Analysis. The mean responses are presented in table 1. The data were initially analyzed using a repeated-measure ANOVA with the tactile and visual product ratings as the repeated measure and affective state as the between-subjects factor. The affective state by product rating interaction was significant ($F(2, 67) = 4.65, p < .05$). The tactile ratings ($F(1, 67) = 4.78, p < .05$) and visual ratings ($F(1, 67) = 7.05, p < .05$) varied by affective condition.¹ Participants in a negative affective state rated the tactile quality of the lotion more favorably ($M = 6.91$) than participants in the neutral affective state ($M = 5.42; F(1, 67) = 6.28, p < .05$), whereas the ratings of participants in the positive affective state ($M = 6.05$) did not vary from the ratings of participants in the neutral affective state ($M = 5.42; F(1, 67) = 1.33, p > .05$).

Participants in a positive affective state rated the visual appeal of the lotion more favorably ($M =$

¹ Theory predicts that the tactile quality ratings should be higher in the negative affective state than in the neutral or positive affective states. The affective state variable was contrast coded (e.g., negative = 1, neutral = -.5, positive = -.5) to be consistent with this prediction (see Keppel and Wickens 2004, pp. 80-83). Contrast coding was used for tactile quality ratings, visual quality ratings, and hedonic responses. Contrast coding was retained for analyses performed in subsequent experiments and will not be discussed further.

7.35) than participants in the neutral affective state ($M = 5.62$; $F(1, 67) = 6.46, p < .05$), whereas the ratings of participants in the negative affective state ($M = 5.86$) did not vary from those of participants in the neutral affective state ($M = 5.62$; $F(1, 67) = .12, p > .05$). Olfactory quality ratings did not vary by affective state ($M_{\text{Negative}} = 7.24, M_{\text{Neutral}} = 7.42, M_{\text{Positive}} = 7.70$; $F(2, 67) = .23, p > .05$).

The next analysis focused on the hedonic response to the lotion and the amount the participant was willing to pay to buy the lotion. The hedonic response ($F(1, 67) = 4.78, p < .05$) and willingness to pay ($F(2, 67) = 3.22, p < .05$) varied by the affective state condition. Participants in a negative affective state indicated the lotion made them feel better ($M = 6.71$) relative to participants in the neutral affective state ($M = 5.12$; $F(1, 67) = 6.47, p < .05$), whereas the ratings of participants in the positive affective state ($M = 5.87$) did not vary from the ratings of participants in the neutral affective state ($M = 5.12$; $F(1, 67) = 1.51, p > .05$). Participants in a negative affective state ($M = \$4.62$) and a positive affective state ($M = \$4.78$) were willing to pay more for the lotion than participants in the neutral affective state ($M = \$3.21$; $F(1, 67) = 4.09, p < .05$; $F(1, 67) = 5.32, p < .05$).

 Insert table 1 about here

Mediation Analysis for Negative Affective State Participants. The Baron and Kenny (1986) three-part procedure was used to assess whether tactile quality rating and hedonic response mediated the influence of the affective state on the amount the participants were willing to pay for the lotion. The analysis used participants in the negative and neutral affective states. First, the affective state was a significant predictor of the willingness to pay ($\beta = -1.41, SE = .58, t(45) = -2.45, p = .02$). Second, the affective state was a significant predictor of the tactile quality

($\beta = -1.48$, $SE = .55$, $t(45) = -2.68$, $p = .01$) and the hedonic response ($\beta = -1.60$, $SE = .65$, $t(45) = -2.46$, $p = .02$). Third, when the willingness to pay measure was regressed on the affective state and the tactile quality, the affective state coefficient became non-significant ($\beta = -.81$, $SE = .58$, $t(44) = -1.40$, $p = .17$) and the tactile quality coefficient remained significant ($\beta = .40$, $SE = .15$, $t(44) = 2.78$, $p < .01$; Sobel $z = -2.13$, $p = .03$). Likewise, when the willingness to pay measure was regressed on the affective state and the hedonic response, the affective state coefficient became non-significant ($\beta = -.62$, $SE = .52$, $t(44) = -1.21$, $p = .23$) and the hedonic response coefficient remained significant ($\beta = .49$, $SE = .11$, $t(44) = 4.42$, $p < .01$; Sobel $z = -2.22$, $p = .03$).

Lack of Mediation for Positive Affective State Participants. The Baron and Kenny (1986) three-part procedure was used to establish that the visual quality rating and hedonic response did not mediate the influence of the affective state on the amount the participants were willing to pay for the lotion. The analysis used participants in the positive and neutral affective states. First, the affective state was a significant predictor of the willingness to pay ($\beta = 1.57$, $SE = .68$, $t(47) = 2.29$, $p = .03$). Second, the affective state was a significant predictor of the visual quality ($\beta = 1.73$, $SE = .68$, $t(47) = 2.55$, $p = .01$) but not of the hedonic response ($\beta = .75$, $SE = .59$, $t(47) = 1.27$, $p = .21$). Third, when the willingness to pay measure was regressed on the affective state and the visual quality measures, the affective state coefficient ($\beta = 1.18$, $SE = .72$, $t(46) = 1.64$, $p = .11$) and the visual quality coefficient ($\beta = .22$, $SE = .15$, $t(46) = 1.54$, $p = .13$) both became non-significant. The non-significance of the hedonic state coefficient in part two of the analysis and visual quality coefficient in part three of the analysis indicates that neither process is a mediator.

Discussion

Experiment 2 provides additional evidence for the affective gating hypothesis. Participants in a negative (positive) affective state were more sensitive to tactile (visual) sensory information. People in the negative affective state experienced a positive hedonic response (hedonic affect) from the tactile stimulation, which in turn resulted in a greater willingness to pay for the product. People in the positive affective state were more sensitive to visual stimulation, but this visual stimulation did not drive the valuation of the product. Instead, the affective state was responsible for the valuation of the product. This mood congruency effect is consistent with many *state* affect findings in the psychology and consumer behavior literature (Forgas 1995; Gardner 1985; Pham 1998).

If different affective states indeed make the consumer sensitive to different sensory channels, and if the tactile sensory channel indeed has privileged access to hedonic affect under negative affective states (through the interaction of β -endorphins with μ -receptors), then consumers should generate less β -endorphins, and subsequently less liking, for the product when tactile quality is reduced. However, for consumers in a positive affective state, the decrease in objective tactile quality should go unnoticed. These predictions were investigated in experiment 3.

EXPERIMENT 3

Experiment 3 tested the hypothesis that a current affect state can influence a person's sensitivity to changes in the quality of sensory stimulation (Hypotheses 1c). Consumers were asked to experience a high or low quality product (skin lotion) while in a negative, neutral, or positive affective state. Afterwards, participants were asked to rate the tactile, visual, and olfactory quality of the product, the hedonic experience of using the product, and the amount

they would pay for the product. It was expected that participants in a negative affective state would be more sensitive to changes in the tactile quality of lotion compared to participants in a neutral or positive affective state. The differential sensitivity to the tactile quality was also expected to be reflected in the consumer's hedonic experience, and willingness-to-pay, for the product.

Design and Procedure

Design. One hundred eighty-eight undergraduate students participated in the study for course credit. The study used a 3 x 2 between-subjects design, in which there was a between-subject manipulation of the affective state (negative, neutral, positive) of the participant and a between-subject manipulation of the objective quality (low quality, high quality) of the product.

Procedure. The procedure was identical to that used in experiment 2. The low quality lotion was created by mixing 8 mL of water into every 100 mL of the lotion. Each bottle of lotion was shaken 20 seconds before the start of each experimental session to ensure product consistency. The high quality lotion was the lotion used in prior experiments.

Results

Primary Analysis. The mean responses are presented in table 2. The key predictions involved the tactile quality, hedonic response, and willingness to pay dependent measures. The affective state by objective product quality interaction was significant for the tactile quality rating ($F(1, 184) = 6.01, p < .05$). Consumers in a negative affective state rated the tactile quality of the lotion to be lower when the lotion had a low ($M = 5.38$) as opposed to high ($M = 6.93$) objective quality ($F(1, 182) = 8.80, p < .05$) whereas neutral ($M_{\text{Low Quality}} = 5.57, M_{\text{High Quality}} = 5.34; F(1, 182) = .18, p > .05$) and positive ($M_{\text{Low Quality}} = 5.55, M_{\text{High Quality}} = 5.74; F(1, 182) = .12, p > .05$) affective state consumers rated the two lotions equally good.

It was predicted that the sensitivity to tactile quality exhibited by the consumers in the negative affective state would influence their hedonic response to the lotion and the amount they were willing to pay for the lotion. Consumers in a negative affective state had a more negative hedonic response to the low ($M = 5.59$) as opposed to high ($M = 6.97$) objective quality lotion ($F(1, 182) = 6.32, p < .05$) whereas neutral ($M_{\text{Low Quality}} = 5.17, M_{\text{High Quality}} = 5.47; F(1, 182) = .30, p > .05$) and positive ($M_{\text{Low Quality}} = 5.59, M_{\text{High Quality}} = 5.77; F(1, 182) = .11, p > .05$) affective state consumers had similar hedonic responses. Consumers in a negative affective state wanted to pay less for the low ($M = \$3.29$) as opposed to high ($M = \4.71) objective quality lotion ($F(1, 182) = 7.86, p < .05$) while neutral ($M_{\text{Low Quality}} = \$2.98, M_{\text{High Quality}} = \$3.62; F(1, 182) = 1.58, p > .05$) and positive ($M_{\text{Low Quality}} = \$3.79, M_{\text{High Quality}} = \$4.40; F(1, 182) = 1.44, p > .05$) affective state consumers wanted to pay similar amounts.

 Insert table 2 about here

Mediation Analysis for Negative Affective State Participants. The Baron and Kenny (1986) three-part procedure was used to assess whether the tactile quality rating and hedonic response mediated the influence of the objective quality of the lotion on the amount the participants were willing to pay for the lotion. The analysis used participants in the negative affective state. First, objective quality was a significant predictor of the willingness to pay ($\beta = 1.41, SE = .50, t(61) = 2.85, p < .01$). Second, the objective quality was a significant predictor of the tactile ratings ($\beta = 1.55, SE = .50, t(61) = 3.13, p < .01$) and the hedonic response ($\beta = 1.38, SE = .50, t(61) = 2.80, p < .01$). Third, when willingness to pay was regressed on the objective quality and the tactile quality ratings, the objective quality coefficient became non-significant ($\beta = .76, SE = .49, t(60) = 1.56, p = .13$) and the tactile quality ratings remained significant ($\beta = .42,$

$SE = .12$, $t(60) = 3.60$, $p < .01$; Sobel $z = 2.56$, $p = .01$). Likewise, when the willingness to pay was regressed on the objective quality and the hedonic response, the objective quality coefficient became non-significant ($\beta = .85$, $SE = .49$, $t(60) = 1.75$, $p = .08$) and the hedonic response remained significant ($\beta = .41$, $SE = .12$, $t(60) = 3.46$, $p < .01$; Sobel $z = 2.33$, $p = .02$).

Discussion

Experiment 3 demonstrates that consumers in a negative affective state were more sensitive to changes in the objective quality of a lotion, leading to changes in the amount they were willing to pay for the product. In contrast, consumers in neutral and positive affective states were relatively insensitive to changes in the objective quality of the lotion, leading to no significant differences in the amount they would pay for the lotion.

A simple way to describe the results thus far is to claim that people in a negative state are sensitive to tactile information, whereas people in a positive state are sensitive to visual information. This explanation is a bit too simplistic because it suggests that the perceptual sensitivity differences between people in a negative and positive affective state is a function of directed attention. This is not so. Neurophysiological findings suggest that people in a negative state are differentially receptive to information from the tactile channel (i.e., there is a gating effect). That is, if visual channel information were to be reduced, the emphasis on the tactile channel information would increase and the hedonic experience would become more intense. However, people in a positive state are not affect-gated, hence, are not receptive to the tactile channel information. Thus, even if the visual channel information were to be reduced, the person would still be unable to affectively appreciate the tactile channel information. In effect, the person in the positive state is affectively numb (in relative terms) to the influence of tactile information.

EXPERIMENT 4

Experiment 4 tested the hypothesis that blocking the visual channel could increase a negative-state consumer's sensitivity to the activation in the tactile sensory pathways. In the experience of tactile stimulation, blocking a competing sensory channel (visual channel) transfers neural activation to the remaining, unblocked channel, increasing its affective sensitivity. In turn, this increased sensitivity should be experienced hedonically and result in an increased valuation of the product. In contrast, blocking the visual channel should not influence consumers in a neutral or positive affective state, because these consumers are not affectively receptive to tactile information.

Design and Procedure

Design. Two hundred and fifty-one undergraduate students participated in the study for course credit. The study used a 3 x 2 between-subjects design, with affective state (negative, neutral, positive) and visual channel blocking (block, control) as the between-subjects factors. Participants were induced into an affective state, and then experienced the lotion while closing their eyes (block visual channel condition) or while keeping their eyes open (control condition). The participants then rated their hedonic experience, the product's perceived tactile, olfactory, and visual qualities, and indicated their willingness-to-pay in dollars and cents. One participant did not follow the blocking instructions and two respondents listed prices that were more than three standard deviations from the mean. These data points were excluded from the analyses.

Procedure. The procedure was identical to experiments 2 and 3 with the exception of the blocking conditions. Participants in the blocking conditions were told, "Please close your eyes

and try the lotion. Remember to keep your eyes closed (for 20 seconds or so) while you are applying the lotion.” In the control condition, participants were not given any instructions. The experiment administrator and assistant confirmed that participants in the control condition kept their eyes open during the application of the product.

Results

Primary Analysis. The mean responses are presented in table 3. The key predictions involved the tactile quality, hedonic response, and willingness to pay dependent measures. The affective state by blocking interaction was significant for the tactile quality measure ($F(1, 244) = 3.95, p < .05$). Consumers in a negative affective state rated the tactile quality of the lotion higher when their eyes were closed during product application ($M = 7.30$) as opposed to open ($M = 6.30; F(1, 242) = 4.30, p < .05$) whereas neutral ($M_{\text{Closed}} = 5.27, M_{\text{Open}} = 5.41; F(1, 242) = .09, p > .05$) and positive ($M_{\text{Closed}} = 6.19, M_{\text{Open}} = 6.36; F(1, 242) = .14, p > .05$) affective state consumers were insensitive to the visual channel blocking manipulation.

It was predicted that the sensitivity to blocking exhibited by the consumers in the negative affective state would influence their hedonic response to the lotion and the amount they were willing to pay for the lotion. Consumers in a negative affective state had a more positive hedonic response with their eyes closed ($M = 7.50$) as opposed to open ($M = 6.37; F(1, 242) = 5.06, p < .05$) whereas neutral ($M_{\text{Closed}} = 5.51, M_{\text{Open}} = 5.36; F(1, 242) = .09, p > .05$) and positive ($M_{\text{Closed}} = 6.05, M_{\text{Open}} = 6.13; F(1, 242) = .03, p > .05$) affective state consumers had similar hedonic responses. Consumers in a negative affective state wanted to pay more for the lotion when their eyes were closed ($M = \$5.13$) as opposed to open ($M = \$3.98; F(1, 242) = 7.22, p < .05$) while neutral ($M_{\text{Closed}} = \$3.30, M_{\text{Open}} = \$3.37; F(1, 242) = .02, p > .05$) and positive (M_{Closed}

= \$4.25, $M_{\text{Open}} = \$4.88$; $F(1, 242) = 1.54, p > .05$) affective state consumers wanted to pay similar amounts.

Insert table 3 about here

Mediation Analysis for Negative Affective State Participants. The Baron and Kenny (1986) three-part procedure was used to assess whether the tactile quality rating and hedonic response mediated the influence of the visual channel blocking on the amount the participants were willing to pay for the lotion. The analysis used participants in the negative affective state. First, visual channel blocking was a significant predictor of the willingness to pay ($\beta = -1.16, SE = .56, t(78) = -2.08, p < .05$). Second, visual channel blocking was a significant predictor of the tactile quality ratings ($\beta = -1, SE = .45, t(78) = -2.22, p < .05$) and the hedonic response ($\beta = -1.13, SE = .49, t(78) = -2.31, p < .05$). Third, when the willingness to pay was regressed on visual channel blocking and the tactile quality ratings, the visual channel blocking coefficient became non-significant ($\beta = -.35, SE = .44, t(78) = -.80, p = .43$) and the tactile quality rating coefficient remained significant ($\beta = .81, SE = .11, t(78) = 7.51, p < .01$; Sobel $z = -2.14, p = .03$). Likewise, when the willingness to pay was regressed on visual channel blocking and the hedonic response, the visual channel blocking coefficient became non-significant ($\beta = -.28, SE = .43, t(78) = -.16, p = .51$) and the hedonic response coefficient remained significant ($\beta = .78, SE = .10, t(78) = 8.10, p < .01$; Sobel $z = -2.23, p = .03$).

Discussion

Experiment four showed that blocking the visual channel increased perceptions of the tactile quality of a product, but only when a person was in a negative affective state. This result

is consistent with the affect-gating hypothesis. Blocking the visual channel increased sensitivity to the activation in the unblocked tactile channel. Blocking the visual channel was especially effective because the visual cortices are the most energy-consuming cortices in the human brain, consuming about 60% of the total oxygen distributed to all five sensory cortical groups when a person is awake. Thus, blocking information acquisition by the visual channel can increase sensitivity to information presented in the remaining four channels. When people were in a negative affective state, the activation of the tactile channel led to a greater release of β -endorphins that provide a pleasant feeling of affective relief. Thus, blocking the sensory channel that did *not* have access to affective gates helped enhance the pleasure of the consumption experience.

The neuroscience literature offers further insights on how to improve the quality of tactile stimulation in affect-specific ways. Panksepp (1998) proposes that separation distress, a major component of negative affect (mediated by CRF, or Corticotrophin Releasing Factor), is accompanied by thermoregulatory changes in the dermis and epidermis (skin). Animal studies show that sad rhesus monkeys that were separated from their mothers had a lower surface temperature compared to control monkeys (Kalin, Shelton, and Barksdale 1989). Panksepp, Nelson, and Bekkedal (1997) suggest that this *decrease* in temperature is an *adaptive* response meant to induce rhesus monkeys to look for their mothers (who provide tactile warmth). It is evolutionarily advantageous for young rhesus monkeys to remain in contact with their mothers, their primary source of nourishment and protection. Otherwise, a rhesus monkey that does *not* experience a negative-affect-mediated decrease in skin temperature may not seek its mother (the adaptive action), and this may lead to permanent separation. This is one of the surprising ways in which negative affect can have positive effects for the organism.

Once the distressed rhesus monkey is reconciled with the parent, it appears that two sources of stimulation restore the monkey toward affective equilibrium: (1) Tactile stimulation from the mother (mediated by Merkel receptors on the skin), and (2) Thermal stimulation from the mother (mediated by unmyelinated C-fibers for perceiving warmth). There is interaction between tactile and thermal stimulation (see Nelson and Panksepp 1998) because tactile stimulation, via rubbing or caressing the skin, can stimulate unmyelinated C-fibers and generate a perception of warmth. This thermo-tactile stimulation leads to opioid release, resulting in pleasurable feelings and lowered blood pressure (Uvnas-Moberg 1998). This stimulation also leads to a decrease in levels of stress hormones, alleviating negative affect (Uvnas-Moberg 1997).

The idea that there are two approaches to increasing the intensity of tactile stimulation (rubbing and direct heat transduction) has conceptual and marketing implications. The first source of tactile stimulation (rubbing) was tested in experiments 1, 2, and 3. These experiments suggest that tactile stimulation in human consumers influences product perception and has a significant impact on the consumer's hedonic response to the product (see Experiment 2). The second source of tactile stimulation (direct heat transduction) will be tested in Experiment 5A and 5B: Experiment 5A tests whether negative affect causes a physiological response of coldness among humans, and experiment 5B tests whether consumers under negative affect, who feel colder, would experience greater pleasure from warming products.

EXPERIMENT 5A

Experiment 5A tested the hypothesis that negative affect causes a physiological response of coldness among consumers. Participants were induced into a negative or neutral affective

state. Afterwards, participants were asked to rate how cold their hands felt. It was predicted that participants under negative affect would rate their hands to be colder than participants under neutral affect.

Design and Procedure

Design. Forty-two undergraduate students participated in the study for course credit. The study used a between-subjects design with affect (negative, neutral) as the between subjects factor.

Procedure. The procedure used the same Velten (1968) affect induction procedure used in the previous experiments. After the subjects are induced into their respective affect conditions, they read the question “How cold do your hands feel right now? (on a scale from 0 to 10, 10 being coldest)” and indicated their answer on a blank next to the question.

Results. The main effect of affective state is significant ($F(1,40) = 4.16, p < .05$). The participants in a negative affective state ($M = 4.23$) felt colder than the participants experiencing a neutral affective state ($M = 2.80; F(1, 40) = 4.16, p < .05$).

Discussion

Participants under negative affect felt colder than participants under neutral affect, a response pattern that is consistent with the idea that negative affect induces a physiological response of coldness to make it more likely for the organism to seek physical or social support when vulnerable. If a physiological response of coldness indeed results from negative affective states, then we should expect that a sensory stimulation of tactile warmth should be perceived as disproportionately pleasurable for consumers under negative affect (but not for consumers under neutral affect). Experiment 5B tests this idea in the context of the consumption of warming versus non-warming products.

EXPERIMENT 5B

Experiment 5B tested the hypothesis that increasing the tactile warmth of a product can enhance a consumer's hedonic response to the product when the consumer is in a negative affective state. Participants were induced into a negative or neutral affective state. Afterwards, participants were asked to try either a regular or warming lotion, and then indicate how the lotion made them feel, as well as rate the perceptual qualities of the lotion. It was expected that participants in a negative affective state would show a greater hedonic response, describe the tactile qualities of the lotion more favorably, and indicate a higher willingness-to-pay for the warming version of the product.

Design and Procedure

Design. One hundred sixty-nine undergraduate students participated in the study for course credit. The study used a 2 x 2 between-subjects design with affect (negative, neutral) and tactile warmth (warming, control) as between-subjects factors.

Procedure and Stimuli. The procedure was identical to experiments 2 and 3. The control lotion was the unadulterated lotion and the warming lotion was the same lotion infused with eucalyptus oil, a well-established warming agent. Exactly 2 mL of eucalyptus oil was infused into 140 mL of lotion using a latex-free syringe and subsequently shaken. Each bottle of lotion was shaken for twenty seconds prior to each experimental session to ensure that the warming ingredient was consistently distributed in the lotion.

Results

Primary Analysis. The key predictions involved the tactile quality, hedonic response, and willingness to pay dependent measures. The affective state by tactile warmth interaction was significant for the tactile quality measure ($F(1, 165) = 4.13, p < .05$). Consumers in a negative

affective state rated the tactile quality of the lotion higher when it contained the warming ingredient ($M = 7.64$) as opposed to not ($M = 6.21$; $F(1, 165) = 9.98, p < .05$), whereas neutral affective state consumers were insensitive to the presence of the warming ingredient ($M_{\text{Warming}} = 5.59, M_{\text{Control}} = 5.46$; $F(1, 165) = .09, p > .05$).

It was expected that the sensitivity to the warming ingredient by the consumers in the negative affective state would influence their hedonic response to the lotion and the amount they were willing to pay for the lotion. Consumers in a negative affective state had a more positive hedonic response to the lotion containing the warming ingredient ($M = 7.38$) as opposed to not ($M = 6.18$; $F(1, 165) = 5.36, p < .05$), whereas neutral affective state consumers had similar hedonic responses ($M_{\text{Warming}} = 5.44, M_{\text{Control}} = 5.59$; $F(1, 165) = .09, p > .05$). Consumers in a negative affective state wanted to pay more for the lotion containing the warming ingredient ($M = \$6.57$) as opposed to not ($M = \5.21; $F(1, 165) = 5.40, p < .05$), whereas neutral affective state consumers wanted to pay similar amounts ($M_{\text{Warming}} = \$4.06, M_{\text{Control}} = \4.06 ; $F(1, 165) = .00, p > .05$).

Insert table 4 about here

Mediation Analysis for Negative Affective State Participants. The Baron and Kenny (1986) three-part procedure was used to assess whether the tactile quality rating and hedonic response mediated the influence of the warming agent on the amount the participants were willing to pay for the lotion. The analysis used participants in the negative affective state. First, the warming ingredient was a marginally significant predictor of the willingness to pay ($\beta = 1.36, SE = .72, t(82) = 1.89, p = .06$). Second, the warming ingredient was a significant predictor of the tactile ratings ($\beta = 1.43, SE = .42, t(82) = 3.44, p < .05$) and the hedonic response ($\beta = 1.20, SE =$

.44, $t(82) = 2.71$, $p < .05$). Third, when the willingness to pay was regressed on the warming ingredient and the tactile quality ratings, the warming ingredient coefficient became non-significant ($\beta = -.23$, $SE = .59$, $t(82) = -.39$, $p = .70$) and the tactile quality rating coefficient remained significant ($\beta = 1.11$, $SE = .15$, $t(82) = 7.56$, $p < .01$; Sobel $z = 3.13$, $p < .01$). Likewise, when the willingness to pay was regressed on the warming ingredient and the hedonic response, the warming ingredient coefficient became non-significant ($\beta = .20$, $SE = .61$, $t(82) = .31$, $p = .74$) and the hedonic response coefficient remained significant ($\beta = .97$, $SE = .15$, $t(82) = 6.69$, $p < .01$; Sobel $z = 2.55$, $p = .01$).

Discussion

Experiment 5B shows that consumers in a negative affective state are sensitive to tactile stimulation as well as the heat generated by a product ingredient. We argue that the tactile contact stimulated the Merkel receptors on the skin and the thermal ingredient stimulated the unmyelinated C-fibers. Both types of stimulation activated β -endorphins that molecularly interacted with μ -receptors, generating the hedonic response. As a consequence, the product was more valued.

GENERAL DISCUSSION

Taken together, the five experiments suggest that the affective-perceptual system has gating properties, in which certain sensory information are intensified or inhibited depending on the affective state. Consumers appear to be more perceptually sensitive, and hedonically responsive, to tactile stimulation when in a negative affective state than when in a neutral or positive affective state (experiment 1). The negative-state induced sensitivity to tactile information results in a greater hedonic affective response (experiment 2), a greater appreciation

for differences in tactile product quality (experiment 3), a greater responsiveness to increases in relative tactile stimulation through blocking a competing channel (experiment 4), and a preference for products that have been engineered to have additional tactile benefits (experiment 5B). All of the negative-state induced responses to tactile information result in a higher willingness-to-pay for the product. Moreover, there is consistent evidence that tactile perception and hedonic experience mediate the relationship between product attributes and product valuation.

There is considerable anecdotal evidence that is consistent with the experimental results. First, tactile stimulation is a common response to distress (experiment 2). Children who are under distress hug their stuffed animal or snuggle with their blanket, and adults who are under distress often desire a massage or a hug. Second, consumers often close their eyes when they kiss or when they experience a massage, especially after a hard day (negative affect). This is consistent with blocking effects, in which blocking a competing sensory channel transfers activation to the unblocked sensory channel and intensifies the pleasure, especially under negative affective states (experiment 4). Third, tactile stimulation and warmth are an effective combination for alleviating negative affective states (e.g., stress or loneliness) (experiment 5B). A warm shower, which combines tactile stimulation from the dribbling water with warmth, appears to alleviate a negative affective state better than simply wearing a thick sweater (which provides warmth but not tactile stimulation). It is also interesting to note that some products are engineered to enhance tactile stimulation (e.g., multiple-jet shower heads), warmth (cough & cold syrups with warming agents, e.g., Theraflu™), or both (e.g., Ben-Gay™ Warming Capsaicin Rub). To the extent that these products are used in negative affective states (e.g.,

medication when sick, showering after a tough day at work), their benefits should be more valued.

There are four conceptual issues related to the different forms of affect and sensory experience. The first issue concerns the influence of sensory stimulation during affective states. The evidence from the studies show that tactile experience influences hedonic affect when people are in a negative affective state. The obvious follow-up question is how does this change in hedonic affect influence the consumer's state affective state? Does tactile stimulation provide a temporary hedonic experience with no underlying influence on the affective state (e.g., the person feels good temporarily, but remains in a negative affective state: Andrade 2005; Vohs, Baumeister, and Lowenstein 2007) or does the hedonic affect from tactile stimulation turn a negative affective state into a neutral or positive affective state?

The neuroscience literature suggests that the influence of tactile stimulation during a negative affective state depends on whether the organism perceives an opportunity to search its environment. If there is no clear opportunity to search the environment, tactile stimulation turns a negative affective state into a neutral state. For example, isolation-induced vocalizations in rats are reduced or eliminated when they receive tactile stimulation (Hofer 1987; Kuhn, Pauk, and Schanberg 1990). However, if rats are presented with the opportunity to search or interact with littermates, tactile stimulation can turn a negative state into a positive state. Imanaka et al. (2008) showed that tactile stimulation not only alleviates negative affect, but also induces positive affect and makes the rats show enhanced exploration and locomotor activity in an open-search task. This appears to be due to the ability of the opioid system to indirectly activate the dopaminergic system (responsible for state affect) (Burgdorf and Panksepp 2006; Smith and Berridge 2007; Spanagel, Herz, and Shippenberg 1990), as long as the environment appears to be conducive for

searching or playing (Panksepp 1998), with many novel and unpredictable stimuli (Schultz 2006). Thus, given an opportunity for consumers to subsequently explore their world or interact with other people, tactile stimulation may not only alleviate a negative affective state, but also indirectly activate a positive affective state.

A second conceptual issue involves the two sources (types) of affect, and their implication on goal pursuit and means valuation. Although the literatures on affect (e.g., Shiv, Fedorikhin, and Nowlis 2005; Johnson and Stewart 2004) and goal pursuit (Baumgartner and Pieters 2008; Dijksterhuis, Chartrand, and Aarts 2007; Ramanathan and Menon 2006) are not well-integrated, emerging neuroscience findings suggest that goal states are mediated by many of the same neuropeptides that mediate state and hedonic affect. Positive state affective states appear to be mediated by dopaminergic and vasopressinergic activation, whereas positive hedonic affective responses appear to be mediated by opioidergic and oxytocinergic activation. The former initiates search processes, a general sense of excitement, and exploration (stimulus hypervaluation during goal pursuit), whereas the latter activates satisfaction, neural habituation, and satiation (stimulus devaluation following goal fulfillment). Given that the two types of positive affect have different underlying processes, the novelty, unpredictability, and variety of products, versus the sensory-hedonic qualities of products, should be differentially important in influencing goal pursuit. For example, it may be more important for product novelty (e.g., new product, new packaging), unpredictability (e.g., sales promos, product-related trivia), and product-line variety (e.g., number of product variations) to activate search processes stimulated by positive state affect. In contrast, the veridical sensory quality of the perceptual stimulation (e.g., tactile quality, thermo-tactile quality) may be more important for influencing the hedonic experience, slowing down habituation, and limiting exposure-induced satiation.

Consumers under positive state affect may be more likely to search, and be attracted to, products and product lines with high novelty, unpredictability, and variety, whereas consumers in negative affective state may be more likely use their remembered hedonic experience as a result of the sensory-hedonic qualities (how good it felt, e.g., Cowley 2007; MacInnis, Patrick, and Park 2006; Pham and Avnet 2009) as the main driver for repeat purchasing. Given that consumers under positive state affect are relatively insensitive to veridical product information (Experiment 3), marketers should spend more effort on releasing new products, increasing unpredictability, or enhancing the variety of the product line. In contrast, given that consumers in a negative affective state are more sensitive to veridical product information (Experiment 3), marketers should spend more effort on improving product quality and the sensory usage experience (e.g., suggest closing eyes during product application) that will directly act on the consumer's hedonic system. The correct strategy would depend on whether the product is marketed at consumers under positive affect (e.g., celebratory products) or consumers under negative affect (e.g., comfort products).

A third conceptual issue is the relationship between higher-order and lower-order processes. The consumer behavior literature shows that consumers under negative affect perform more systematic cognition (Batra and Stayman 1986; Forgas 1995). Our findings suggest that the influence of a negative affective state is not limited to higher-order thought processes such as the evaluation of the strength of message arguments, but can also come in the form of increased reliance on lower-order sensory-perceptual processes (bottom-up processing, i.e., relying on objective sensory information as opposed to top-down, brand-induced inferences). The relationship between these two forms of affectively moderated processes is a potential area of investigation.

An important social issue for consumers is how the experience of hedonic affect influences compulsive consumption. The opioids generated from hedonic affect appear to contribute to biologically-mediated compulsive behavior, a form of aberrant goal pursuit. For example, consider sexually compulsive behavior. It is estimated that between 17 million and 37 million Americans exhibit uncontrollable sexual behaviors that result in negative consequences for the person and relevant others (Hagedorn and Juhnke 2005). Although public displays of socially aberrant sexual behaviors receive significant media attention, roughly 70% of sexually compulsive people perform these behaviors in private (Kafka 2001). One contribution to the compulsion may be that the tactile-induced hedonic pleasure is not subsequently accompanied by readily available, non-sexual opportunities to search, play, or interact. In non-enriched environments, repeated hedonic pleasure can lead to hypersensitization to object-specific incentives related to the pleasure-generating stimulation and devaluation of other stimuli (Tindell et al. 2005). Repeated hedonic pleasure and hypersensitization can increase the “seeking” of that *specific* stimulation (as opposed to *nonspecific* seeking of general rewards in a healthy, positive affective state) and the seeking of cues predictive of that *specific* source of hedonic affect (hedonic pleasure). This can cause the consumer to spiral into a cycle of hedonic self-stimulation. Thus, the lack of access to alternative means of enrichment appears to be a key moderator that tilts hedonic consumption toward compulsion, although there are undoubtedly other variables that contribute to the phenomenon.

Finally, this article is an effort to bring attention to the under-researched area of consumer experience and perception. Despite the undeniable importance of studying the actual consumer experience, perception, and real-time hedonics in consumption, the literature in consumer behavior has hitherto focused disproportionately on higher-order cognitive processes

that explore how the consumer predicts the consumption experience from advertising messages, branding, and other linguistic and symbolic stimuli, rather than how the consumer experiences the lower-order sensory consumption of the product or service itself. The cognitive revolution sparked by Miller (1956) and the linguistic revolution sparked by Chomsky (1955) has served the field of consumer behavior well for five decades, but the last decade has seen the affective and consciousness revolution provide equally important insights. Certainly, consumer prediction based on linguistic symbols is important in the consumer literature, but exploring the processes that generate hedonic experience in real-time is equally important in understanding the actual process of consumption and repeat consumption (Pham et al. 2001). Given that Nisbett and Wilson (1977) admonishes that consumers are generally unable to accurately predict their affective preferences through symbolic cognition (e.g., lay theories), studying affective hedonics, and non thinking-mediated preferences generated from consumption experiences in real-time, would be an important complement to the symbol-based prediction we have inherited from the cognitive and linguistic revolution.

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TABLE 1
THE EVALUATION OF SKIN LOTION UNDER DIFFERENT AFFECTIVE STATES
(EXPERIMENT 2)

Affective State	Dependent Measure				
	Tactile	Visual	Olfactory	Hedonic	Value (\$)
Negative	6.91 ^a	5.86 ^b	7.24	6.71 ^a	4.62 ^a
Neutral	5.42 ^b	5.62 ^b	7.42	5.12 ^b	3.21 ^b
Positive	6.05	7.35 ^a	7.70	5.87	4.78 ^a

NOTE — Column means with different superscripts are different at $p < .05$.

TABLE 2**THE EVALUATION OF DIFFERENT QUALITIES OF SKIN LOTION UNDER
DIFFERENT AFFECTIVE STATES (EXPERIMENT 3)**

Affective State	Dependent Measure				
	Tactile	Visual	Olfactory	Hedonic	Value (\$)
Negative					
Low Quality	5.38	5.29	7.24	5.59	\$3.29
High Quality	6.93	5.17	7.48	6.97	\$4.71
Neutral					
Low Quality	5.57	5.83	7.70	5.17	\$2.98
High Quality	5.34	5.75	6.88	5.47	\$3.62
Positive					
Low Quality	5.55	6.74	6.70	5.59	\$3.79
High Quality	5.74	6.62	7.24	5.77	\$4.40

TABLE 3**THE EVALUATION OF SKIN LOTION UNDER DIFFERENT AFFECTIVE STATES
AND VISUAL INFORMATION PRESENT OR ABSENT (EXPERIMENT 4)**

Affective State	Dependent Measure				
	Tactile	Visual	Olfactory	Hedonic	Value (\$)
Negative					
Eyes Closed	7.30	4.95	7.10	7.50	\$5.14
Eyes Open	6.30	6.03	6.68	6.37	\$3.98
Neutral					
Eyes Closed	5.27	5.81	6.90	5.56	\$3.30
Eyes Open	5.41	5.87	7.00	5.36	\$3.37
Positive					
Eyes Closed	6.19	6.35	7.98	6.05	\$4.25
Eyes Open	6.36	6.71	7.47	6.13	\$4.88

TABLE 4**THE EVALUATION OF REGULAR OR WARMING SKIN LOTION UNDER
DIFFERENT AFFECTIVE STATES (EXPERIMENT 5B)**

Affective State	Dependent Measure				
	Tactile	Visual	Olfactory	Hedonic	Value (\$)
Negative					
Control	6.21	5.39	7.44	6.18	\$5.21
Warming	7.64	5.91	6.38	7.38	\$6.57
Neutral					
Control	5.46	5.50	6.74	5.59	\$4.06
Warming	5.59	6.08	6.82	5.44	\$4.06