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Introduction

As Lina browses her TikTok feed, she sees a video about someone's experience with a new type of pill, a cognitive enhancer called a nootropic. The pill clearly put the user in a good mood and helped with focus and productivity, but it also led to a headache and difficulty sleeping that night. This mix of positive and negative information about the nootropic is making Lisa ambivalent toward this new product, an uncomfortable state of arousal because of conflicted beliefs (Priester and Petty 1996; Thompson, Zanna, and Griffin 1995). Might Lisa's ambivalence lead her to want to try it? Might further contextual elements, such as the perceived prevalence of use of this pill among other TikTok viewers, exacerbate the effect of ambivalence on behavior?

Like Lina, consumers face decisions daily about products that feature positive *and* negative outcomes. For example, food choices often entail both favorable and unfavorable consequences. One option may taste indulgent but contain high amounts of unhealthy saturated fats, while another may be healthier but less appealing (Buttler and Walther 2018). The large body of research on alcohol and other drugs has long documented the prevalence of consumers' positive and negative beliefs about the expected outcomes of substances, whether legal (e.g., alcohol, pharmaceuticals) or illegal (e.g., drugs). Despite the prevalence of ambivalence, past research has yielded conflicting findings about how it affects consumers' behavior: Some research shows ambivalence enhances approach behavior (Nowlis, Kahn, and Dhar 2002; Roster and Richins 2009; van Harreveld, van der Pligt, and de Liver 2009); other research shows ambivalence reduces it (Foster, Young, Bryan, and Quist 2016; Oser, McKellar, Moos, and Moos 2010; Plambeck and Weber 2009).

We contribute to this mixed body of research by advancing a theoretically grounded explanation for how (process) and under what conditions (contextual moderator) ambivalence causes consumers to approach risky products. We argue that ambivalence-evoked arousal focuses consumers on the immediate consequences of a consumption decision and thus increases desire for products whose immediate outcomes are positive. Because physiological arousal also sensitizes people to normative information, which is prevalent in the social media-saturated consumption environment, we offer further evidence of this process by showing that information about salient social norms moderates the relationship between ambivalence and an approach toward risky products; the degree to which a product is viewed as normative affects whether and to what degree ambivalent consumers are interested in it.

We focused our research on adolescents' and young adults' consumption of risky products. We define these products as those that may pose a hazard to consumers' well-being (Pechmann and Knight 2002). These products— such as energy drinks, electronic cigarettes, and cognitive enhancers— provide immediate positive benefits. Yet, they also carry negative health consequences that worry policymakers. Given these products' costly lifelong negative consequences for consumers and society, understanding the effects of ambivalence in such contexts is also relevant and important from the perspective of policy and consumers' well-being (Moschis 2007).

Our primary contribution is thus to research and practice related to the influence of ambivalence on consumption and related behaviors. Across six studies, as part of a nationally funded cancer prevention research program, we show that ambivalence enhances consumers' tendencies to approach products whose consumption yields immediate, positive benefits, yet also carries risks (negative consequences), such as energy drinks (Study 1), tobacco (Study 3), e-

cigarettes (Studies 3 and 4), and cognitive enhancers (Studies 2 and 5). We also provide evidence that this effect occurs because of arousal (Studies 2, 3, and 6).

Further, we build on past work that has theorized that social norms may moderate the effect of ambivalence on hypothetical, non-personally relevant decisions (e.g., Wang 2008) to empirically show that perceived norms moderate the effect of ambivalence on product-related responses. We also document an asymmetric effect of social norms that function to enhance the effect of ambivalence on approach-behavior or maintain it when descriptive norms are perceived to be higher but attenuate the effect when these norms are perceived as lower.

On the nature of ambivalence

Ambivalence entails a sense of being torn or mixed with regard to an attitudinal object (Priester and Petty 1996; Thompson et al. 1995). It occurs frequently in consumption contexts, given that consumers often hold both positive and negative beliefs about products they consider buying or consuming (Penz and Hogg 2011; Roster and Richins 2009; Ruth et al. 2002; Sipilä, Tarkiainen, and Sundqvist 2018). They become ambivalent when the positive and negative components are simultaneously accessible (van Harreveld, Van der Pligt, and de Liver 2009), whether as a function of internal processes (e.g., introspection) or in response to external factors (e.g., marketing communications with two-sided appeals, others' behavior).

Ambivalence is associated with negative moods, discomfort, and physiological arousal (Nohlen et al. 2013; van Harreveld et al. 2009a). Providing indirect support for these associations, past research shows that ambivalent people process information selectively (Clark et al. 2008), focusing on information that can decrease their ambivalence. People respond more quickly to targets of ambivalent attitudes than to neutral attitudinal targets, implying that ambivalence simulates arousal (De Liver et al. 2007). Van Harreveld and colleagues (2009b)

provided direct evidence of the physiological discomfort of ambivalence by showing that, when facing an actual decision or choice on an issue toward which individuals are ambivalent, their skin conductance levels increase, reflecting heightened arousal.¹

Behavioral consequences of ambivalence

Although existing research provides consistent evidence that ambivalence is uncomfortable and physiologically arousing, it is less consistent in terms of what consumers do to reduce it (Rothman et al. 2017). As Table 1 illustrates, some research has linked ambivalence to *approach* behavior (Foster et al. 2016; Oser et al. 2010; Menninga, Dijkstra, and Gebhardt 2011) but some has linked it to *avoidance* (Johnson and Bharadwaj 2005; Malshe and Friend 2018; Nowlis et al. 2002; Roster and Richins 2009).

The inherently aversive arousal associated with the experience of ambivalence provokes a motivational drive state to reduce it. This defining feature of ambivalence offers a novel lens to reconcile these disparate findings. Indeed, when the immediate consumption consequences associated with the attitudinal target are positive, ambivalence enhances approach behavior. In the context of substance use, often experienced as immediately pleasurable, ambivalence is generally linked to more consumption of the ambivalence-laden product. For example, ambivalence about alcohol predicts more alcohol consumption (Foster et al. 2016; Oser et al. 2010), and ambivalence toward smoking predicts a smoking relapse (Menninga, Dijkstra, and Gebhardt 2011). In contrast, ambivalence reduces approach behavior in contexts in which the immediate outcomes are not positive. Clark, Wegener, and Fabrigar (2008) found that ambivalence induced opposition to policies regarding junk food taxation and the development of

¹ However, this finding does not have unanimous support. Maio et al. (2001) documented a negative effect of ambivalence on physiological arousal. Their study focused on people's ambivalence toward people from other countries, compared with extreme positive or negative views of these groups. Their findings underscore the importance of the attitudinal target (general group attitudes vs. a target with personal consequences) in understanding the effects of ambivalence, as outlined by van Harreveld et al. (2009b).

nuclear power plants (i.e., policies that, if enacted, would not have immediate pleasant consequences). Similarly, ambivalence toward banner ads—seldom experienced as immediately pleasant—leads consumers to avoid them (Jin and Villegas 2007). Research on the experience and consequences of arousal in consumption contexts, which we consider next, may help explain the relationship between ambivalence and approach behavior.

Arousal and product decisions: Implications for ambivalence-related contexts

Because past research shows ambivalence elicits physiological arousal, separate research on the consequences of arousal for information processing and consumer behavior can help to explain how ambivalence-induced arousal influences behavioral outcomes. First, arousal biases information processing. Mandler (1975) argues that attention is more selective when people are in a highly aroused state because the feedback from the heightened autonomic nervous system becomes salient and constrains attentional capacity. Arousal also reduces systematic processing of information, instead engaging more heuristic processing (Rydell, McConnell, and Mackie 2008; Sanbonmatsu and Kardes 1988). For example, classic work on stereotyping suggests that emotional arousal promotes simplified information processing and encourages the use of stereotypes (Bodenhausen 1993).

Second, arousal focuses people on the immediate consequences of their choices leading to a preference for those that bring pleasure (Noseworthy, Di Muro, and Murray 2014; Raghunathan et al. 2006). Aroused consumers make pleasure-seeking decisions because they focus on immediate gains (Ariely and Loewenstein 2006; Loewenstein 2005). Research on willpower suggests that arousal reduces one's ability to resist temptations or delay gratifications (Metcalf and Mischel 1999). In a related line of reasoning, Wiggin, Reimann, and Jain (2019, p. 1196) described curiosity as an “an appetite to obtain missing information” akin to arousal. Curious

consumers' activated states lead them to desire immediate rewards, thus increasing indulgent consumption.

Further, research on the mechanisms underlying the persuasive effects of two-sided communication, which simultaneously present positive and negative information, align with the proposal that ambivalence-evoked arousal enhances interest in products (Eisend 2006, 2007, 2010). Although several theories have been advanced to explain the persuasive effects of two-sided communication, the explanation based on optimal arousal theory (Berlyne 1960) best parallels the process we propose. Namely, two-sided messages are novel and garner attention that in turn, increases the probability of favorable changes in attitudes. Accordingly, Eisend's (2006) meta-analysis examining the consequences of two-sided messages identified a message's perceived novelty as having the largest effect size. Not only do novel stimuli generate interest in the content (Burke and James 2008), they also activate arousal states that lead individuals to seek more information about it (Loewenstein 1994; Magni, Taylor, and Venkatesh 2010). Given that novelty is associated with an approach-orientation (up to a certain point), we reason that exposure to ambivalent information leads to similar approach behavior (Tokunaga 2013; Wells et al. 2010).

Collectively, these bodies of consumer and psychology research support the proposition that ambivalence-induced arousal increases approach behavior in the context of consumption choices that yield immediate positive consequences, especially those that are hedonically rewarding. If a consumer experiences ambivalence and arousal in a context in which the immediate consequences associated with consumption are positive (as is the case with many risky products),

we should observe a greater preference for wanting and choosing a product despite its eventual potential negative consequences.²

H1: Consumers' experience of more (versus less) ambivalence toward risky products that feature immediate positive benefits enhances interest in and intention to approach these products.

H2: Physiological arousal mediates the effect of more (vs. less) ambivalence on interest in and intention to use risky products that provide immediate benefits.

The moderating role of social norms

As outlined above, ambivalent consumers rely more on heuristic processing because of their state of arousal. To provide further evidence of the underlying process linking ambivalence to approach behavior, we examined the role of a major heuristic cue: social norms—one's perceptions of what other people think and do³ (Cialdini, Reno, and Kallgren 1990; White, Argo, and Sengupta 2012). Normative information is prevalent (Li, Larimo, and Leonidou, 2020) and serves as a powerful heuristic cue in numerous marketing contexts (Albrecht et al. 2017; Elgaaied-Gambier, Monnot, and Reniou 2018). Past research shows that social norms shape risky decision making. For example, Mandel (2003) showed that people primed with their interdependent sense of self (increasing the salience of social norms) make risk-seeking decisions in a financial domain but pursue reduced risk-seeking decisions in a social domain. More directly, Litt and Stock (2011) showed that increasing social norms about older teens' drinking through exposure to social media sites increased younger teens' interest in drinking.

² We contrast the effects of high ambivalence with corresponding low ambivalence conditions. In the current work, we have operationalized low ambivalence in the form of positive, univalent conditions as well as in the form of mixed valence (but less inducing of ambivalence) conditions.

³ We have focused on descriptive norms that reflect an individual's judgment of the prevalence of a behavior in a given reference group ("e-cigarette use is common among my peer group"); Ravis and Sheeran 2003).

The influence of social norms is especially prominent in ambiguous social situations, serving as a cue for “correct” behavior (Cialdini, Reno, and Kallgren 1990). Consistent with this position, Wang (2008, p. 84) proposed that when a message about risk presents mixed cues (those that may elicit ambivalent or incongruent preferences), people are more susceptible to contextual influences: “Such ambivalence in preference would entail the use of secondary cues embedded in a risk message as a sort of a tie breaker.” Social information is especially relevant for the present work, given the body of evidence that social information exerts a strong influence on behavior when one is physiologically aroused. Classic research on deindividuation (Zimbardo 1969) shows aroused individuals prioritize information about the actions of others instead of their own. Evidence of this deindividuation occurs in consumption contexts. For example, physiologically aroused consumers are likelier to make choices that follow the majority, relying on social media metrics of “popular choice” to inform their consumption decisions (Coker 2020). Further, acting in accordance with social norms feels good, increasing feelings of solidarity (Christensen et al. 2004).

Based on this evidence, we propose that salient normative information moderates the relationship between ambivalence-induced arousal and risky product-related behavior. If arousal constrains information processing and encourages a focus on immediate desirable consequences, salient normative information should lead ambivalent consumers to behave in accordance with others. We note that the effect of social norms information should be especially influential when it is present and diagnostic for the focal decision (akin to Pham (1996), which illustrates that arousal interacts with information diagnosticity to influence decision making).

Surprisingly little work has examined the interplay between social norms and ambivalence. Wang (2008) is perhaps an exception in broadly proposing that social and cultural norms (and other forms of “tie-breaking” cues) may help ambivalent individuals make risk-

related decisions (as examined in the context of hypothetical, personally irrelevant decisions). In this research, which focuses on consumption choices, we documented the role of social norms as a moderator of the relationship between ambivalence and consumers' behavior.

H3: Associative group norms moderate the relationship between ambivalence and interest in risky products that provide immediate positive benefits. When perceptions of group usage are normative, ambivalence is related positively to interest in and intentions to use the product. When perceptions of usage are nonnormative, the relationship between ambivalence and interest in and intention to use the product is attenuated.

Overview of studies

We tested our hypotheses with adolescent and young adult consumers across six studies. Although the use of risky substances is broadly problematic, practices adopted earlier in life shape subsequent well-being, potentially compounding negative effects. Normative information is also especially important to this age group, which may increase the strength of the manipulations (given their personally relevant nature) and enhance ecological validity.

Study 1 is a controlled experiment in which we activated ambivalence among consumers of a risky product (energy drinks) and used the incentive-compatible Becker DeGroot Marschak (BDM) paradigm (Becker, DeGroot, and Marschak 1964; Schmidt and Bijmolt 2020; Wertenbroch and Skiera 2002) to assess the influence of ambivalence on willingness to pay (WTP) for a new brand of energy drink. Study 2 used biometric measures to document the effect of ambivalence about cognitive enhancers on physiological arousal and demonstrates that arousal mediates the effect of ambivalence on attention to positive (but not negative) information about a product. Study 3 used a process-by-moderation approach to provide further evidence that arousal encourages young adults' interest in cognitive enhancers: a TikTok video featuring highly

arousing music led to heightened interest in the featured product regardless of the ambivalence-related content. Study 4, a cross-sectional study conducted with French teenagers, shows that ambivalence toward e-cigarettes and cigarettes is related to heightened intention to use these substances and also documents the moderating role of normative information. Study 5, an intervention experiment also conducted among French teens, shows that reducing the perceived normativity of substance use among an associative group attenuates the effect of ambivalence toward e-cigarettes on intention to use them. Finally, Study 6 shows that the positive effect of ambivalence on WTP (using the incentive-compatible BDM paradigm) is attenuated when perceived normativity is low and does not differ from the control condition when perceived normativity is high. See Table 2 (following the references) for an overview of these studies, and Figure 1 for an overview of our conceptual model.

Study 1: The effect of ambivalence on WTP for a risky product

To address Hypothesis 1, this first study activated consumers' ambivalence toward the energy drinks (such as Red Bull, Monster, and RockStar) and assessed the resulting behavioral responses to a new energy drink brand. Energy drinks are increasingly recognized as a health hazard (Al-Shaar et al. 2017) because of their caffeine and added sugar, two substances linked to health problems when used in volume. We measured participants' WTP for the new drink brand using the BDM procedure, which delivers an incentive-compatible indicator of consumers' valuation of the product (Becker, DeGroot, and Marschak 1964; Schmidt and Bijmolt 2020; Wertenbroch and Skiera 2002).

Method

Recruitment, sample, and procedures Participants in the U.S. were recruited from the Prolific Academic Research panel. All were prescreened consumers of energy drinks. Their prescreening

was based on a custom screening criterion offered by the Prolific panel and through an additional screener question at the outset of the survey in which they indicated how many energy drinks they drank in the prior week (Those who answered “none” were excluded; $N = 107$, $M_{age} = 28.80$, 32.4% female).

Participants were first asked to imagine they were talking with a friend who had never tried energy drinks, but wanted to know about their positive aspects (low ambivalence) or both their positive and negative aspects (high ambivalence). Participants were given 10 seconds to think about these aspects. Then they were prompted with six open text fields in which they listed these positive aspects (low ambivalence) or positive and negative aspects (high ambivalence). Participants then indicated their views of energy drinks. Two items captured components of positive attitudes toward energy drinks (“How positive are your feelings (beliefs) about energy drinks?” $r = .71$, $p < .001$, on a scale of 1 = *not at all* to 7 = *extremely*) and two measures captured components of negative attitudes (“How negative are your feelings (beliefs) about energy drinks?” $r = .69$, $p < .001$).⁴ We also collected a measure of the ambivalence manipulation (“I am ambivalent toward energy drinks” 1 = *not at all* to 7 = *a great deal*).

Participants were next asked to evaluate the V brand of energy drink sold in New Zealand but not in the U.S. We selected it because participants would have no preexisting knowledge or attitudes about it. Participants watched a short commercial for the brand (created by the company) and were introduced to the BDM paradigm. The BDM paradigm is an incentive-compatible procedure used in marketing and economics research to measure WTP for a product (Homburg, Koschate, and Hoyer 2005; Wertenbroch and Skiera 2002). Willingness to pay

⁴ The experience of mixed feelings or of being torn about an attitudinal object is conceptually distinct from positive and negative components held with reference to the object. Our analyses controlled for positive and negative components to reduce the plausibility that the effect of ambivalence on behavior was capturing aspects of the attitudinal target’s valence and to isolate the effect of ambivalence *relative* to the effects of the attitudinal target’s valence (positive and negative attitude components).

measures the value a person assigns to a consumption or usage experience in monetary units and reflects the person's interest in trying a product (Homburg et al. 2005). In keeping with past research using this procedure, participants evaluated the V energy drink by creating a series of 10 choices between receiving V or a specified monetary amount (in 50-cent increments). The point at which a person chose money over the product reflects the limit of that person's WTP (e.g., \$2.00 if \$2.50 is the first 50-cent increment in which money was chosen over the product).

Results

Manipulation check Participants in the high ambivalence condition reported greater ambivalence ($M = 3.66$, $SD = 1.58$) than those in the low ambivalence condition ($M = 3.00$, $SD = 1.52$), $t(106) = 2.21$, $p = .03$, $\eta_p^2 = .04$.

WTP A one-way ANOVA on WTP indicated high ambivalence participants would pay more ($M = \$1.96$, $SD = \$1.24$) than low ambivalence participants ($M = \$1.50$, $SD = \$1.09$), $F(1, 106) = 4.99$, $p = .04$, $\eta_p^2 = .04$. We repeated this analysis, controlling for positive and negative attitudinal components as well as baseline consumption of energy drinks (reported use in past week), and the effect of ambivalence on WTP remained significant, $F(1, 103) = 4.49$, $p = .03$, $\eta_p^2 = .05$. The positive composite was significant, $F(1, 103) = 10.52$, $p < .01$, $\eta_p^2 = .10$, but neither the negative composite $F(1, 103) = .77$, $p = .38$, nor past use, $F(1, 103) = .20$, $p = .65$, was.

Discussion

This first experiment shows ambivalence is linked to WTP more for a new product among current users of a risky product category, in support of Hypothesis 1. The effect of ambivalence on approach behavior cannot be explained by differences in the favorability of

views toward the product, given that the effect remained significant when controlling for participants' positive and negative attitudes toward energy drinks. The next study examined a context in which individuals did not have preexisting attitudes, extending this study in which participants held previously developed attitudes toward a product category.

Study 2: The effect of ambivalence on arousal and attention to positive product information

The goal of Study 2 was to demonstrate the mediating role of physiological arousal (electrodermal activity; Hypothesis 2) on measures reflecting interest in a product—cognitive enhancers—in a context in which people were less likely to have well-developed attitudes. These drugs are available on the market and limited in terms of adoption but growing in terms of projected use (Heid 2019). We selected a product from this nascent category as the target because it poses both risks and benefits relevant to a sample population of young adults.

Method

Participants and design Undergraduate students ($N = 89$, 64% female, $M_{\text{age}} = 20.2$) at a U.S. university participated in the study in exchange for course credit. The study involved two phases. Participants were randomly assigned to one of two conditions (ambivalence: low, high) in a between-subjects design.

Procedure and measures Participants completed the study individually in a university behavioral lab. Each participant was seated and informed that physiological measures of their responses would be taken. A lab assistant connected electrodes to each person's fingers to measure skin conductance and guided participants through a calibration procedure to enable tracking of their eye movements. (More information on the biometric measures is given below.)

Participants were told that the research would examine their responses to nootropics, which were introduced as “drugs, supplements, and other substances that may influence cognitive function, especially executive functions such as memory, creativity, or motivation.” Piracetam, prototypical of the nootropic category, was selected as the focal product.

Participants were first introduced to Piracetam and exposed to 10 statements about it (statements selected based on a pretest with another group of participants). In the low ambivalence condition, participants viewed randomly presented favorable statements about Piracetam. In the high ambivalence condition, participants viewed five positive and five negative statements that also were presented randomly. All statements appeared individually on the screen for 10 seconds. After viewing the statements, participants completed initial measures, including manipulation and attention checks, and indicated any prior experience with the product category.

Participants then completed a task for a separate study that took approximately 10 minutes. Then, in Phase 2, they were asked to think back to Phase 1 in which they learned about a nootropic called Piracetam. They were presented with an image of an e-commerce site selling it and asked to browse the page naturally. We imposed a temporal separation between the inducement of ambivalence (in Phase 1) and measurement of physiological responses to the target product. This separation was intended to reduce the potential carryover effects posed by contiguous measurement.

Biometric measures: Electrodermal activity We examined skin conductance (SC) as an indicator of arousal because it is the measure of choice in most studies of psychophysiological arousal (Blascovich and Kelsey 1990; Caruelle, Gustafsson, Shams, and Lervik-Olsen 2019) and a reliable indicator of sympathetic nervous system activity. When a stimulus is experienced, eccrine sweat glands produce sweat, which is an efficient conductor of current (Stern, Ray, and Quigley 2000). The more emotionally arousing the stimulus, the more sweat is secreted and the

more the electrical properties of the skin change (see Caruelle, Gustafsson, Shams, and Lervik-Olsen 2019 for a detailed discussion).

We measured skin conductance response (SCR) with a Shimmer3 GSR+ Unit wireless device. In keeping with common practice, two 8mm snap-style finger type electrodes (GSR electrodes, Shimmer Sensing) with a 15.9Hz frequency range were attached to the middle parts of participants' left index and ring fingers.

We treated the beginning of Phase two in which participants were reintroduced to the focal topic as the target for our skin conductance measurement phase. We considered this the focal point in time because reminding participants of the target toward which they potentially felt ambivalence should be sufficient alone to induce arousal, the preferred situation for our measurement rather than the processing of additional stimuli about it. We gathered measures five seconds after the initial reintroduction of the topic, a delay dictated by SCR time (Caruelle, et al. 2019).

We used the amplitude of the SCR (i.e., the number of μS by which skin conductance value rose) as an indicator of arousal. Caruelle and colleagues (2019) noted that SCR amplitudes are often positively skewed (Benedek and Kaernbach, 2010), requiring transformations to obtain nonskewed distributions for analysis. The SCR responses were indeed positively skewed, and the analyses used the log transformation of these values.

Biometric measures: Eye tracking. Eye movements were recorded using a Tobii X2 30 eye-tracking system. Eye-tracking studies typically record the amount of time each individual looks at defined areas of interest (Holmqvist et al. 2011). When people attend to different elements or features in a visual display, they move their eyes to those features for at least a brief period (Duc, Bays, and Husain 2008). Attention is measured by examining how often the eye data can be mapped into each region of interest. The measurement can be of either the data points themselves

or of an aggregation of them that occurs at the same location on the screen for a predetermined length of time (referred to as a fixation).

We measured attention to two key areas of the e-commerce site: a rectangular area of interest (AOI) set around the warning (warning AOI) and a rectangular area set around the list of product benefits (benefits AOI). We measured average fixation duration (in milliseconds) in these areas of interest. Given that fixation duration measures were skewed, as is common with eye-tracking data, we used log transformed measures in our analyses.

Results

Skin conductance T-tests revealed that participants experienced more arousal in the high ambivalence condition, as indicated by higher amplitude SCR ($M = 1.52$, $SD = .82$), relative to the low ambivalence condition ($M = 1.06$, $SD = .91$); $t(86) = 2.47$, $p = .02$; $\eta^2 = .07$.

Attention to e-commerce AOIs T-tests also revealed that participants in the high ambivalence condition spent more time looking at the benefits AOI ($M = 3.85$, $SD = .83$) relative to those in the low ambivalence condition ($M = 3.51$, $SD = .51$) $t(86) = 2.31$, $p = .02$; $\eta^2 = .06$. There were no differences in attention to the warning AOIs as a function of the condition ($M_{\text{high ambivalence}} = 2.93$, $SD = 1.53$, $M_{\text{low ambivalence}} = 3.25$, $SD = .98$); $t(86) = 1.18$, $p = .24$.

Model test: AOI Using PROCESS Model 4 (Hayes 2017), we examined the indirect effect of ambivalence (0 = low, 1 = high) on attention to the benefits AOI through arousal. The indirect effect was significant ($b = .08$, $SE = .05$, 95% CI: .0044, .2038). The pattern supports H2: Ambivalence-triggered arousal increases interest in the benefits associated with a risky product.

Study 2 Discussion

Study 2 shows that ambivalence triggers greater product interest among nonusers (building on the results of Study 1's examination of users) of products promising immediately positive benefits. Compared with less ambivalent participants, more ambivalent participants paid more attention to product benefits, thus, supporting Hypothesis 1. Study 2 also provides process evidence: The effect of ambivalence on attention to positive information is mediated through physiological arousal, as measured by galvanic skin response. These results are consistent with van Harreveld et al. (2009b), who also documented a positive effect of ambivalence on arousal.

Study 3: Providing additional evidence of arousal's explanatory role

The aim of Study 3 was to provide additional evidence that arousal explains the effect of ambivalence on product-approach behavior. Because of the difficulties in using self-report items to measure processes that may occur outside of conscious awareness, we adopted a process-by-moderation approach in which we manipulated the proposed mediator (arousal), as done in classic research on arousal (e.g., Zillmann, Katcher, and Milavsky 1972). This approach is encouraged as a means to increase ecological validity (Spencer, Zanna and Fong 2005; Van Heerde et al. 2021). Specifically, we examined the moderating role of arousal-inducing music: if ambivalence-induced arousal increases product interest, it follows that increasing arousal via another source should also enhance product interest. To do so, we created TikTok videos to present messages. We manipulated arousal through the audio modality by using slow versus fast tempo background music. We manipulated ambivalence through the visual modality by varying the order in which written statements were presented.

Method

Participants and design American Prolific Academic participants younger than 25 ($N = 399$, 42.6% female, 1.3% other, $M_{\text{age}} = 22.6$) who were active users of the TikTok platform (based on a screening question; enacted to enhance the personal relevance of the study) were randomly assigned to a condition in a 2 (arousal: low, high) x 2 (ambivalence: low, high) between-subjects design. Sixteen participants indicated that we should not use their data (based on a question included at the end of the study), yielding a final sample of $N = 383$.

Procedure and measures We used professionally edited TikTok videos as experimental stimuli. We conducted two pretests to develop this manipulation. First, we pretested individual statements taken from internet forums about the positive (e.g., “helps focus”) and negative (e.g., “causes blurred vision”) aspects of the focal brand of cognitive enhancer. After identifying three positive and three negative statements to embed in the videos, we subsequently pretested how the sequence of the statements within the video (positive and negative items interspersed; negative items first, positive items first) influenced the resulting ambivalence. This pretest revealed that negative items succeeded by positive items evoked the least ambivalence (constituting the low ambivalence manipulation), but alternating the presentation of positive and negative items resulted in more ambivalence (constituting the high ambivalence manipulation).

Prior research suggests that music can induce physiological arousal (Biswas, Lund, and Szocs 2018). Specifically, musical tempo is strongly correlated with arousal, indicating faster music can raise arousal levels (Balch and Lewis 1996; Husain et al. 2002). To create the arousal manipulation, we used two versions of the same song: a slower, relaxed version (63 BPM) and an up-tempo remix (152 BPM). These classifications were based on past work that has categorized songs slower than 95 BPM or faster than 135 BPM as slow and fast conditions, respectively (Knoferle et al. 2012).

After watching the video, participants indicated their interest in the featured product (“To what extent are you interested in trying Alpha Brain, the product featured in the video? If given the opportunity, would you try taking Alpha Brain? Would you be interested in receiving a sample package of Alpha Brain? To what extent are you interested obtaining more information about Alpha Brain?” on 7-point Likert scales. Answers were combined into an overall product interest composite, $\alpha = .91$). Participants then completed measures of positive and negative attitudes toward Alpha Brain (as in Study 1; $r_{\text{positive}} = .84$; $r_{\text{negative}} = .87$), followed by judgments of the music in the video on 7-point bipolar scales (“If you can, please recall the music in the TikTok video. Please evaluate it on the following dimensions: Energetic-Mellow; Calm-Frenzied; Slow-Fast”; $\alpha = .94$).⁵ We also used a 7-point Likert scale to measure and control for familiarity with the product category of cognitive enhancers because it is a relevant predictor of product interest. Our question was “To what extent are you familiar with cognitive enhancers?”

Results

Manipulation check A t-test on the music judgment composite indicated that participants perceived the faster BPM music as more arousing ($M = 6.20$, $SD = .82$) than the slower BPM music ($M = 2.74$, $SD = 1.24$), $t(86) = 32.31$, $p < .001$; $\eta^2 = .73$.

Product interest A 2 (arousal: low, high) x 2 (ambivalence: low, high) ANCOVA (controlling for product category familiarity and components of positive and negative attitudes) yielded a main effect of product familiarity (such that it enhanced interest; $F(1,376) = 21.94$, $p < .001$, η^2

⁵ Participants also indicated the extent to which they felt negative emotions (“sad, depressed, irritated, angry”) on 7-point Likert scales. Participants also completed the Need for Affiliation scale (Hill 1987) as well as the discomfort with ambiguity subscale of the Need for Cognitive Closure scale (Kruglanski et al. 1993) Controlling for these measures does not change the patterns of effects nor do they exert significant influence on product interest, but the effect of negative mood is significant ($F(1,372) = 4.24$, $p = .04$, $\eta^2 = .01$).

= .06), positive attitudinal components, $F(1,376) = 167.60, p < .001, \eta^2 = .31$, and negative attitudinal components, $F(1,376) = 41.30, p < .001, \eta^2 = .10$, (in such a way that they enhanced and reduced interest, respectively), and a marginal effect of arousal, $F(1,376) = 4.55, p = .07, \eta^2 = .01$ (such that it enhanced interest). These effects were qualified by an interaction, $F(1,376) = 4.73, p = .03, \eta^2 = .01$: ambivalence significantly increased interest among those exposed to slow music, $F(1,376) = 7.93, p < .01, \eta^2 = .02$, in such a way that participants in the high ambivalence condition showed greater product interest than those in the low ambivalence condition. There were no differences in product interest among those exposed to the up-tempo music, $F(1,376) = .05, p = .83$, nor did interest in these conditions differ from interest in the slow music, high ambivalence condition (p 's $> .49$). See Figure 2, following the references.

Discussion

By using a process-by-moderation approach, this study provided evidence of arousal's role in explaining the effect of ambivalence (Hypothesis 2) on product interest (e.g., Spencer et al. 2005). We examined the moderating role of arousal-inducing music; if ambivalence-induced arousal increases product interest, then increasing arousal via another source should also enhance product interest. The pattern of results is consistent with this logic. With fast music, participants indicated relatively higher interest in the product featured in the video (regardless of the ambivalence manipulation). Differences in product interest emerged with the slower music rated as less arousing, demonstrating that participants' interest in the product was significantly lower when they were exposed to a low ambivalence message, relative to participants exposed to the high ambivalence message (whose interest did not differ from those participants exposed to

videos featuring highly arousing music). This pattern aligns with the physiological evidence advanced in Study 2 that arousal explains why ambivalence influences approach behavior.

With this empirical evidence of the main effect of ambivalence on product interest in hand, the subsequent studies focused on the moderating role of the norms of reference groups' usage. We examined how perceptions of different groups' usage norms enhanced or reversed the risk-seeking tendency associated with the experience of ambivalence (Hypothesis 3).

Study 4: The moderating role of associative group norms

We adopted a cross-sectional survey approach in Study 4 to measure the relationship between ambivalence and youths' intention to engage in risky consumption, specifically in the context of cigarettes and e-cigarettes. France, where this study was conducted and funded, has one of the world's highest rates of smoking (Andler et al. 2018). Research on cigarette and e-cigarette use and on perceptions of smoking and vaping indicate that these two products have distinct use motivations and different patterns of experimentation (Kong et al. 2015). Thus, we treated these two products as replicates. In addition to testing Hypothesis 1 in another context, we tested whether perceptions of associative norms moderated the positive relationship between ambivalence and intention to use a risky substance (Hypothesis 3).

Method

Recruitment, sample, and procedures Survey data were collected online from a nationally representative sample of children ages 13-17 in France as part of a research program funded by the National Institute of Cancer (INCA). Parents were recruited by a research company that maintains consumer panels representative of France's population in terms of gender,

socioeconomic status, and region (Callegaro et al. 2014). The research company contacted members who were parents of the children. Requirements for parental consent and child assent complied with the requirements of the authors' ethics committees and with the guidelines of the International Chamber of Commerce.

The research company sent an invitation to 1,189 parents. Parents who indicated a child's age was outside the 13-17 range ($n = 21$) or indicated a lack of legal authority over that child ($n = 50$) were ineligible. Participants whose eligibility was verified (758 complete responses, 45.3% female) completed the survey on a secure website, with instructions to do so out of their parents' sight. The survey covered several health and media topics, but only the variables of relevance to the current study are reported here. The variables' order was randomized to prevent order effects. Analyses controlling for order did not change the significance patterns.

Positive and negative e-cigarettes and cigarettes attitudinal components Participants' personal views of the consequences of e-cigarette/cigarette use were assessed using measures of outcome beliefs developed in previous research (Dalton et al. 1999; Pokhrel et al. 2018). For each substance, the measures included physical, emotional, and social outcomes that are either positive or negative. The presentation order of the items was randomized.

Positive ($\alpha = .95$) and negative ($\alpha = .95$) attitudinal components were measured on 5-point scales (1 = *very unlikely* to 5 = *very likely*). We averaged each set to create positive and negative attitudes regarding the personal consequences of e-cigarettes. We took the same approach to measuring the favorability of participants' views of smoking tobacco cigarettes and captured positive ($\alpha = .93$) and negative ($\alpha = .89$) attitudes regarding the personal consequences of smoking.

Ambivalence measures: E-cigarettes and cigarettes We measured ambivalence with four items adapted from Priester, Petty, and Park (2007); for example, "I feel mixed about the use of

e-cigarettes” (e-cigarettes: $\alpha = .91$; cigarettes: $\alpha = .91$) on a 7-point scale (1= *strongly disagree* to 7 = *strongly agree*).

Associative norms Participants indicated their perceptions of peer usage norms on a slider scale (0 – 100%). This measure reflected the percentage of young people of the participants’ age who used e-cigarettes and cigarettes. These values were normally distributed (skewness and kurtosis values less than 1).

Past use Participants indicated whether they had tried either e-cigarettes or cigarettes (no/yes), which we used as a control variable (29% had tried e-cigarettes, and 39% cigarettes).

E-cigarette and cigarette use intentions We measured behavioral intentions by asking participants, “Do you think you will want to use e-cigarettes in the future?” / “Do you think you will want to smoke (cigarette or other tobacco) in the future?” on a scale ranging from 1 *certainly not* to 5 *certainly yes*.

Results

Model test: E-Cigarettes To test Hypotheses 1 and 3, we regressed intention to use e-cigarettes on ambivalence toward e-cigarettes, perceived associative group norms, and their interaction. Results indicate that ambivalence and associative group norms are both related to use intention (see Table 3, following the references) and that these main effects are qualified by a significant interaction: As perceived peer norms increase, the relationship between ambivalence and use intention also increases at low (1 SD below the mean; $b = .10, t = 4.49, p < .001$), average ($b = .14, t = 9.18, p < .001$), and high (1 SD above the mean; $b = .19, t = 8.47, p < .001$) levels of perceived norms. After controlling for the independent effects of positive and negative attitudinal components and past use (which were also significant), ambivalence is significantly related to

use intention at higher (1 SD above the mean; $b = .05$, $t = 2.52$, $p = .01$) levels of perceived norms, which is in line with Hypothesis 3.

Model test: Cigarettes We conducted a similar regression analysis with intention to use cigarettes as the focal dependent variable. Ambivalence and perceived peer norms are also positively related to intention to use cigarettes. The interaction between ambivalence and norms is also significant in such a way that the relationship between ambivalence and use intention increases as perceived peer norms of use increase at low (1 SD below the mean; $b = .17$, $t = 8.78$, $p < .001$), average ($b = .21$, $t = 14.54$, $p < .001$), and high (1 SD above the mean; $b = .24$, $t = 11.89$, $p < .001$). When controlling for positive and negative attitudinal components and past use (which were also significant), the significance of the interaction term becomes $p = .08$.

Discussion

Across two substance contexts, Study 4 shows the relationship between ambivalence and teens' interest in risky substances is moderated by perceptions of usage normativity among peers. The more they view usage as normative among their associative group (peers), the stronger the (positive) relationship between ambivalence and intention to vape or smoke, supporting Hypothesis 3. Although the patterns generally converged across the two substances, there were differences. In the cigarette context, ambivalence is related to teens' interest in smoking regardless of norms (but became stronger as norms increased). When controlling for positive and negative beliefs and past use of cigarettes, the interaction between ambivalence and norms became marginally significant. In the context of e-cigarettes, the relationship between ambivalence and intention to use e-cigarettes is not significant at lower levels of perceived use of e-cigarettes (when positive and negative beliefs are also included in the model). Differences may be attributed to variations in the product lifecycle of the two substances. Whereas tobacco-based

products are a more established product, e-cigarettes are rapidly evolving, and use intention in the vaping context may be more malleable and subject to the influence of peer norms. The pattern of use in the study (fewer had tried e-cigarettes relative to cigarettes) is consistent with this explanation, as is past evidence that people are likelier to use normative information in uncertain or ambiguous situations (Albrecht et al. 2017; Cialdini et al. 1990).

Study 5: Associative group norms intervention

Study 5 assessed whether intervention based on public health norms can reduce the influence of ambivalence on risky intentions. Building on the cross-sectional results of Study 4, we manipulated teens' perceptions of the prevalence of e-cigarette usage among their peers to assess whether this changes the relationship between ambivalence and intention to use e-cigarettes. Thus, Study 5 is a two-condition design in which participants received an intervention message (designed to reduce perceptions of associative group vaping norms) or a control message.

In addition to testing Hypothesis 3 experimentally, Study 5 tests the potential for a simple, effective public health intervention based on social norms. As noted by Miller and Prentice (2016, p. 355), "The growing popularity of norm-based interventions to reduce collectively (and sometimes personally) costly behavior is a response to the failure of other intervention efforts. Programs that educate people about the riskiness of behavior through information and persuasion campaigns are stunningly ineffective." Thus, norms interventions are especially relevant for public health and well-being advocates because they represent a simple, easily applied messaging strategy. Some work suggests that norms interventions may be especially effective in the context of the onset of substance use (Chung and Rimal 2016).

Method

Recruitment, sample, and procedure Participants were teenagers who had participated in Study 4 and whose parents were still members of the commercial research company, and thus available for this study. Procedures for parental consent and child assent were the same as in Study 4. The measures for this second study were obtained nine months after the first (Phase 1 was collected in September, Phase 2 in June of the next year). Of the 206 parents who were recontacted, 13 did not have legal authority over the child, and three did not consent. Twenty-two participants either did not assent or did not complete the survey, and five more did not meet the age criteria. We further eliminated participants who did not pass an attention check (correctly identifying the percentage featured in the focal message), yielding a final sample of 122 (52.8% female, $M_{\text{age}} = 16.14$).

At the beginning of the study, participants were informed it was a follow-up to the larger study in which they had participated nine months earlier. All were told this new study was designed to explore intriguing findings from that first study. The respondents were then randomly assigned to one of two between-subject norms conditions in which a norms-inducing statement was displayed on the screen for at least five seconds. Participants in the intervention condition were told, “The majority of youths your age do not use e-cigarettes; only 11% of youths ages 14-17 vape.” This manipulation was developed to ensure comparability and emphasize a close age group in terms of social identity (Goldstein, Cialdini, and Griskevicius 2008). The prevalence was based on the results of the first study, which indicated that actual e-cigarette use in this age group was 25%. Participants in the control condition were presented with the same statement, replacing the reference to e-cigarettes with magazines (in keeping with the study’s cover story as a study of youth media and general consumption). A short media/social

media questionnaire followed (unrelated to the aims of the present study and served as a distractor task), followed by the key measures.

Measures Participants completed the same measure of intention to use as in Study 4. The change in use intention from Time 1 to Time 2 (difference score) served as the dependent variable. We also collected a manipulation check of participants' perceptions of their peers' e-cigarette usage norms on a slider scale (0 – 100%). Participants were also asked whether they had tried e-cigarettes, information we used as a control variable. The analyses used ambivalence and positive and negative attitudes collected nine months earlier in data collection.

Results

Manipulation check Participants in the intervention condition reported significantly lower perceptions of the prevalence of their peers' using e-cigarettes ($M = 16.86$, $SD = 13.10$) than participants in the control condition ($M = 24.72$, $SD = 21.10$, $F(1, 123) = 6.43$, $p = .01$, $\eta_p^2 = .05$), confirming the success of the manipulation of the norms intervention.

Model test We regressed changes in use intention on ambivalence, the norms intervention, and their interaction. No effects were significant. We then repeated these analyses, controlling for past use as well as positive and negative attitudinal components. Past use and ambivalence had a positive relationship with increases in use intention, and negative beliefs had a negative relationship with use intention. When controlling for positive and negative attitudinal components, the moderating effect of the intervention on the relationship between ambivalence and the increase in use intention was significant. Ambivalence enhanced use intention in the control condition ($b = .18$, $t = 3.07$, $p < .001$), but its effect in the intervention condition was not significant ($b = .03$, $t = .60$, $p = .55$), supporting the efficacy of the norms intervention. See

Figure 3 and Table 4, following the references.

Discussion

Study 5 shows that ambivalence predicts changes in intention to use e-cigarettes over a nine-month time horizon, providing additional empirical support for Hypothesis 1. In addition, the study provides empirical support for Hypothesis 3 and for the efficacy of norms-related public health interventions: Reducing perceptions of peer usage norms suppressed the (otherwise positive) influence of ambivalence on use intention. The responses of participants in the control condition (who, on average, perceived higher and accurate levels of peer usage norms, based on the results of Study 4) replicated the findings of Study 4 in which ambivalence had a positive relationship with use intention. For participants in the intervention condition, their learning that use was less prevalent among peers removed the relationship between ambivalence and an increase in intention to use e-cigarettes. Uncertainty about the correct or appropriate mode of behavior, as is often the case in contexts characterized by ambivalence, may make people more receptive to making their own behavior conform with information about how other members of an associative reference group behave in the same circumstances. This suggestion is consistent with Wang's (2008) broad suggestion that people are more susceptible to contextual influences (such as information on social norms) when they feel ambivalent about a topic.

Of note, these effects emerged only when controlling for positive and negative attitudes toward e-cigarettes as well as one's own past behavior. This is unsurprising, given that the nine-month span of the study coincides with the teenage years, the most active period of experimentation with substances.

Study 6: Experimentally manipulating associative group norms

This study tests the proposed full model, examining the mediating role of arousal (Hypothesis 2), and the moderating role of associative group norms (Hypothesis 3), on WTP (as measured by the incentive-compatible Becker-DeGroot-Marschak procedure used in Study 1). Study 4 showed that the relationship between ambivalence and use intention is *greater* at high levels of norms, and Study 5 showed that the effect of ambivalence is *reduced* when perceived norms are lower. These studies used correlational or quasiexperimental designs. This final experimental study includes a control condition to identify more precisely the moderating nature of low versus high associative group norms. That is, we designed this study to examine whether high peer norms enhance, or low peer norms suppress, interest in using a risky product relative to a control condition. The study induced ambivalence using the TikTok video stimuli from Study 3, which contained positive and negative statements about the focal product and manipulated perceived associative norms by displaying TikTok users' reactions to the video that were either favorable (high norms) or unfavorable (low norms) about the product or reactions that were unrelated to the product (control condition, comments unrelated to the product).

Method

Recruitment, sample, and procedures Data were collected online from the Prolific Academic panel from 445 participants. We used a screening question at the start of the survey to restrict the sample to American consumers between the ages of 18 and 25 who actively used TikTok. Eight indicated that we should not use their data and were removed from the sample, leaving a final $N = 437$ ($M_{\text{age}} = 22.3$, 22.4% male, 74.6% female, and 3.0% other).

This study relied on a 2 (ambivalence: low, high) x 3 (associative group norms: control, low, high) design. Before exposure to experimental stimuli, we measured baseline tense arousal

on 7-point bipolar scales (Please indicate how you feel right now: sluggish-frenzied; dull-jittery; sleepy-wide awake; unaroused-aroused; $\alpha = .86$; Pozharliev et al. 2021, Shapiro and Macinnis 2002, Wirtz et al. 2000). To impose a temporal buffer, we then asked participants to describe the last time they did the laundry (the neutral control task adapted from Griskevicius, Shiota, and Neufeld 2010). Participants then watched one of the TikTok videos used in Study 3 (set to different, medium-tempo music) to induce low or high ambivalence toward the cognitive enhancer. Participants next completed measures of tense arousal ($\alpha = .83$), which were used to calculate a difference score (increase in tense arousal because of the video).

Participants then viewed a static page featuring comments about the video, as it was typically presented on the TikTok interface. This page featured six posts, four of which were made by users whose comments indicated they either used the product (high norms condition: “I use it, it really works”) or would not (low norms condition: “I would never use it, I doubt it works”). A pretest in which participants were presented with the question “In your best guess, what percentage of TikTok users like you take Alpha Brain?” revealed differences, $F(2,177) = 3.71$, $p = .03$, in such a way that those in the high norms condition believed use was twice as high among people like themselves ($M = 21.12\%$, $SD = 22.78$), a contrast with those in the low norms condition ($M = 10.72\%$, $SD = 16.38$); perceived norms in the control condition were 17.62% ($SD = 22.32$), reflecting the early diffusion phase of this product category. Participants were exposed to this page for at least 10 seconds.

In the final portion of the study, participants were informed that “Alpha Brain is developing sample pill packs (containing two pills, as featured in the video). We are interested in how much you are willing to pay for a sample pack.” The BDM procedure was then introduced (as in Study 1), and participants made a series of 10 choices between receiving a sample pack or cash (in \$.25 increments, for a maximum of \$2.50). Participants completed measures of the

components of positive ($r = .87$) and negative attitudinal components ($r = .91$) adapted from Study 1. We also measured experience with the product category as in Study 3.⁶

Results

Arousal A one-way ANOVA on the arousal change measure revealed a difference, $F(1,435) = 4.46, p = .035, \eta^2 = .01$, in which participants in the high ambivalence condition experienced increased arousal ($M = .21, SD = .99$) relative to participants in the low ambivalence condition ($M = .01, SD = .92$).

WTP We conducted a 2 (ambivalence: low, high) x 3 (norms: control, low, high) ANCOVA on the WTP measure, controlling for positive and negative attitudes toward the focal brand and familiarity with the product category, all of which exerted significant effects on WTP (positive attitude: $F(1,428) = 30.18, p < .001, \eta^2 = .09$; negative attitude; $F(1,428) = 3.94, p = .048, \eta^2 = .01$; product category familiarity; $F(1,428) = 6.37, p = .012, \eta^2 = .02$). There was a main effect of ambivalence, $F(1,428) = 5.65, p = .018, \eta^2 = .01$. The ambivalence X norms interaction was marginally significant, $F(2,428) = 2.36, p = .096, \eta^2 = .01$. Given our a priori hypotheses, we examined the simple effects, which cohere with our predictions: in the high norms condition, high ambivalence led to greater WTP than low ambivalence, $F(1,428) = 6.51, p = .01, \eta^2 = .01$. The pattern was the same in the control condition, but the difference was marginal, $F(1,428) = 3.26, p = .07, \eta^2 = .01$. There were no differences in the low norms condition $F(1,428) = 1.17, p = .74$. See Figure 4.

⁶ We also collected manipulation check measures of the perceived normativity of product use, as in the pretest. The analyses yielded the same results: there were differences, $F(2,434) = 6.37, p < .01$, such that those in the high norms condition believed that use was almost twice as high among people like themselves ($M = 22.08\%, SD = 23.19$) in contrast with those in the low norms condition ($M = 13.53\%, SD = 16.53$); perceived norms in the control condition were 17.92% ($SD = 20.74$), reflecting the early diffusion phase of this product category.

Mediation We examined whether the effect of ambivalence on WTP was mediated by change in arousal and whether the effect of the ambivalence manipulation and arousal on WTP differed depending on the norms conditions. To do so, we used PROCESS (Model 15, Hayes 2017) and, as in the ANCOVA analyses, controlled for positive and negative attitudes toward the product and for familiarity with the product category. The results indicate that the indirect effect of ambivalence on WTP through arousal change was significant in the control condition ($b = .0280$, $SE = .0193$, 95% CI: .0003, .0742) and not the low norms condition, which aligns with the predictions ($b = .0005$, $SE = .0100$, 95% CI: -.0178, .0228). However, the indirect effect was not significant in the high norms condition ($b = -.0062$, $SE = .0167$, 95% CI: -.0412, .0287), a finding considered in the discussion.

Discussion

The results of this final study generally support Hypothesis 1 (ambivalence toward a risky product enhances WTP for that product) and replicated past work showing that ambivalence enhances arousal (Nohlen et al. 2013; van Harreveld et al. 2009a; van Harreveld et al. 2009b). The results also support Hypothesis 2. In the control condition, free of norms information, the effect of ambivalence on WTP was mediated through self-reported arousal.

The pattern of results is also mostly consistent with Hypothesis 3. As expected, when use of a product was perceived as less normative, ambivalence had no effect on WTP. This effect reinforces the findings of Study 5 in which a norms intervention effectively reduced the effect of ambivalence on vulnerable populations' interest in risky substances. In this study, when use is perceived as more normative, ambivalence did enhance WTP for a product, and this level of support was similar to that obtained in the control condition. However, we did not find support for arousal as a mediator of the effect of ambivalence on WTP when norms information is involved. We advance at least four potential explanations for this. In brief, providing norms

information may trigger a process other than arousal; there may be a difference between *forming* and *accessing* norms in terms of their moderating influence on the relationship between arousal and WTP; the self-report measure of arousal may suffer from a lack of sensitivity; and efforts to increase the perceived normativity of the use of cognitive enhancers in which perceptions of use are low may trigger more effortful processing (given the contrast with perceptions of reality) than in product contexts in which perceived normativity is higher. These matters and their consequences for ambivalence research are considered further in the general discussion.

General discussion

Consumption of risky products continues to threaten individual and societal well-being, as illustrated by the opioid crisis and increased e-cigarette use. These persistent societal challenges underscore the need to understand and shape consumers' behavior regarding these and other substances likely to induce ambivalence. Across six studies, as part of a nationally funded cancer prevention research program, we considered the complex interplay between consumers' ambivalence toward risky products and perceptions of these products' normativity on their interest in, and intention to use, these products. We showed that ambivalence generally enhances interest in using risky products that feature immediate positive benefits—in the context of energy drinks (Study 1), tobacco (Study 3), e-cigarettes (Studies 3 and 4), and cognitive enhancers (Studies 2 and 5)—supporting Hypothesis 1. We also provided evidence that this effect occurs because of arousal (Studies 2, 3, and 6) and depends on perceived normativity of product use (Studies 4-6): When perceived normativity is low, the effect of ambivalence on product interest attenuates. When high, the effect of ambivalence increases (Study 3) or persists (Study 6).

Theoretical contributions

This research makes three broad contributions to the literature on ambivalence and consumption. First, connecting the study of ambivalence to research on products with immediate short-term benefits (and often longer-term costs) provides a new lens on the relationship between ambivalence and consumers' responses to risky products. In developing predictions about the effects of ambivalence on consumption, past research has largely ignored or overlooked the role of the objects of consumption. Not all objects are equal in being either desired or rejected, and ambivalence towards these objects may affect behavior distinctly. We focused on risky products that deliver immediate, positive benefits, and showed that ambivalence enhances consumers' tendencies to approach these products. Research in other fields (such as self-control and willpower) supports the tendency for consumers in an aroused state to make pleasure-seeking (reflecting a short-term focus) decisions (Ditto et al. 2006; Loewenstein 2005). Knowing that ambivalence-induced arousal enhances risk-seeking tendencies in contexts featuring immediate positive consequences is relevant for research on risk and maladaptive consumption (Ruvio, Somer, and Rindfleisch 2014). Indeed, whenever decisions or choices about consumption might result in immediate gratification, a person's ambivalence could increase maladaptive consumption.

A related contribution lies in documenting the role of ambivalence and the arousal it induces as potential process explanations for previously documented findings of the superior persuasiveness of two-sided messages (Eisend 2006, 2007, 2010). Surprisingly, research on two-sided communications has not considered that the coexistence of positive and negative messaging elements creates ambivalence. Instead, the focus has been on contrasting the

persuasive effect of univalent messages (describing exclusively positive attributes) and messages describing a mix of positive and negative attributes. The proposition that ambivalence could explain how people respond to two-sided messages aligns with Eisend's (2006) meta-analysis finding that the superiority of such messages lies in their arousal-inducing novelty (Loewenstein 1994; Magni, Taylor, and Venkatesh 2010). We trust our findings will motivate future research on ambivalence as a driver of persuasive communications.

Second, we provide evidence of physiological arousal as a process explanation for why ambivalence increases interest in risky products. Our work is consistent with van Harreveld and colleagues' (2009b) finding that ambivalence evokes physiological arousal. Our work extends theirs by connecting ambivalence-induced arousal with the consumer-related outcome of tendencies to engage in product approach tendencies. This finding also aligns with past research on willpower (Metcalf and Mischel 1999) and curiosity (Wiggin, Reimann, and Jain 2019) in which arousal increased one's appetite for attitudinal targets, especially when they are indulgent or hedonic in nature. The variety of arousal measures and approaches (mediation with self-report measures, mediation with physiological measures, process by moderation by experimentally inducing arousal) in our studies provide fodder for discussions of ecological and external validity. As Pozharliev et al. (2021) noted, retrospective self-report measures are fraught with bias that is especially problematic in contexts in which the construct of interest is one of which people are less consciously aware. Collectively, our results align with their recommendations to rely on state-of-the-art biometric measures to capture arousal rather than on retrospective self-report measures.

Third, we put forth the moderating role of normative information as additional evidence for the underlying role of arousal—which encourages the use of heuristics. Normative information—information about what other people do—is often easily accessible given that

consumers are embedded in social contexts and social media environments. Nevertheless, past research on ambivalence has not accounted for how the social context might moderate the effects of ambivalence. This past research has focused primarily on individual, internal, psychological moderators such as construal level and personality type (Hong and Lee 2010; Ramanathan and Williams 2007). The current work provides empirical evidence that normative information may help ambivalent people decide how to appraise and reconcile the separate conflicting positive and negative beliefs they hold. The tendency for ambivalent consumers to use such “tie breaker” techniques has been suggested in prior research in the context of broad, hypothetical decisions (Wang 2008) but never validated empirically.

We also identified an asymmetry in the moderating effect of lower versus higher social norms. First, we found that perceptions that a product’s use is more normative among an associative group either enhances (Study 4) or does not change (Study 6) the positive effect of ambivalence on interest in risky products. In contrast, studies that reduced participants’ perceived norms (Study 5 manipulated norms directly; Study 6 manipulated them indirectly) removed the effect of ambivalence on product-related interest or intention. Our work converges with Stok (2012) who showed not only that high (versus low) norms information enhances (reduces) related behavior but also that these high norms made an impact regardless of the level of one’s identification with the group. On the other hand, low norms exerted a stronger, negative effect when group identification was strong. Stok’s (2012) proposition that low norms may influence behavior through a different mechanism than high norms (that is, “minority norm information becomes especially focal and exerts its influence through salience rather than social proof,” p. 92) is consistent with our finding that, although higher norms information appears to enhance the effect of ambivalence on risk-seeking behavior, people’s awareness that product use is lower appears to override the effect of ambivalence (rather than interact with it). This

asymmetry is also consistent with a negativity bias effect (Rozin and Royzman 2001) and other work on framing (Maheswaran and Meyers-Levy 1990) that suggests that equivalent information posed in opposite ways does not necessarily have equal, opposing effects.

Consistent with this proposition, the results of Study 6 suggest that the provision of norms information may trigger a process other than arousal. Indeed, the effect of ambivalence on WTP in the high norms condition remained significant even when arousal was included in the model, suggesting that a process other than arousal, such as social proof, may be at play in that condition (Cialdini, Reno, and Kallgren 1990). This explanation is consistent with our proposal that ambivalence may simply encourage reliance on salient heuristic cues. Moreover, the overall pattern of effects across our studies suggests that there may be a difference in the moderating effect of information that helps to *form* norms (as in our Study 6) versus norms-related cues that *remind* and adjust the norms that people have already formed about others' behavior (as in Study 5). It is possible that the process of forming (versus accessing) norms involves a higher degree of cognitive processing, which attenuates the effect of arousal on product interest. Albeit speculative, these post-hoc explanations can stimulate future research in both the norms domain and at the intersection of norms and ambivalence.

Practical implications

Our six studies coalesce around a finding that ambivalence creates greater WTP for, take an interest in, form an intent to use, and pay attention to positive information about risky products. This effect is clearly undesirable from a public health perspective. Although communicators in the public interest may present “both sides” of an issue or product in an effort to appear credible (as research on two-sided communications has documented; Eisend 2006, 2007, 2010), these efforts may undermine their broader goals and unintentionally increase

consumers' inclination to try these products. For example, the FDA requires advertisements for prescription drugs to list their negative side effects alongside the touted benefits, which may evoke ambivalence.

The pretest for the stimuli used in Study 3 revealed that the sequence in which positive and negative content is presented also matters. For example, displaying negative before positive information generated less ambivalence relative to displaying positive information first, or alternating the display of positive and negative information. In light of the finding that the ambivalence created by exposure to conflicting information may unintentionally increase consumers' inclination to try these products, our work suggests it is critical for public health communicators to test their messages before disseminating them. Although it is common to pretest messages for clarity and comprehensibility, the current work suggests that pretesting to determine whether communication efforts unintentionally create ambivalence is also an important dimension to examine.

On the other hand, practitioners seeking to encourage product interest and use may benefit from consumers' ambivalence. Although it is unethical to intentionally foster discomfort and encourage consumption of products that threaten well-being, consumers are naturally ambivalent about many products and everyday consumption scenarios. The present research suggests that marketers of products or services with immediate positive benefits may induce ambivalence (and trigger approach behavior) in the service of *fostering* well-being by, for example, highlighting the delight of cooking at home with family (despite the effort that goes into such an activity) or the immediate sensory pleasure of organic produce (despite often higher prices). Marketers of truly new products—a scenario in which ambivalence is common—may consider highlighting the immediate, hedonic benefits of their products to encourage their trial use.

Finally, the moderating influence of reference groups' norms presents both opportunities and challenges to public health officials and consumers' advocates. Although addressing consumers' underlying ambivalence toward risky products may prove challenging, our work shows that *reducing* perceptions of norms is a fruitful path to mitigating the negative consequences of ambivalence on consumption of risky products. As Miller and Prentice (2016) note, norms-based interventions are especially effective when people overestimate the prevalence of risky behavior among their peers and feel some level of reluctance to engage in the behavior. When well designed, these messages represent a simple, cost-effective messaging approach to reducing the influence of consumers' ambivalence on risk-related behavior.

Limitations and future research

Notwithstanding its novel findings, our work has several limitations. First, the ethical challenges posed by inducing ambivalence and measuring consumption of risky products prevented us from assessing consumption in the field. Willingness to pay as measured by the BDM paradigm represents a behavioral indicator of interest in a product, but it would be nonetheless advisable for future work to capitalize on natural experimental conditions to examine how ambivalence affects actual choice and consumption of risky products. This measurement limitation is tempered by the fact that the intention-behavior gap examined in our studies is much smaller than in many other contexts referenced in Hulland and Houston's (2021) editorial on the topic. Consumption of risky products is less affected by forgetting to act, failing to prepare to act, failing to monitor goal progress, lack of willpower, and becoming overextended, among others noted in Figure 1 of that editorial (p. 431).

Another limitation relates to the participants in the samples. First, research focused on teenagers and young adults because we intentionally selected our participant samples to maintain

consistency across studies. Future research should explore the generalization of the results to other age groups. Indeed, age may affect proneness to ambivalence or physiological responses to it in ways that the current program of research could not assess. A related limitation is that we sampled Western participants (American young adults, French teenagers). Because culture may moderate the experience and effects of ambivalence (Pang et al. 2017; Wang et al. 2016), research across other cultural contexts would be welcome. Individually, each study is inevitably bound to the procedural and sampling choices we made. For example, Study 1's focus on current users of a product category may have distorted results because current users may process incoming information more carefully or be more favorably inclined toward the product category. Although subsequent studies included both users and nonusers of product categories in which use was not yet prevalent as way to facilitate the manipulations of norms, it would be beneficial for future research to assess whether users' status moderates the demonstrated effects in contexts in which use is more prevalent.

A final limitation (and direction for future research) relates to the sensitivity of our measures used in Study 6. Self-reports of level of arousal assume that participants can accurately identify this state. However, past research has revealed inconsistent relationships between self-reports and physiological measures of arousal (Abel and Larkin 1990; McGarrigle et al. 2017; Rooney, Benson, and Hennessy 2012). Indeed, Cacioppo et al. noted that their results "provide evidence that residual arousal is not directly accessible to verbal reports" and considered several sources of error associated with self-report measures of physiological arousal (1987; p. 147). A recent article by Pozharliev et al. (2021) confirms the limitations of retrospective self-reported measures of arousal in predicting behavioral intentions. Compared with real-time physiological measures of arousal (i.e., galvanic skin responses) self-reports are likelier to be biased by affective peaks during the focal experience (Kahneman and Krueger 2006). Researchers

examining arousal may be better served by using biometric measures of this process rather than, or in addition to, self-report measures.

As a direct extension of this research, we encourage investigations of whether ambivalence-induced arousal may lead to *avoidance* behavior when the immediate outcomes of consumption are negative. Along these same lines, moving beyond our focus on consumers' responses to risky products that feature immediate positive benefits, researchers could examine whether similar arousal processes and outcomes operate in the context of ambivalence toward (less risky, for ethical reasons) products that vary in short- and long-term positive and negative consequences. Indeed, ambivalence may influence consumers' responses and behaviors through mechanisms other than the physiological arousal documented here as a function of product types and social contexts.

Further, as previously noted, our findings about ambivalence and its arousal mechanism offer insights into how consumers process and respond to two-sided communications (Eisend 2006, 2007, 2010). Future research could revisit the many moderators that have been explored in the context of two-sided communication (such as the relative quantity of positive and negative information provided; Eisend 2006) through the lens of ambivalence. For instance, we found that the placement of negative information (interspersed with positive information, or grouped together) influences ambivalence. However, to the best of our knowledge, research has not examined negative information placement in the context of two-sided messages. Future research on ambivalence and two-sided messages can leverage optimal arousal theory (Berlyne 1960) to examine elements such as the nature or severity of the negative information that evokes the ideal level of arousal—some, but not too much (Berlyne's lambda hypothesis).

The current research raises broad questions about the role of attitudinal (in)stability in marketing and about consumer research that serve as directions for future research. Common

approaches to attitudinal measurements in consumer research focus almost exclusively on valence. The present research points to the importance of considering the effects of ambivalence in conjunction with individual components of positive and negative attitudes toward an object. In some of our studies, controlling for positive and negative components strengthened the effect of ambivalence. In others, it attenuated the effect. This suggests that the relative influence of ambivalence on behavior may depend on higher order moderators, such as aspects of the situation or consumer experience in the product category. In either case, past research on ambivalence that did *not* control for positive and negative beliefs may contain false positive (Type 1) *or* false negative (Type 2) errors, and future research should explore the aspects that govern the influence of positive and negative components on behavior.

We hope our investigation into ambivalence in the context of physically consumable risky products will motivate further research into whether the proposed relationships generalize to other consumption and social contexts. It would be worthwhile to extend these findings to contexts of risk-related consumption that vary in emphasis on hedonic and utilitarian components as well as whether the risk is borne personally (as in the case of e-cigarettes and energy drinks) or socially (as in the case of products that have negative environmental consequences). Extending this research to other risky behavioral contexts such as gambling, compulsive shopping, or unsafe sex also holds promise from a societal perspective.

Conflicts of Interest

The authors declare that they have no conflict of interest.

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Fig 1 Conceptual model

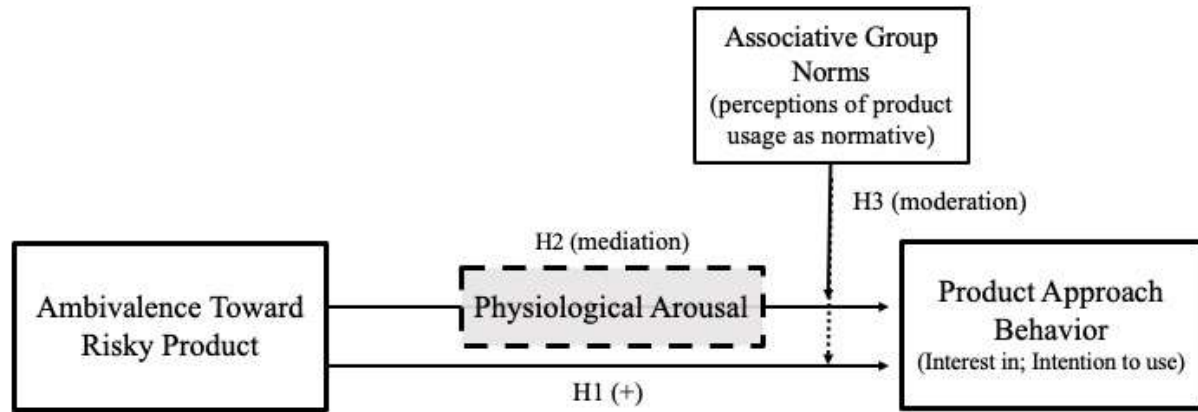


Fig 2 The effect of ambivalence on product interest as moderated by arousing music, Study 3

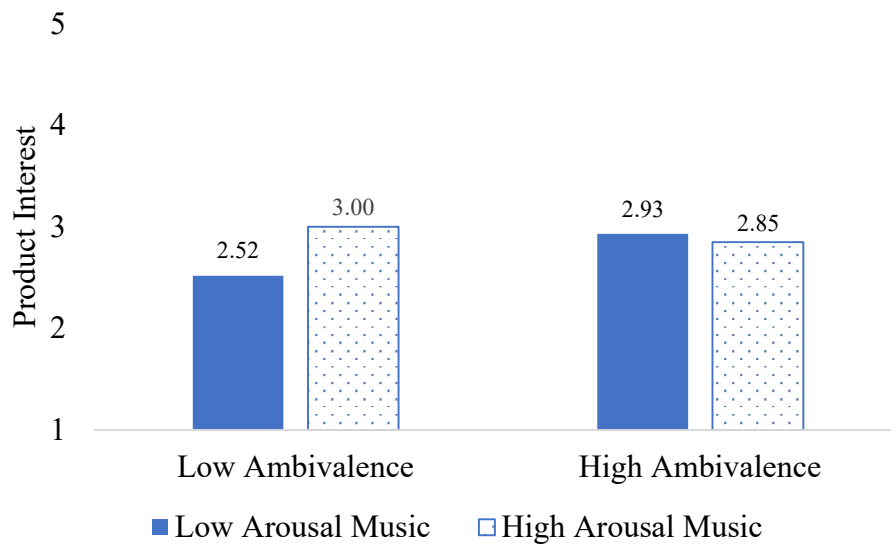


Fig 3 The effect of ambivalence on change in use intention as moderated by norms intervention

Study 5

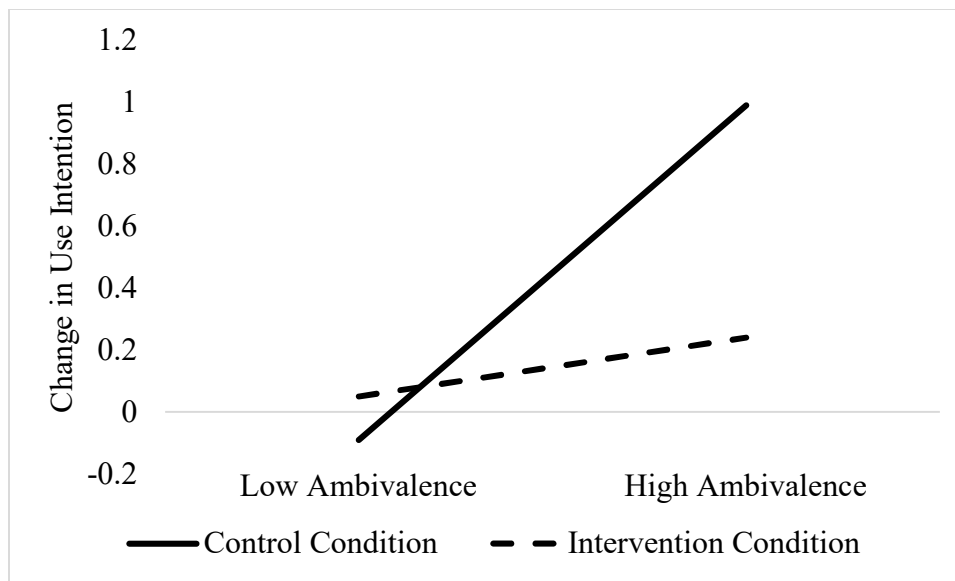


Fig 4 The effect of ambivalence on product willingness to pay as moderated by associative group norms, Study 6

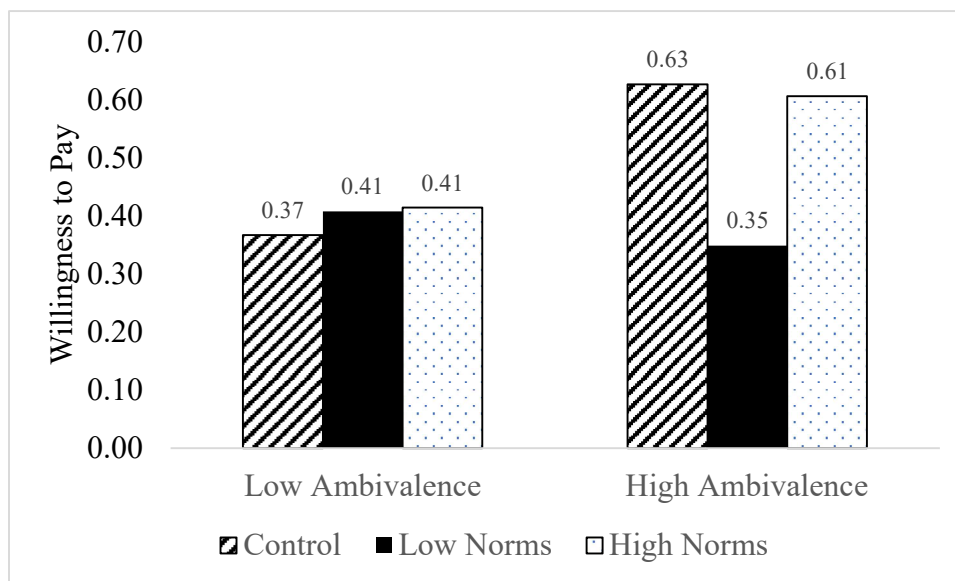


Table 1 A Sample of Research Examining the Relationship Between Ambivalence and Risk-Related Behavior

Authors (Year)	Population and Topic Context Examined	Key Findings and notes
Nowlis, Kahn, and Dhar (2002)	Students' risky financial investments (Study 5), product selection (Study 4: DVD players, credit cards, grills. Study 6: apartments, CD players, TVs)	Ambivalence toward functional products and financial investments enhances risk-avoidant decision making (relying on the status quo, reliance on the risk-avoidant lexicographic decision-making rule, selecting a less risky investment option).
Costa-Font and Mossialos (2005)	European consumers' attitudes toward biotechnology (genetically modified food/medicine)	Ambivalence reduces policy support for genetically modified food and medicines.
Jin and Villegas (2007)	Students' responses to internet advertising	Ambivalence toward online advertising predicted participants' avoidance of internet pop-up advertisements.
Clark, Wegener, and Fabrigar (2008)	Students' ambivalence toward nuclear power plants and junk food taxation policies	People who were more ambivalent toward nuclear power plants and junk food taxation avoided processing counter attitudinal messages about these topics.
MacDonald and Hynie (2008)	Students' safe sex and condom use	Ambivalence toward sex predicted (reduced) accuracy in planning sex and decreased use of condoms.
Plambeck and Weber (2009)	European CEO's ambivalence toward EU enlargement	CEOs' ambivalence toward European enlargement enhanced the predicted riskiness of their strategic responses.
Roster and Richins (2009)	Customers who were actively contemplating replacement of a durable possession (examples provided: cars, boats, TVs, stereos)	Ambivalence about a decision to replace a durable good is negatively associated with intention to purchase a replacement, positively associated with intention to retain an incumbent possession, and positively associated with intention to delay making the replacement decision.
Forward (2010)	Consumers' intentions to speed while driving	Drivers who were high (vs. low) in ambivalence toward speeding while driving were more likely to indicate future intention to speed , especially if they were in a hurry or if they felt irritated.
Oser, McKellar, Moos, and Moos (2010)	Alcohol users who initiated alcohol-related help-seeking behavior (who had not sought treatment before)	Ambivalence toward alcohol predicted subsequent heavy alcohol use and related problems at delay posttest.
Menninga, Dijkstra, and Gephardt 2011	Former smokers' relapses	Ambivalence toward smoking predicted former smokers' relapses .
Foster, Neighbors, Prokhorov (2014);	Students' binge drinking	Ambivalence toward alcohol is associated with more problem drinking (quantity/frequency of alcohol consumption).

Foster, Young, Bryan, and Quist, (2016)		
Huang, Korfiatis, and Chang (2017)	Taiwanese and American consumers' shopping cart abandonment	Ambivalence toward online shopping enhances cart abandonment at checkout.
Kim, Pjesivac, and Jin (2019)	Students' decision to receive the influenza vaccine	Ambivalence toward the influenza vaccine reduces intention to receive an influenza vaccine.

Table 2 Set of studies and contribution

	Context/population	Constructs	Contribution
Study 1: Experiment	Energy drinks / energy drink users	Ambivalence (manipulated), WTP measured by BDM	Tests H1: Relative to a positive-only condition, ambivalence enhances WTP
Study 2: Experiment with physiological measures	Cognitive enhancers / college students	Ambivalence (manipulated), arousal (GSR), eye-tracking measures	Tests H1 and H2: Demonstrates that ambivalence enhances arousal, which then influences attention to positive (vs. negative) information about the product
Study 3: Experiment	Cognitive enhancers /young adults	Ambivalence (manipulated), Arousal (manipulated), product interest	Tests H2: Shows that increasing participants' arousal enhances interest in the featured product
Study 4: Cross-sectional survey	Smoking and vaping/ French teens	Ambivalence (measured), social norms, use intention	Tests H1 and H3: Replicates basic effect that ambivalence enhances use intention. Moderated by social norms so that use intention is enhanced at higher levels of peer norms
Study 5: Quasiexperiment	Vaping/ French teens	Ambivalence (measured), norms (manipulated: low, control), use intention	Tests H1 and H3: Replicates the effect that ambivalence enhances use intention. Moderated by social norms so that reducing perception of use norms suppresses the influence of ambivalence
Study 6: Experiment 2 (ambivalence: low, high) x 3 (norms: control, low, high)	Cognitive enhancers /young adults	Ambivalence (manipulated), arousal (self-report), norms (manipulated – low, control, high), WTP measured by BDM	Tests H1, H2, and H3: Demonstrates that low norms attenuate effect of ambivalence and arousal

Table 3 Study 4 Regression Results: Ambivalence and Associative Norms on Intention to Use E-cigarettes and Cigarettes

	Model 1: Base Model (Ambivalence, Norms, and Their Interaction)		Model 2: Base Model with Controls		Model 1: Base Model (Ambivalence, Norms, and Their Interaction)		Model 2: Base Model with Controls	
	DV: E-cigarette Use Intention				DV: Cigarette Use Intention			
	<i>B</i> (SE)	<i>t</i>	<i>B</i> (SE)	<i>t</i>	<i>B</i> (SE)	<i>t</i>	<i>B</i> (SE)	<i>t</i>
Constant	1.75 (.04)	45.03***	.80 (.16)	5.01***	1.83 (.04)	47.73***	.82 (.20)	4.15***
Ambivalence	.15 (.02)	9.62***	.02 (.01)	1.55	.21 (.01)	14.55***	.04 (.01)	3.05***
Associative norms	.01 (.01)	3.89***	.01 (.01)	3.74***	.01 (.01)	6.18***	.01 (.01)	3.84***
Ambivalence x associative norms	.01 (.01)	2.89**	.01 (.01)	2.15*	.01 (.01)	2.36*	.01 (.01)	1.41 ^t
Positive attitude component			.36 (.04)	10.02***			.31 (.03)	8.74***
Negative attitude component			-.09 (.04)	-2.46*			-.06 (.04)	-1.40
Past use			1.07 (.08)	13.17***			1.26 (.08)	16.80***
	R ² = .12		R ² = .45		R ² = .23		R ² = .53	
	<i>F</i> (3,889) = 38.90***		<i>F</i> (6,773) = 76.24***		<i>F</i> (3,875) = 85.45***		<i>F</i> (6,758) = 142.67***	

^t $p < .1$ * $p < .05$ ** $p < .01$ *** $p < .001$

Notes: Variables are mean-centered

Table 4 Study 5 Regression Results: Effect of Ambivalence and Norms Intervention on Change in Intention to Use E-cigarettes

	Model 1: Base Model (Ambivalence, Norms, and Their Interaction)		Model 2: Base Model with Controls	
	DV: Change in E-Cig Use Intention			
	<i>B</i> (SE)	<i>t</i>	<i>B</i> (SE)	<i>t</i>
Constant	-.08 (.26)	-.31	.23 (.55)	.42
Ambivalence	.12 (.06)	1.97 ^t	.18 (.06)	3.07**
Norms intervention (0 = control, 1 = intervention)	-.08 (.35)	.22	-.24 (.19)	-1.28
Ambivalence x intervention	-.07 (.08)	-.82	-.15 (.07)	-2.03*
Positive attitude component			-.08 (.10)	-.78
Negative attitude component			-.43 (.10)	-4.33***
Past use			1.13 (.24)	4.72***
	R ² = .05		R ² = .28	
	<i>F</i> (3,114) = 1.84		<i>F</i> (6,105) = 6.92***	

^t $p = .05$

* $p < .05$

** $p < .01$

*** $p < .001$

Notes: Variables are mean-centered