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**DOI**

[10.1016/j.jesp.2019.103938](https://doi.org/10.1016/j.jesp.2019.103938)

**Publication date**

2020

**Document Version**

Final published version

**Published in**

Journal of Experimental Social Psychology

**License**

Article 25fa Dutch Copyright Act

[Link to publication](#)

**Citation for published version (APA):**

Itzchakov, G., Amar, M., & Van Harreveld, F. (2020). Don't let the facts ruin a good story: The effect of vivid reviews on attitude ambivalence and its coping mechanisms. *Journal of Experimental Social Psychology*, 88, [103938]. <https://doi.org/10.1016/j.jesp.2019.103938>

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# Don't let the facts ruin a good story: The effect of vivid reviews on attitude ambivalence and its coping mechanisms<sup>☆</sup>



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## ABSTRACT

Purchasing decisions are increasingly based on reviews by fellow consumers which often consist of positive and negative evaluations about the product (i.e. valence-inconsistency). We tested how the vividness of these reviews affects individuals' attitude ambivalence towards the product and their strategies to cope with this ambivalence. We hypothesized that reading vivid and valence-inconsistent reviews would lead to increased awareness of opposing features of attitudes towards the product (i.e. increased simultaneous accessibility) as compared to reading less vivid valence-inconsistent reviews. If this is indeed the case, individuals should feel more conflicted towards the attitude object (i.e. increased subjective ambivalence) and should be motivated to reduce it by using ambivalence-coping strategies, specifically (a) processing additional information that is congruent with their initial attitude and (b) delaying their decision. These hypotheses were mostly supported across five experiments. The experiments included manipulations of valence-inconsistent information between reviews and within a review including three pre-registered studies ( $N_s = 247, 396, 701, 433, 313$ , respectively).

## 1. Introduction

Imagine that you want to surprise your partner and take him or her to a restaurant. You have heard about a new restaurant and to find out more about it, you surf the internet to find a website where people share their experiences. Some reviews paint a positive picture, mentioning that the food is great, the prices are fair and the place is well maintained. However, in other reviews, people mention negative experiences about parking and service quality. How will these opposing reviews impact your attitude towards the restaurant? Will you feel conflicted? If so, will you search for additional information that is consistent or inconsistent with your initial view of the restaurant? Will you delay your decision? In this paper, we argue that the answers to these questions depend on the extent to which the reviews are presented in a vivid manner.

Specifically, we examine the interactive effect of vividness and valence consistency (i.e. ambivalent/univalent) of online reviews on attitude ambivalence and their subsequent coping strategies. We chose to operationalize vividness with experience-based content because it is usually associated with a high degree of vividness (e.g., Brewer, 1988). Although experience-based reviews are considered more persuasive than other framings, less is known about how they impact attitude structure, and in particular, how attitudes are shaped when individuals are exposed to both positive and negative information. For example, a

person searching for information about a dance club may find reviews stating that: “the music was terrific; the DJ played all kinds of songs. The atmosphere in the club made my partner and I feel the same excitement as we had on our first date”, and “There is hardly any parking space in the vicinity, and my friend and I looked for more than 30 minutes for space. Eventually, we parked almost a mile away from the club, which was a nightmare when we needed to get back to the car exhausted at the end of the evening”. We hypothesized that these reviews would have more impact on readers' attitude ambivalence they are written as vivid personal experiences relative to listing attributes, even when the overall rating was comparable.

## 2. Attitude ambivalence

Attitude ambivalence usually refers to two constructs that are known as objective-attitude ambivalence and subjective-attitude ambivalence. Objective ambivalence is defined as the presence of both positive and negative evaluations of an attitude object (Fabrigar, MacDonald, & Wegener, 2005). For example, a person can love the taste of ice cream, but hate the calories, or have mixed feelings about a colleague. Objective ambivalence is based on the strength of positive and negative thoughts. Similar and strong levels of both opposing evaluations represent high levels of objective ambivalence and low levels of both represent indifference (Kaplan, 1972).

<sup>☆</sup> This paper has been recommended for acceptance by Jarret Crawford.

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While most people have positive and negative evaluations towards many different things, they do not always experience conflict. In the ambivalence literature, such experience of inner evaluative conflict which includes the evaluative conflict associated with the attitude object is known as subjective ambivalence (Priester & Petty, 1996). While objective ambivalence is a necessary precondition for subjective ambivalence to occur, only when both opposing evaluations are *salient at the same time* individuals become aware of their inner conflict and subjective ambivalence arises. The accessibility of the opposing evaluations is termed simultaneous accessibility of objective ambivalence (Newby-Clark, McGregor, & Zanna, 2002).

To further distinguish between objective and subjective ambivalence it is noteworthy that the presence of opposite aspects in memory regarding the attitude object (objective ambivalence) cannot exist without awareness of both sides. However, an experience of the inner conflict (subjective ambivalence) requires more than mere awareness of the pros and cons and can exist without awareness to the opposite aspects (automatic subjective ambivalence; Petty, Tormala, Brinol, & Jarvis, 2006). This is reflected by findings that show that objective and subjective ambivalence shows fairly modest correlations (e.g., Armitage & Arden, 2007; DeMarree, Wheeler, Briñol, & Petty, 2014).

In the present research, we focus on the relationship between simultaneous accessibility of opposing evaluations (objective ambivalence) and the experience of conflict that may result from it: subjective ambivalence. (For an overview of the ambivalence literature see; Rothman, Pratt, Rees, & Vogus, 2017; Van Harreveld, Nohlen, & Schneider, 2015).

It is important to distinguish subjective ambivalence from subjective decision difficulty, which is defined as the difficulty level which is experienced in forming a preference for a specific option (Novemsky, Dhar, Schwarz, & Simonson, 2007). While there are indeed important similarities between ambivalence and difficulty as they are both constructs related to meta-cognition (thoughts about thoughts; DeMarree & Briñol, 2012). However, as the ambivalence literature has shown, there are important differences as well. For example, depending on the context, ambivalent decisions can be difficult or not (Nohlen, van Harreveld, & Cunningham, 2019; Nohlen, van Harreveld, Rotteveel, Barends, & Larsen, 2016). Moreover, subjective ambivalence is a feature of the attitude structure whereas subjective difficulty is a feature of a choice. Second, many difficult choices do not involve ambivalence (approach-approach for example) and conversely, ambivalent decisions can be easy or difficult, depending on the context (Nohlen et al., 2016) (see Van Harreveld, Van der Pligt, & de Liver, 2009 for a discussion of how ambivalence relates to the work on decision difficulty). In addition, it is important to study attitude ambivalence because it is so immensely prevalent in our lives and the attitude literature has shed light on a wide range of affective, cognitive and behavioral consequences of ambivalent attitudes (e.g., Van Harreveld et al., 2015). In fact, it is safe to say that within the vast literature on attitudes, ambivalence is one of the topics receiving the most attention in research.

Here, we examine an unexplored aspect of subjective ambivalence; namely, vividness and memory. We hypothesized that subjective ambivalence should be enhanced when individuals encounter valence-inconsistent information that is vivid and memorable. Valence-inconsistent information framed as vivid personal experience should enhance simultaneous accessibility (as discussed above a precondition for objective ambivalence becoming subjective ambivalence) and thus subjective ambivalence more than valence-inconsistent information framed as facts. Based on the ambivalence literature we also hypothesized that the enhanced subjective ambivalence should have downstream consequences on ambivalence coping strategies (e.g., Van Harreveld et al., 2009). That is, conflicted individuals will be more inclined to process information which is congruent with their initial attitude (e.g., Clark, Wegener, & Fabrigar, 2008; Maio, Bell, & Esses, 1996) and delay their decision (Durso, Briñol, & Petty, 2016; Nohlen, 2017).

In sum, the focal goal of the present research is to examine if the

vividness level of valence-inconsistent information impacts simultaneous accessibility, subjective ambivalence, and its coping strategies, namely, biased-information processing and procrastination. We next elaborate on the constructs in the models and the theory for the hypothesized associations among them.

### 3. The effect of vividness on memory

Vivid information attracts attention and activates imagination if it is emotionally interesting, concrete and provokes imagery (Nisbett & Ross, 1980, p. 45). Vividness is perceived as a form of message communication. For example, presenting information through videos, direct experience and case history arguably enhances its vividness for the recipient (Taylor & Thompson, 1982). Vivid information is argued to have a greater effect on judgments relative to less vivid information because it (a) is processed and encoded to a greater extent, (b) is easier and more available to recall (Nisbett & Ross, 1980), (c) elicits more imagination (Taylor & Thompson, 1982), and (d) induces emotional involvement in the information (Cacioppo, Sandman, & Walker, 1978).

In the present research, we chose to induce vividness using online reviews framed as personal experiences. Personal experiences entail direct experience and case history with the attitude object and are emotionally interesting. For the control group (less vividness condition) we used fact-based reviews that did not convey direct experience or case history with the product.

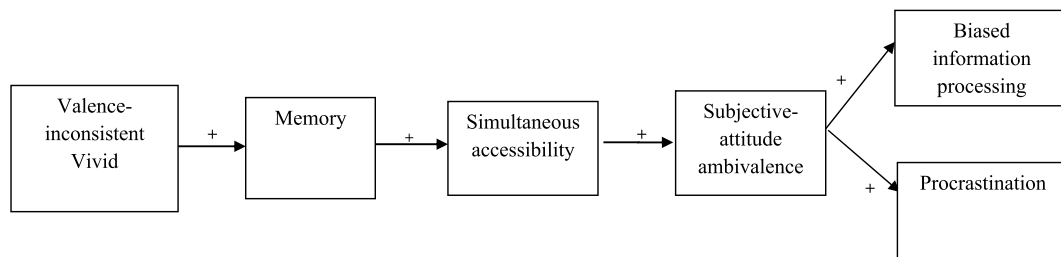
Previous work found that experiential reviews are more vivid than fact-based reviews and have been found to generate more cognitive personalization for search goods (Xia & Bechwati, 2008; Study 1). Specifically, Xia and Bechwati (2008) found that cognitive personalization is a function of the experiential vs. factual content of the review (among other antecedents). Cognitive personalization is defined as the extent to which readers feel and think the review describes something that happened to them, thus inducing self-referential thinking (Larsen, Diener, & Cropanzano, 1987; Xia & Bechwati, 2008). Encoding information in a self-referent manner produces better memory than other structural encodings of the same material such as semantic encoding (Klein & Loftus, 1988; McCaul & Maki, 1984). Two mechanisms may account for this phenomenon. First, framing information as personal induces higher levels of incidental recall where readers recall similar situations that happened to them (Kuiper & Rogers, 1979). Second, self-referential thinking organizes words into categories that enhance recall by creating associative paths in memory that are used during information retrieval (Klein & Kihlstrom, 1986). A meta-analysis found that self-referent encoding results in better memory than other encoding strategies (Symons & Johnson, 1997).

**H1.** Vivid experience-based reviews will enhance memory more than less vivid fact-based reviews.

### 4. Simultaneous accessibility of opposing evaluations

If vivid experience-based information is more memorable than fact-based information, readers of valence-inconsistent reviews- which include positive and negative attributes of the attitude object should experience greater awareness of the opposing features than readers of valence-consistent reviews- which include only one-sided information (only positive or only negative). Moreover, personal experience with a product has been associated with greater awareness (cognitive accessibility) of the attitude towards the product (Borgida & Campbell, 1982). This awareness is termed simultaneous accessibility of objective ambivalence and refers to the extent to which the positive and negative attributes of the attitude object come to mind both quickly and equally quickly (Newby-Clark et al., 2002).

**H2.** When an attitude object is presented in a valence-inconsistent way, vivid experience-based information will enhance simultaneous



**Fig. 1.** Model of the effect of valence-inconsistent reviews framed as personal experience on biased-information processing and procrastination via memory, simultaneous accessibility, and subjective ambivalence.

accessibility more than none-vivid information. This effect will be mediated by enhanced memory of the opposite aspects.

### 5. The effect of simultaneous accessibility on evaluative conflict

Exposure to opposing evaluations results in more subjective-attitude ambivalence when those evaluations are simultaneously accessible to the attitude holder (Newby-Clark et al., 2002), such as when people have to make a dichotomous choice (Van Harreveld et al., 2009). We aim to shed light on vividness as a heretofore unexplored antecedent of simultaneous accessibility, which in turn leads to subjective ambivalence. That is, because vivid experience-based reviews are more memorable than fact-based reviews, they should increase simultaneous accessibility and as a result enhance subjective ambivalence. Support for the link between memory and subjective ambivalence comes from work reporting that subjective ambivalence increases when individuals engage in introspection about their attitude (Van Harreveld, Rutjens, Schneider, Nohlen, & Keskinis, 2014).

**H3.** Vivid information will increase subjective-attitude ambivalence via increasing simultaneous accessibility.

### 6. How individuals cope with evaluative conflicts?

The notion that subjective ambivalence is unpleasant has led to the prediction that it triggers coping processes (DeMarree et al., 2014; Van Harreveld et al., 2009). Specifically, wanting to reduce subjective ambivalence directs people's attention to information that might help them resolve their ambivalence (Briñol, Petty, & Wheeler, 2006; Maio et al., 1996). When individuals feel ambivalent towards an attitude object, they prefer to seek and process information that is consistent with their initial attitude (Clark et al., 2008; Clark & Wegener, 2013; Sawicki et al., 2013), which is referred to as biased information processing. That is, ambivalent attitude holders who are slightly negative (positive) tend to prefer negative (positive) information since this is the most direct way to achieve consistency within their overall evaluation. Hence it is likely that individuals who are ambivalent about a product will seek additional information that supports their initial attitude to reduce conflict.

**H4.** Vivid information will increase biased information-processing via increased simultaneous accessibility and subjective ambivalence.

Biased information processing is considered a problem-focused coping strategy prompted by the motivation to reduce conflict (Van Harreveld et al., 2015). However, it has been argued that people also deal with the unpleasant nature of ambivalence by employing (low-effort) emotion-focused coping strategies such as procrastination (MAID; Van Harreveld et al., 2009). Specifically, it has been argued that individuals use procrastination as a distraction technique to mitigate negative ambivalence-induced affect (Van Harreveld et al., 2015). This claim has received indirect support in work showing that (a) difficult choices lead to negative feelings and avoidant behavior (Luce, Bettman,

& Payne, 1997), (b) powerful people who feel ambivalent prefer to delay their decision to a greater extent than powerless people who felt ambivalent (Durso et al., 2016), and (c) the subjective difficulty of a decision increases choice deferral for consumers, unless they attribute the experience to an unrelated cause (Novemsky et al., 2007). However, to the best of our knowledge, the notion that the experience of ambivalence increases the inclination to procrastinate through simultaneous accessibility has not been tested directly. Hence, an additional goal of the current work was to test whether the subjective ambivalence induced by experience-based reviews would increase procrastination.

**H5.** Vivid information will increase the tendency to procrastinate a decision through increased simultaneous accessibility and subjective ambivalence.

As shown in Fig. 1, we predicted that vivid valence-inconsistent reviews (framed as personal experiences as compared to merely listing the attributes) should increase the simultaneous accessibility of oppositions, which should increase subjective-attitude ambivalence. Finally, increased subjective ambivalence should make individuals more inclined to use the ambivalence coping strategies of processing attitude-congruent information and procrastination to reduce their evaluative conflicts.

### 7. Overview of studies

We conducted five studies and two pilot studies to test the hypotheses. To reduce to the length of this manuscript the first study and two pilot studies are reported in the Supplementary material and is labeled Study 0. In Study 1 we tested the hypothesized model on biased-information processing as the dependent variable. Specifically, we manipulated the objective ambivalence level between the reviews (valence-consistent vs. valence-inconsistent). In Study 2 (preregistered) we replicated the design of Study 1 and tested procrastination as an additional DV. Study 3 (preregistered) extended these studies further. First, we manipulated objective ambivalence within a review by presenting readers with a consumer who discussed both the advantages and disadvantages of the product. Second, we added an opinion-based review condition. Third, we measured memory to test whether it would drive the effect of the experimental induction on simultaneous accessibility. Importantly, we kept the rating constant across all conditions (see Supplementary material). Finally, in Study 4 (preregistered) we compared valence-inconsistent reviews framed as personal experiences vs. valence-inconsistent reviews framed as facts towards a smartwatch using a different preface.<sup>1</sup>

In each study, the reviewers rated the product on a 1–5 scale. Moreover, in all studies, we used real consumer reviews which were adapted from Amazon.com. We did not recruit additional participants after the initial hypothesis-testing data analysis in any of the studies. All

<sup>1</sup> We made sure that none of the reviews contained emotional words (e.g., disappointed, satisfied, angry) to control for emotional language as a confounding variable.

measures, inductions, and exclusions in the studies are disclosed, as well as the method of determining the final sample size. In each study, we measured subjective ambivalence again after participants had a chance to engage in ambivalence-coping strategies. These results, along with the results of the objective-ambivalence manipulation checks and the detailed reviews, are reported in the Supplementary material. In every preregistration, we specified the research hypotheses, variables and measures, type of analysis, exclusion criteria, experimental conditions and sample size. Finally, we included a summary table that describes which variables and hypotheses were tested in each study and whether these hypotheses were supported (see Table 6).

## 8. Study 1

### 8.1. Procedure

After filling in the consent form, participants were randomly assigned to vividness (experience/facts) and a valence condition. In the valence-consistent condition, participants read six positive reviews about a smartwatch. The reviews were framed either as vivid personal experience or as a less vivid list of attributes. In the valence-inconsistent condition, participants read three positive and three negative reviews framed as experience or facts. Afterwards, we measured the dependent variables. Finally, participants were debriefed and rewarded for their participation.

### 8.2. Method

#### 8.2.1. Participants and design

We recruited 396 participants ( $M_{\text{age}} = 40.12$ ,  $SD = 13.43$ , 58.1% female) through Prolific Academic. We crossed the vividness of the review (experience/facts) with its valence (consistent/inconsistent) in a between-participants design. Each participant was paid 0.80£ for participation. This sample size has a power of 0.79 to detect the interaction effect of the induction on biased-information processing which was obtained in the study 0 (see Supplementary materials), *Cohen's*  $f = 0.14$ . We chose this effect size because biased information-processing was the dependent variable in the model and thus should have the smallest effect size of all the variables. With regard to the sensitivity power analysis, the minimum effect size that this sample size has a power of 0.80 to detect is *Cohen's*  $f = 0.15$ .

#### 8.2.2. Procedure

Participants were invited to take part in a study about consumers' attitudes towards smartwatches. In the consent form, participants read the following preface:

"This study aims to learn more about consumers' evaluations and preferences for smartwatches. In this study you will read a description of "Apple watch series 2", or "Samsung smart-watch gear s3" (depending on the smartphone you own). Afterwards, you will read reviews written by customers who purchased the watch." Half of the participants indicated they owned an iPhone (48.7%) whereas the other half indicated owning a Samsung.<sup>2</sup>

After filling in the consent form, participants were presented with a description of the associated smartwatch (see Supplementary material). Afterwards, they were informed that in this study they could either be entered into a lottery where they could win the smartwatch they read about, or be paid in the standard fashion for their participation. Participants were presented with the following passage:

"In this study, you will be given the opportunity to enter a lottery for the watch described above rather than being paid for your participation. The odds of winning the lottery are 1/100 (one out of every

hundred participants will win a watch). Please note that you are not required to make your decision now. We will only ask you to give us your decision at the end of the study." The winning ratio was determined by a pre-test ( $N = 71$ ) where participants rated the minimum odds ratio they found acceptable for trading their earnings (0.80£) for a chance to enter the raffle for a smartwatch, which is valued at \$350. The chosen ratio (1/100) was the median score. Almost two-thirds of the participants (63.4%) chose to participate in the lottery, indicating that the decision was meaningful.

Next, participants were randomly assigned to vividness and valence conditions. Participants in the vividness condition read reviews framed as personal experiences, whereas participants in less vividness condition read the information in the form of a list of facts. Participants in the valence-consistent condition read six positive reviews about the smartwatch, whereas participants in the valence-inconsistent condition read three positive and three negative reviews (see Supplementary material for all reviews).

After reading the reviews, we measured the dependent variables as well as demographics and asked participants to make their decision about entering the raffle. Finally, we debriefed the participants.

### 8.3. Measures

#### 8.3.1. Simultaneous accessibility

Simultaneous accessibility of objective ambivalence was calculated as in previous work (Newby-Clark et al., 2002) by recording the response latencies for a pair of split-semantic differential items asking separately about the positive and negative features of the attitude object (e.g., "considering only your positive thoughts, how positive is your attitude towards X"; Kaplan, 1972). We controlled for individual differences in response time by using an idiographic approach (Fazio & Powell, 1997) where each score is standardized on its corresponding simultaneous accessibility score for a control object (i.e. "going on a vacation"). We calculated simultaneous accessibility by squaring the slower speed score and dividing it by the faster speed score (Newby-Clark et al., 2002):  $\text{slow}^2/\text{fast}$ .

The formula developed by Newby-Clark et al. (2002) makes the properties of simultaneous accessibility similar to those of objective ambivalence (Kaplan, 1972). Objective ambivalence was calculated by subtracting the absolute value of the difference between the positive (P) and negative (N) attributes of the split-semantic differential scale:  $(P + N)/2 - |P - N|$  (M. M. Thompson, Zanna, & Griffin, 1995) where higher scores indicate higher simultaneous accessibility of evaluative components.<sup>3</sup>

#### 8.3.2. Attitude favorability

Attitude favorability towards the smartphone was calculated as the difference between the positive-negative split-semantic differential items with positive scores reflecting positive attitudes and negative scores reflecting negative attitudes. Scores ranged from  $-10$  to  $10$ .

#### 8.3.3. Subjective-attitude ambivalence

Subjective-attitude ambivalence was measured on three items taken from previous research (indecision, conflict, and mixed feelings; Priester & Petty, 1996),  $\alpha = 0.88$ .

#### 8.3.4. Biased information processing

We presented the participants with a list of eight review titles. Half of the titles reflected positive reviews, and half presented negative reviews. Participants were divided into two groups based on their initial attitude favorability scores. Participants who reported a higher or equal score on the positive split semantic-differential scale than on the

<sup>2</sup> One of the eligibility requirements for participation in the study was having a smartphone that supports smartwatches.

<sup>3</sup> The effects of the experimental manipulations on objective ambivalence (i.e., manipulation check) are reported in the Supplementary materials.

negative split-semantic differential scale composed group 1. Participants who reported the opposite score composed group 2. For example, participants who assigned a rating of 2 to the positive attributes of the product and 9 to the negative attributes were assigned to group 2. The measure of consistency bias was calculated based on the ratings of participants expressing interest in reading titles as follows:

Group 1: (*sum positive titles*)-(sum negative titles)

Group 2: (*sum negative titles*)-(sum positive titles)

This measure was used in previous work (Itzhakov & Van Harreveld, 2018); its advantage is that it captures both the direction and the extent of information processing bias. A score above 0 indicates that individuals focused on titles that corresponded to their initial attitude, whereas a score below 0 indicates individuals focused on titles that countered their initial attitude. Higher scores reflect a higher consistency bias. We treated participants who scored 0 on their attitude favorability measure as having an initially positive attitude towards the product; however, the results did not differ when we treated them as having an initially negative attitude.<sup>4</sup>

#### 8.4. Results & discussion

Table 1 presents the descriptive statistics and correlations between the variables.

##### 8.4.1. Simultaneous accessibility

The response latencies were reciprocally transformed and thus became speed scores. There was no main effect of the valence condition,  $F(1,392) = 2.34, p = .127, \eta_p^2 = 0.01, (M_{\text{valence-inconsistent}} = 0.10, SE = 0.07; M_{\text{valence-consistent}} = -0.05, SE = 0.07)$ , or a main effect of the vividness condition,  $F(1,392) = 2.35, p = .126, \eta_p^2 = 0.01, (M_{\text{vivid}} = 0.10, SE = 0.07; M_{\text{less vivid}} = -0.05, SE = 0.07)$ . Critically, there was a Valence X Vividness interaction,  $F(1,392) = 7.05, p = .008, \eta_p^2 = 0.02$ . Simple effect analysis indicated that this interaction was driven by differences in the valence condition. Specifically, under valence-inconsistency, simultaneous accessibility was higher for participants in the vivid condition ( $M = 0.30, SE = 0.10$ ) than for participants in the less vivid ( $M = -0.11, SE = 0.10$ ),  $p = .003, 95\%CI [0.13, 0.67]$ . No difference was observed in the valence-consistent condition ( $M_{\text{vivid}} = -0.10, SE = 0.09; M_{\text{less vivid}} = 0.004, SE = 0.10$ ),  $p = .423, 95\%CI [-0.16, 0.37]$ .

##### 8.4.2. Subjective ambivalence

An ANOVA indicated a main effect for the valence condition,  $F(1,392) = 22.46, p < .001, \eta_p^2 = 0.06$ . Participants in the valence-inconsistent condition reported more subjective ambivalence ( $M = 4.63, SE = 0.18$ ) than participants in the valence-consistent condition ( $M = 3.46, SE = 0.17$ ). There was no main effect for the vividness condition,  $F(1,392) = 3.06, p = .081, \eta_p^2 = 0.01, (M_{\text{vivid}} = 4.27, SE = 0.17; M_{\text{less vivid}} = 3.83, SE = 0.18)$ . Critically, there was a significant Vividness X Valence interaction,  $F(1,392) = 15.23, p < .001, \eta_p^2 = 0.04$ . Specifically, under valence-inconsistency, participants in the vivid condition reported greater subjective ambivalence ( $M = 5.34, SE = 0.25$ ) than participants in the less vivid condition, ( $M = 3.93, SE = 0.25$ ),  $p < .001, 95\%CI [0.71, 2.09]$ . No difference was observed in the valence-consistent condition, ( $M_{\text{vivid}} = 3.19, SE = 0.24; M_{\text{less vivid}} = 3.73, SE = 0.25$ ),  $p = .128, 95\%CI [-1.22, 0.15]$ .

##### 8.4.3. Biased-information processing

Response latencies were log-transformed because of skewness. An ANOVA indicated a main effect for the valence condition,  $F$

**Table 1**

Descriptive statistics and correlations for Study 1.

	M	SD	1	2	3
1. Subjective ambivalence	4.04	2.58			
2. Simultaneous accessibility	0.02	0.97	0.14**		
3. Biased-information processing	-0.37	1.86	0.13*	0.07	
4. Attitude favorability	3.23	4.19	-0.12**	0.17**	-0.16**

\*\*  $p < .01$ .

\*  $p < .05$ .

(1,392) = 14.02,  $p < .001, \eta_p^2 = 0.03$ . Participants in the valence-inconsistent condition processed information in a more biased manner ( $M = -0.03, SE = 13$ ) than participants in the valence-consistent condition ( $M = -0.71, SE = 13$ ). There was also a main effect of the vividness condition,  $F(1,392) = 6.13, p = .014, \eta_p^2 = 0.01$ . Participants who read vivid (experience-based) reviews were more biased in their information processing ( $M = -0.15, SE = 13$ ) than participants who read less vivid (facts;  $M = -0.60, SE = 13$ ). Importantly, there was a significant Vividness X Valence interaction,  $F(1,392) = 6.95, p = .009, \eta_p^2 = 0.02$ . Under valence-inconsistency, participants in the vivid condition were more biased in terms of the time they spent reading the reviews ( $M = 0.43, SE = 0.18$ ) than participants in the less vivid condition, ( $M = -0.50, SE = 0.18$ ),  $p < .001, 95\%CI [0.42, 1.42]$ . There was no difference between participants in the valence-consistent condition ( $M_{\text{vivid}} = -0.73, SE = 0.18; M_{\text{less vivid}} = -0.70$ ),  $p = .909, 95\%CI [-0.47, 0.53]$ .

##### 8.4.4. Attitude favorability

There was no main effect of the vividness condition, or a Vividness X Valence interaction on attitude favorability towards the smartwatch  $F(1,392) = 0.08, 0.13, p = .778, 0.719, \eta_p^2 = 0.00$ . There was a main effect for the valence condition  $F(1,392) = 25.64, p < .001, \eta_p^2 = 0.06$ , such that participants in the valence-consistent condition reported a more favorable attitude towards the smartwatch ( $M = 4.26, SE = 0.29$ ) than participants in the valence-inconsistent condition ( $M = 2.19, SE = 0.29$ ).

##### 8.4.5. Mediation analysis

We tested a moderated serial-mediation analysis (Model 83, PROCESS; Hayes, 2017) with 5000 bootstrapped samples (Preacher & Hayes, 2008). We estimated the valence condition as 0 (consistent) or 1 (inconsistent). As can be seen in Fig. 2, there was a significant Vividness X Valence interaction on simultaneous accessibility,  $b = 0.51, SE = 0.19, p = .008$ . Simple effect analysis indicated that reviews framed as personal experience increased simultaneous accessibility in the valence-inconsistent condition  $b = 0.40, SE = 0.14, p = .003$ , but not in the valence-consistent condition,  $b = -0.11, SE = 0.13, p = .428$ . Second, the conditional indirect effect of the vividness condition through simultaneous accessibility and subjective ambivalence on biased-information processing was significant in the valence-inconsistent condition,  $b = 0.01, SE = 0.01, 95\%CI [0.00004, 0.04]$ , but not in the valence-consistent condition,  $b = -0.003, SE = 0.005, 95\%CI [-0.02, 0.004]$ . The direct effect was significant  $b = 0.39, SE = 0.18, p = .034, 95\%CI [0.03, 0.76]$ . The index of moderated mediation was marginally significant,  $b = 0.02, SE = 0.01, 95\%CI [0.000, 0.05]$ . That is, simultaneous accessibility and subjective-attitude ambivalence mediated the effect of the vividness condition only when participants read valence-inconsistent reviews. This supports the hypothesis that vivid reviews framed as personal experience induce biased information processing by increasing the awareness of contradictions and subsequent feelings of conflict when the content is inconsistent in its valence.

Study 1 provided support for hypotheses H2-H4. Moreover, it provided support for the model while employing an actual decision that participants had to make (exchanging their monetary credit for a raffle

<sup>4</sup> This is true for each study reported in this manuscript.

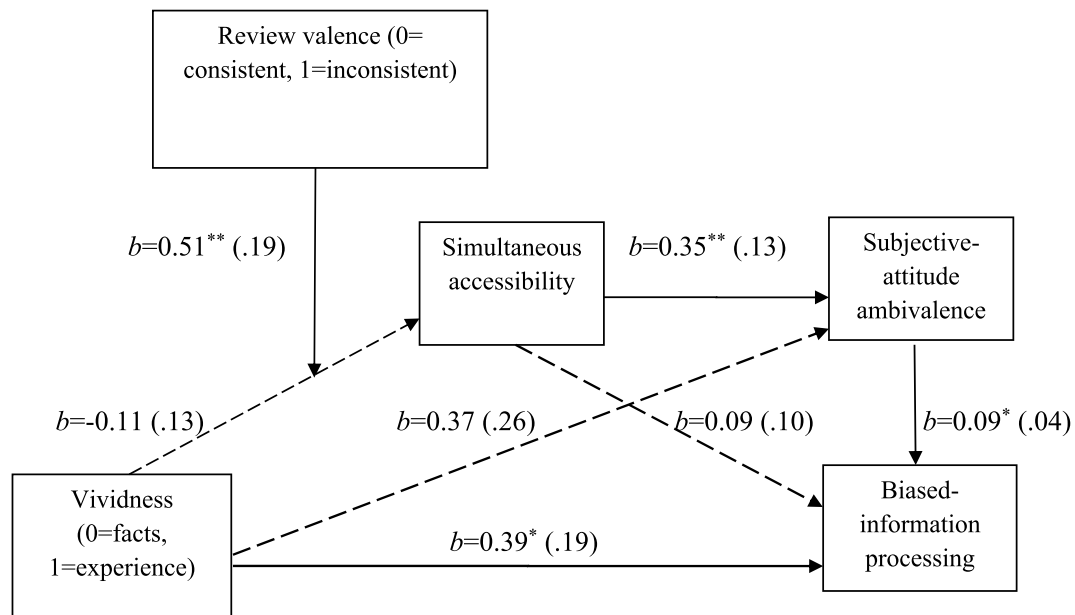


Fig. 2. Moderated-mediation model for Study 1. Standard errors in parentheses.  $^{**}p < .01$ ,  $^*p < .05$ .

ticket). Interestingly because participants had to make an actual decision, one might expect that their inner conflict would lead them to read more reviews that represent both sides (i.e. positive and negative). However, instead, they read additional information that is consistent with their prior attitude. Moreover, this study did not test for the effects of ambivalence on emotion-focused coping. Hence, we conducted Study 2 to examine whether the opportunity to procrastinate before making a decision (Van Harreveld et al., 2009) plays a role in our model.

## 9. Study 2

The goals of Study 2 (preregistered) were twofold. The first was to replicate the results of Study 1 with highly powered sample size. The second was to test the effects of vivid and valence-inconsistent reviews on an additional coping strategy to deal with ambivalence-induced discomfort; namely, procrastination. Specifically, if vivid personal experiences are indeed more effective in generating subjective ambivalence, they should also impact downstream consequences of ambivalence such as delaying a decision (e.g. Van Harreveld et al., 2009).

### 9.1. Method

#### 9.1.1. Participants and design

We recruited 720 participants ( $M_{\text{age}} = 30.93$ ,  $SD = 9.01$ , 43.6% female) through Prolific Academic. We excluded 19 participants who took an extremely short time ( $< 2 SDs$  below the mean) to complete the study. Hence, the final sample size was 701 participants. We crossed vividness (personal experience/facts) with the valence of the review content (consistent/inconsistent) in a between-participants design. Each participant was paid 0.85£ for participation. Only individuals who did not participate in the previous studies were allowed to participate. This sample size has a power of above 0.80 to detect the average effect size found in the first two studies of the Vividness X Valence interaction on biased-information processing,  $Cohen's f = 0.14$ . With regard to the sensitivity analysis, the smallest effect size that this sample size has a power of 0.80 to detect is  $Cohen's f = 0.10$ .

#### 9.1.2. Procedure

The procedure was exactly like in Study 1. In addition, we included a measure of procrastination; namely, that participants were given the choice of entering a smartwatch raffle lottery or being paid in the

normal fashion (cf. Study 1 procedure). More than two-thirds of the participants (68.7%) chose to participate in the lottery, indicating as in Study 1, that the decision was meaningful. Procrastination was measured after the measures of biased-information processing and subjective-ambivalence.

### 9.2. Measures

#### 9.2.1. Procrastination

Procrastination was measured by asking “When would you like to make your decision on participation in the lottery for the smartwatch?” (“Now”, 1–8 h from now, 9–16 h from now, 17–24 h from now, 25–32 h from now, 33–40 h from now, 41–48 h from now). Procrastination was limited to 48 h because participants in Prolific Academic are aware that they should receive payment for their participation up to 48 h from the completion of the study. This item was presented just before participants received the final list of reviews (where biased-information processing was measured). The other measures were the same as in study 1,  $\alpha_{\text{subjective ambivalence}} = 0.92$ .

### 9.3. Results & discussion

Table 2 presents the descriptive statistics and correlations between the variables.

#### 9.3.1. Simultaneous accessibility

Response latencies were reciprocally transformed. An ANOVA

Table 2  
Descriptive statistics and correlations for Study 2.

	<i>M</i>	<i>SD</i>	1	2	3	4
1. Subjective ambivalence	3.65	2.78				
2. Simultaneous accessibility	0.015	0.59	0.22 <sup>**</sup>			
3. Biased-information processing	-0.40	1.84	0.13 <sup>**</sup>	0.06		
4. Attitude favorability	3.66	4.14	-0.21 <sup>**</sup>	0.08 <sup>*</sup>	-0.22 <sup>**</sup>	
5. Procrastination	1.64	1.51	0.18 <sup>**</sup>	0.08 <sup>*</sup>	0.08 <sup>*</sup>	-0.03

<sup>\*\*</sup>  $p < .01$ .

<sup>\*</sup>  $p < .05$ .

indicated a main effect of the valence condition,  $F(1,697) = 9.97$ ,  $p = .002$ ,  $\eta_p^2 = 0.01$ , such that simultaneous accessibility was higher for participants in the valence-inconsistent condition, ( $M = 0.09$ ,  $SE = 0.03$ ) than in the valence-consistent condition, ( $M = -0.05$ ,  $SE = 0.03$ ). Moreover, there was a main effect for vividness condition,  $F(1,701) = 7.53$ ,  $p = .006$ ,  $\eta_p^2 = 0.01$ , such that simultaneous accessibility was higher for participants in the vivid condition ( $M = 0.08$ ,  $SE = 0.03$ ) than in the less vivid condition, ( $M = -0.04$ ,  $SE = 0.03$ ). Critically, there was a significant Vividness X Valence interaction,  $F(1,701) = 4.91$ ,  $p = .027$ ,  $\eta_p^2 = 0.01$ . Under valence-inconsistency, participants in the vivid condition ( $M = 0.19$ ,  $SE = 0.04$ ) experienced significantly higher simultaneous accessibility than participants in the less vivid condition ( $M = -0.02$ ,  $SE = 0.04$ ),  $M_{\text{difference}} = 0.22$ ,  $SE_{\text{difference}} = 0.063$ ,  $p < .001$ ,  $95\%CI[0.10, 0.34]$ . No difference was observed in the valence-consistent condition. Namely, participants in the vivid condition ( $M = -0.04$ ,  $SE = 0.04$ ) did not differ from participants in the less vivid condition ( $M = -0.06$ ,  $SE = 0.04$ ),  $M_{\text{difference}} = 0.02$ ,  $SE_{\text{difference}} = 0.06$ ,  $p = .708$ ,  $95\%CI[-0.15, 0.10]$ .

### 9.3.2. Subjective ambivalence

Participants in the valence-inconsistent condition experienced more subjective ambivalence ( $M = 4.40$ ,  $SE = 0.14$ ) than participants in the valence-consistent condition ( $M = 2.87$ ,  $SE = 0.14$ ),  $F(1,697) = 63.57$ ,  $p < .001$ ,  $\eta_p^2 = 0.08$ . There was a main effect of the vividness condition,  $F(1,697) = 24.80$ ,  $p < .001$ ,  $\eta_p^2 = 0.03$ , such that participants in the vivid condition experienced more subjective ambivalence, ( $M = 4.14$ ,  $SE = 0.14$ ) than participants in the less vivid condition, ( $M = 3.16$ ,  $SE = 0.14$ ). Critically, an ANOVA indicated a significant Vividness X Valence interaction,  $F(1,697) = 7.505$ ,  $p = .006$ ,  $\eta_p^2 = 0.01$ . Specifically, under valence-inconsistency, participants in the vivid condition experienced greater subjective ambivalence ( $M = 5.20$ ,  $SE = 0.20$ ) than participants in the less vivid condition ( $M = 3.68$ ,  $SE = 0.20$ ),  $M_{\text{difference}} = 1.52$ ,  $SE_{\text{difference}} = 0.28$ ,  $p < .001$ ,  $95\%CI[0.98, 2.07]$ . Under valence-consistency, there was no difference between participants in the vivid ( $M = 3.09$ ,  $SE = 0.19$ ) and less vivid conditions ( $M = 2.65$ ,  $SE = 0.20$ ),  $M_{\text{difference}} = 0.44$ ,  $SE_{\text{difference}} = 0.28$ ,  $p = .113$ ,  $95\%CI[-0.11, 0.99]$ .

### 9.3.3. Biased-information processing

First, response latencies were log-transformed. An ANOVA indicated a main effect for the valence condition,  $F(1,697) = 36.07$ ,  $p < .001$ ,  $\eta_p^2 = 0.05$ , such that participants in the valence-inconsistent condition spent more time reading reviews that were in line with their initial attitude ( $M = 0.01$ ,  $SE = 0.09$ ) than participants in the valence-consistent condition, ( $M = -0.80$ ,  $SE = 0.09$ ). The ANOVA also indicated a main effect for the vividness condition,  $F(1,697) = 7.85$ ,  $p = .005$ ,  $\eta_p^2 = 0.01$ . Participants in the vivid condition exhibited more biased-information processing ( $M = -0.21$ ,  $SE = 0.09$ ) than participants in the less vivid condition ( $M = -0.59$ ,  $SE = 0.10$ ). Critically, the Vividness X Valence interaction was significant,  $F(1,697) = 4.98$ ,  $p = .026$ ,  $\eta_p^2 = 0.01$ . Under valence-inconsistency, participants in the vivid condition were more biased in their information processing ( $M = 0.34$ ,  $SE = 0.13$ ) than participants in the less vivid condition ( $M = -0.76$ ,  $SE = 0.13$ ),  $M_{\text{difference}} = 0.68$ ,  $SE_{\text{difference}} = 0.19$ ,  $p < .001$ ,  $95\%CI[0.30, 1.05]$ . Under valence-consistency there was no difference between participants in the vivid ( $M = -0.33$ ,  $SE = 0.13$ ) and less vivid conditions ( $M = -0.84$ ,  $SE = 0.14$ ),  $M_{\text{difference}} = 0.08$ ,  $SE_{\text{difference}} = 0.19$ ,  $p = .686$ ,  $95\%CI[-0.30, 0.45]$ .

### 9.3.4. Attitude favorability

An ANOVA indicated a main effect of the valence condition on attitude favorability,  $F(1,697) = 67.91$ ,  $p < .001$ ,  $\eta_p^2 = 0.09$ . Namely, participants in the valence-consistent condition reported more favorable attitudes towards the smartwatch ( $M = 4.89$ ,  $SE = 0.21$ ) than participants in the valence-inconsistent condition ( $M = 2.43$ ,  $SE = 0.21$ ). There was no main effect of the vividness condition  $F$

(1,697) = 0.28,  $p = .596$ ,  $\eta_p^2 = 0.00$ . Specifically, participants in the vivid condition ( $M = 3.58$ ,  $SE = 0.21$ ) did not differ from participants in the less vivid condition ( $M = 3.74$ ,  $SE = 0.21$ ). There was also no Vividness X Valence interaction,  $F(1,697) = 0.06$ ,  $p = .808$ ,  $\eta_p^2 = 0.00$ . Namely, under valence-inconsistency there was no difference between participants in the vivid ( $M = 2.31$ ,  $SE = 0.30$ ) and less vivid conditions ( $M = 2.54$ ,  $SE = 0.30$ ),  $M_{\text{difference}} = -0.23$ ,  $SE_{\text{difference}} = 0.42$ ,  $p = .584$ ,  $95\%CI[-1.06, 0.60]$ . There was also no difference under the valence-consistent condition. Namely, participants in the vivid condition ( $M = 4.85$ ,  $SE = 0.30$ ) did not differ from participants in the less vividness condition ( $M = 4.94$ ,  $SE = 0.30$ ),  $M_{\text{difference}} = -0.09$ ,  $SE_{\text{difference}} = 0.42$ ,  $p = .836$ ,  $95\%CI[-0.74, 0.92]$ .

### 9.3.5. Procrastination

An ANOVA indicated significant main effects for the valence condition,  $F(1,697) = 7.65$ ,  $p = .006$ ,  $\eta_p^2 = 0.01$ . Participants in the valence-inconsistent condition wanted to delay their decision ( $M = 1.80$ ,  $SE = 0.08$ ) more than participants in the valence-consistent condition ( $M = 1.49$ ,  $SE = 0.08$ ). There was also a main effect of the vividness condition,  $F(1,697) = 5.12$ ,  $p = .024$ ,  $\eta_p^2 = 0.01$ . Participants in the vivid condition wanted to delay their decision ( $M = 1.77$ ,  $SE = 0.08$ ) more than participants in the less vivid condition ( $M = 1.52$ ,  $SE = 0.08$ ). Critically, ANOVA indicated a significant Vividness X Valence interaction,  $F(1,697) = 6.31$ ,  $p = .012$ ,  $\eta_p^2 = 0.01$ . In the valence-inconsistent condition, participants in the vivid condition procrastinated more ( $M = 2.07$ ,  $SE = 0.11$ ) than participants in the less vivid condition ( $M = 1.53$ ,  $SE = 0.11$ ),  $M_{\text{difference}} = 0.54$ ,  $SE_{\text{difference}} = 0.16$ ,  $p = .001$ ,  $95\%CI[0.22, 0.85]$ . In the valence-consistent condition there was no difference between participants in the experience ( $M = 1.47$ ,  $SE = 0.11$ ) and facts ( $M = 1.50$ ,  $SE = 0.11$ ) conditions,  $M_{\text{difference}} = -0.03$ ,  $SE_{\text{difference}} = 0.16$ ,  $p = .860$ ,  $95\%CI[-0.28, 0.34]$ .

### 9.3.6. Mediation analysis

We conducted the same mediation analysis and employed the same bootstrapping approach as in Study 1. The conditional indirect effect of the vivid condition through simultaneous accessibility and subjective ambivalence on biased-information processing was significant in the valence-inconsistent condition,  $b = 0.02$ ,  $SE = 0.01$ ,  $95\%CI[0.003, 0.03]$ , but not in the valence-consistent condition,  $b = 0.000$ ,  $SE = 0.005$ ,  $95\%CI[-0.01, 0.01]$ . The index of moderated mediation was significant,  $b = 0.01$ ,  $SE = 0.01$ ,  $95\%CI[0.001, 0.04]$ . The direct effect was also significant  $b = 0.29$ ,  $SE = 0.14$ ,  $95\%CI[0.01, 0.56]$  (see Fig. 3).

The second purpose of Study 3 was to test whether the vivid and valence-inconsistent information resulted in a desire to procrastinate before making a decision. Hence, an additional mediation analysis with procrastination as the dependent variable was conducted (see Fig. 4). The conditional indirect effect of the vivid condition via simultaneous accessibility and subjective ambivalence on procrastination was significant in the valence-inconsistent condition,  $b = 0.02$ ,  $SE = 0.01$ ,  $95\%CI[0.005, 0.04]$ , but not in the valence-consistent condition,  $b = 0.000$ ,  $SE = 0.01$ ,  $95\%CI[-0.01, 0.01]$ . The index of moderated mediation was significant,  $b = 0.02$ ,  $SE = 0.01$ ,  $95\%CI[0.001, 0.04]$ . The direct effect was not significant  $b = 0.16$ ,  $SE = 0.11$ ,  $95\%CI[-0.07, 0.38]$ .

Thus overall, Study 2 increased the robustness of the model by providing replication and expanding the model to procrastination, an additional variable that has been argued to serve as a coping strategy to deal with ambivalence (Van Harreveld et al., 2009). Put differently, the analysis provided additional support for hypotheses H2-H4 and initial support for hypothesis H5. The finding that vivid information, operationalized as experience-based reviews, has downstream consequences for consumer behavior towards the attitude object further substantiates the importance of the current insights into the effects of the different ways in which reviews are presented.



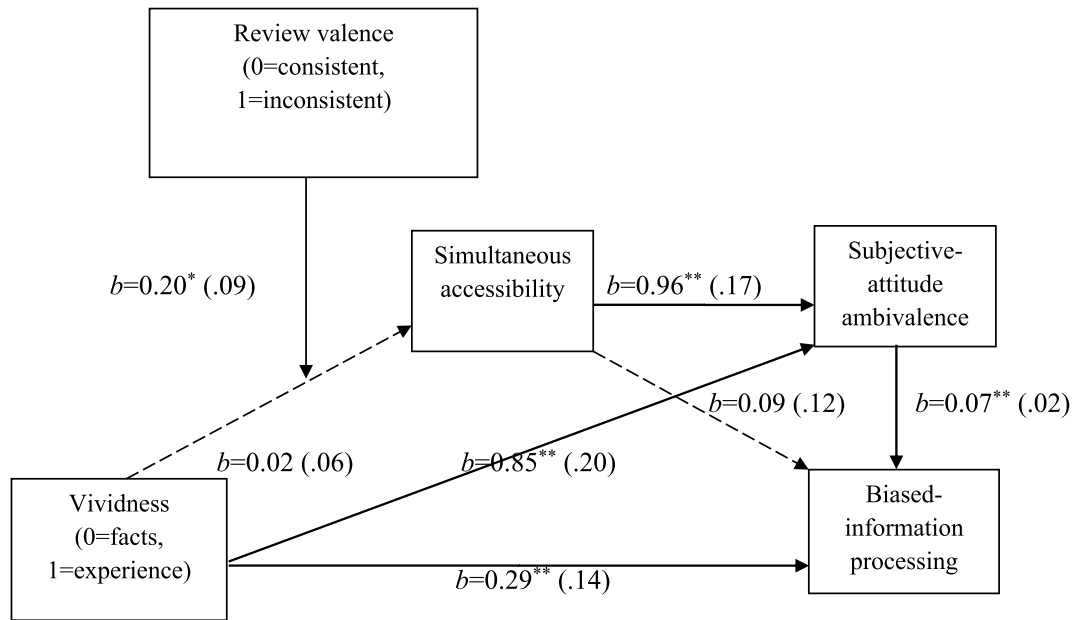


Fig. 3. Moderated-mediation model for Study 2. Standard errors in parentheses.  $**p < .01$ ,  $*p < .05$ .

However, studies 1 and 2 (and the study reported in the Supplementary materials) leave important questions unanswered. The first question relates to alternative explanations rather than vividness that drive the effects on ambivalence and its coping strategies. It could be argued that because vividness was operationalized with experienced-based reviews it also represents stronger reflections of the opinion of the reviewer than the less vivid-factual reviews. An additional limitation is that only one and relatively new measure for information processing was used in the previous studies. To substantiate the construct validity the results need to be replicated using an established measure of information processing.

Also, the previous studies did not empirically examine whether enhanced memory leads to higher simultaneous accessibility of contradictions. Therefore, we conducted an additional study to address these matters. Finally, the present studies presented oppositions *between*

the reviews. Hence, a question remains as to whether the results would be replicated when the opposition is presented *within* a review.

### 10. Study 3

Study 3 was a preregistered study that was conducted to answer the questions above. The goals of the study were fourfold. First, to examine whether the effects of vividness on attitude ambivalence and ambivalence coping strategies were independent of the evaluative content. That is, the use of experience-based reviews as a vividness induction may emphasize the evaluative aspect of the reviews to a greater extent than the less vivid-fact framing condition, and this greater salience of evaluation may produce higher simultaneous accessibility and subjective ambivalence. To examine this alternative explanation, we added a condition in which a consumer shared an opinion about a product.

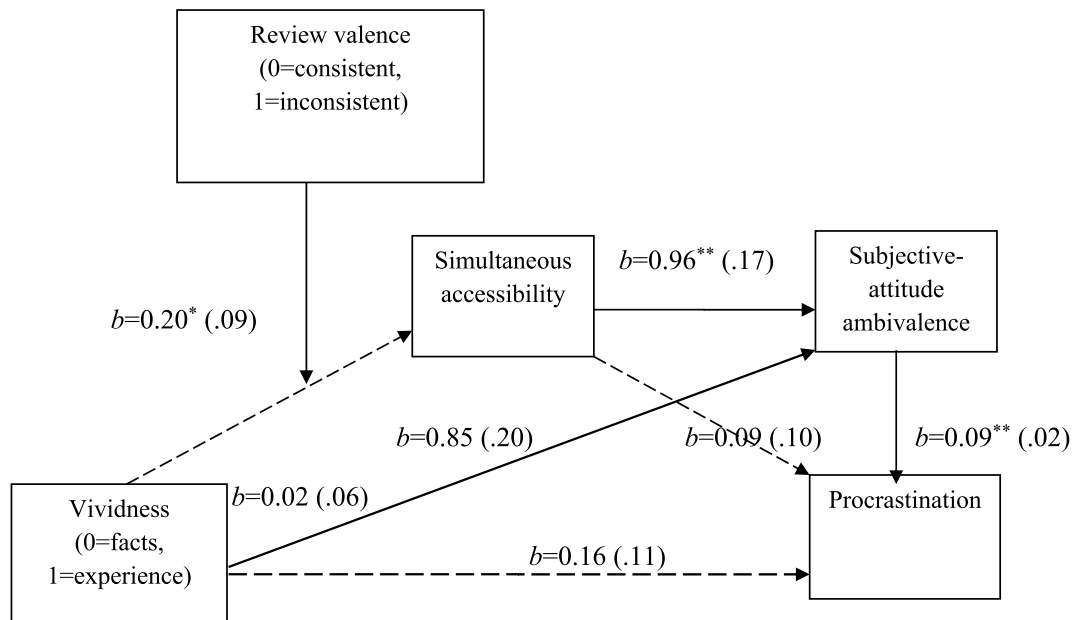


Fig. 4. Moderated-mediation model for Study 2 with procrastination as the dependent variable. Standard errors in parentheses.  $**p < .01$ ,  $*p < .05$ .

Second, the previous studies did not empirically test whether increased memory drives the effect on simultaneous accessibility. Hence, Study 3 examined whether memory mediated the effect of the vividness induction on simultaneous accessibility. Third, we used a different measure of information processing. Finally, we aimed to replicate the previous findings by presenting mixed information within one review rather than between different reviews as we did in the previous studies.

## 10.1. Method

### 10.1.1. Participants

We recruited 440 undergraduates from an Israeli college in exchange for course credit. Seven participants were excluded because they scored  $>2$  *SD* above below the average in their response latencies; hence the final sample size was 433 participants ( $M_{\text{age}} = 26.58$ ,  $SD = 6.06$ , 51.9% female). This sample size has a power of 0.80 to detect the average effect size obtained in the previous studies for the difference between vivid valence-inconsistent reviews and non-vivid valence-inconsistent reviews, *Cohen's f* = 0.15, which is also the smallest effect size that this sample size has a power of 0.80 to detect in terms of sensitivity analysis.

### 10.1.2. Procedure

Participants came to the laboratory to take part in a study for course credit. The procedure was identical in Studies 1 and 2 with a few exceptions. Specifically, participants were randomly assigned to read a review about a smartwatch that was presented in the format of personal experience (vivid condition), an opinion, or facts (control conditions).

After participants read the review they completed a questionnaire and were asked to list the information that they remembered from the review. Afterwards, participants completed questionnaires containing the attitude variables. As in Study 2, we informed participants that they could participate in a raffle for the smartwatch in exchange for their credit. Subsequently, we measured information processing, and procrastination, towards the smartwatch. Afterwards, we asked participants to make their decision about entering the raffle. As in the previous study, most of the participants (71.2%) chose to participate in the lottery. Finally, we debriefed the participants.

## 10.2. Measures

### 10.2.1. Review format

We asked the participants to rate the extent to which the review they read was framed as (a) personal experience, (b) opinion, (c) facts.

### 10.2.2. Cognitive personalization

We measured cognitive personalization using a scale from previous work (Xia & Bechwati, 2008). This measure assesses the extent that readers process the review in a self-referent manner. Namely, it captures their thoughts about how they would feel in the situation described in the review. The items were: "As I read the review, I thought about how I would feel if my friends, family, or I were in that situation", "While reading the review, I was thinking about my own emotional reactions", and "As I read the review, I kept on thinking about how I would feel if the same thing happened to me" (Xia & Bechwati, 2008),  $\alpha = 0.93$ . All measures were assessed on an 11-point Likert-type scale (0- not at all, 5- moderately, 10- completely).

### 10.2.3. Memory

Participants listed each piece of information they remembered from the review. We provided participants with ten boxes and asked them to list each piece of information in a separate box. Afterwards, two independent coders counted the number of valid thoughts<sup>5</sup>; 94.8% of the

recalls were coded as valid. The inter-rater reliability was high,  $r = 0.92$ .

### 10.2.4. Simultaneous accessibility

Simultaneous accessibility was measured similarly as in the previous studies. We used a new control attitude object; i.e., we asked participants to rate their positive and negative thoughts and feelings about the exam period.

### 10.2.5. Attitude favorability, subjective ambivalence, and procrastination

We measured these variables in the same way as in the previous studies,  $\alpha_{\text{subjective ambivalence}} = 0.89$ .

### 10.2.6. Biased information processing

We used a thought listing procedure task (Cacioppo & Petty, 1981) to measure biased information processing. Specifically, we provided participants with eight boxes and gave them two and a half minutes to list all their thoughts about the product. Participants rated each thought as positive, neutral or negative. Two independent coders rated the thoughts,  $r = 0.89$ . Note that the results were similar when using the participants' self-ratings. Biased information processing was measured as the number of thoughts that supported the initial attitude divided by the total number of thoughts. For example, if a participant had an initially positive attitude towards the smartwatch (i.e. attitude favorability  $>0$ ) then the number of positive thoughts was divided by the total number of thoughts. Hence, biased-information processing ranged from 0 to 1. We treated participants who scored 0 on their attitude favorability measure as having an initially positive attitude towards the smartwatch; as in the previous studies, the results did not differ when we treated them as having an initially negative attitude. A similar approach for assessing information processing was used in previous work on attitude ambivalence (Nordgren, Van Harreveld, & Van Der Pligt, 2006).

## 10.3. Results & discussion

Table 3 presents the descriptive statistics and correlations between the variables.

### 10.3.1. Review format

An ANOVA indicated a significant main effect of the vividness induction,  $F(2,430) = 146.69$ ,  $p < .001$ ,  $\eta_p^2 = 0.41$ . Specifically, participants in the vivid condition rated the review as reflecting a personal experience ( $M = 8.62$ ,  $SE = 0.23$ ) more than participants in the opinion-based ( $M = 4.13$ ,  $SE = 0.23$ ),  $p < .001$ , 95%CI [3.86, 5.13], and fact-based ( $M = 3.60$ ,  $SE = 0.23$ ) conditions,  $p < .001$ , 95%CI[4.38, 5.65]. There was no difference between the opinion and fact-based conditions,  $p = .109$ , 95%CI[-1.16, 0.12].

There was a main effect for the opinion format,  $F(2,430) = 77.27$ ,  $p < .001$ ,  $\eta_p^2 = 0.26$ . Specifically, participants in the opinion-based condition rated the review as reflecting an opinion ( $M = 7.83$ ,  $SE = 0.22$ ) more than participants in the vivid experience-based condition ( $M = 4.96$ ,  $SE = 0.22$ ),  $p < .001$ , 95%CI[2.26, 3.48], and participants in the fact-based condition ( $M = 4.15$ ,  $SE = 0.22$ ),  $p < .001$ , 95%CI[3.07, 4.29]. Participants perceived the reviews in the vivid experience-based condition as formatted as opinions more than reviews in the fact-condition condition,  $p = .009$ , 95%CI[0.20, 1.41].

Finally, there was a main effect of perceiving the review in a fact format  $F(2,430) = 90.62$ ,  $p < .001$ ,  $\eta_p^2 = 0.30$ . Specifically, participants in the fact-based condition rated the review as reflecting facts ( $M = 7.56$ ,  $SE = 0.21$ ) more than participants in the experience-based condition ( $M = 4.57$ ,  $SE = 0.21$ ),  $p < .001$ , 95%CI [2.42, 3.56], and

(footnote continued)  
interesting".

<sup>5</sup>An example of an invalid piece of information is "this review was

**Table 3**  
Descriptive statistics and correlations for Study 3.\*

	M	SD	1	2	3	4	5	6	7	8	9
1. Personal experience format (manipulation check)	5.48	3.55									
2. Opinion (manipulation check)	5.63	3.06	0.00								
3. Facts (manipulation check)	5.33	2.95	-0.28**	-0.15**							
4. Subjective-attitude ambivalence	4.50	2.30	0.37**	-0.17**	-0.31**						
5. Memory	5.58	2.47	0.41**	-0.26**	-0.21**	0.41**					
6. Cognitive personalization	4.45	3.10	0.55**	0.00	-0.29**	0.44**	0.44**				
7. Simultaneous accessibility	-0.04	0.46	0.20**	-0.13**	-0.09	0.24**	0.24**	0.15**			
8. Biased-information processing	0.48	0.29	0.27**	0.10	-0.18**	0.27**	0.27**	0.36**	0.14**		
9. Attitude favorability	0.80	2.69	0.08	-0.08	-0.14**	0.11**	0.05	0.01	0.09	-0.04	
10. Procrastination	2.01	1.99	0.36**	-0.16**	-0.31**	0.48**	0.36**	0.46**	0.18**	0.26**	0.07

\*\*  $p < .01$ .

\*  $p < .05$ .

participants in the opinion-based condition ( $M = 3.85$ ,  $SE = 0.20$ ),  $p < .001$ , 95%CI [3.13, 4.29]. Participants in the experience-based condition reported higher ratings than participants in the opinion-based condition,  $p = .014$ ,  $p < .001$ , 95%CI [0.14, 1.29]

### 10.3.2. Cognitive personalization

ANOVA indicated a significant main effect of the vividness induction on cognitive personalization,  $F(2,430) = 85.25$ ,  $p < .001$ ,  $\eta_p^2 = 0.28$ . Participants in the vivid condition felt as though the review described something that had actually happened to them ( $M = 6.74$ ,  $SE = 0.22$ ) more than participants in the opinion-based ( $M = 3.45$ ,  $SE = 0.22$ ),  $p < .001$ , 95%CI[2.68, 3.89], and fact-based conditions ( $M = 3.09$ ,  $SE = 0.22$ ),  $p < .001$ , 95%CI[3.04, 4.25]. There was no difference between participants in the control conditions,  $p = .244$ , 95%CI[-0.25, 0.97]

### 10.3.3. Memory

An ANOVA indicated a main effect of the vividness induction on memory,  $F(2,430) = 43.28$ ,  $p < .001$ ,  $\eta_p^2 = 0.17$ . Participants in the vivid condition recalled successfully more information ( $M = 6.97$ ,  $SE = 0.19$ ) than participants in the opinion-based ( $M = 4.65$ ,  $SE = 0.19$ ),  $p < .001$ , 95%CI [1.80, 2.84], and fact-based conditions ( $M = 5.08$ ,  $SE = 0.19$ ),  $p < .001$ , 95%CI [1.36, 2.40]. There was no difference between participants in the control conditions,  $p = .104$ , 95% CI[-0.09, 0.96].

### 10.3.4. Simultaneous accessibility

As in the previous studies, a reciprocal transformation was applied to the speed scores. An ANOVA indicated a significant main effect of the vividness induction,  $F(2,430) = 6.05$ ,  $p = .003$ ,  $\eta_p^2 = 0.03$ . Participants in the vivid experience-based condition were more simultaneously aware of opposing features in their attitude towards the smartwatch ( $M = 0.06$ ,  $SE = 0.04$ ) than participants in the opinion-based ( $M = -0.12$ ,  $SE = 0.04$ ),  $p = .001$ , 95%CI[0.08, 0.29], and participants in the fact-based conditions ( $M = -0.05$ ,  $SE = 0.04$ ),  $p = .049$ , 95%CI [0.001, 0.21]. No difference emerged between participants in the control conditions,  $p = .138$ , 95%CI[-0.01, 0.13].

### 10.3.5. Subjective-attitude ambivalence

An ANOVA indicated a significant main effect of the vividness induction,  $F(2,430) = 29.77$ ,  $p < .001$ ,  $\eta_p^2 = 0.12$ . Participants in the vivid experience-based condition reported a higher evaluative conflict towards the smartwatch ( $M = 5.62$ ,  $SE = 0.18$ ) than participants in the opinion-based ( $M = 3.94$ ,  $SE = 0.18$ ),  $p < .001$ , 95%CI [1.17, 2.17], and fact-based vividness conditions ( $M = 3.91$ ,  $SE = 0.18$ ),  $p < .001$ , 95%CI [1.21, 2.21]. No difference was found between participants in the control conditions,  $p = .887$ , 95%CI [-0.47, 0.54].

### 10.3.6. Biased-information processing

An ANOVA indicated a main effect of the vividness induction,  $F$

(2,430) = 16.85,  $p < .001$ ,  $\eta_p^2 = 0.07$ . Participants in the vivid condition listed thoughts that were congruent with their initial attitude (i.e. biased;  $M = 0.59$ ,  $SE = 0.02$ ) to a greater extent than participants in the opinion-based ( $M = 0.42$ ,  $SE = 0.02$ ),  $p < .001$  95%CI[0.11, 0.24], and fact-based conditions ( $M = 0.43$ ,  $SE = 0.02$ ),  $p < .001$  95%CI [0.10, 0.23]. There was no difference between the two control conditions,  $p = .794$ , 95%CI[-0.07, 0.06].

### 10.3.7. Procrastination

An ANOVA indicated a main effect of the vividness induction  $F(2,430) = 26.61$ ,  $p < .001$ ,  $\eta_p^2 = 0.11$ . Participants in the vivid condition stipulated that they wanted to delay their decision on trading their payment for a raffle ticket for the smartwatch ( $M = 2.94$ ,  $SE = 0.16$ ) more than participants in the opinion- ( $M = 1.51$ ,  $SE = 0.16$ ),  $p < .001$  95%CI[0.99, 1.86], and fact-based conditions ( $M = 1.56$ ,  $SE = 0.16$ ),  $p < .001$  95%CI[0.94, 1.81]. There was no difference between the control conditions,  $p = .829$ , 95%CI[-0.39, 0.49].

### 10.3.8. Mediation analysis

We conducted a mediation analysis using Model 6 in PROCESS (Hayes, 2017) with 5000 bootstrapped samples. We created two dummy codes to separately compare the vivid experience-based condition to the opinion-based condition (dummy 1) and the fact-based condition (dummy 2). In each dummy code the experimental-based condition was coded 1 and the control condition was coded 0.<sup>6</sup> We tested the effect of the vividness induction via memory, simultaneous accessibility and subjective ambivalence on (a) biased-information processing (Figs. 5a-5b), and on procrastination (Figs. 6a-6b).

### 10.3.9. Mediation on biased information processing

As can be seen in Fig. 5a and b, the mediation analysis supported the hypothesized model. Specifically, the vivid experience-based condition in comparison to the less vivid fact-based condition increased biased-information through increasing memory, simultaneous accessibility and subjective ambivalence, as indicated by a significant indirect effect,  $b = 0.003$ ,  $SE = 0.002$ , 95%CI[0.001,0.08]. The direct effect was significant,  $b = 0.09$ ,  $SE = 0.03$ , 95%CI[0.02, 0.15], as well as the total effect,  $b = 0.16$ ,  $SE = 0.03$ ,  $t = 4.99$ ,  $p < .001$ , 95%CI[0.10, 0.23]. The same pattern of results emerged when comparing the experience-based condition to the opinion-based condition. Namely, the indirect effect was significant,  $b = 0.002$ ,  $SE = 0.001$ , 95%CI[0.002, 0.004], the direct effect was significant,  $b = 0.09$ ,  $SE = 0.004$ , 95%CI[0.01, 0.16] as well as the total effect,  $b = 0.17$ ,  $SE = 0.03$ ,  $t = 4.99$ ,  $p < .001$ , 95%CI[0.10, 0.24].

<sup>6</sup> In all the mediation analyses, the results were similar when comparing the vividness condition to the two control conditions together.

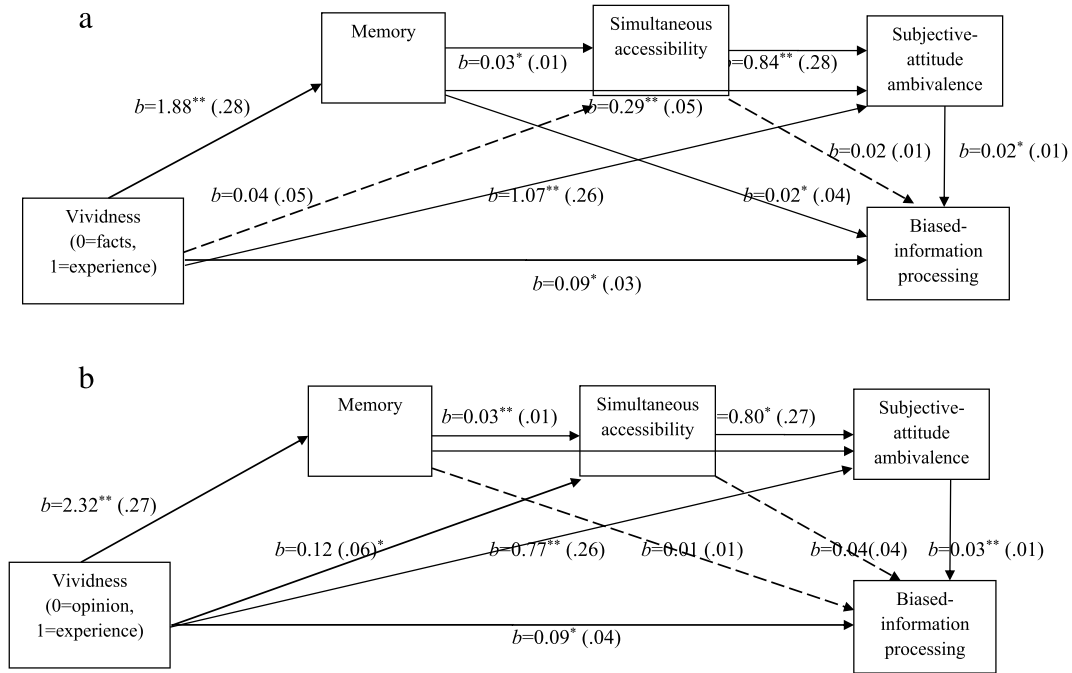


Fig. 5. a. Serial mediation model for Study 3 dependent variable. Standard errors in parentheses.  $^{**}p < .01$ ,  $^*p < .05$ . b. Serial mediation model for Study 3. Standard errors in parentheses.  $^{**}p < .01$ ,  $^*p < .05$ .

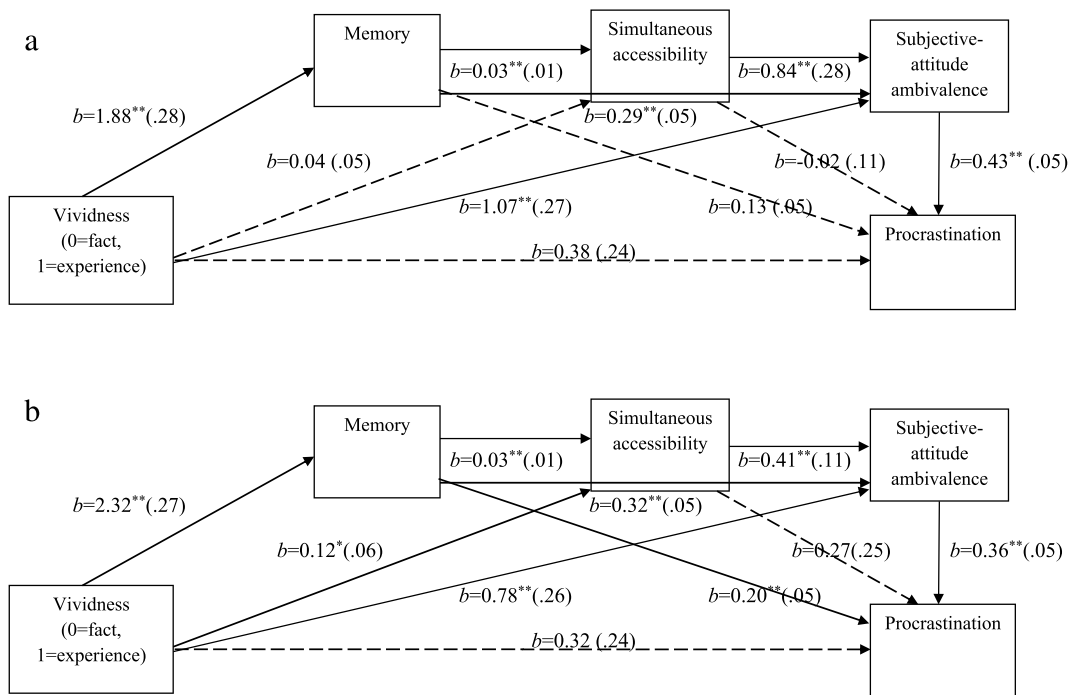


Fig. 6. a. Serial mediation model for Study 3 comparing experience-and-fact-based reviews with procrastination as the dependent variable. Standard errors in parentheses.  $^{**}p < .01$ ,  $^*p < .05$ . b. Serial mediation model for Study 3 comparing experience-and-opinion-based reviews with procrastination as the dependent variable. Standard errors in parentheses.  $^{**}p < .01$ ,  $^*p < .05$ .

10.3.10. Mediation on procrastination

As can be seen in Fig. 6a–b, mediation emerged for the effect of the vividness induction on procrastination. Specifically, in comparison to the fact-based review condition, participants in the vivid experience-based condition tended to procrastinate before making their decision through increased memory, simultaneous accessibility and subjective ambivalence as indicated by a significant indirect effect,  $b = 0.02$ ,

$SE = 0.01$ ,  $95\%CI[0.005,0.04]$ . The direct effect was not significant  $b = 0.38$ ,  $SE = 0.24$ ,  $95\%CI[-0.10, 0.86]$ . The total effect was significant,  $b = 1.38$ ,  $SE = 0.25$ ,  $t = 5.40$ ,  $p < .001$ ,  $95\%CI[0.87, 1.88]$ . The same pattern of results emerged when comparing the experience condition to the opinion-based condition; namely, the indirect effect was significant,  $b = 0.02$ ,  $SE = 0.01$ ,  $95\%CI[0.003, 0.05]$ . The direct effect was not significant,  $b = 0.32$ ,  $SE = 0.24$ ,  $t = 1.33$ ,  $p = .184$ ,

95%CI[-0.15, 0.78]. The total effect was significant,  $b = 1.42$ ,  $SE = 0.24$ ,  $t = 5.88$ ,  $p < .001$ , 95%CI[0.95, 1.90].

Study 3 provided a preregistered replication of the previous findings. All of the research hypotheses; namely, H1-H5 were supported. These findings have important implications. First, the replication of the results in a design that included an opinion-based review refutes the possibility that the previous effects obtained on the constructs of attitude ambivalence and its downstream coping strategies were the result of the increased evaluative features of the experience-based format. Second, the findings for the memory measure provide evidence that the difference in recall was responsible for the difference in simultaneous accessibility documented in the present studies. Third, participants in the vivid condition showed a greater tendency to process information in a biased manner measured by a thought listing task. This effect increases the generalization of the effects on biased-information processing obtained in the previous studies and also refutes the possibility that they were driven by a similarity between the format of the primary information on which the attitude was based and the format of the additional reviews in the vivid experience-based condition (but not in the less vivid fact-based condition). Finally, Study 3 replicated the previous findings by manipulating valence-inconsistency within rather than between the reviews. This suggests that when reading valence-inconsistent reviews, individuals are more ambivalent regardless of whether the opposing aspects are presented between reviews (i.e. some positive and some negative) or within a review.

## 11. Study 4

Before Study 4, we conducted a preregistered pilot study that examined the effects of all the inductions that were used in the previous studies on vividness and cognitive personalization, as well as on additional related constructs (see “Pilot study 2” in the Supplementary materials). As predicted, all the vividness inductions had main effects on vividness and cognitive personalization, but no main effect on source credibility or source involvement. The results also indicated that the vivid experience-based reviews in the first three studies (manipulation of valence-inconsistency between the reviews), the reviews in the vivid condition were perceived as more emotional than the reviews less vivid fact-based reviews. However, there was no difference in the emotional language in the last study (manipulation of valence-inconsistency within the review). This suggests that the most parsimonious explanation appears to be that vividness drives the effects on the dependent variables. Nevertheless, we conducted an additional preregistered study to test whether the results would be replicated when the reviews did not differ in their emotional language and had a different preface.

### 11.1. Methods

#### 11.1.1. Participants

We recruited 331 undergraduates to participate in the study in exchange for course credit. We excluded 11 participants who had extreme scores of more than two SDs from the mean of the simultaneous accessibility measure as specified in the preregistration and 7 participants who did not provide any answers to the open-ended measures as specified in the preregistration. Hence, the final sample size was 313 participants ( $M_{\text{age}} = 25.23$ ,  $SD = 5.36$ , 66.1% female). This sample size has a power of above 0.80 to detect the average effect size which was obtained on the dependent variables in the previous studies ( $d = 0.35$ ). In addition, sensitivity analysis with 80% power indicated that the smallest effect size that this sample size can detect is  $d = 0.28$ .

#### 11.1.2. Procedure

Participants went to the laboratory to take part in a study about “consumer behavior”. Participants were tested individually on partitioned computers. Participants were randomly assigned to a vivid or

less vivid condition. In each condition, participants read two positive and two negative reviews about a smartwatch. In the vivid vividness condition, the reviews were framed as personal experiences and the headline of each review stated that the review was based on the experience that the customer had with the product (e.g., “This review is based on Michael’s experience with the smartwatch”). In the less vivid condition, the reviews were framed as bullet-points and started with headlines which stated that they were based on facts that a customer collected about the smartwatch (e.g., “This review is based on facts that Michael collected about the smartwatch”). Importantly, in both conditions, there were no words that conveyed emotions (e.g., love, disappointed, furious). After reading the reviews participants completed questionnaires containing the research variables and were debriefed.

### 11.2. Measures

The manipulation checks ranged from 0 to 10 on a Likert-type scale and the self-report dependent variables ranged from 1 to 9. All measures were similar to the ones used in the previous studies.

### 11.3. Results & discussion

#### 11.3.1. Cognitive personalization ( $\alpha = 0.88$ )

Participants in the vivid condition reported higher cognitive personalization ( $M = 6.09$ ,  $SD = 2.57$ ) than participants in the less vivid condition ( $M = 5.04$ ,  $SD = 2.74$ ),  $t(311) = 3.49$ ,  $p = .001$ , 95%CI [0.46, 1.64],  $d = 0.39$ .

#### 11.3.2. Vividness

Participants in the vivid condition ( $M = 6.16$ ,  $SD = 2.02$ ) reported that the reviews they read were more vivid than participants in the less-vivid condition ( $M = 5.45$ ,  $SD = 1.52$ ),  $t(311) = 3.52$ ,  $p = .001$ , 95%CI [0.31, 1.11],  $d = 0.40$ .

#### 11.3.3. Emotional language

There was no difference in emotional language between participants in the vivid ( $M = 5.24$ ,  $SD = 1.77$ ) and less vivid conditions ( $M = 4.87$ ,  $SD = 2.40$ ),  $t(311) = 1.59$ ,  $p = .114$ , 95%CI [-0.09, 0.85],  $d = 0.18$ .

#### 11.3.4. Source credibility

There was no difference in source credibility between participants in the vivid ( $M = 6.20$ ,  $SD = 2.01$ ) and less-vivid conditions ( $M = 6.00$ ,  $SD = 1.85$ ),  $t(311) = 0.95$ ,  $p = .343$ , 95%CI [-0.22, 0.64],  $d = 0.11$ .

#### 11.3.5. Memory

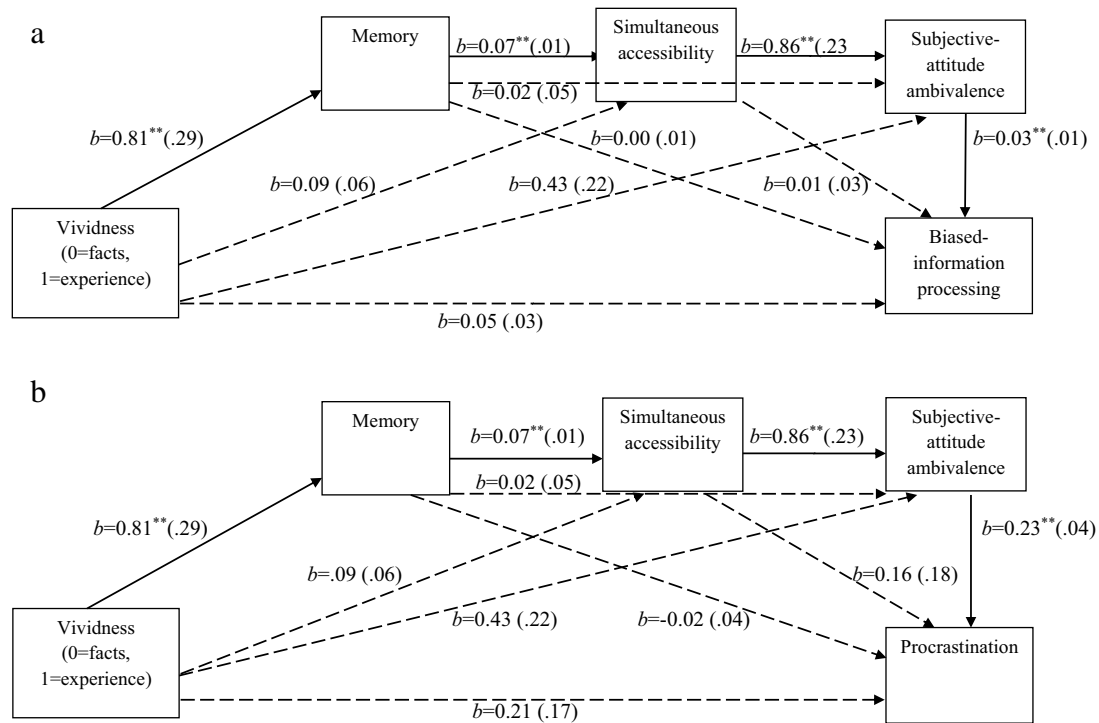
As in Study 4, two research assistants who were blind to the research hypotheses coded the responses for memory. The inter-rater agreement was high,  $r = 0.90$ ,  $p < .001$ . As in Study 3, participants in the vivid condition recalled correctly more information ( $M = 5.60$ ,  $SD = 2.51$ ) than participants in the less vivid condition ( $M = 4.79$ ,  $SD = 2.53$ ),  $t(311) = 2.85$ ,  $p = .005$ , 95%CI[0.25, 1.37],  $d = 0.32$ .

#### 11.3.6. Simultaneous accessibility

As in previous studies, response latencies were reciprocally transformed. Participants in the vivid condition had greater simultaneous accessibility ( $M = 0.18$ ,  $SD = 0.52$ ) than participants in the control condition ( $M = 0.03$ ,  $SD = 0.51$ ),  $t(311) = 2.53$ ,  $p = .012$ , 95%CI [0.03, 0.26],  $d = 0.29$ .

#### 11.3.7. Subjective ambivalence ( $\alpha = 0.89$ )

Participants in the vivid condition experienced a higher evaluative conflict ( $M = 4.86$ ,  $SD = 2.01$ ) than participants in the control condition ( $M = 4.28$ ,  $SD = 1.97$ ),  $t(311) = 2.58$ ,  $p = .010$ , 95%CI [0.14, 1.02],  $d = 0.29$ .



**Fig. 7.** a. Serial mediation model for Study 5 with biased-information processing as the dependent variable. Standard errors in parentheses. \*\* $p < .01$ , \* $p < .05$ . b. Serial mediation model for Study 5 with procrastination as the dependent variable. Standard errors in parentheses. \*\* $p < .01$ , \* $p < .05$ .

11.3.8. Attitude favorability

There was no difference with regard between participants in the vivid ( $M = 1.21, SD = 2.83$ ) and control conditions ( $M = 1.23, SD = 2.66$ ),  $t(311) = -0.08, p = .936, 95\%CI [-0.63, 0.59], d = -0.01$ .

11.3.9. Biased information-processing

Participants in the vivid condition were more biased in their information processing ( $M = 0.57, SD = 0.23$ ) than participants in the control condition, ( $M = 0.51, SD = 0.25$ ),  $t(311) = 2.14, p = .033, 95\%CI [0.005, 0.11], d = 0.24$ .

11.3.10. Procrastination

There was no difference between participants in the vividness ( $M = 1.79, SD = 1.34$ ) control condition ( $M = 1.59, SD = 0.93$ )  $t(311) = 1.54, p = .125, 95\%CI [-0.06, 0.46], d = 0.17$ .

11.4. Mediation analysis

11.4.1. Mediation on biased-information processing

As can be seen in Fig. 7a, there was a significant indirect effect of the vividness induction on biased-information processing through

memory, simultaneous accessibility, and subjective ambivalence, as indicated by a significant indirect effect,  $b = 0.001, SE = 0.001, 95\%CI [0.0003, 0.003]$ . The direct effect was marginally significant,  $b = 0.05, SE = 0.03, t = 1.72, p = .085, 95\%CI [-0.01, 0.10]$ . The total effect was significant,  $b = 0.06, SE = 0.03, t = 2.14, p = .033, 95\%CI [0.005, 0.11]$ .

11.4.2. Mediation on procrastination

Although the main effect of the vividness induction on procrastination was not significant mediation can still occur (Rucker, Preacher, Tormala, & Petty, 2011). As shown in Fig. 7b, the indirect effect from the vividness induction on procrastination through memory, simultaneous accessibility, and subjective ambivalence was significant,  $b = 0.01, SE = 0.01, 95\%CI [0.003, 0.03]$ . The direct effect was not significant  $b = 0.21, SE = 0.17, t = 1.20, p = .229, 95\%CI [-0.13, 0.56]$ . The total effect was marginally significant,  $b = 0.35, SE = 0.18, t = 1.95, p = .052, 95\%CI [0.00, 0.70]$ .

In sum, Study 4 largely supported the research hypotheses (except for procrastination) using a vividness induction that was not confounded with emotional words and with a different preface (Table 4).

**Table 4**  
Descriptive statistics and correlations for Study 4.

	M	SD	1	2	3	4	5	6
1. Subjective ambivalence	4.57	2.00						
2. Cognitive personalization	5.56	2.70	0.26**					
3. Memory	5.19	2.55	0.13**	0.12*				
4. Simultaneous accessibility	0.10	0.52	0.25**	0.13*	0.38**			
5. Biased-information processing	0.54	0.24	0.24**	0.07	-0.03	0.06		
6. Attitude favorability	1.22	2.74	-0.17**	-0.10	-0.11	-0.07	0.07	
7. Procrastination	1.69	1.16	0.29**	0.14*	0.02	0.15**	0.22**	-0.12*

\*\*  $p < .01$ .  
\*  $p < .05$ .

**Table 5**Meta-analyses testing the effects of experimental conditions vs. control conditions on the research variables across six experiments ( $N = 2226$ ).

	<i>K</i>	<i>n</i>	<i>d</i>	<i>LL</i>	<i>UL</i>	<i>SE</i>	<i>Z</i>	<i>p(Z)</i>	$\tau$	<i>Q</i>	<i>df</i>	<i>p(Q)</i>
<i>DV</i>												
Cognitive personalization <sup>a</sup>	3	900	0.67	0.07	1.27	0.31	2.17	0.030	0.27	1.77	2	0.412
Memory	2	746	0.61	0.04	1.18	0.29	2.11	0.035	0.16	1.00	1	0.317
Simultaneous accessibility	5	2072	0.28	0.18	0.37	0.05	5.66	<0.001	0.00	1.44	4	0.837
Subjective-attitude ambivalence	5	2072	0.41	0.21	0.62	0.10	4.04	<0.001	0.04	3.41	4	0.492
Biased information-processing	5	2072	0.31	0.18	0.44	0.07	4.58	<0.001	0.01	3.66	4	0.454
Procrastination	3	1.447	0.36	0.03	0.69	0.17	2.11	0.035	0.08	2.06	2	0.356

<sup>a</sup> In Pilot study 2 we used the average effect size of the experimental manipulations.

## 12. Mini meta-analysis

We conducted a random-effects meta-analysis on the effects of the experimental inductions using the data from the five experiments and Pilot study 2 ( $k = 6, N = 2226$ ). In the first three studies, we converted the partial eta squared of the Vividness X Ambivalence interaction to a *Cohen's d*. As can be seen in Table 5, the meta-analytic effect on all the dependent variables was significant and ranged from 0.28 to 0.67. Furthermore, there was no evidence for heterogeneity across the studies on any of the variables.

## 13. General discussion

Across five studies (the first study is reported in the Supplementary materials) using different attitude objects, we found support for the research hypotheses. Vivid reviews framed as personal experiences made the positive and negative attributes of the attitude object more simultaneously accessible than less vivid reviews presented as a list of facts or opinions. The vivid reviews thus increased simultaneous accessibility and, consequently, made participants feel more conflicted towards the product. As a result, these participants were motivated to process information that was in the direction of their initial attitude (i.e. increased biased-information processing). The results supported the theoretical model both when valence-inconsistency was manipulated between reviews and within a single review. Moreover, in Studies 3 and 4 participants' memory was higher in the vividness condition, which mediated the effect of the induction on simultaneous accessibility.

Pilot study 2 revealed that the vivid reviews in studies involving short reviews (Studies 1–3) were also perceived as being more emotional than the fact-based reviews. Therefore, we conducted Study 4, which showed that the hypothesized model could be replicated with short reviews that did not differ in emotional language, thereby strengthening the assumption that the vividness is the active ingredient in increasing ambivalence and its downstream consequences. However, it is noteworthy that the effect sizes in this study were smaller relative to the previous studies.

The current work makes several contributions to the ambivalence literature and more broadly to research on cognitive inconsistency. First, this is the first work to shed light on vividness and memory as potential antecedents of subjective ambivalence. Second, the current

work empirically bridges between areas in the ambivalence literature that have been theoretically argued to be related but have not been examined simultaneously (Van Harreveld et al., 2009). Specifically, one line of work found that ambivalence is unpleasant when the opposite aspects of the attitude are simultaneously accessible (Newby-Clark et al., 2002; Van Harreveld et al., 2014), and another line of work found that ambivalence leads to biased information processing (e.g., Clark et al., 2008; Maio et al., 1996). The current work is the first to associate simultaneous accessibility and information processing and shows that biased information processing is more likely to occur when simultaneous accessibility of opposite features within an attitude is present. This is an important element of the ambivalence literature that required empirical testing (Van Harreveld et al., 2015).

Moreover, although previous work has theorized that valence-inconsistent attitude holders use procrastination to deal with their conflict (Van Harreveld et al., 2009), there is very little work (Durso et al., 2016; Nohlen, 2017) that has examined this notion empirically. Apart from further establishing the notion that ambivalence does indeed lead to procrastination, the current work innovates by pointing to the process involved: when both components of the valence-inconsistent attitude are accessible, a conflict arises and this is when a decision is delayed.

Inducing vividness through personal experience is only one way to affect memory and subsequent cognitive inconsistencies. Additional inductions can employ inductions such as rehearsal of the information (i.e. repeated expression), emotional level of the content, the unusualness of the attitude object, interestingness or credibility of the message provider.

In addition, several previous studies on the effect of vividness on persuasion did not find a main effect (e.g., Borgida, 1979; Gottlieb, Taylor, & Ruderman, 1977). A review of the experimental literature concluded that the evidence does not support the notion that there is an effect of vividness on persuasion, and that the processes through which vividness arguably impact persuasion, memory among them are not clear (Taylor & Thompson, 1982). However, a recent meta-analysis found a significant small-to-medium effect of vividness on persuasion ( $d = 0.31, 95\%CI = [0.18, 0.43]$ ); Blondé & Girandola, 2016). Critically, the authors found that memory amplifies the vividness-persuasion relationship. This is congruent with the present research wherein studies 3 and 4 where participants in the vividness condition exhibited better memory than participants in the none-vividness condition (see

**Table 6**

Summary of variables and hypotheses measured in each study.

	Study 1	Study 2	Study 3 (preregistered)	Study 4 (preregistered)	Study 5 (preregistered)
Hypothesis					
H1 ( <i>memory</i> )	–	–	–	Supported	Supported
H2 ( <i>simultaneous accessibility</i> )	Supported	Supported	Supported	Supported	Supported
H3 ( <i>subjective ambivalence</i> )	Supported	Supported	Supported	Supported	Supported
H4 ( <i>biased-information processing</i> )	Supported	Supported	Supported	Supported	Supported
H5 ( <i>procrastination</i> )	–	–	Supported	Supported	Not supported

The dash indicates that the hypothesis was not measured.

also Pilot study 1 in the Supplementary materials).

Practically, our work suggests that exposure to positive and negative reviews of a product can make the individuals seek information in a biased manner. This finding is contrary to the rationale behind many consumer platforms that advocate writing positive and negative reviews and allocating separate space for positive and negative evaluations. Vivid valence-inconsistent reviews may lead individuals to buy less because in this case, they tend to delay their decision.

#### 14. Limitations and future research

The present work has some limitations. First, the effects of the vividness induction on cognitive inconsistency cannot be generalized to other sorts of experience-and-fact based information. It is unlikely that merely labeling information as experience-or-fact based while keeping the content constant will enhance memory or impact cognitive inconsistencies. Hence, in the present studies, as part of the vividness induction, the reviews differed also in their content (all studies) and emotionality (studies 1 and 2), which is defined as part of vividness (cf. introduction). However, experiential and factual information can vary in vividness which in turn affects memory in a different and even opposite way than found in the current examination. For example, pallid experience-based information could produce less vividness and memory than an interesting and credible fact-based review.

Second, the experience-based reviews could also be seen as reflecting a narrative. However, it should be noted they lacked some of the characteristics of a narrative such as a series of temporally associated events (McLean, Pasupathi, & Pals, 2007). In Study 2 we also measured transportation, using items adapted from a transportation measure (Green & Brock, 2000). As can be seen in the Supplementary material, there was a main effect of the vividness induction on transportation. However, this result should be interpreted with caution because transportation is used in the context of a single story rather than several stories. Furthermore, we measured transportation in general, hence, our data cannot be harnessed to determine which review or combination of reviews elicited the main effect.

Third, although the rationale for the mediation model was based on theory, our experimental designs did not manipulate the mediators. Hence the data cannot indicate the causal direction of the observed relationships between the mediators (Fiedler, Harris, & Schott, 2018; Giner-Sorolla, 2016).

Future work should examine the role of affect. That is, given that vivid experience-based reviews increased emotionality then the effect on attitude ambivalence may depend on an individual's dispositional sensitivity to emotional information. Previous work (R. Thompson & Haddock, 2012) reported that individuals high in need of affect are more likely to become immersed in personal-based content (NFA; Haddock, Maio, Arnold, & Huskinson, 2008; Maio & Esses, 2001), are more likely to engage with the emotional nature of the content and are left with the impression that it is in some way relevant to them. This is consistent with findings that participants with higher levels of affect intensity (Larsen et al., 1987) report greater cognitive personalization when reading online reviews (Xia & Bechwati, 2008; Study 1).

Finally, the findings of Pilot study 2 showed that in Studies 1–2, and study 0 (Supplementary material) the vivid reviews were perceived as more emotional than the less vivid reviews. Although this is an arguable confound, emotional interest is part of the definition of vividness (Nisbett & Ross, 1980). However, it is possible that the vividness induction also manipulated emotional ambivalence, which refers to the co-existence of positive and negative emotions (Rees, Rothman, Lehavy, & Sanchez-Burks, 2013). This opens up an avenue for future research regarding the effect of ambivalence on information processing. Specifically, the present results are congruent with research on attitude ambivalence which found that ambivalence leads to more biased-information processing, which reflects less receptivity to alternative perspectives (Clark et al., 2008; Maio et al., 1996; Sawicki et al., 2013).

However, work on emotional ambivalence found that ambivalence can lead individuals to process information in a more balanced manner which is reflected in enhanced accuracy (Rees et al., 2013), and greater creativity (Fong, 2006). Hence, an intriguing avenue for future work would be to explore the moderators that influence the association between ambivalence and information processing.

#### 15. Conclusion

The current work sheds light on vivid and valence-inconsistent information as an unexplored process that leads to cognitive inconsistency and impacts ambivalence-coping strategies. We hope that this work will pave the way for more research on the intersection between vividness, memory and attitude strength.

#### Open practices

This manuscript received a preregistration badge because studies 2, 3 and 4 were preregistered. The preregistration forms are available through the links in the overview of each of the studies.

#### Acknowledgements

Guy Itzchakov's contribution was supported by grant #460/18 from the Israel Science Foundation.

#### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jesp.2019.103938>.

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