Odor-Evoked Nostalgia and Product Assessment: A mediating effect of positive affect?

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Thesis

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Abstract

Ambient scents have proven to have a rather powerful effect on consumer choices, affecting such things as product evaluation and spending behaviour. However, there is little research that has examined the mechanism behind such effects, and so this research set out to do just that. A total of 53 participants were randomly assigned to write about a childhood memory after being presented with one of two scents, a childhood related scent or everyday scent. Then they indicated their preference between an indulgent good and a healthy alternative, and stated their willingness to pay for the good they chose. The results reveal that childhood related odor leads to greater feelings of nostalgia and more positive affect than the everyday scent. The experimental scent also leads to a preference for the healthy good compared to the indulgent good, whereas the reverse is observed for the neutral scent. Furthermore, participants in the Vicks Vapo rub condition are willing to pay significantly more for the healthy good as compared to the indulgent good. The findings of this study suggest that scents are a strong trigger of nostalgia and bring to light some novel mechanisms worthy of further exploration. However, given that there is such a small sample size we are highly cautious of these findings.

Odor-Evoked Nostalgia and Product Assessment: The Mediating Effect of Positive Affect

Decision-making processes have long been of interest to researchers and there is a growing interest in olfaction and such processes as there is an ever-growing scent marketing business (Bradford & Desrochers, 2009). Ambient scents have been shown to influence product evaluation (Bosman, 2006; Knasko, 1995), consumer spending behaviour (Chebat & Michon, 2003), purchase intention (Hussain & Ali, 2015), store evaluation (Doucé, & Janssens, 2013; Leenders, Smidts & El Haji, 2016) and brand memory and evaluation for unfamiliar brands (Morrin & Ratneshwar, 2000). This is important as every day we are inundated with scents and thus opportunities to affect behaviours. However, there is not a lot of research that looks into the mechanism behind such effects. This research intends to examine the effect of odor on product evaluation, specifically product preference and willingness to pay, and in doing so, further investigate the role nostalgia may play. In this way, this research attempts to clarify the mechanism(s) behind the many observed effects of scent.

Ambient Scent and Product Evaluation

Ambient scents have a rather strong effect on product evaluation; however selecting the correct scent pairing for a given product is tricky. In a study conducted by Knasko (1995), it was found that participants, regardless of the scent condition – chocolate (congruent scent) and baby powder (incongruent scent) – evaluated images of chocolate equally positively. An explanation for this may be found in Bosman's (2006) studies, which demonstrated that pleasant ambient scents have a positive effect on product evaluation, such that participants evaluate the product more highly. Like Knasko (1995), this effect also held for incongruent scents but only when the scent was not made salient or when processing motivation was low. Importantly, in Bosman's (2006) study, even when the processing motivation was high or the scent was made salient, a

congruent scent still had a positive effect on product evaluation. Furthermore, these scents acted like affective cues and Bosman (2006) theorized that the observed effect on the product evaluation was a result of misattribution of their reactions.

However, taken into a real purchasing situation, Schifferstein and Blok (2012) found no empirical support for the effect of ambient odors on product evaluation. In fact, they observed the opposite of their expected findings. Scents increased magazine sales for thematically incongruent products e.g., smell of sunflowers and football magazine, and decreased sales for thematically congruent products e.g., sunflower and women's magazine. But, this may not be so surprising, as magazines are goods that are not inherently hedonic purchases (i.e. unplanned, impulsive purchases), but are rather utilitarian in nature. Thus, regardless of the scent, the participants were entering the store with the intent to purchase, or not purchase, a magazine. Furthermore, they proposed that the scent may not have triggered the correct association, and so they suggest that when selecting odors one should focus more on it's "concept evoking power and not merely on its congruency to products" (Schifferstein and Blok, 2012).

In sum, ambient scents do positively affect product evaluation, but may work best for hedonic goods. To further understand why, it is of interest to directly examine and expand upon Bosman's (2006) finding concerning affective cue. We propose that one of the strongest of such links between affect and scent is via autobiographical memory, specifically nostalgia.

What we Know About Odor, Autobiographical Memory, Nostalgia and Affect

Odors, as compared to other sensory cues, have been demonstrated to trigger autobiographical memories that are limbic (Arshamian et al., 2013), old (Chu & Downes, 2000; Willander & Larsson, 2006), vivid (de Bruijn & Bender, 2017), emotional (Chu & Downes, 2002) and rare. This follows the LOVER model proposed by Larsson et al. (2014). Furthermore,

a review conducted by Hackländer et al. (2018) found evidence supporting these findings, and moreover, they noted that there was strong support for the ability of scents to trigger the "feeling [of being] brought back." The ability of odors to cue personal memories that are rich in detail (Chu & Downes, 2002) and especially from childhood (Chu & Downes, 2000; Willander & Larsson, 2006; de Bruijn & Bender, 2017), are important components to the feeling of nostalgia. However, nostalgia does differ from autobiographical memory in that it is a filtered version of autobiographical memory such that it is often viewed through rose-tinted glasses (Marchegiani & Phau, 2010). These are important and potentially powerful effects of scents in the world of scent marketing.

Nostalgia once held a rather negative connotation, having been conceptualized as a medical disorder and disease (Sedikides et al., 2008). However, this has since changed and there is now a more positive perception of nostalgia and empirical support for such a view. Personal nostalgia, which we will label as nostalgia from now on, is commonly defined as an idealization of one's own past (Stern, 1992). Wildschut et al. (2006) have since investigated the psychological function of nostalgia and found that it bolsters social bonds, increases positive self-regard, and generates positive affect. They also noted that nostalgia results in more positive than negative affect. In line with these findings, Reid et al. (2015) found that odor-evoked nostalgia leads to higher levels of positive affect, self-esteem, self-continuity, optimism, social connectedness and meaning in life. Furthermore, Reid et al. (2015) and Orth and Bourrain (2008) demonstrated that odors cue strong feelings of nostalgia and Wildschut et al. (2006) found that second to negative affect, sensory inputs (namely scents and music) were also strong triggers of nostalgia.

H_1: Odors that are typically only experienced in childhood will prime autobiographical memories that are nostalgic and will elicit feelings of nostalgia, as compared to odors experienced in everyday life

H_2: Odor-evoked nostalgia will lead to more positive affect (than negative affect) compared to a neutral odor

The Underlying Mechanisms of Nostalgia

In a paper by Wang et al. (2018) participants were primed to feel nostalgic using two methods, asking participants directly to think of a nostalgic moment and visual cues, such as pictures of China in 1970s. They consistently demonstrated throughout four studies, that participants had a preference for an indulgent snack compared to a healthier option. Additionally, they found that the feeling of social connectedness was the underlying psychological mechanism that mediated the relationship between nostalgia and the preference for indulgent foods. They did not find support for a mediating role of any of the other functions of nostalgia. However, Wang et al. (2018) utilize historical nostalgia rather than personal nostalgia, which Marchegiani and Phau (2010), upon conducting a literature review, suggest may result in different cognitive and emotional effects and in turn different strengths of consumer responses.

Research in other domains, specifically advertising, suggests that positive affect plays a significant role in product assessment. In a study conducted by Pham et al. (2013), in which they had participants view a large number of television commercials, they found that the ad-evoked (emotional) feeling had a positive influence on brand evaluation. Their results also indicated that the effects of ad-evoked feelings were marginally stronger for hedonic products than for utilitarian ones. Although they did not assess positive affect directly, ad-evoked nostalgia was also observed to positively affect brand attitude and purchase intent (Pascal et al., 2002). This

also ties into Bosman's (2006) theory that the affective cues of the scents will translate to the product assessment. And so another explanation for Knasko's (1995) findings may be the selection of the scents, as baby powder may have triggered nostalgia, generating positive affect and in turn led to the positive evaluation observed for the chocolate image. Thus, the main hypotheses are as follows:

H_3: Odor-evoked nostalgia (compared to a neutral odor) will lead to a greater preference for an indulgent good

H_4: Positive affect will mediate the relationship between nostalgia and preference

H_5: Odor-evoked nostalgia (compared to a neutral odor) will lead to a greater willingness to pay for the indulgent good

H_6: Positive affect will mediate the relationship between nostalgia and the willingness to pay

Method

Pilot Study

A pilot study was conducted in order to identify which scent would best cue nostalgia and should in turn be selected. The pilot study was conducted in collaboration with two other pilot studies. A small convenience sample of the student body (N = 18) was presented eleven flasks containing the scents, of which four were of interest for this study. For each of the scents, the participant indicated how nostalgic it made them feel (1 = not at all, 7 = very much). Four scents had been selected that were hypothesized to cue nostalgia and a strong childhood association. Three scents were exploratory in nature, Play-doh, crayons and bubble gum. It was hypothesize that they would cue nostalgia, as they are items that are typically only used during childhood. Vicks Vapo Rub had also been selected, but on a more empirical basis. It had been found to be

strongly associated with childhood (de Bruijn & Bender, 2017) and thus was likely to elicit nostalgia. The scents were presented in a randomized order to each participant. They also evaluated three different indulgent goods (chips, chocolate cake mix and Coca-Cola) that had a corresponding 'healthier' alternative (e.g. chips with less salt). Participants indicated their preference between each pair, and for each of the six goods they rated their liking and health perception on a 7-point scale. They were also provided a textbox in which they could write down whether there were any other factors that led to their preference.

Scents

Based on frequency tables, the scent of bubble gum and Vicks Vapo Rub elicited the highest rate of evoked memory (88.9% and 83.3% respectively), followed by Zwitsal (72.2%) and Play-doh (66.7%). A repeated measure ANOVA was also run. The scents that made the participants feel the most nostalgic were bubble gum (M = 3.56, SD = 1.98) and Play-doh (M = 3.50, SD = 1.92), followed by Vicks Vapo Rub (M = 3.33, SD = 2.11) and Zwitsal (M = 3.22, SD = 1.99). However, there was no significant difference between the four scents on the measure of nostalgia, F (3,51) = 0.15, p = .932.

Indulgent Goods

T-tests revealed that participants overwhelmingly preferred Classic Coca-Cola to Coca-Cola light ($N_{\text{preferred classic}}$= 17) and on average liked it better (M_{classic} = 3.33, M_{light} = 2.22). This was mainly due to flavor, as many participants indicated that Coca-Cola light had a 'fake taste' due to the artificial sweetener. For the Lays chips participants once again favored the classic chip ($N_{\text{preferred regular}}$ = 14) rather than the lightly salted one and liked it better (M_{classic} = 3.67, $M_{\text{lightly salted}}$ = 2.83). Although they indicated that the lightly salted lays chips may be healthier, when buying chips most participants were inclined to go 'completely unhealthy'. The packaging also

played a role in their preferences, but both were attractive to different participants. Lastly, for the chocolate cake mix there was a preference for the regular mix ($M_{classic} = 3.33$) as compared to the less fat option ($M_{less\ fat} = 2.67$), however the preference here was slightly more split ($N_{preferred\ regular} = 12$). The reason that participants preferred the regular mix was similar to the chips, if they were going for fatty foods, they would chose the full fat. The packaging also played a substantial role, many participants indicated that the packaging for the regular cake mix was warmer and thus seemed tastier.

Based on the results of pilot study the Vicks Vapo rub scent was retained for the study as nostalgia ratings of the scents did not significantly differ and it was the scent that best suited two study designs. Of the products examined, the chocolate cake mixes were used to assess product assessment as the liking of the goods differed the least, there was the most variation in choice (thus avoiding any potential ceiling effect) and the health factor appeared to be the most salient. Furthermore, the photo of the chocolate cake with less fat was photoshopped to address some stark visual differences that participants brought up, thus ensuring that both goods were more on par. See Appendix, figure 1 for the changes.

Main Study

Participants

A priori power analyses revealed that the target sample size, if expecting a small to medium effect size ($w = 0.20$), should be 197 participants to obtain sufficient power ($1\text{-}\beta = 0.80$), as this study was combined with another thesis, this was not obtained. The sample of interest for this study consisted of Tilburg University undergraduate students ($N = 58$) who received university credit for completing this study. Only participants born in the Netherlands were used for this study, as the odors being utilized may not have stimulated (enough) nostalgia for the

international population of Tilburg University. For this reason, the experiment was also conducted in Dutch and all materials were written in Dutch. Upon examining the reported memories, three participants were removed as they had been given the wrong scent stimulus and two other participants failed to report any memory associated with the scent. This brought the total sample to 53 of which 28 were in the Vicks Vapo rub condition and 25 were in vinegar condition. The mean age of the participants was 19.94, and consisted of 81.13% female participants.

Materials

Two scents were used for this study, Vicks Vapo rub and vinegar. The scents were placed in a cylindrical metal container with a perforated lid. This container was placed in a sealable plastic bag and put into a cardboard box. Vicks Vapo rub was placed in box A and vinegar in box B. The quantities of each scent were as follows, 1 teaspoon of Vicks Vapo rub and 10 ccs of vinegar that was poured onto two cotton pads.

Design

A between-subject design was used where the independent variable was odor (experimental vs. neutral) and the dependent variables were the product preference and willingness to pay. Cubicles in the laboratory of Tilburg University were used in which two boxes (A and B) containing one of each of the scents was placed. Scent A was placed to the left of the participant and scent B to the right. Before the participants arrived the experimenter set up the boxes and cubicles, ensuring that each scent was in place and that the computer displayed a new Qualtrics survey. They also ensured that the room was odorless and that the scents were replaced when necessary. This study was done in conjunction to another study such that there were four conditions in total. There was the experiment scent condition (Vicks Vapo rub),

neutral scent condition (vinegar), visual condition (image of Vicks Vapo rub) and control condition (no stimulus) and each participant was randomly assigned to one of these conditions. For the purpose of this paper, only the scent conditions and relevant content will be discussed.

The study began with half of the participants receiving a pre-cue label stimulus, in which they were asked to recall and subsequently describe a childhood memory they associated with Vicks Vapo rub. They also assessed the quality of the memory by rating on a seven-point Likert scale how vivid, detailed, emotionally intense and lively it was and the valence (positive or negative) of the memory.

All participants then went on to complete the following. Participants were randomly assigned to smell one of the two scents and they were asked to describe a memory associated with that scent in an open textbox. Then they assessed the quality of the memory using the same scale as was described previously. Next, they completed a preference task and a product evaluation task, for which one of the two tasks was randomly assigned first.

Preference Task. They were presented with an indulgent good (chocolate cake mix) and a healthier alternative (low fat chocolate cake mix), which are similar types of item as those presented in Wang et al.'s (2018) study. The two options were presented alongside one another and the side on which they were presented was counterbalanced between participants and across conditions. They were asked to "imagine that [they] are looking for a snack. Which of these two options would [they] prefer?" (See Appendix, figure 2). They were then asked to evaluate their liking for each good on a 5-point Likert Scale (1 = do not like at all, 5 = like very much). And, as a manipulation check, they were also asked to what extent they thought the chocolate cake mix with less fat was healthier (1 = not at all, 5 = very). Next, they were asked to indicate how much they were willing to spend on the good that they chose under the following hypothetical

situation, “You walked into the supermarket shortly before closing time and you spot a cake mix that you would like to have. How much are you willing to pay for the product you have chosen?” A price slider was used and anchored between one and five euros, the amount of money typically spent on this type of good.

Product Evaluation Task. Participants were presented two versions of ten different items, five were congruent with the scent of Vicks Vapo rub and five were incongruent. Participants evaluated the brand image (e.g. familiarity, pleasantness), stated their willingness to pay and how congruent the smell was with the product.

After this, participants completed the following measures, which were obtained in this order.

Frequency of Nostalgia. Dispositional nostalgia, was assessed using the seven-item Southampton Nostalgia Scale (SNS version 2, $\alpha = 0.93$; Barrett et al., 2010)

Scent Level Measures. Scent level measures, which have been validated by Reid et al. (2015), measured how nostalgic the scent made them feel (i.e. “How nostalgic does this scent make you feel?”), and how arousing (i.e. “How exciting/arousing do you find this scent?”), familiar (i.e. “How familiar is this scent?”) and autobiographically relevant (i.e. “Describe your autobiographical association with this scent. How personally relevant is this scent?”) the scent was on a scale from 1 = not at all to 7 = very much.

State Nostalgia Measures. State nostalgia measures were taken to ensure that the manipulation of nostalgia worked and it was used in both conditions. The two validated items were, “Right now, I am feeling quite nostalgic” and “Right now, I’m having nostalgic feelings” ($\alpha = 0.96$; Wildschut et al., 2006). They are evaluated on a 6-point Likert scale (1 = strongly disagree, 6 = strongly agree).

Function of Nostalgia. The function of nostalgia was measured using eight items that measure four psychological functions of nostalgia: social bonding, positive self-regard and positive and negative affect (Wildschut et al., 2006). Specifically participants rated (1 = not at all, 5 = extremely) the extent to which thinking about the memory made them feel "loved" and "protected" (social bonding), "significant" and "high self-esteem" (positive self-regard), "happy" and "content" (positive affect), and "sad" and "blue" (negative affect). All reliability alphas were above 0.75.

In the last phase of the survey they answered some control questions regarding the study, e.g. "Did you have any problems during the procedure? If so, please explain the problems you encountered." And finally they filled in some demographic information. They then read a small debrief and were thanked for their participation.

Results

After collecting all the data, it was then analyzed using SPSS. First, t-tests were performed to determine whether the nostalgia manipulation had worked, this was done by examining the scent level measures as well as the state nostalgia measures. Then an independent samples t-test was used to see if there was a difference of positive and negative affect between the two conditions. Next a Chi Square test was conducted to see if there was a difference in preference of the snacks between the two groups. T-tests were also used to assess liking and perceived health of the two goods. Additionally, a binominal logistics regression was performed to look at the effect that positive affect had on the preference choice. Finally, a two-way ANOVA was performed to assess whether there was a difference in the willingness to pay between the two groups based on their preference. Lastly, a regression was conducted to look at the mediating role of positive affect on the relationship between odor-evoked nostalgia and

willingness to pay.

Data Integrity

The experimenter read through the memories to ensure that they contained relevant content, i.e. that they had a memory relevant to the scent stimuli. The memories were deemed relevant if they explicitly mentioned at least one of the following: the product (vinegar or Vicks), the characteristics of the scent (e.g. sour or minty) and/or discussed the circumstances in which the scent is typically used (e.g. being sick or cooking). Three participants were removed as they had received the wrong stimulus scent and two other participants were removed, as they were not able to come up with a memory for the given stimulus.

Next the quality of the memories that were elicited by the two scents was compared and it was found that they were quite similar. T-tests revealed that the two groups did not differ significantly on the measures of vividness, detail, emotional intensity, liveliness and valence (all p-values ranged between .417 and .977).

Lastly, dispositional nostalgia was assessed using the Southampton Nostalgia Scale (SNS), for which the reliability alpha was 0.70, and, after combining the first six measures into one variable, it was revealed that there was no significant difference between the two conditions, $t(51) = 0.89$, $p = .378$. In other words, dispositional nostalgia did not differ between the experimental condition and control condition, meaning that their tendency towards nostalgic feelings did not differ. Additionally, the frequency of nostalgic experiences did not differ X^2 (6, $N = 53$) = 5.70, $p = .458$.

Main Analysis I: Nostalgia and Affect

To begin, a series of t-tests were used to examine the scent level measures, which assessed the extent to which a given scent made one feel nostalgic and aroused, and how familiar

and autobiographically relevant it was. Participants rated the scent of Vicks Vapo rub significantly higher on all of these measures compared to the scent of vinegar (see table 2). Of particular interest was how nostalgic the scents made participants feel, as it was hypothesized that the scent of Vicks Vapo rub would make participants feel nostalgic whereas vinegar would not. Participants in the experimental condition found the scent of Vicks Vapo rub to be significantly more nostalgic (M = 4.96 SD = 1.35) than in the scent of vinegar in the control condition (M = 3.76, SD = 1.56), $t(51) = 3.01$, p =.004, d = 0.83. Furthermore, in the Vicks Vapo rub condition, the mean nostalgia rating was significantly above the midpoint, $t(27) = 5.75$, p <.001, whereas in the vinegar condition it was not significantly greater than the midpoint, $t(24)$ = 0.83, p = .260. However analysis of the intended manipulation check of state nostalgia (α = 0.89), which assessed the extent to which participants had nostalgic feelings, revealed that the feeling of nostalgia did not differ between the two conditions, $t(51) = 1.21$, p =.230.

Table 2

Independent Samples T-Test of the Scent Level Measures Compared Across Condition Type

									95% CI	
	Condition	*N*	*Mean*	*SD*	*t*	*df*	*p*	*d*	Lower	Upper
Nostalgia	1	28	4.96	1.35	3.01	51	.004	0.83	0.40	2.00
	2	25	3.76	1.56						
Arousing	1	28	2.93	1.63	2.68	48.85	.010	0.73	0.27	1.84
	2	25	1.88	1.19						
Familiar	1	28	6.36	0.73	4.32	51	.000	1.19	0.73	1.99
	2	25	5.00	1.47						
Autobiographically relevant	1	28	4.57	1.29	2.41	51	.020	0.66	0.16	1.71
	2	25	3.64	1.52						

Next, t-tests were run to examine the relation between the odors, memory and affect. To do so the extent to which thinking about the memory made them feel happy and content were combined to create the variable positive affect, and the extent to which the memory made them feel sad and blue were combined to create the variable negative affect (all reliability alphas were

above 0.78). Then positive and negative affect was compared across the two conditions. It was observed that those exposed to the scent of Vicks Vapo rub (M = 3.71, SD = 0.91), as opposed to vinegar (M = 2.92, SD = 1.14), experienced a greater amount of positive affect, $t(51) = 2.82$, p = .007, d = 0.77. However, the two groups did not differ on the measure of negative affect, $t(51) = -0.60$, p = .552. To determine if there was a difference between positive and negative affect between the two groups, as had been predicted, a variable was created that subtracted the scores of negative affect from positive affect for each participant. An independent samples t-test was conducted and the difference between positive and negative affect was significantly greater in the Vicks Vapo rub condition (M = 2.04, SD= 1.53) then the vinegar condition (M = 1.08, SD = 1.30), $t(51) = 2.44$, p = .018, d = 0.67. Thus, in line with hypothesis two, participants who experienced odor-evoked nostalgia, compared to the neutral odor condition, experienced more positive (than negative) affect.

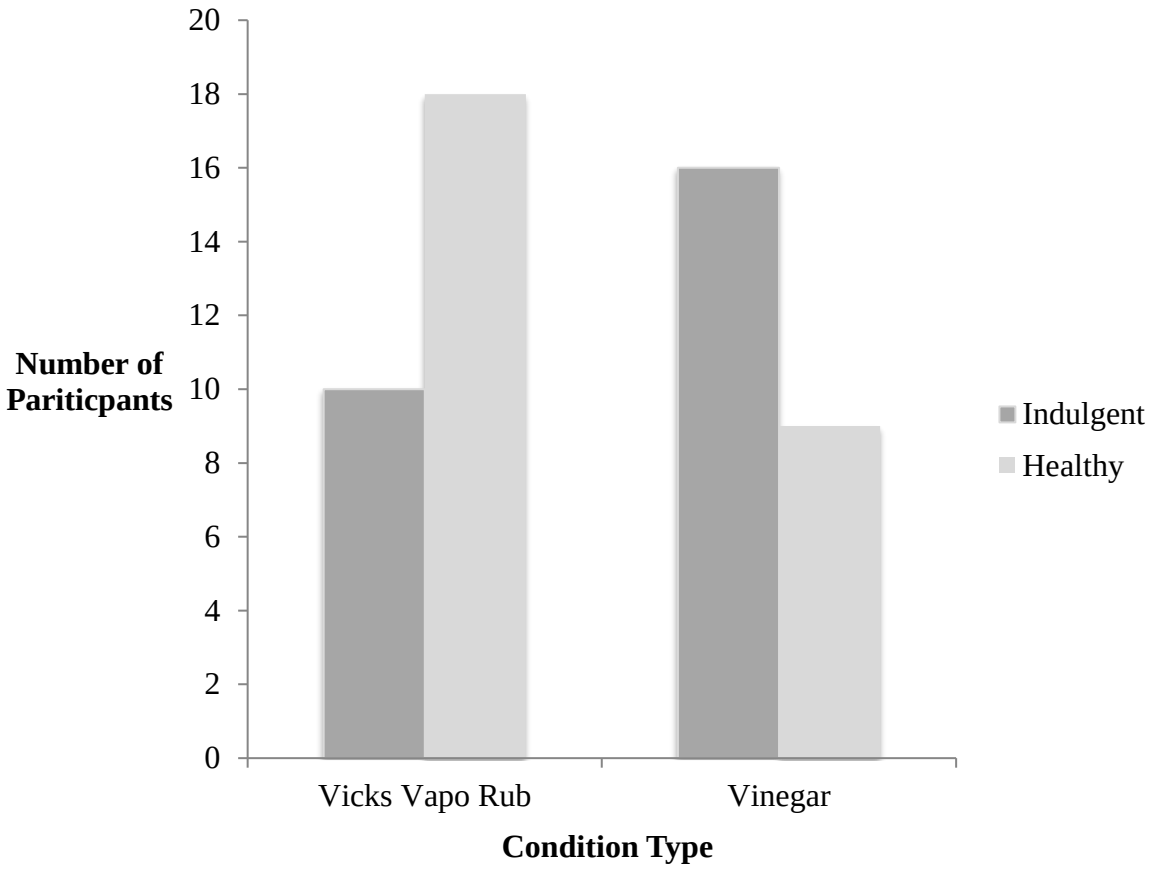
Main Analysis II: Nostalgia and Preference

In order to investigate whether the experiment scent would stimulate a greater preference for the indulgent good as had been predicted, a chi square test was conducted. It was found that there was a significant association between condition type and preference of the good, X^2 (1, N = 53) = 4.23, p = .040, φ = 0.28. However, it was not in the expected direction, rather the majority of participants in the Vicks Vapo rub condition preferred the healthier alternative (64.3%), while in the vinegar condition participants preferred the indulgent good (64.0%). A series of t-tests revealed that participants did not differ in how much they liked the chocolate cake, $t(51) = 0.87$, p = .389. However, they did differ in their liking of the chocolate cake with less fat, (henceforth referred to as the healthy option), $t(51) = 3.04$, p = .004, d = 0.84, such that those in the Vicks condition liked it more (M =3.79, SD = .92) than those in the vinegar condition (M =2.96, SD =

1.06). Further analysis looking at paired sample t-tests revealed that the liking of the two types of chocolate cakes was not significantly different for participants in the Vicks Vapo rub condition, $t(27) = 1.77$, $p = .088$, $d = 0.33$, however it was significantly different for those in the vinegar condition, $t(24) = 3.37$, $p = .003$, $d = 0.67$, such that participants liked the regular chocolate cake (M =3.80, SD = 1.29) more than the healthy option (M =2.96, SD = 1.06).

Figure 3

Preference of Good Based on Condition Type



Furthermore, participants in the two groups differed significantly on their health perception of the healthy option, $t(51) = 2.90$, $p = .006$, $d = 0.79$, such that those in the Vicks Vapo rub condition (M =3.39, SD = 1.23) perceived it as more healthy than those in the vinegar condition (M =2.48, SD = 1.05).

Next, a binominal logistics regression was performed to determine the effect that affect would have on preference choice. The model was statistically significant, X^2 (5,53) = 13.25, p = .021, and it explained 29.5% (Nagelkerke R^2) of the variance in preference choice. The model reiterated that those in the Vicks condition were 0.19 times more likely to prefer the healthier good than those in the vinegar condition. Furthermore, an increase in positive affect was negatively associated with a preference for the indulgent good (see table 3). In other words, more positive affect tends to lead to a preference for the healthy option. Although positive affect did mediate the relation between nostalgia and preference, this was not in line with hypothesis four, as positive affect was hypothesized to result in a preference for the indulgent good rather than the healthy one.

Table 3

Binominal Logistics Regression: the Interaction Effect Between the Functions of Nostalgia and the Preference Between the Goods

	B	*S.E.*	*W*	*Df*	*p*	*Exp.(B)*	95% CI	
							Lower	Upper
Condition type	-1.68	0.79	4.57	1	.033	0.19	0.04	0.87
Social bond	.92	0.55	2.82	1	.093	2.50	0.86	7.29
Positive self regard	0.59	0.47	1.57	1	.211	1.80	0.72	4.53
Positive affect	-1.57	0.76	4.27	1	.039	0.21	0.05	0.92
Negative affect	0.68	0.38	3.11	1	.078	1.97	0.93	4.18
Constant	0.52	1.43	0.01	1	.971	1.05		

Main Analysis III: Nostalgia and Willingness to Pay

A two-way ANOVA was run to assess whether there was a difference in the willingness to pay for the preferred good between the two groups, as it was hypothesized that those in the Vicks condition were willing to pay more for the indulgent good. There was no significant interaction effect between preferred good and condition, F (1, 49)= 0.88, p = .352, and there was no main effect of condition, F (1, 49)= 0.10, p = .750. However there was a main effect of preference, F (1, 49)= 5.09, p = .029. To further understand these finding t-tests were conducted. It was observed that those who chose the indulgent option and those who chose the healthy option did not differ in willingness to pay between the two conditions (see table 4). However, collapsing across condition, participants who chose the healthy option, were willing to pay significantly more (M = 3.06 SD = 0.78) than those who chose the regular chocolate cake option (M = 2.54 SD = 0.71), t(51) = -2.53, p = .015, d = 0.70. A visual examination of the frequency distribution for the willingness to pay for both the healthy and indulgent good demonstrated that this was not attributed to any ceiling or floor effects (see figure 4 and 5 respectively).

Table 4

Independent Sample-Test Comparing Willingness to Pay Between the Odor Conditions Based on Preference

								95% CI	
	Condition	*N*	*Mean*	*SD*	*t*	*df*	*p*	Lower	Upper
Chocolate cake	1	10	2.46	0.83	-0.56	24	.648	-0.73	0.46
	3	16	2.59	0.64					
Healthy Chocolate Cake	1	18	3.15	0.75	0.85	25	.404	-0.39	0.93
	3	9	2.88	0.85					

Figure 4

Frequency Distribution of Willingness to Pay for Those who Chose the Healthy Good

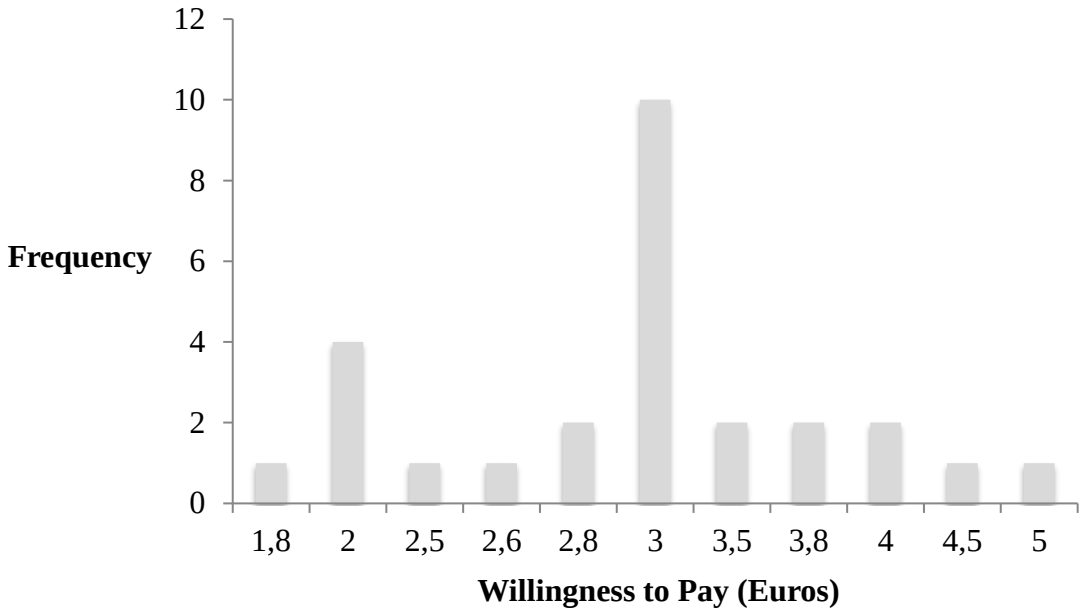
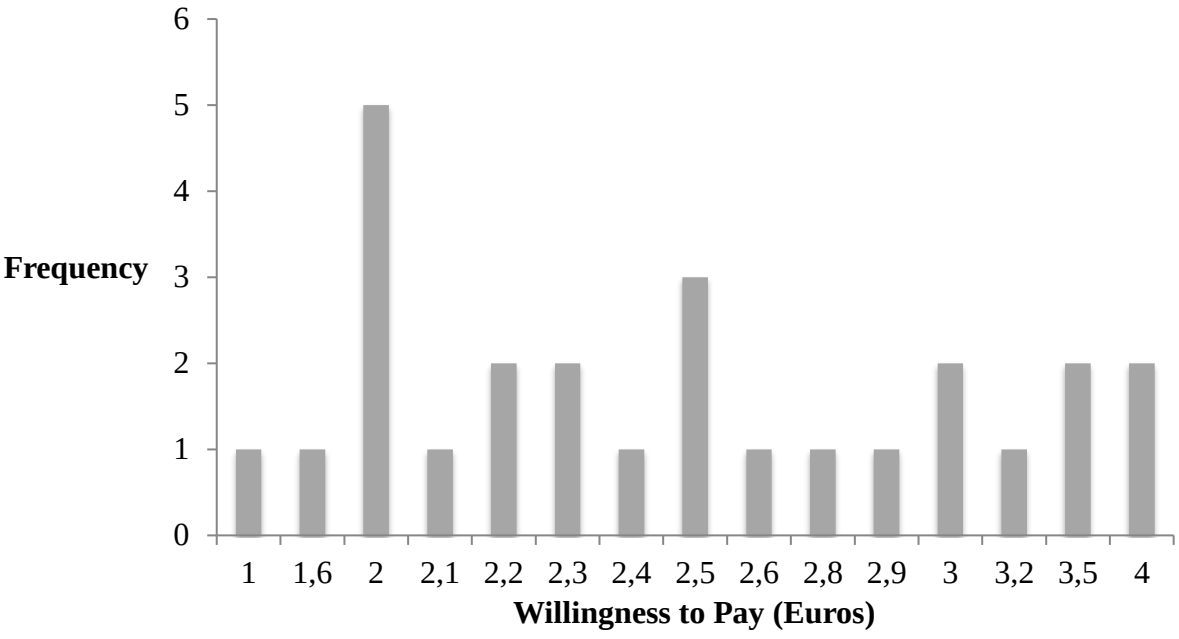


Figure 5

Frequency Distribution of Willingness to Pay for Those who Chose the Indulgent Good

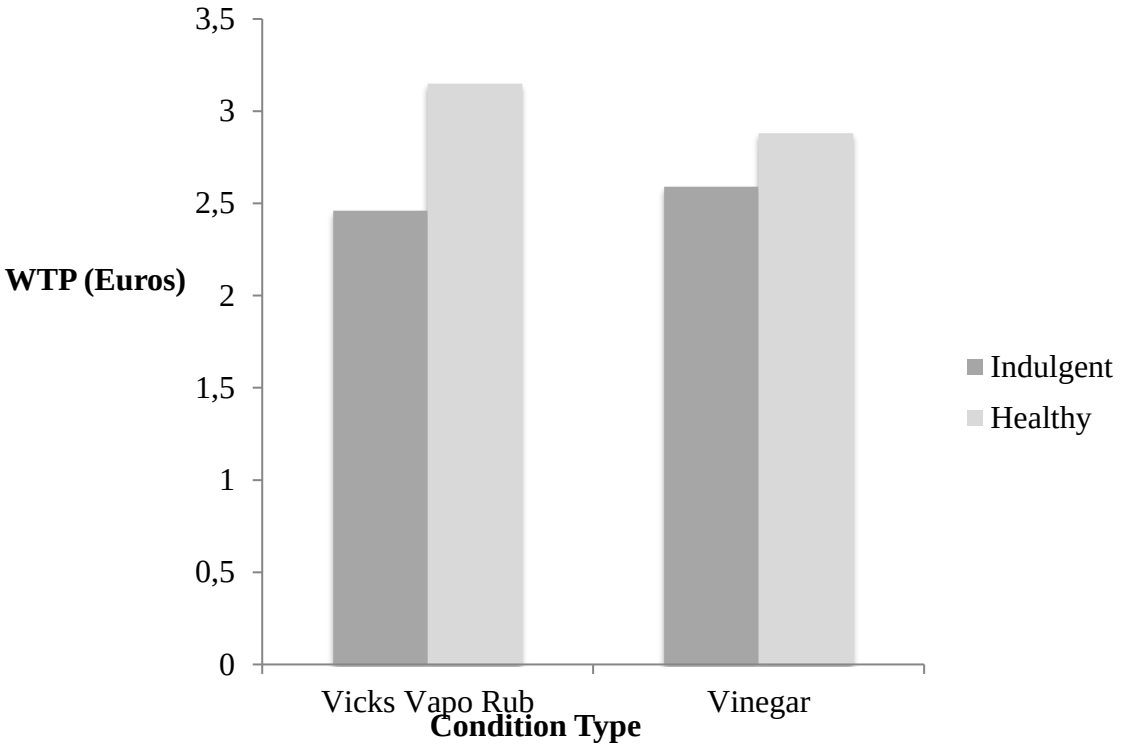


T-tests further revealed that in the Vicks Vapo rub condition participants were willing to pay significantly more for the healthy options (M = 3.15, SD = 0.75) than the indulgent option

(M = 2.46, SD = 0.83), $t(26) = -2.24$, $p = .034$, $d = 0.89$. However there was no significant difference in willingness to pay for the two different types of cakes in the vinegar scent condition, $t(23) = -0.95$, $p = .353$.

Figure 6

Willingness to Pay Based on Preference and Condition Type



In sum, although there is no significant effect of condition, participants were willing to pay more for the healthy option ($M_{healthy}$= 3.06, $M_{indulgent}$ = 2.54) and those in the Vicks Vapo rub condition were willing to pay significantly more for it (Vicks: $M_{difference\ WTP}$ = 0.69; Vinegar: $M_{differene\ WTP}$ = 0.29).

Lastly, a regression analysis was conducted to determine if positive affect, mediated the willingness to pay. The model revealed that there was no significant relation between the predictor variables and the willingness to pay (see table 5).

Table 5

Regression: The Effect of the Function of Nostalgia Items on Willingness to Pay

	Unstandardized Coefficients		*Standardized Coefficients*		
	B	*S.E.*	*B*	*t*	*p*
Constant	2.55	0.43		5.90	.000
Social bond	0.13	0.16	0.20	0.84	.404
Positive self regard	0.11	0.16	0.14	0.66	.512
Positive affect	-0.15	0.19	-0.20	-0.77	.444
Negative affect	-0.01	0.12	-0.02	-0.11	.917

Discussion

This study set out to examine the effect that scents and nostalgia had on preference and willingness to pay and to determine the underlying mechanism of the observed outcomes. The results of this study indicate that an odor typically experienced in childhood, compared to a neutral everyday odor, elicits strong feelings of nostalgia and leads to more positive affect as well as more positive than negative affect, which is in line with hypotheses I and II respectively. However, counter to what was expected, participants exposed to the nostalgia-evoking scent prefer the healthy option. Furthermore, there is no significant main effect of condition on willingness to pay for the goods. Lastly, and notably, the small sample size is a significant limitation and plays an important role in interpreting the results. These results are discussed in detail in the following sections.

Nostalgia and Affect

Based on the results we found (partial) support for the first hypothesis. An odor typically associated with childhood (Vicks Vapo rub) elicits a greater feeling of nostalgia compared to a scent experienced in everyday life (vinegar). This adds to a growing body of literature (Reid et al., 2015; Orth & Bourrain, 2008; Wildschut et al., 2006) that demonstrates that scents are a powerful mean with which one can evoke nostalgia. Furthermore, this can be achieved in an

experimental setting. However, it is difficult to assess the nostalgic nature of the participants' memories, i.e. whether the memories themselves brought on feelings of nostalgia. Although a manipulation check was utilized, it may have come too late in the survey to have properly measured state nostalgia, as oppose to being assessed directly after smelling the scent. Taken alone, the manipulation check indicates that there is no difference in state nostalgia between the two groups. However, the scent level measures, of which one is a nostalgia measure, was taken at the same time and the results demonstrate that the scent of Vicks itself is significantly more nostalgic than vinegar, thus it is clear that the scent stimulates nostalgia. So, rather than there being a discrepancy between the two nostalgia measures, it is more likely an issue of the nature of the questions. The scent level measure specifically assesses how nostalgic the scent made participants feel, which is easy to recall, whereas state nostalgia assesses the present state of the participants. Since participants completed many tasks after smelling the respective scents, but before state nostalgia was assessed, the state of interest (nostalgia) was no longer being assessed. Rather, the potential nostalgic effect of recalling the respective memories was likely replaced over time with a more neutral state or even boredom as the tasks they had to complete were repetitive. In sum, the manipulation check of state nostalgia did not actually function as a manipulation check as the questions were placed too late in the survey to assess the manipulation. However, it is tentatively hypothesized that the corresponding memories the scent conjured were, by extension, also nostalgic. Future research should evaluate the nostalgic nature of the memories more directly by including a qualitative question about the memory participants have described, such as: to what extent did thinking about the memory make you feel nostalgic?

The second hypothesis is also confirmed by the results as they demonstrate that odor-evoked nostalgia leads to more positive affect (than negative affect) compared to the neutral

odor. This is in line with the literature that has previously been discussed which found that nostalgia generates positive affect and results in more positive than negative affect (Wildschut et al., 2006; Reid et al., 2015). Thus these results reinforce the findings that positive affect is one of the main functions of nostalgia.

Nostalgia and Preference

Interestingly, the results do not confirm hypothesis four, but rather reveal the opposite. Those in the Vicks condition have a preference for the healthier chocolate cake, rather than in the expected direction, which was a preference for the more indulgent good (regular chocolate cake). The first thing that was examined was the manipulation check of health perception, and notably, there is a difference of health perception based on condition type. Those in the experimental condition (Vicks) deem the less fat chocolate cake as more healthy than the regular chocolate cake compared with those in the control condition (vinegar). Those in the Vicks Vapo rub condition also like the healthier option more than those in the vinegar condition, however their liking of the indulgent good does not differ. Within each condition, there is a significant difference in participants liking of the two goods such that those in the vinegar condition prefer the indulgent good (compared to the healthy option) and a greater liking of the indulgent good also approaches significance, for those in the Vicks condition. And so the liking of the goods is fairly similar for the indulgent good across the two conditions. However, participants do differ in their liking of the healthy good, such that those in the Vicks condition either like it more than those in the vinegar condition, or those in the vinegar condition dislike it a lot more than those in the Vicks condition. Thus, it appears that the manipulation of scents affects health perception and may in turn affect liking and preferences. Although no baseline health perception measure was obtained, and so the directionality cannot be determined using these results, there is some

literature to suggest directionality. In three studies conducted by Kersten et al. (2016) they observed that nostalgic reverie, compared to a control condition, led to greater health optimism, more positive health-related behaviour intentions and a significant increase in physical activity over a period of two weeks. Thus it is hypothesized that in the present study odor-evoked nostalgia leads to a preference for the healthy option, rather than the neutral scent leading to a preference for an indulgent good. To further understand these results future studies may wish to have a third condition with no stimulus or to obtain participants health perception of the two goods as a baseline measure or during a pilot study.

Notably, the results did suggest one mechanism by which this preference may have been affected, which is positive affect. Our results demonstrate that the more positive affect an individual experiences, the more likely they are to choose the healthier option. This is in contrast to the research conducted by Wang et al. (2018) who found that social connectedness was the only function of nostalgia that mediated the relationship between nostalgia and preference. However, this may be due to the way in which nostalgia was evoked. In the present study a scent was used whereas in Wang et al.'s (2018) study they used two methods, one was self-generated (e.g. think of a nostalgic moment) and the other was a visual stimuli (images of China in the 1970s). These three modalities play a very different role in the memory quality (e.g. vividness or age of the memory), for instance de Bruijn and Bender (2017) found that olfactory cues, as compared to visual cues, yielded richer childhood memories. Furthermore, the thematic association with the stimuli differs. For instance Vicks may elicit health related themes whereas historical images of China may elicit themes of community. The types of memory it elicits in conjunction with the modality would likely result in a variety of different participant states and may in turn affect their preference, which suggests a more nuanced effect of stimuli and

nostalgia. Another reason for this contrast may be due to the sample type and context. In the present study the sample consists of young students from the Netherlands who are predominantly female, whereas Wang et al.'s (2018) study consisted of a more diverse and older sample using participants from Amazon's M-Turk and directly from the streets of Shanghai. These two samples differ on multiple dimensions and so the difference in preference may be due to any number of variables, e.g. culture, age, sex, stimuli.

Nostalgia and Willingness to Pay

Lastly, willingness to pay was examined, and the results indicate that the difference is due to their preference, rather than the condition type. Participants are willing to pay more for the healthy option than the regular option across both conditions. None of the variables that were examined mediate this relation, but there may be other reasons for this effect that were not assessed. For one, participants buying habits and purchasing context may dictate their willingness to spend. Research by Haws et al. (2017), which found that participants inferred that healthier food was more expensive (healthy = expensive intuition), would suggest that people pay more or at least believe that others pay more for healthy products and so they view healthy products as being typically more expensive. Thus, participants are willing to pay more for the healthy good, regardless of condition. Another reason may be related to the research that was previously discussed. The results of Kersten et al.'s (2016) second study indicated that nostalgia, as compared to a neutral condition, led to more positive health-related behaviour intentions, which may also extend to purchase intentions. Thus, the reason for the higher willingness to pay for the healthy good may be because those who are stimulated with nostalgia are more willing to invest in healthy goods, or may be less inclined to invest in unhealthy goods. This theory is further reinforced if we examine the neutral condition where participants are willing to pay more

for the healthy good than the indulgent good, however they are not willing to pay significantly more for it; whereas it is significantly greater in the experimental condition. Thus nostalgia may indeed lead to a difference in willingness to pay. Lastly, these results may stem from a lack of power and an unequal sample size, which may over-exaggerate the findings. To better understand these results it is worth investigating these hypotheses in future research or at the very least addressing these issues as control variables.

Limitations

One of the main limitations, which was discussed earlier, is the sample. It consists of predominantly young female participants and is thus not representative of the Tilburg University population or of the general Dutch population. Future researchers should utilize a more diverse sample in order to strengthen reliability and generalizability. Furthermore, there is a rather small sample size, which may limit power, and thus the ability to find significance. And so the results and above discussion should be taken as more of an indication of the direction in which future research may wish to investigate, rather than it adding significantly to the literature. However, the results should not be overlooked as they reveal that evoking nostalgia and the subsequent outcomes are rather nuanced. Furthermore, the effect sizes for many of the observed results vary from medium to large, and those concerning nostalgia and affect are similar in size to those observed in Reid et al's (2015) study. The other findings are rather novel and the effect sizes also suggest that these relationships are worth paying attention to. Lastly, as discussed earlier, the scents themselves may have affected the outcome. Vicks Vapo rub is a common scent that many in the Dutch population are familiar with and they make a strong association between it and health, as many of their parents used it on them when they were sick as children. This health association may have been a natural prime, which led to greater health perceptions and the

observed preference, rather than it being a result of the nostalgia manipulation itself. Future research may consider replicating this study with other nostalgic scents such as bubble gum, which proved to be just as good at evoking nostalgia in the pilot study. Researchers may also be interested in the congruency between scent and product categories (of varying degrees of health) and the respective preferences and willingness to pay.

Summary

In this study, we were able to replicate the findings of Reid et al. (2015), Orth and Bourrain (2008) and Wildschut et al. (2006), which were that an odor-stimulus evokes nostalgia and can in turn lead to strong feelings of positive affect. These results may also suggest a novel effect of nostalgia on product preference and willingness to pay. Specifically eliciting nostalgia may lead to a preference for healthy goods and a higher willingness to pay for the good. The literature and the results suggest that this could be due to health related perceptions, though the exact mechanism(s) needs further investigation. This would be worthy of investigation as it may be another means by which marketers and policy makers can encourage the purchase of healthy alternatives and, more generally, to promote a healthier lifestyle.

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Appendix

Figure 1

Chocolate Cake-mix with Less Fat: Original image versus photo shopped

Original Image

Edited Image

Figure 2

Scenario for the Preference Task

Imagine you are looking for a snack. Which of these two options would you prefer?