**WEB APPENDIX**

**Seeing is Smelling:**

**Pictures Improve Product Evaluations by Evoking Olfactory Imagery**

**Contents**

[**Web Study 1** 2](#_Toc157532901)

[**Web Study 2** 4](#_Toc157532902)

[**Web Study 3** 6](#_Toc157532903)

[**Web Study 4** 8](#_Toc157532904)

[**Additional Analyses: Study 2A** 10](#_Toc157532905)

[**Additional Analyses: Study 2B** 11](#_Toc157532906)

[**Additional Analyses: Exclusions and Covariates** 12](#_Toc157532907)

[**Web Study 1** 12](#_Toc157532908)

[**Web Study 2** 12](#_Toc157532909)

[**Study 1A** 12](#_Toc157532910)

[**Study 1B** 12](#_Toc157532911)

[**Study 2A** 13](#_Toc157532912)

[**Web Study 3** 13](#_Toc157532913)

[**Study 2B** 13](#_Toc157532914)

[**Study 3** 14](#_Toc157532915)

[**Web Study 4** 14](#_Toc157532916)

[**Study 4** 15](#_Toc157532917)

[**Study 5** 16](#_Toc157532918)

# **Web Study 1**

This study provided a preregistered, incentive-compatible demonstration of the visual-olfactory effect (**H1**).[[1]](#footnote-1) Participants simply chose between two scented hand soaps (i.e., clementine, pear), after being informed that one random participant would be delivered six bottles of their chosen soap. Critically, the soaps were shown in an advertisement that either contained a picture of the scented object (*picture*) or not (*control*). See Figure W1. Half the participants (List A) saw the clementine soap without a picture and saw the pear soap with a picture of pears, whereas the other half (List B) saw the clementine soap with a picture of clementines and saw the pear soap without a picture. We predicted a preference reversal, such that participants would be more likely to choose whichever soap was advertised with a picture of the scented object.

**Figure W1.** Stimuli, Web Study 1.

A close up of a bottle

Description automatically generated**List A** A close-up of a bottle

Description automatically generated

A screenshot of a cell phone

Description automatically generatedA picture containing table, sitting, lotion, orange

Description automatically generated**List B**

***Methods***

***Pretest: Scent Preference.*** We used *Method* brand hand soaps because (a) they use no pictures on their packaging and (b) they offer several different object-scented products. In this pretest we sought to identify a pair of scented *Method* hand soaps for which consumers do not have a clear preference. We selected the brand’s “clementine,” “french lavender,” and “juicy pear” scented soaps as candidate stimuli for the main study. In this pretest, we presented all three pairwise combinations of those scented soaps to 100 US-based respondents on Prolific. For each pair, participants viewed the two bottles of soap and answered the following question: “Which of these two hand soaps would you be more likely to buy?” The position of each soap (left vs. right) and the ordering of the three pairs of soaps were both randomized. For use in the main study we selected the pair of soaps for which the preference was closest to 50%. This resulted in the selection of “clementine” (48% choice) and “juicy pear” (52%).

***Participants.*** Given two experimental lists, we sampled 200 US-based respondents (*M* = 30 years, *SD* = 11; 92 males) from Prolific online panel.

***Stimuli.*** For each of the selected hand soaps (clementine, juicy pear) we created two versions of an advertisement. All four ads had the same basic structure: All included a creative visual element on the left, the brand name and scent in the center, and the bottle of hand soap on the right. For each scent, one ad included a picture of the scented object (*picture* version) and the other ad did not (*control* version). Stimuli are shown in Figure W1. From these four ads we created two experimental lists. List A included the control ad for the clementine soap and the picture ad for the pear soap. List B included the picture ad for the clementine soap and the control ad for the pear soap. Participants were randomly assigned to one of these lists.

***Procedure.*** Unless otherwise stated, in all studies reported herein we used the same *introductory block* in which participants first provided informed consent, indicated their sex and age, completed an attention check, and read some general instructions before advancing to the main study. In Web Study 1, after this introductory block, participants were briefly introduced to the *Method* brand, including a stock image of several of the brand’s products. They were then informed:

“On the following pages, we will show you ads for two different hand soaps by ***method***. Simply view each ad for as long as you'd like, then proceed to the next page. After you have viewed both ads, we will ask you to choose which hand soap you prefer. **IMPORTANT: At the conclusion of this study, we will randomly select one participant, and ship to that participant a pack of 6 bottles of his or her selected hand soap (approximate value = $30). Please be sure to select the option that you genuinely prefer, because you may actually receive 6 bottles of your selected soap.**”

Participants then proceeded to view the two ads at their own pace (order randomized), then were asked “Which of these two hand soaps would you prefer to have?” The position (left vs. right) of the two options was randomized. Finally, participants were informed that if they were the randomly selected winner of our lottery, we would contact them separately via Prolific to obtain their shipping address. At the conclusion of the study, we shipped six bottles of the selected hand soap to the winner’s address.

***Results and Discussion***

One participant failed the attention check and, as preregistered, was excluded. Neither of the demographic measures (sex, age) significantly predicted choice of the hand soap, both *p* > .29. Critically, the interaction of experimental list and product scent was significant, χ2(1) = 6.15, *p* = .013. As predicted, participants preferred whichever soap included a picture of the scented object in the ad (59% of choice overall). Participants preferred the clementine soap when its ad contained a picture of clementines (57% choice), but preferred the pear soap when its ad contained a picture of pears (61%).[[2]](#footnote-2) Thus, by simply including a picture of the scented object in an advertisement, we significantly reversed consumers’ consequential choices of a real product.

# **Web Study 2**

Web Study 2 provided a preregistered, between-participants test of olfactory imagery using Koubaa and Eleuch’s (2021) verbal protocol procedure for an open-ended, text-based measure of olfactory imagery. We created two ads for a lavender-scented laundry detergent, one with a picture of lavender (*picture* condition) and one with no picture (*control* condition; see Figure W2). Participants first viewed one of the ads and then completed a short distractor task. Then, without seeing the ad again, participants were asked to describe their thoughts about (1) the previously shown ad, and (2) the smell of the advertised product. As our measures of olfactory imagery, we coded (1) whether participants included scent-related words in their descriptions of the ad, and (2) the extent of olfactory imagery in their descriptions of the product. We predicted that the picture condition would elicit more scent-related words (e.g., “lavender”) and would evoke more olfactory imagery than the control condition.

**Figure W2.** Stimuli, Web Study 2.

A picture containing indoor

Description automatically generatedA picture containing text, indoor, bed

Description automatically generated

***Methods***

Two hundred UK-based respondents (*M* = 41 years, *SD* = 11; 129 females) on Prolific were randomly assigned to one of two conditions (picture, control). Stimuli are shown in Figure W2. Participants first completed the introductory block (see Study 1A for details), except that we did not include an attention check in this study because we assumed the writing task (described below) was intensive enough to discourage inattentive participants. After this introductory block, participants were briefly informed that they would be participating in multiple tasks, and they were instructed as follows: “Below is an ad for a laundry detergent from EveryDay brand. Please take your time and view the ad as you would normally view any ad.” Participants viewed the ad for at least five seconds, during which time they were prevented from advancing to the next page. Once they advanced to the next page, they were introduced to a task in which they would complete six simple calculation problems (e.g., 5 X 2; 3 + 33). This served as a filler task; we chose a numerical task so as not to interfere with olfactory processing. We also measured the time they took to solve the problems, to ensure that both groups had an equivalent delay before the next task.

On the next page, they were introduced to yet another task with the following instructions: “This question is about the ad you viewed earlier for the EveryDay laundry detergent. Please write at least 4 sentences reporting the thoughts that came across your mind while seeing the EveryDay ad.” Then, on a separate page, they were asked “Now please describe and report the smell of the advertised product.” We included two distinct measures to capture both (1) the likelihood of spontaneously including scent in their description of the ad and (2) the extent of olfactory imagery in their description of the product smell. Finally, on a separate page, participants completed the concluding block (see Study 1A for details).

***Results and Discussion***

None of the control measures (i.e., sex, age, liking of the scent, involvement with the product) differed significantly between conditions, all *p* > .07. There was also no difference in the time taken to solve the math problems (*M* = 24 seconds, *p* = .89), nor in the number of math problems solved correctly (*M* = 5.98, *p* = .70), indicating that the distractor task was equally easy and quick for both groups.

Three research assistants, who were blind to experimental conditions, coded participants’ text responses to create two preregistered measures of olfactory imagery. For participants’ general descriptions of the ad, the coders independently coded whether each response included any scent-related word (i.e., scent, lavender, smell, olfaction, aroma, fragrance, or any synonym of these). Coding discrepancies were resolved by discussion until consensus. As predicted, participants were significantly more likely to mention scent-related words in the picture condition (82%) than in the control condition (56%), χ2 = 15.80, *p* < .001.

For participants’ descriptions of the product smell, the coders independently rated the extent to which the participant appeared to engage in olfactory imagery (scale: 1 = none to 5 = a great deal). We averaged the three coders’ ratings (Cronbach α = .89), and as predicted, olfactory imagery was significantly higher in the picture condition (*M* = 2.30, *SD* = .72) than in the control condition (*M* = 1.95, *SD* = .80), *t*(198) = 3.29, *p* = .001, *d* = .46. Thus, the picture of lavender in the ad increased both the likelihood of describing the ad with scent-related words and the extent of olfactory imagery when describing the product’s scent. These results provide further evidence that a picture of a scented object in a marketing communication enhances olfactory imagery.

# **Web Study 3**

This study provided a preregistered, between-participants test of the visual-olfactory effect (**H1**) and its presumed mediation by olfactory imagery (**H2**), using a different product and scent (lemon-scented cleaning spray) than Study 2A (lavender-scented laundry detergent). We created two packages for a cleaning spray, one with a picture of cut lemons (*lemon* condition) and one with no picture (*control* condition; see Figure W3). Participants viewed one of the packages, and as in Study 2A, we controlled the awareness of the product scent by requiring all participants to correctly identify the scent before they could proceed to the main study. They then evaluated the product, and rated the olfactory imagery and visual attractiveness of the package.

**Figure W3.** Stimuli, Web Study 3.



***Methods***

Two hundred UK-based respondents (*M* = 34 years, *SD* = 10; 60 males) on Prolific were randomly assigned to one of two conditions (picture, control). Stimuli are shown in Figure W3. The procedure was identical to Study 2A, except that we reduced the 13-item measure of olfactory imagery to the 3-item measure that we developed (i.e., “AU-3” in Table W1): “This product evokes a scent in my mind”, “I can imagine a fragrance by seeing the product”, “While looking at the product, I imagined the smell of lemon”.

***Results and Discussion***

None of the control measures (sex, age, liking of the scent, involvement with the product) differed significantly between conditions, all *p* > .35. We averaged the three olfactory imagery items into an olfactory imagery index (Cronbach α = .87), the three visual attractiveness items into a visual attractiveness index (α = .97), and the three product attitude items into a product attitude index (α = .90). As predicted, independent samples *t*-tests revealed significantly greater olfactory imagery when the label included a picture of a lemon (*M* = 3.79, *SD* = .86) than when it did not (*M* = 2.60, *SD* = 1.08), *t*(198) = 8.57, *p* < .001, *d* = 1.21, and significantly more positive attitudes toward the product with the picture (*M* = 3.30, *SD* = .83) than without it (*M* = 2.77, *SD* = .95), *t*(198) = 4.22, *p* < .001, *d* = .60. The product was also significantly more visually attractive with the lemon picture (*M* = 2.96, *SD* = 1.07) than without it (*M* = 2.34, *SD* = 1.07), *t*(198) = 4.11, *p* < .001, *d* = .58.

Before testing **H2** via mediation analysis, we tested for discriminant validity between our mediator variable (olfactory imagery) and dependent variable (product attitude), in two ways. First, we submitted the three olfactory imagery items and the three product attitude items to a principal components analysis with Varimax rotation. The results confirmed two latent factors (i.e., with eigenvalue > 1.0) among the six items: one consisting of the three olfactory imagery items, and one consisting of the three product attitude items. That is, the two measures emerged as distinct constructs. Second, we examined the correlation between the olfactory imagery and product attitude indexes (i.e., the two averaged measures). A sweetspot analysis (Pieters 2017) indicated that olfactory imagery and product attitude exhibited sufficient discriminant validity (Pearson *r* = .48, *p* < .001) for meaningful mediation.

We therefore conducted a bootstrap mediation analysis (Hayes 2013, model 4, 10K samples) with label condition as independent variable (control = 0, lemon = 1), olfactory imagery as mediator, and product attitude as dependent variable. As preregistered, we also included visual attractiveness as a covariate. As predicted, the lemon picture increased olfactory imagery (A-path; *B* = .98, *t* = 7.28, *p* < .001), which in turn improved product evaluation (B-path; *B* = .16, *t* = 3.35, *p* = .001), thus producing a significant indirect (mediation) effect, *B* = .16, *CI* = .06 to .26. The direct effect was nonsignificant, *CI* = -.19 to .20. The indirect effect was also significant and even larger when visual attractiveness was not included as a covariate, *B* = .44, *CI* = .29 to .61. Thus, a package with a picture of cut lemons improved product evaluations by increasing olfactory imagery of lemons, even after controlling for visual attractiveness and scent awareness. We also obtained this indirect effect in a similar study conducted in the lab.[[3]](#footnote-3) These results support **H1** and **H2**.

# **Web Study 4**

This study tested whether individuals’ need for smell moderates the effect of a scent-inducing picture on product evaluation (**H3**). We replicated Study 1A, in which participants chose between dish soaps that included a picture of either whole lemons (lower olfactory imagery) or cut lemons (higher olfactory imagery). In this study, however, we additionally measured participants’ need for smell. We predicted that consumers are more likely to choose the dish soap with a picture of cut lemons on the label (**H1**), and that this preference is stronger among consumers who have a higher need for smell (**H3**). This study was preregistered.

***Methods***

Because we were testing for moderation (i.e., whether individuals’ need for smell predicts choice of the cut-lemons label), we increased the sample size relative to Study 1A: We recruited 400 residents of the UK or Ireland (*M* = 42 years, *SD* = 13; 151 males) on Prolific. The stimuli and procedure were identical to those of Study 1A, with two exceptions. First, after choosing which product they would be more likely to buy, here we used the 3-item measure of olfactory imagery validated in Study 2A (see Web Appendix) instead of the single-item measure used in Study 1A. Second, after evaluating the olfactory imagery evoked by each label, participants completed the 11-item ENFAS measure of the need for smell (Koller et al. 2023), which consists of an informational dimension (e.g., “When I smell a product, it helps me judge its quality”) and an affective dimension (e.g., “I like to smell certain products”). ENFAS items were rated on a scale from 1 (strongly disagree) to 7 (strongly agree).

***Results and Discussion***

One participant failed the attention check and, as preregistered, was excluded from analyses. None of the control measures of sex, age, involvement with the product, or liking of the scent significantly predicted choice, all *p* > .06.

As predicted, a significant majority of participants (75%) preferred the label with cut lemons, χ2(1) = 101.26, *p* < .001. Olfactory imagery (α = .85) was also significantly higher from the cut-lemons label (*M* = 4.18, *SD* = .70) than from the whole-lemons label (*M* = 3.56, *SD* = .92), *t*(398) = 13.38, *p* < .001, *d* = .67. As in Study 1A, we tested whether olfactory imagery predicted label preference by subtracting ratings of the whole-lemon label from ratings of the cut-lemon label. A binary logistic regression confirmed that olfactory imagery significantly predicted label choice, Wald χ2 = 52.98, *B* = 3.49, *p* < .001. This result also held when instead using olfactory imagery from the cut-lemon label alone (i.e., without subtracting olfactory imagery from the whole-lemon label), Wald χ2 = 36.31, *B* = 1.10, *p* < .001. These results fully replicate those of Study 1A.

Scores on the ENFAS need for smell scale were highly variable (Range = 1.00 – 7.00, *M* = 5.28, *SD* = .85) and normally distributed (skew = -.75), indicating suitability for regression analyses. As predicted, individuals’ need for smell significantly predicted choice, Wald χ2 = 5.35, *B* = .31, *p* = .021. This moderating effect, though significant, was small. For illustrative purposes, we conducted a median split on participants’ need for smell scores. 71.6% of participants with a lower need for smell (*M* = 4.65, *SD* = .64) chose the cut-lemons label, whereas 79.3% of participants with a higher need for smell (*M* = 5.98, *SD* = .38) chose the cut-lemons label. Thus, those with a higher need for smell were 7.7% more likely to choose the cut-lemons label. Exploratory analyses revealed that the relation between need for smell and choice of the cut-lemons label was due primarily to the affective dimension of the ENFAS, which itself significantly predicted choice, Wald χ2 = 6.77, *B* = .30, *p* = .009, rather than the informational dimension, which did not predict choice, *p* = .104.[[4]](#footnote-4)

In sum, as in Study 1A, participants were significantly more likely to buy the dish soap with a picture of cut lemons than with a picture of whole lemons, and olfactory imagery predicted that preference. These results support **H1** and **H2**. Additionally, individuals’ need for smell moderated the preference for the cut-lemons label. The stronger one’s need for smell, the more likely they were to choose the label with cut lemons. This result supports **H3**. These results were not attributable to visual attractiveness, which was matched across conditions (see Study 1A). Nor were they attributable to the salience or awareness of the scent, as both labels had the same number of scent cues.

# **Additional Analyses: Study 2A**

Study 2A included several measures of olfactory imagery: an adaptation of Bone and Ellen’s (1992) *ease* of imagination, an adaptation of Babin and Burns’ (1998) *elaboration* of imagery, an adaptation of Babin and Burns’ (1998) *vividness* of imagery, and three olfactory-specific items developed by the present authors. The correlations among these measures are shown below in Table W1. “AU-3” refers to the authors’ 3-item measure of olfactory imagery, used in Studies 2B, 3, and 4 (Post-Test) and in Web Study 3, and “AU-1” refers to the authors’ 1-item measure of olfactory imagery, used in Studies 1A, 1B and 5.

**Table W1.** Correlations (Pearson *r*) among measures of olfactory imagery, Study 2A.



*Note.* All correlations are *p* < .001.

Each measure correlated strongly and significantly with each other measure (all *r* ≥ .69 and *p* < .001). The authors’ 3-item measure (AU-3) correlated most strongly with the other measures (all *r* ≥ .77 and *p* < .001), suggesting that this measure best encapsulated the various dimensions of olfactory imagery. Even the authors’ single-item measure (AU-1; “This [ad/label/product] evokes a scent in my mind”) showed high convergence with the other measures developed in prior research (all *r* ≥ .72 and *p* < .001). Thus, the various measures of olfactory imagery strongly converged, and hence they also validate the use of the AU-3 and AU-1 measures in other studies.

In Study 2A, we found in a principal components analysis that one of the thirteen olfactory imagery items did not load clearly onto the olfactory imagery factor (see main document). As preregistered, we therefore excluded that item from our main analyses, reporting results from the average of the remaining twelve olfactory imagery items. When we instead retain all thirteen items, the results remain unchanged: The picture condition again elicited greater olfactory imagery than the control condition, *t*(198) = 3.98, *p* < .001, *d* = .56, and olfactory imagery again mediated the effect of the picture on product attitudes, *B* = .07, *CI* = .01 to .15. Thus, the results of Study 2A were robust across both the trimmed 12-item version and the full 13-item version of this composite measure.

# **Additional Analyses: Study 2B**

Study 2B had a 2 (salience of scent: 1 cue, 2 cues) × 2 (picture of scented object: present, absent) between-participants design. We preregistered (i) a significant main effect of picture, and significant differences between the text+picture condition and (ii) the text-only condition and (iii) the text+text condition. Those three analyses are reported in the main text, and all three predictions were supported, thus providing strong evidence of the visual-olfactory effect (**H1**). In the main text we also report that the picture-only condition evoked stronger olfactory imagery and more positive evaluations than the text-only condition.

Here we report exploratory analyses comparing the remaining conditions, again with age included as a covariate (ANCOVA). Interestingly, the comparison of the picture-only and text+picture conditions (for which we preregistered no hypothesis) did not differ in olfactory imagery, *F*(1, 198) = .63, *p* = .429, *d* = .10, but they did differ significantly in product attitudes, *F*(1, 198) = 5.19, *p* = .024, *d* = .27. That is, when the product scent was conveyed only via picture with no corresponding text (i.e., picture-only), the picture evoked strong olfactory imagery, but that only partially improved consumers’ product evaluations. We speculate that the picture-only condition elicited slightly less positive product attitudes because this condition is perceived as odd (i.e., it rarely if ever occurs in the real market) and/or because the lack of textual indication of the product’s scent induces uncertainty about the product’s scent.

In contrast, the picture-only condition evoked stronger olfactory imagery than the text+text condition, *F*(1, 198) = 42.67, *p* < .001, *d* = .93, but those conditions did not differ in product attitudes, *F*(1, 198) = 1.02, *p* = .313, *d* = .16. The increased olfactory imagery in the picture-only condition is presumably due to the presence of the picture. However, we speculate that the null difference in product attitudes may be due to the negative effect(s) of oddity and/or uncertainty (see above) nullifying the positive effect of olfactory imagery in the picture-only condition.

Finally, the text+text condition did not differ significantly from the text-only condition in either olfactory imagery, *F*(1, 197) = 3.17, *p* = .077, *d* = .25, or product attitudes, *F*(1, 197) = 2.10, *p* = .149, *d* = .19. This result reveals that scent salience, in terms of the number of scent cues, is not sufficient to enhance olfactory imagery or improve evaluations.

# **Additional Analyses: Exclusions and Covariates**

The following analyses present results of each study when analyzed in alternative ways, such as without excluding participants who failed an attention check (Studies 1A, 1B, 3, 4, and 5, and Web Study 1), without including covariates (Studies 2A, 2B, 3, and 4, Web Study 4), or without excluding participants who failed to correctly identify the product scent (Study 4).

## **Web Study 1**

All participants, regardless of their response to the attention check, were included in the following analysis (*N* = 200). Critically, the interaction of experimental list and product scent remained significant, χ2(1) = 5.79, *p* = .016. As predicted, participants preferred whichever soap included a picture of the scented object in the ad (58% of choice overall). Participants preferred the clementine soap when its ad contained a picture of clementines (56% choice), but preferred the pear soap when its ad contained a picture of pears (61%).

## **Web Study 2**

There were no exclusions or covariates.

## **Study 1A**

***A. No participant exclusions based on attention check.*** All participants, regardless of their response to the attention check, were included in the following analysis (*N* = 101). Critically, a significant majority of participants (71%) preferred the label with cut lemons, χ2(1) = 18.31, *p* < .001. Olfactory imagery was also significantly higher from the cut-lemons label (*M* = 4.20, *SD* = .93) than from the whole-lemons label (*M* = 3.65, *SD* = .96), *t*(100) = 4.97, *p* < .001, *d* = .50. To test whether olfactory imagery predicted label preference, we subtracted ratings of the whole-lemon label from ratings of the cut-lemon label (positive scores indicate greater imagery from the cut lemons). A binary logistic regression with liking of the scent as a covariate confirmed that olfactory imagery significantly predicted label preference, Wald χ2 = 15.89, *B* = 2.08, *p* < .001. Olfactory imagery from the cut-lemon label alone (i.e., without subtracting olfactory imagery from the whole-lemon label) also significantly predicted label preference, Wald χ2 = 7.86, *B* = 0.93, *p* < .01.

***B. No covariates.*** Three participants who failed the attention check were excluded. A significant majority of participants (71%) preferred the label with cut lemons, χ2(1) = 18.00, *p* < .001. Olfactory imagery was also significantly higher from the cut-lemons label (*M* = 4.20, *SD* = .94) than from the whole-lemons label (*M* = 3.64, *SD* = .98), *t*(97) = 4.99, *p* < .001, *d* = .50. To test whether olfactory imagery predicted label preference, we subtracted ratings of the whole-lemon label from ratings of the cut-lemon label (positive scores indicate greater imagery from the cut lemons). A binary logistic regression confirmed that olfactory imagery significantly predicted label preference, Wald χ2 = 18.28, *B* = 2.19, *p* < .001. Olfactory imagery from the cut-lemon label alone (i.e., without subtracting olfactory imagery from the whole-lemon label) also significantly predicted label preference, Wald χ2 = 12.28, *B* = 1.09, *p* < .001.

## **Study 1B**

All participants, regardless of their response to the attention check, were included in the following analysis (*N* = 100). Most importantly, a significant majority of participants (61%) preferred the ad with a rose, χ2(1) = 4.84, *p* = .03. Olfactory imagery was also significantly higher from the rose ad (*M* = 4.07, *SD* = .77) than from the sunflower ad (*M* = 3.11, *SD* = 1.11), *t*(99) = 7.12, *p* < .001, Cohen’s *d* = .71. To test whether olfactory imagery predicted ad preference, we subtracted ratings of the sunflower ad from ratings of the rose ad (positive scores indicate greater imagery of the rose). A binary logistic regression confirmed that olfactory imagery significantly predicted ad preference, Wald χ2 = 22.26, *B* = 1.33, *p* < .001. Olfactory imagery from the rose ad alone (i.e., without subtracting olfactory imagery from the sunflower ad) also significantly predicted ad preference, Wald χ2 = 14.54, *B* = 1.85, *p* < .001.

## **Study 2A**

There were no participant exclusions. We preregistered that we would include visual attractiveness as a covariate in the mediation analysis. In the main text, we report the indirect (mediation) effect both with and without that covariate.

## **Web Study 3**

There were no participant exclusions. We preregistered that we would include visual attractiveness as a covariate in the mediation analysis. We report the indirect (mediation) effect both with and without that covariate above (see Web Study 3).

## **Study 2B**

***No covariate*:** There were no participant exclusions as there was no attention check in the study. Separate 2 (salience) × 2 (picture) ANOVAs on olfactory imagery and product attitudes, without age included as a covariate, revealed significant main effects of picture on both olfactory imagery, *F*(1, 397) = 123.93, *p* < .001, and product attitudes, *F*(1, 397) = 15.02, *p* < .001. As predicted, the picture-present conditions evoked greater olfactory imagery (*M* = 3.90, *SD* = .91) than the picture-absent conditions (*M* = 2.68, *SD* = 1.27), and more positive attitudes (*M* = 3.51, *SD* = 1.05) than the picture-absent conditions (*M* = 3.09, *SD* = 1.14). This result supports **H1**. The effect of salience was marginal on olfactory imagery, *F*(1, 397) = 3.31, *p* = .07, and significant on product attitudes, *F*(1, 397) = 5.26, *p* = .02, with greater olfactory imagery from two olfactory cues in the ad (*M* = 3.39, *SD* = 1.23) than from only one cue (*M* = 3.19, *SD* = 1.29) and more positive attitudes from two cues (*M* = 3.43, *SD* = 1.06) than from one cue (*M* = 3.18, *SD* = 1.15). The salience × picture interaction was nonsignificant on both olfactory imagery, *p* = .30, and product attitudes, *p* = .78.

In addition to the main effect of picture reported above, we also preregistered more specifically that the text+picture condition should evoke stronger olfactory imagery and more positive attitudes than both the text-only and the text+text conditions. As predicted, the text+picture condition indeed evoked stronger olfactory imagery, *F*(1, 198) = 84.01, *p* < .001, and more positive attitudes, *F*(1, 198) = 18.79, *p* < .001, than the text-only condition. These results replicate the findings of our prior studies. Crucially, the text+picture condition also evoked stronger olfactory imagery, *F*(1, 200) = 51.31, *p* < .001, and more positive attitudes, *F*(1, 200) = 9.55, *p* = .002, than the text+text condition.

Exploratory analyses revealed that the picture-only condition evoked stronger olfactory imagery, *F*(1, 197) = 73.57, *p* < .001, and more positive attitudes, *F*(1, 197) = 5.88, *p* = .016, than the text-only condition.

Mediation by Olfactory Imagery. A sweetspot analysis (Pieters 2017) indicated that olfactory imagery and product attitude exhibited sufficient discriminant validity (*r* = .58, *p* < .001) for meaningful mediation. We therefore conducted a bootstrap mediation analysis (Hayes 2013, model 4, 10K samples) with picture condition as independent variable (picture-absent = 0, picture-present = 1), olfactory imagery as mediator, and product attitude as dependent variable. Due to the lack of salience × picture interaction, this mediation analysis collapses across the salience variable (i.e., text-only and text+text conditions are combined, and picture-only and text+picture conditions are combined). As predicted, the picture of clementines increased olfactory imagery (A-path; *B* = 1.22, *t* = 11.09, *p* < .001), which in turn improved product attitude (B-path; *B* = .56, *t* = 13.68, *p* < .001), thus producing a significant indirect (mediation) effect, *B* = .68, CI95 = [.54, .84]. The direct effect was also significant, *B* = -.26, CI95 = [-.47, -.06].

## **Study 3**

All participants, regardless of the attention check, were included in the following analysis (*N* = 400). As predicted, paired-samples *t*-tests revealed significantly greater olfactory imagery in the cut-lemon condition (*M* = 4.18, *SD* = .75) than in the whole-lemon condition (*M* = 3.49, *SD* = 0.92), *t*(399) = 14.77, *p* < .001, *d* = .74, and significantly more positive attitudes toward the ad in the cut-lemon condition (*M* = 3.72, *SD* = .82) than in the whole-lemon condition (*M* = 3.49, *SD* = 0.78), *t*(399) = 6.67, *p* < .001, *d* = .33.

Next, we tested whether olfactory imagery mediated the effect of picture (cut vs. whole lemon) on product evaluation (Montoya and Hayes 2017, MEMORE model 1, 10K reps). The effect of the picture on olfactory imagery was significant (*B* = .70, *t* = 14.77, *p* < .001). Similarly, olfactory imagery had a significant positive effect on product evaluations (*B* = .56, *t* = 19.67, *p* < .001). The indirect effect of the picture on product evaluation through olfactory imagery was significant, *B* = .39, *CI95* = [.32, .47]. The direct effect was also significant, *B* = -.15, CI95 = [-.21, -.08]. As predicted, olfactory imagery mediated the effect.

We first tested whether the need for smell (ENFAS scores) moderated the effect of picture (cut vs. whole lemon) on product evaluations (Montoya 2019, MEMORE model 2, 10K reps). The index of moderation was significant, *B* = .13, *t*(398) = 3.12, *p* = .002. Next, we tested whether the effect of olfactory imagery (difference of cut- and whole-lemon conditions) on product evaluation (difference of cut- and whole-lemon conditions) was moderated by the need for smell (Hays 2013, PROCESS model 1, 10K reps). There was no main effect of olfactory imagery (*CI95* = [-.22, .44]) or ENFAS (*CI95* = [-.07, .07]). However, as predicted, the interaction was significant, *B* = .08, *t*(396) = 2.59, *p* = .01.

## **Web Study 4**

All participants, regardless of the attention check, were included in the following analysis (*N* = 400). None of the control measures of sex, age, or liking of the scent significantly predicted choice, all *p* > .06.

As predicted, a significant majority of participants (75.25%) preferred the label with cut lemons, χ2(1) = 102.01, *p* < .001. Olfactory imagery (α = .88) was also significantly higher from the cut-lemons label (*M* = 4.18, *SD* = .70) than from the whole-lemons label (*M* = 3.57, *SD* = .92), *t*(399) = 13.43, *p* < .001, *d* = .67. As in Study 1A, we tested whether olfactory imagery predicted label preference by subtracting ratings of the whole-lemon label from ratings of the cut-lemon label. A binary logistic regression confirmed that olfactory imagery significantly predicted label choice, Wald χ2 = 53.16, *B* = 3.49, *p* < .001. This result also held when instead using olfactory imagery from the cut-lemon label alone (i.e., without subtracting olfactory imagery from the whole-lemon label), Wald χ2 = 36.56, *B* = 1.11, *p* < .001. These results fully replicate those of Study 1A.

Scores on the ENFAS need for smell scale were highly variable (Range = 1.00 – 7.00, *M* = 5.28, *SD* = .85) and normally distributed (skew = -.75), indicating suitability for regression analyses. As predicted, individuals’ need for smell significantly predicted choice, Wald χ2 = 5.42, *B* = .31, *p* = .020.

## **Study 4**

***A. No participant exclusions based on attention check.*** All participants, regardless of their response to the attention check, were included in the following analysis (*N* = 402). Separate 2 (centrality) × 2 (picture) ANOVAs on the control factors revealed an age difference between the picture and control conditions, *F*(1, 398) = 3.91, *p* < .05, and a significant interaction on product involvement, *F*(1, 398) = 6.53, *p* < .05. Therefore, age and involvement were both included as covariates in the subsequent analysis.

Overall, 91.29% of participants correctly identified lemon as the scent of the product. However, the picture of lemons significantly increased participants’ awareness, χ2 = 20.02, *p* < .001. Specifically, 97.06% of participants correctly identified the lemon scent in the picture conditions, whereas only 85.35% in the control conditions identified the lemon scent. To examine the effect of pictures on product attitudes – independent of this awareness benefit – we excluded those 8.71% of participants who failed to correctly identify the lemon scent. Thus, 367 participants were included in the following analyses. A 2 (centrality: high, low) × 2 (picture: present, absent) ANCOVA revealed significant main effects of centrality, *F*(1, 361) = 15.45, *p* < .001, and picture, *F*(1, 361) = 5.12, *p* < .05. More importantly, the predicted interaction was significant, *F*(1, 361) = 4.08, *p* < .05. A picture of a scented object (lemon) improved evaluations of a high-centrality product (cleaning spray), *t*(189) = 3.42, *p* < .001, *d* = .50, but had no effect on a low-centrality product (lint roller), *p* = .39.

***B.* *No covariates used.*** Five participants who failed the attention check were excluded. Separate 2 (centrality) × 2 (picture) ANOVAs on the control factors revealed an age difference between the picture and control conditions, *F*(1, 393) = 3.82, *p* = .051, and a significant interaction on product involvement, *F*(1, 393) = 7.57, *p* < .01. However, in the following analysis, we did not include these two factors as covariates.

Overall, 91.20% of participants correctly identified lemon as the scent of the product. However, the picture of lemons significantly increased participants’ awareness, χ2 = 17.22, *p* < .001. Specifically, 98.00% of participants correctly identified the lemon scent in the picture conditions, whereas only 85.20% in the control conditions identified the lemon scent. We excluded 8.80% of participants who failed to correctly identify the lemon scent. Thus, 362 participants were included in the following analyses.

A 2 (centrality: high, low) × 2 (picture: present, absent) ANOVA revealed significant main effects of centrality, *F*(1, 358) = 7.58, *p* < .01, and picture, *F*(1, 358) = 8.80, *p* < .01. However, the predicted interaction was not significant, *F*(1, 358) = 2.50, *p* = .107. Despite the nonsignificant interaction, a picture of a scented object (lemon) significantly improved evaluations of a high-centrality product (cleaning spray), *t*(188) = 3.50, *p* < .001, *d* = .51, but had no effect on a low-centrality product (lint roller), *p* = .38.

In this analysis, we did not include any covariates. While the *t*-test indicates that there is a positive impact of pictures of scented objects on evaluations for high-centrality products, there was no such effect for low-centrality products, as predicted. However, the interaction was not significant. Evidently, one or both covariates that differed significantly between conditions (i.e., age and involvement with the product) strongly influenced the evaluations of the product.

***C. No participant exclusions based on awareness check.*** Five participants who failed the attention check were excluded. Separate 2 (centrality) × 2 (picture) ANOVAs on the control factors revealed an age difference between the picture and control conditions, *F*(1, 393) = 3.82, *p* = .051, and a significant interaction on product involvement, *F*(1, 393) = 7.57, *p* < .01. Therefore, age and involvement were both included as covariates in the subsequent analysis.

Overall, 91.20% of participants correctly identified lemon as the scent of the product. However, the picture of lemons significantly increased participants’ awareness, χ2 = 17.22, *p* < .001. Specifically, 98.00% of participants correctly identified the lemon scent in the picture conditions, whereas only 85.20% in the control conditions identified the lemon scent. For the following analysis, no participant was excluded based on the awareness of the scent. Therefore, a total of 397 participants were included in the following analyses. A 2 (centrality: high, low) × 2 (picture: present, absent) ANCOVA revealed significant main effects of centrality, *F*(1, 391) = 18.02, *p* < .001, and picture, *F*(1, 391) = 6.15, *p* < .05. More importantly, the predicted interaction was marginally significant, *F*(1, 391) = 3.72, *p* = .054. A picture of a scented object (lemon) significantly improved evaluations of a high-centrality product (cleaning spray), *t*(201) = 3.28, *p* = .001, *d* = .46, but had no effect on a low-centrality product (lint roller), *p* = .21.

## **Study 5**

All participants, regardless of their response to the attention check, were included in the following analysis (*N* = 201). Lemon olfactory imagery ratings were subtracted from fish olfactory imagery ratings (*r* = -.37, *p* < .001) to form a single measure of olfactory imagery, whereby positive scores indicate stronger olfactory imagery of fish, and negative scores indicate stronger olfactory imagery of lemon. As predicted, the fish picture (*M*= 1.91, *SD* = 1.94) elicited stronger fish olfactory imagery than the oven picture (*M*= -.13, *SD* = 1.61), *t*(199) = 8.10, *p* < .001, *d* = 1.14, and the fish picture also elicited less positive product evaluations (*M*= 2.38, *SD* = 1.10) than the oven picture (*M*= 3.22, *SD* = .92), *t*(199) = 5.90, *p* < .001, *d* = .83. A bootstrap mediation analysis (Hayes 2013, model 4, 10K samples; oven = 0, fish = 1) revealed that the fish picture increased olfactory imagery of fish (A-path; *B* = 2.04, *t* = 8.10, *p* < .001), which in turn reduced product evaluation (B-path; *B* = -.25, *t* = 7.01, *p* < .001), thus producing a significant negative indirect (mediation) effect, *B* = -.52, *CI* = -.72 to -.32.

1. All preregistrations and all data are available in a Research Box (https://researchbox.org/2061&PEER\_REVIEW\_passcode=HCDLAL). [↑](#footnote-ref-1)
2. In a pilot version of this study (*N* = 199) with hypothetical choice, participants completed the exact same procedure as the main study, but instead were asked “Which of these two hand soaps would you be more likely to buy?” The predicted interaction of experimental list and product scent was again significant, χ2(1) = 6.19, *p* = .013. As in the main study, participants preferred the clementine soap when its ad contained a picture of clementines (60% choice) but preferred the pear soap when its ad contained a picture of pears (57%). [↑](#footnote-ref-2)
3. In an earlier version of this study conducted in the lab (*N* = 170) with slightly modified stimuli and with no measure of visual attractiveness, participants again indicated significantly greater olfactory imagery from the lemon label (*M* = 3.66, *SD* = 1.08) than from the control label (*M* = 2.72, *SD* = 1.12), *t*(168) = 5.57, *p* < .001, *d* = .79, and significantly more positive attitudes toward the lemon label (*M* = 2.98, *SD* = .80) than the control label (*M* = 2.71, *SD* = .82), *t*(168) = 2.18, *p < .05*, *d* = .33. The indirect (mediation) effect was again significant, *B* = .27, *CI* = .15 to .43, and the direct effect was nonsignificant, *CI* = -.24 to .25. [↑](#footnote-ref-3)
4. We preregistered that we would regress participants' choices on (1) olfactory imagery, (2) need for smell, (3) their interaction, and (4) any control variable(s) that significantly predicted choice (e.g., involvement). However, olfactory imagery and need for smell were significantly correlated, causing severe multicollinearity and invalidating the analysis. We therefore analyzed the effects of olfactory imagery and need for smell separately. [↑](#footnote-ref-4)