



Making a big splash: Packaging imagery with implied motion enhances product liking through design appeal and naturalness perception

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3 1 **Title**
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5 2 Making a big splash: Packaging imagery with implied motion enhances product liking through design
6 3 appeal and naturalness perception
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9 4 **Abstract**

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11 5 • **Purpose.** This paper aims to investigate how implying movement in food packaging imagery
12 6 may affect product liking. Furthermore, the underlying mechanism is investigated by studying
13 7 the effect of implied motion visuals on design appeal and naturalness perception.
14 8 • **Design/methodology/approach.** Two packages of pineapple juice were designed in which
15 9 the implied motion depicted in their imagery was manipulated, and a tasting experiment was
16 10 conducted in which two samples of the same juice were evaluated.
17 11 • **Findings.** The results show that the effect of packaging imagery on product liking occurs
18 12 indirectly through both design appeal and the product naturalness perception. The results of
19 13 a parallel multiple-mediator analysis show that (1) depicting implied motion made the package
20 14 be perceived as more appealing, (2) the product corresponding to the package depicting
21 15 implied motion was perceived as being more natural, and (3) both effects equally contributed
22 16 to the positive effect of visuals depicting implied motion on product liking.
23 17 • **Originality/value.** Overall, these findings widen our understanding of the effects of packaging
24 18 design on product liking and may help both designers and manufacturers design more
25 19 appropriate packaging for their products.
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32 20 **Keywords**

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36 22 **Paper type**

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24 1. Introduction

25 Designers face numerous decisions when designing food packaging. For example, when it comes to
26 packaging imagery, they must decide on its primary subject (e.g. the product or its ingredients),
27 whether to depict the product alone or with other elements (e.g. a serving suggestion), and the
28 rhetorical style of the image (i.e. whether it has a symbolic or literal meaning). Although such
29 decisions are often based on intuition, research has shown that their impact goes beyond mere
30 aesthetics and can influence consumer perception and response (Gil-Pérez *et al.*, 2020). For
31 example, prior studies show that displaying an image on packaging helps to attract attention and
32 increase purchase intention (Simmonds and Spence, 2017), that food imagery evokes sensory
33 associations related to taste, appearance and texture (Rebollar *et al.*, 2016, 2017; Smith *et al.*,
34 2015), and that symbolic imagery can lead to higher-level inferences about expected product
35 attributes (Fenko *et al.*, 2018; Festila and Chrysochou, 2018; Gil-Pérez, Rebollar, Lidón, Martín, *et*
36 *al.*, 2019).

37 One of the decisions that designers have to make is whether to include implied motion in packaging
38 imagery. The term “implied motion” usually refers to the dynamic information extracted from static
39 visuals, such as a picture of an athlete in the middle of a run or a ball falling to the ground (Kourtzi
40 and Kanwisher, 2000). Within the food-packaging context, implied motion can be frequently seen in
41 packaging imagery depicting events such as splashing (e.g., a stream of milk splashing from a bowl),
42 pouring (e.g., yoghurt being poured into a glass), or explosions (e.g., a bunch of chocolate chips
43 shooting out of a cracking cookie; Yu *et al.*, 2023). However, despite its widespread use as a graphic
44 tool in food packaging, the number of studies dedicated to assessing the effects of implied motion on
45 consumer perception remains relatively modest (Yu *et al.*, 2022). To date, these studies have mainly
46 focused on analysing the effects of implied motion on product freshness expectations (Amar *et al.*,
47 2021; Gvili *et al.*, 2015, 2017)¹, healthiness expectations (Amar *et al.*, 2021), taste expectations
48 (Amar *et al.*, 2021; Gvili *et al.*, 2017; Li and Liu, 2022; Mulier *et al.*, 2021; Xiong *et al.*, 2023; Yu *et al.*,
49 2022), attention (Yu *et al.*, 2022) and purchase intention (Yu *et al.*, 2022). Building on grounded
50 cognition and processing fluency theories, this study goes a step further to show that displaying
51 implied motion in packaging imagery can enhance product liking during tasting, and that the influence
52 of implied motion on product liking is mediated in parallel by packaging appeal and naturalness
53 perceptions. These findings contribute to the literature by demonstrating that implied motion can
54 affect consumer evaluations not only by influencing in-store expectations, but also by increasing
55 overall liking of the product during the tasting process. Furthermore, they suggest two possible
56 mechanisms behind this effect.

57 2. Theoretical background

58 2.1. Implied motion effect on product liking during tasting

¹ Although some of Wansink's papers have been retracted due to concern about the validity of their results, as far as we know, that is not the case for the findings reported by Gvili *et al.* (2015, 2017) (<https://retractionwatch.com/?s=wansink>).

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3 59 Research on cognitive psychology has investigated how static visuals can elicit a perception of
4 60 movement and how implied motion can be used to modulate consumer behaviour and response.
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6 61 Cian *et al.* (2014) investigated how brand logos can create a perception of movement through
7 62 implied motion, and consequently influence consumer engagement and attitudes towards the brand.
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9 63 Their findings show that static brand logos can evoke perceptions of motion, which increases
10 64 consumer engagement and positively influences attitudes towards the brand. They also show that
11 65 this relationship is moderated by the congruence between the evoked dynamism of the logo and the
12 66 brand characteristics, where, for example, a traditional brand with a dynamic logo is considered
13 67 incongruent and a traditional brand with a static logo is considered congruent.

16 68 Other authors have shown that images with implied motion can enhance the expected taste of food.
17 69 Following up on the results of an earlier paper (Gvili *et al.*, 2015), Gvili *et al.* (2017) conducted four
18 70 experiments in which they showed that food presented in motion generates better taste expectations
19 71 than food presented still. Amar *et al.* (2021) subsequently extended these findings by showing that
20 72 imagery depicting implied motion causes foods presented in motion to be perceived as healthier, and
21 73 that this increase in perceived healthiness due to motion does not negatively affect taste
22 74 expectations. The results of more recent studies by Li and Liu (2022), Yu *et al.* (2022) and Xiong *et*
23 75 *al.* (2023) confirmed these findings, showing that a food image with implied motion increases taste
24 76 expectations (for an exception, see Mulier *et al.*, 2021). Although none of these studies examined the
25 77 effect of implied motion on product liking, their findings suggest that images depicting implied motion
26 78 may increase product liking. Taste is the main driver of overall food liking (Andersen *et al.*, 2019), so
27 79 it is likely that better taste expectations will translate into higher product liking.

33 80 From a theoretical point of view, both processing fluency and grounded cognition theories provide
34 81 theoretical frameworks to explore why visual aspects of packaging design such as implied motion
35 82 imagery might influence product liking during tasting (Barsalou, 2008; Li, Zeng, *et al.*, 2020; Xia *et al.*,
36 83 2023). According to processing fluency theory, the ease with which information is processed
37 84 enhances positive evaluations and judgments (Alter and Oppenheimer, 2009). This notion has
38 85 significant implications for how packaging design can influence product liking. For example, studies
39 86 by Gmuer *et al.* (2015) and Bigoin-Gagnan and Lacoste-Badie (2018) illustrate how packaging that
40 87 facilitates easy sensory or conceptual processing can enhance product evaluations, particularly
41 88 during tasting experiences, by making fluently processed information more mentally accessible and
42 89 enjoyable. Gmuer *et al.* (2015) found that wine labels with high processing fluency (easy-to-read
43 90 fonts) led to a more positive hedonic taste evaluation, regardless of the consumption occasion.
44 91 Similarly, Bigoin-Gagnan and Lacoste-Badie (2018) demonstrated that symmetrical packaging, by
45 92 reducing perceived visual complexity, increased perceptual fluency, thereby improving aesthetic
46 93 evaluations and intentions to purchase. In the implied motion literature, Li and Liu (2022) adopted a
47 94 processing fluency approach and demonstrated that images of food in motion favour higher levels of
48 95 affective fluency, thereby increasing taste expectations. Thus, visual elements that show implied
49 96 motion may increase product liking by facilitating easy sensory processing due to their ability to
50 97 attract attention (Yu *et al.*, 2022), increase consumer engagement (Cian *et al.*, 2014; Li *et al.*, 2020;
51 98 Roggeveen *et al.*, 2015) and provoke higher levels of affective fluency (Li and Liu, 2022).

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3 99 In addition, grounded-cognition theory posits that we understand the world by relying on
4 100 nonconscious simulations of contextually relevant sensory modalities (Barsalou, 2009). By relying on
5 101 mental simulations formed according to previous experiences, we are able to set expectations
6 102 regarding what a given sensory experience will be like (Barsalou, 2009). In the specific case of food,
7 103 that means that each interaction with a food item elicits a situated memory integrating information
8 104 from various sensory modalities (e.g., vision, smell, taste...), triggering a simulation of the expected
9 105 sensory experience (Papies *et al.*, 2020). Within the literature devoted to implied motion, Xiong *et al.*
10 106 (2023) adopted a mental simulation perspective and demonstrated that food presented in motion
11 107 increases taste expectations by promoting the mental simulation of eating it. Their research shows
12 108 that depicting implied motion in food advertisements activates mental simulations of sensory
13 109 experiences, thereby shaping consumer expectations regarding taste. Thus, packaging visuals with
14 110 implied motion may increase product liking by better simulating its sensory attributes, triggering
15 111 representations of taste, texture or smell (Papies *et al.*, 2020; Xiong *et al.*, 2023).

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21 112 Furthermore, the expanding body of literature on packaging influence on consumer perception
22 113 reveals that the impact of packaging visual cues such as implied motion may extend beyond the
23 114 purchasing stage, where expectations are typically set, to influence also consumer experience during
24 115 tasting (Motoki *et al.*, 2023). This insight is particularly interesting for designers and food companies,
25 116 considering that approximately one-third of products are consumed directly from their packaging
26 117 (Spence, 2017). For example, Becker *et al.* (2011) demonstrated that the shape of a yogurt package
27 118 can significantly influence product attitude. During a tasting event in a supermarket, they found that
28 119 yogurt from an angular-shaped package elicited a more positive product attitude compared to yogurt
29 120 in a rounded package. Meanwhile, Mizutani *et al.* (2010) showed that juices presented with pleasant
30 121 images were rated as more palatable than those presented with unpleasant images. Other studies
31 122 have explored how packaging cues such as colour (Spence and Velasco, 2018), texture (Ferreira,
32 123 2019), and imagery (Gil-Pérez *et al.*, 2020; Lidón *et al.*, 2018; Machiels and Karnal, 2016; Sakai and
33 124 Morikawa, 2006), influence product perception during tasting. However, no study has investigated
34 125 the potential effect of implied motion imagery at the moment of consumption.

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41 126 To date, studies investigating how packaging visual cues influence actual consumer perception have
42 127 yielded mixed results: while some have found significant effects, others have failed to do so and
43 128 reported null or limited results. In a recent systematic review exploring the conditions under which
44 129 visual cues influence perception during tasting (namely colour and shape), Motoki *et al.* (2023)
45 130 offered some clues as to why implied motion imagery might modulate consumer evaluation at the
46 131 moment of consumption. In their review, the authors suggest that studies investigating how visual
47 132 cues influence taste/flavour perception have had mixed results due to the presence of multiple
48 133 moderators and boundary conditions. Specifically, they suggest four: the salience/attentional capture
49 134 of visual cues, the perceived diagnosticity of visual cues in signalling taste/flavour, the strength of the
50 135 association between visual cues and taste/flavour, and the evaluative malleability of food judgments
51 136 (i.e. the degree to which food judgments are changeable or open to extraneous influences). In the
52 137 case of implied motion imagery, both salience and diagnosticity may be relevant. Presenting food in
53 138 motion increases the salience of the image (Acik *et al.*, 2014), which helps to capture attention (Yu *et al.*
54 139 *et al.*, 2022). In addition, consumers tend to view food images on packaging as diagnostic elements

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3 140 from which they can infer relevant information about product attributes (Gil-Pérez, Rebollar, Lidón,
4 141 Piqueras-Fiszman, *et al.*, 2019; Smith *et al.*, 2015). Thus, implied motion imagery could impact liking
5 142 during tasting because it is a salient and vivid cue from which consumers infer product information
6 143 (Gil-Pérez *et al.*, 2020). Therefore:

9 144 H1. Packaging imagery with implied motion (vs. without) will enhance (decrease) product
10 145 liking during tasting.

13 146 2.2. Packaging appeal as a mediator between implied motion and liking

15 147 The current study proposes that one way in which packaging imagery with implied motion may
16 148 increase product liking is by making the packaging design more appealing. Previous research has
17 149 shown that humans prefer images with implied motion (over completely still images) from very early
18 150 stages in life (Shirai and Imura, 2014, 2016), and that images depicting implied motion elicit a better
19 151 aesthetic experience than static visual cues (Bara *et al.*, 2021; Cazzato *et al.*, 2012; Di Dio *et al.*,
20 152 2016; Zhao *et al.*, 2020). In the context of food imagery, food presented in motion is rated as more
21 153 appealing than food presented still. Specifically, the results of two studies show that an image of
22 154 orange juice being poured into a glass (vs. an image of a glass of juice with no motion) increases the
23 155 appeal of the juice (Gvili *et al.*, 2015), and an image of milk being poured into a glass (vs. an image
24 156 of a glass of milk with no motion) increases the appeal of the milk (Yu *et al.*, 2022). It is therefore
25 157 expected that packaging with implied motion will be perceived as more appealing than packaging
26 158 with a static image:

32 159 H2a. Packaging imagery with implied motion (vs. without) will enhance (decrease) the
33 160 package design appeal.

36 161 In addition, although the specific effect of packaging appeal on product liking has not been explicitly
37 162 investigated yet, some studies have explored how enhancing food appeal through design makes the
38 163 food more palatable (Di Cicco *et al.*, 2020; Michel *et al.*, 2014; Techawachirakul *et al.*, 2023; Zellner
39 164 *et al.*, 2010, 2011, 2014). For example, Michel *et al.* (2014) showed that plating inspired by a work of
40 165 art increased the tastiness ratings of the food served on it, and Zellner *et al.* (2014) demonstrated
41 166 that consumers reported liking the same food more when the plating was rated as more attractive.
42 167 Furthermore, the literature suggests that appealing packaging increases the hedonic value of the
43 168 product it contains (Zhao *et al.*, 2019), positively influences brand preference by enhancing attitudes
44 169 towards the product (Wang, 2013), and increases purchase intention (Bigoin-Gagnan and Lacoste-
45 170 Badie, 2018). Accordingly, we propose:

50 171 H2b. The effect of packaging imagery with implied motion on product liking will be mediated
51 172 by the package design appeal.

54 173 2.3. Naturalness perception as a mediator between implied motion and liking

56 174 To further explore the mechanism of the proposed effect of implied motion on product liking, this
57 175 study presents naturalness perception as a potential mediator. Previous research shows that
58 176 imagery with implied motion enhances the freshness expectations of a food item (Amar *et al.*, 2021;
59 177 Gvili *et al.*, 2015, 2017; Li *et al.*, 2019; Yu *et al.*, 2022). These studies draw on evolutionary

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3 178 psychology, and show that images with implied motion trigger associations that relate the movement
4 179 of a food to its freshness. However, it is likely that implied motion also serves as a heuristic for the
5 180 quick judgement of other attributes related to freshness, such as naturalness. Freshness and
6 181 naturalness are interrelated factors (Román *et al.*, 2017; Sanchez-Siles *et al.*, 2019), especially for
7 182 products such as fruit juices that are intended to be consumed either fresh or with minimal levels of
8 183 processing (Machiels and Karnal, 2016; Péneau *et al.*, 2009; Sylvander and Francois, 2015).
9 184 Although naturalness is a common attribute used by consumers to evaluate commercial products
10 185 such as fruit juices (Comax Flavors, 2017; Sabbe *et al.*, 2008; Włodarska *et al.*, 2019), the effect of
11 186 implied motion on perceived naturalness has not been previously studied. A grounded cognition
12 187 approach suggests that an image with implied motion, such as a splash on a fruit being squeezed,
13 188 may elicit a simulation of the expected sensory experience of squeezing a fruit. The image of a fruit
14 189 splashing juice may enhance the perception of naturalness by evoking a situated memory that
15 190 integrates information from different sensory modalities, making the idea of freshly squeezed juice
16 191 more accessible. Thus, it might be expected that a fruit juice with implied motion in its packaging
17 192 would evoke higher associations of naturalness, thereby increasing the perception of naturalness
18 193 during tasting:

194 H3a. Packaging imagery with implied motion (vs. without) will enhance (decrease) a
195 product's perceived naturalness.

196 Furthermore, consumers increasingly show a preference for products perceived as natural and
197 unprocessed (Jorge *et al.*, 2020; Román *et al.*, 2017), partly due to the belief (discussed by some
198 authors; e.g., Scott & Rozin, 2020) that they relate to better taste, greater healthfulness, and a
199 greater respect for the environment (Li & Chapman, 2012; P. Rozin, 2006; Paul Rozin, Fischler, &
200 Shields-Argelès, 2012). We therefore propose:

201 H3b. The effect of packaging imagery with implied motion on product liking will be mediated
202 by the product perceived naturalness.

203 3. Materials and methods

204 3.1. Participants.

205 Data were analysed from 66 participants (\bar{x} = 21.9 years; SD = 4.4 years; 59% male) who
206 volunteered for the experiment. Participants were mainly undergraduate students at the University of
207 Zaragoza and were recruited based on their interest in participating in the study. They were not
208 aware of the real objectives of the study and were not compensated for their participation. The
209 experiment was carried out in the city of Zaragoza (Spain).

210 3.2. Stimuli

211 Two packages of pineapple juice were designed in which the image depicted on the front was
212 manipulated (Figure 1). Both depicted the same image of a pineapple cut into two pieces, but one of
213 the images showed implied motion in the form of a splash of juice (splash visual), while the other did
214 not (still visual). A *faux* brand (Yuisy), specially designed for this experiment, was used in order to
215 avoid any resemblance to commercial products. The shape and size of the package, the brand, the

216 colours, the text “*zum de piña*” (Spanish for “pineapple juice”), and the nutritional information were
 217 identical on both designed packages. These stimuli were designed using Adobe Photoshop CC
 218 2017.1.1 software (Adobe Systems Incorporated, 2006).



219
 220 **Fig. 1.** Stimuli designed for this investigation: packaging imagery with implied motion (splash visual,
 221 left) and packaging imagery without implied motion (still visual, right)

222 3.3. Procedure

223 The experiment was conducted following a within-subject design. It was carried out in a room of the
 224 Faculty of Engineering and Architecture of the University of Zaragoza (Spain), where the same
 225 lighting and temperature conditions were maintained for all the participants. To avoid any type of bias
 226 during the evaluation, all participants accessed the room individually. The order in which the stimuli
 227 were shown was randomized for each participant.

228 Each participant was seated in front of a 23" LED monitor with a resolution of 1920×1080px and a
 229 refresh rate of 60 Hz. The participant's distance from the monitor was 60 cm. Once the participant
 230 was seated, they were told that they were going to try two different samples of pineapple juice and
 231 that they would then have to evaluate them by completing a short questionnaire. First, one of the
 232 stimuli was shown on the screen in front of the participant, with a similar size to the real-life package.
 233 Then, the participant was given a sample of pineapple juice to taste, contained in a 10cl clear glass.
 234 To ensure that all the juice samples were served at the same temperature, they were kept in a
 235 refrigerator for at least 6 hours before the test. The participant was told that the sample of pineapple
 236 juice was going to be marketed in the package shown on the screen. Before tasting the sample, the
 237 participant was asked to rate the packaging design appeal, and once they had tasted it they were

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3 238 asked to complete a questionnaire asking them to evaluate the juice according to the attributes
4 239 presented in section 3.4. When the participant had finished the first sample, the empty cup was
5 240 removed and water was offered to rinse the mouth. After performing an unrelated task aimed at
6 241 distracting the participant, the procedure described above was repeated with the next stimulus.
7 242 Finally, participants were asked to explain what they thought was the aim of the experiment. Only
8 243 data from the 66 participants who remained naïve were analysed.

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12 244 Once the experiment was over, the participant was thanked for their collaboration and the next
13 245 participant was invited into the room.

15 246 3.4. Measurements

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18 247 The questionnaire was divided into three sections: one asking demographic information of the
19 248 participants (age and gender), and two asking the participants to evaluate a series of attributes of the
20 249 sample of pineapple juice they had just tasted. According to the hypotheses raised, the participants
21 250 were asked to rate, following an intensity scale of 1 (nothing) to 7 (very much), how appealing they
22 251 considered the package (design appeal), how natural they perceived the juice flavour (naturalness),
23 252 and how much they liked the juice (liking). They were given the option of leaving the questionnaire
24 253 blank for questions they did not know how to answer.

27 254 3.5. Data analysis

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30 255 A paired-measures t-test was used to compare the ratings given to each juice sample in order to
31 256 assess if liking, design appeal and naturalness were influenced by depicting implied motion in
32 257 packaging imagery, as proposed by H1, H2a, and H3a. The effect size of each paired-measures t-
33 258 test was operationalized as Cohen's d_z standardized difference scores (Cohen, 1988; Lakens, 2013).

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37 259 In order to assess whether the effect of implied motion on liking was mediated by design appeal and
38 260 naturalness, two simple mediation analyses were conducted. Mediation analysis is a regression-
39 261 based statistical method used to evaluate if an independent variable influences a dependent variable
40 262 through one or more other intervening variables (Hayes, 2009, 2018). A simple mediation model is a
41 263 causal system in which an independent variable X is proposed to influence a dependent variable Y
42 264 through a single mediating variable M, thus allowing to assess the mechanism by which X exerts its
43 265 effect on Y (Hayes, 2018). According to the first of the proposed mediation models (H2b), the design
44 266 of the package with implied motion is perceived as being more appealing, which in turn enhances
45 267 product liking (the opposite being true for the package without implied motion). Hence, the image
46 268 depicted on the package (splash or still) was used as the two-condition independent variable, liking
47 269 was used as the dependent variable, and design appeal was used as the mediating variable. On the
48 270 other hand, according to the second of the proposed mediation models (H3b), the juice from the
49 271 package with implied motion is perceived as being more natural, which in turn enhances product
50 272 liking (the opposite being true for the package without implied motion). Hence, the image depicted on
51 273 the package (splash or still) was used as the two-condition independent variable, liking was used as
52 274 the dependent variable, and naturalness was used as the mediating variable. Moreover, in order to
53 275 rule out other alternative explanations of these effects, such as a spillover effect, by which perceiving
54 276 the design as more appealing may in turn positively influence the naturalness evaluation (Chernev

277 and Gal, 2010), an additional simple mediation analysis was conducted in which the assumption of
278 no causal relation between design appeal and naturalness was tested. Hence, the image depicted on
279 the package (splash or still) was used as the two-condition independent variable, naturalness was
280 used as the dependent variable, and design appeal was used as the mediating variable.

281 Furthermore, to explore the underlying mechanism of these effects, and given that there did not
282 appear to be a causal influence between the two proposed mediators (i.e. design appeal and
283 naturalness), a parallel multiple mediator analysis was conducted with two mediators. In contrast to
284 the simple mediation model, a parallel multiple-mediator model is a causal system in which an
285 independent variable X is proposed to influence a dependent variable Y through two or more
286 mediating variables (M1, M2...). These mediators may be correlated, but do not causally influence
287 each other (Hayes, 2018). In a parallel multiple-mediator analysis, there are as many indirect effects
288 as there are mediators. This model is useful since it allows for a more complex assessment of the
289 processes through which X affects Y (Kane and Ashbaugh, 2017). Thus, the image depicted on the
290 package (splash or still) was used as the two-condition independent variable, liking was used as the
291 dependent variable, and design appeal and naturalness were used as the mediating variables.

292 The mediation analyses were carried out using the MEMORE 2.1 macro for SPSS according to the
293 method proposed for within-subject experimental designs by Montoya and Hayes (2017). MEMORE
294 is a macro for SPSS which allows easily implementing the method described by Judd *et al.* (2001),
295 by which mediation analysis should be conducted in within-subject designs. Bias-corrected
296 bootstrapping (5,000 samples) was used to calculate confidence intervals for the indirect effect.

297 Effects for the t-tests were considered statistically significant when $p < 0.05$. The indirect effect of
298 each mediation analysis was considered significant if it did not include zero (Montoya and Hayes,
299 2017). The data was processed and analysed by using SPSS Statistics 23 (Armonk, NY, USA).

300 4. Results

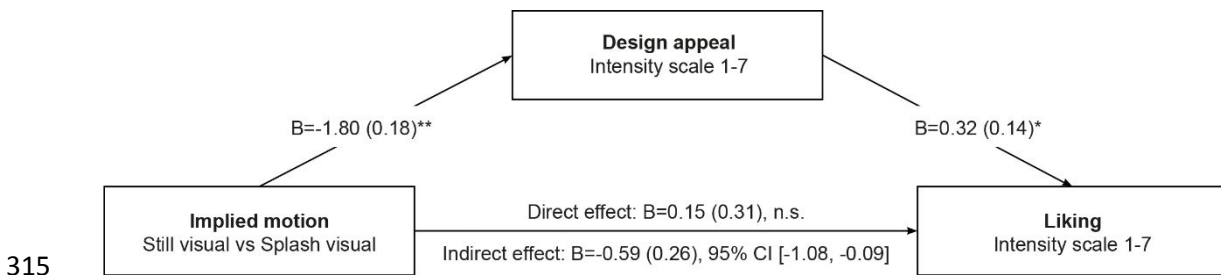
301 The results of the paired t-tests show that packaging imagery with implied motion enhances liking,
302 design appeal, and naturalness (Table 1), thus supporting H1, H2a, and H3a. These results were not
303 influenced by the order in which the stimuli were shown, as neither of the possible interactions was
304 significant (Liking \times Order $F(1,64) = 0.022$, $p = 0.883$, $\eta^2 < 0.001$; Design appeal \times Order $F(1,64) =$
305 1.302 , $p = 0.258$, $\eta^2 = 0.020$; Naturalness \times Order $F(1,64) = 0.366$, $p = 0.548$, $\eta^2 = 0.006$).

306 [Insert Table 1 here]

307 In order to assess the proposed mediating role of design appeal and naturalness in the effect
308 between implied motion and liking, two simple mediation analyses were conducted.

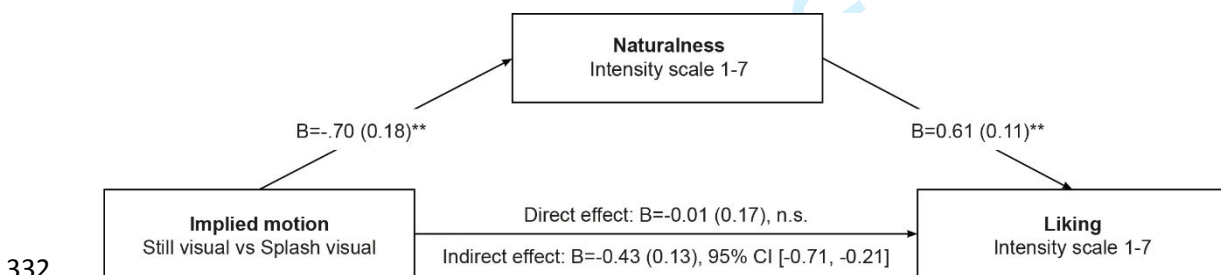
309 The results of the first mediation analysis show that implying motion on packaging imagery indirectly
310 influenced product liking through its effect on packaging appeal (Figure 2), thus supporting H2b. The
311 indirect effect of implied motion on liking through design appeal was statistically significant, with the
312 95% not including zero (Bootstrap [5000] results: $B = -0.59$, $SE = 0.26$, 95% CI $[-1.08, -0.09]$). The

313 participants considered the splash visual package as more attractive than the still visual package
 314 ($B=-1.80$, $SE=0.18$, $p < 0.01$), which in turn increased liking ($B=0.32$, $SE=0.14$, $p=0.02$).



315
 316 **Fig. 2.** Mediation of the perceived packaging appeal between the implied motion depicted on
 317 packaging imagery and product liking (MEMORE 2.1, number of bootstraps=5,000; Montoya &
 318 Hayes, 2017). Note: Negative values in the dependent variable represent a higher value of product
 319 liking, while the opposite is true for positive values. Coding=still visual (1), splash visual (0); B
 320 (SE)=path coefficient (standard error); * $p < 0.05$, ** $p < 0.01$.

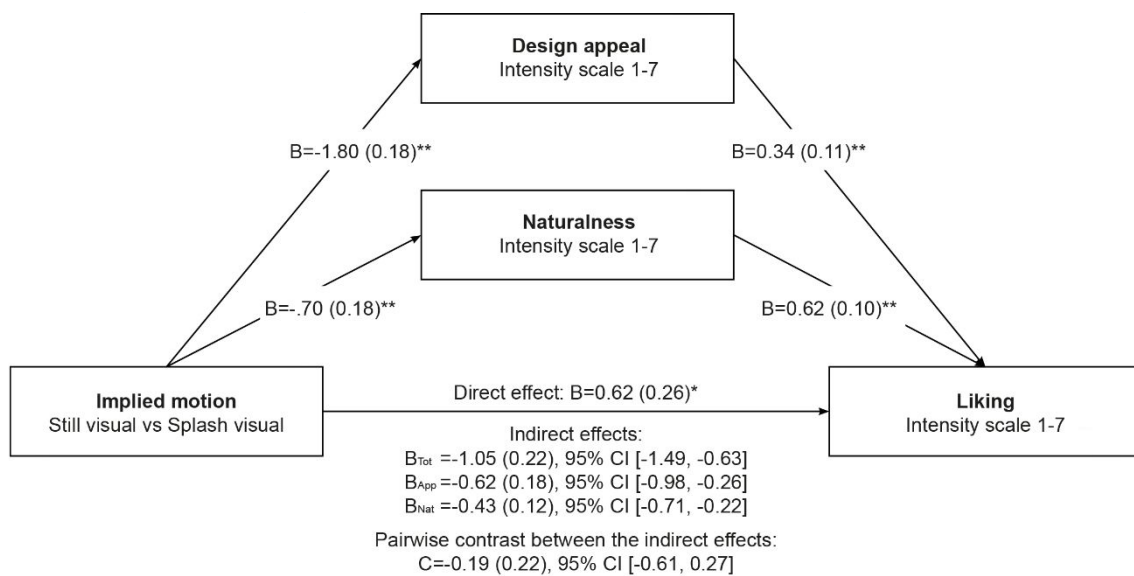
321 The results of the second mediation analysis show that implying motion on packaging imagery
 322 indirectly influenced product liking through its effect on naturalness perception (Figure 3), thus
 323 supporting H3b. The indirect effect of implied motion on liking through naturalness was statistically
 324 significant, with the 95% not including zero (Bootstrap [5000] results: $B=-0.43$, $SE=0.13$, 95% CI
 325 $[-0.71, -0.21]$). The participants perceived the juice corresponding to the splash visual package as
 326 being more natural than that corresponding to the still visual package ($B=-0.70$, $SE=0.18$, $p < 0.01$),
 327 which in turn increased liking ($B=0.61$, $SE=0.11$, $p < 0.01$). Furthermore, the possibility of the specific
 328 influence of implied motion on naturalness being explained in terms of a spillover effect triggered by
 329 the package design appeal was ruled out by an additional simple mediation analysis, since the
 330 indirect effect of implied motion on naturalness through design appeal was not statistically significant,
 331 with the 95% including zero (Bootstrap [5000] results: $B=-0.01$, $SE=0.26$, 95% CI $[-0.48, 0.53]$).



332
 333 **Fig. 3.** Mediation of the juice perceived naturalness between the implied motion depicted on
 334 packaging imagery and product liking (MEMORE 2.1, number of bootstraps=5000; Montoya &
 335 Hayes, 2017). Note: Negative values in the dependent variable represent a higher value of product
 336 liking, while the opposite is true for positive values. Coding=still visual (1), splash visual (0); B
 337 (SE)=path coefficient (standard error); * $p < 0.05$, ** $p < 0.01$.

338 Once H2b and H3b were validated, a parallel multiple-mediator analysis with two mediators was
 339 conducted (Figure 4) to further explore the role of both mediators (i.e., design appeal and
 340 naturalness). The results of the parallel multiple-mediator analysis with two mediators show that
 341 implying motion on packaging imagery indirectly influenced product liking through both its effect on

the package design appeal and on the product naturalness perception. The total indirect effect of implied motion on liking through both mediators was statistically significant, with the 95% not including zero (Bootstrap [5000] results: $B_{Tot}=-1.05$, $SE=0.22$, 95% CI [-1.49, -0.63]). In addition, the specific indirect effect of each mediator was also statistically significant, with the 95% not including zero (Bootstrap [5000] results: $B_{App}=-0.62$, $SE=0.18$, 95% CI [-0.98, -0.26]; $B_{Nat}=-0.43$, $SE=0.12$, 95% CI [-0.71, -0.22]). Moreover, the pairwise contrast between both specific indirect effects was not statistically significant, with the 95% including zero ($C=-0.19$, $SE=0.22$, 95% CI [-0.61, 0.27]). Thus, the effect of the visuals implying motion enhances product liking both because they make the design more appealing and because they raise the naturalness perception, without the effect of one mediator being greater than that of the other.



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Fig. 4. Parallel mediation of the packaging design appeal and the juice perceived naturalness between the implied motion depicted on packaging imagery and product liking (MEMORE 2.1, number of bootstraps=5000; Montoya & Hayes, 2017). Note: Negative values in the dependent variable represent a higher value of product liking, while the opposite is true for positive values. Coding=still visual (1), splash visual (0); B (SE)=path coefficient (standard error); * $p < 0.05$, ** $p < 0.01$.

359 5. Discussion

This study investigated whether liking for a product could be increased by manipulating the implied motion of the image on its packaging. To this end, an experiment was conducted to assess whether liking of a pineapple juice could be enhanced by manipulating the implied motion of the image depicted on its packaging. In addition, two possible mechanisms by which this effect might occur were explored and the mediating role of design appeal and naturalness perceptions was analysed. The results show that the juice from the package with implied motion imagery was liked more, whereas the juice from the package without implied motion imagery was liked less. This influence was mediated in parallel by the appeal of the packaging design and the perception of naturalness, so that the moving images increased juice liking by making the packaging more attractive and also by increasing the perceived naturalness of the juice.

5.1. Theoretical contributions

First, our findings reveal a novel mechanism by which implied motion influences product liking. Although previous research demonstrated that implied motion enhances food tastiness expectations (Amar *et al.*, 2021; Gvili *et al.*, 2017; Li and Liu, 2022; Xiong *et al.*, 2023; Yu *et al.*, 2022; for an exception see Mulier *et al.*, 2021), this investigation goes one step further by showing that implied motion also affects product liking. This is consistent with previous research showing that taste is a critical driver of liking (Andersen *et al.*, 2019), given the positive effect that implied motion has been shown to have on taste expectations. In addition, the present research adds to the literature demonstrating that theories of processing fluency and grounded cognition provide a useful theoretical framework for conducting packaging research. Both frameworks offer different but complementary approaches that help to explain the model proposed in this study. According to the processing fluency approach, stimuli that are cognitively easier to process are likely to elicit more positive responses than those that require greater cognitive effort to process (Alter and Oppenheimer, 2009). Previous research shows that an image with implied motion helps to capture attention in a cluttered environment (Yu *et al.*, 2022) and improves affective fluency (Li and Liu, 2022). The results of this research are consistent with these findings, showing that packaging with implied motion imagery generates higher liking than packaging displaying a still image. In terms of grounded cognition theory, an image of a fruit with a splash might be symbolically interpreted by consumers as representing natural and freshly squeezed juice, suggesting that the fruit was freshly cut while still ripe (Fenko *et al.*, 2018; Gil-Pérez, Rebollar, Lidón, Martín, *et al.*, 2019; Machiels and Karnal, 2016). Moreover, for products with a positive valence (such as the juice in this study), an image with implied motion facilitates the mental simulation of the sensory characteristics of the product depicted, making its attributes (taste, aroma or texture) more accessible (Xiong *et al.*, 2023). Thus, this study adds to the literature showing that the impact of packaging imagery with implied motion can influence consumer evaluations at the moment of consumption (Gil-Pérez *et al.*, 2020).

Second, the current study shows that packaging appeal and naturalness perception both mediate the relationship between implied motion and product liking in parallel. Previous studies have identified the role of perceived freshness (Amar *et al.*, 2021; Gvili *et al.*, 2017; Yu *et al.*, 2022), affective fluency (Li and Liu, 2022), and mental simulation (Xiong *et al.*, 2023) as mediators between implied motion imagery and expected taste, but the role of packaging appeal and naturalness perception had not been investigated so far.

This research shows that implied motion imagery can increase product liking by enhancing design appeal. Previous studies have examined how liking is influenced by the impact of aesthetics (Michel *et al.*, 2014; Zellner *et al.*, 2010, 2011, 2014) or certain specific packaging cues (Di Cicco *et al.*, 2020; Gil-Pérez *et al.*, 2020), but the specific effect of packaging design appeal was yet to be assessed (for a discussion of aesthetics as a topic in psychology and neuroscience, see Skov & Nadal, 2020). This finding is consistent with other research suggesting that attractive packaging draws attention and can increase the hedonic value of the products it contains (Stoll *et al.*, 2008), as well as the perceived product quality (Wang, 2013). It is also in line with research such as that of Mizutani *et al.* (2010), where orange juice drunk from containers with positively valenced images (e.g., cute animal pictures or attractive oranges) was liked more than that from containers with

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3 411 negatively valenced images (e.g., pictures of insects or rotten oranges). Overall, this finding supports
4 412 the notion that consumers rely on extrinsic product cues (such as the packaging) to form judgments
5 413 about product attributes (Smith *et al.*, 2015), with a spillover effect appearing to occur between
6 414 packaging and product evaluations (Hagtvedt and Patrick, 2008).

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9 415 The results of this investigation also show the positive effect that packaging with implied motion
10 416 imagery may have on naturalness perception, and how this effect may contribute to raising product
11 417 liking. The relationship between naturalness perception and liking should come as little surprise, as
12 418 consumer preference for products perceived as natural is well known (Jorge *et al.*, 2020; Román *et*
13 419 *al.*, 2017). However, these findings contribute to the literature by showing that both liking and
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15 420 naturalness perceptions are enhanced by visuals implying motion, and that the specific influence of
16 421 implied motion on naturalness is not explained by a spillover effect triggered by the package design
17 422 appeal. Although the influence of implied motion on the perception of naturalness had not been
18 423 empirically tested, there was reason to believe that visuals suggesting motion could enhance the
19 424 perception of naturalness. The naturalness of commercial fruit juices can vary widely, leading to the
20 425 expectation that consumers will use the packaging as a diagnostic tool to assess the naturalness of
21 426 the product (Deval *et al.*, 2013; Feldman and Lynch, 1988). In addition, depicting food with implied
22 427 motion makes it look fresher (Gvili *et al.*, 2015, 2017; Li *et al.*, 2019), and in some product categories,
23 428 freshness is perceived to be interrelated with naturalness (Román *et al.*, 2017; Sanchez-Siles *et al.*,
24 429 2019). This may be the case in the fruit juice category, where consumers tend to associate
25 430 naturalness with minimal processing, pureness, and freshness (Machiels and Karnal, 2016;
26 431 Sylvander and Francois, 2015). Nonetheless, it should be highlighted that freshness and naturalness
27 432 may not be equally related in all product categories, as both concepts are somewhat context-
28 433 dependent and not always understood in the same way (Asioli *et al.*, 2017; Péneau *et al.*, 2009; Siipi,
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37 435 Finally, the present study contribute to the existing literature on the effects of packaging visuals on
38 436 consumer perception during tasting. All previous studies of implied motion imagery have only tested
39 437 the effect of implied motion on expectations (Amar *et al.*, 2021; Gvili *et al.*, 2015, 2017; Li *et al.*,
40 438 2019; Li and Liu, 2022; Mulier *et al.*, 2021; Xiong *et al.*, 2023; Yu *et al.*, 2022), so this research
41 439 extends the literature by going one step further and showing that the effects of implied motion can
42 440 also influence consumer evaluation at the moment of consumption. Therefore, this investigation adds
43 441 to the literature studying how packaging design affects consumer perception and response during
44 442 tasting, where the effects of packaging cues such as packaging colour (Piqueras-Fiszman and
45 443 Spence, 2011; Spence and Velasco, 2018), packaging shape (Velasco *et al.*, 2016), packaging
46 444 texture (Ferreira, 2019), packaging imagery (Gil-Pérez *et al.*, 2020; Lidón *et al.*, 2018), or even
47 445 packaging sound (Spence and Wang, 2015, 2017) have been previously explored.

5.2. Managerial implications

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55 447 The findings reported in the current study are of interest to designers and manufacturers as they can
56 448 help them make more optimal decisions during the packaging design process. A visit to any
57 449 supermarket shows that a large number of packages display some form of implied motion on their
58 450 visuals. Designers usually make this decision intuitively, based mainly on aesthetic criteria. However,

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3 451 the results of this study add to those of Yu *et al.* (2022), demonstrating that implied motion imagery
4 452 can be used as a packaging design tool, and highlighting the notion that the choices made during the
5 453 packaging design process can affect the consumer experience beyond mere aesthetics and
6 454 modulate consumer evaluations. Specifically, the results of this study suggest an inexpensive way to
7 455 enhance product liking, which is considered a critical factor in product acceptance (Delgado *et al.*,
8 456 2013; Mueller and Szolnoki, 2010). Furthermore, they show that the influence of implied motion
9 457 imagery occurs not only in the shopping context, but also during tasting. This is particularly relevant
10 458 for products such as fruit juices, sodas, yoghurts and other foods that are commonly consumed
11 459 directly from their packaging (and which are estimated to account for up to a third of the total;
12 460 Spence, 2017), as the packaging will be present at the moment of consumption. In addition, the
13 461 results of this research also show that implied motion visuals can increase the attractiveness of the
14 462 packaging. Attractive packaging attracts attention (Stoll *et al.*, 2008), enhances taste expectations
15 463 (Techawachirakul *et al.*, 2023) and can increase perceived product quality (Wang, 2013), so these
16 464 findings may be relevant also for products that are not intended to be consumed directly from their
17 465 packaging.

24 466 5.3. Limitations

26 467 Besides the fact that part of the findings reported here may be context-dependent, and thus may not
27 468 be extrapolated to other product categories, this investigation has other limitations that should be
28 469 taken into account. For example, it should be highlighted that this experiment was conducted in a
29 470 laboratory setting and used stimuli composed by computer images but not actual packages, which
30 471 could have affected the ecological validity of the experiment (Bangcuyo *et al.*, 2015; Galiñanes Plaza
31 472 *et al.*, 2019; Hannum *et al.*, 2019; Nijman *et al.*, 2019; for a review on the topic, see Jaeger &
32 473 Porcherot, 2017). Moreover, the sample of participants who took part in the experiment may be
33 474 biased, since all were recruited in a university context (Haynes and Robinson, 2019).

38 475 Regarding the experimental design, a within-subject approach such as the one used in this study
39 476 may introduce potential carry-over effects and difficulties in maintaining the independence of
40 477 observations across packaging conditions. However, this design choice facilitates a controlled
41 478 comparison of participants' responses to packaging variations, minimising between-subject variability
42 479 and suggesting that any observed differences are due to the design manipulation. In addition, to
43 480 minimise the possibility of carry-over effects, the order of stimuli was counterbalanced across
44 481 participants, participants were offered water to rinse their mouths between samples, and a distractor
45 482 task was performed between samples.

50 483 For the dependent variables, single-item scales were used to measure liking, packaging appeal and
51 484 perception of naturalness. This may make it difficult to capture the multidimensional nature of these
52 485 constructs and may oversimplify and limit the accuracy of the results of this study. However, to our
53 486 knowledge, there are no validated scales to measure packaging appeal and naturalness perception,
54 487 and the use of 7- or 9-point hedonic scales to measure liking is well established in the literature (Lim,
55 488 2011). It was therefore decided to use single-item scales to avoid participant fatigue and to prevent
56 489 one of the dependent variables from becoming more salient than the others in the minds of the
57 490 participants. With regard to liking, it is important to note that although the literature suggests that

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3 491 greater liking is associated with greater purchase intention (Delgado *et al.*, 2013; Mueller and
4 492 Szolnoki, 2010), it does not directly account for the nuanced decision-making process that leads to a
5 493 purchase, nor does it fully capture the complexity of the product experience (Heussen *et al.*, 2023).
6 494 However, the aim of this research was not to investigate the impact of implied motion on purchase
7 495 intention, but rather on product liking during tasting, as this is generally considered to be a key
8 496 variable in determining consumer acceptance of food products (Andersen *et al.*, 2019).

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12 497 Finally, previous research asked their participants about the perceived movement of each stimuli,
13 498 which let for checking the effectiveness of the manipulation (i.e., the implied motion elicited by the
14 499 stimuli) and for assessing the impact of the perceived implied motion in a more explicit way (Amar *et al.*,
15 500 2021; Yu *et al.*, 2022). Similarly, one might note that the visual intended to be considered as still
16 501 in this experiment may indeed be perceived as implying motion, since the two parts of the depicted
17 502 pineapple are in an unstable position (perhaps giving the idea that the top part of the pineapple is
18 503 falling). However, this was not considered a relevant limitation, since the interest of this experiment
19 504 resided in assessing the effects produced by the relative difference between the implied motion
20 505 conveyed by the two stimuli, and not necessarily in the fact that one of them was perceived as being
21 506 completely still.

22 507 5.4. Further research

23 508 Despite the contributions of this research, several important questions remain. For example, the
24 509 effects reported here might vary depending on the type of splash depicted in the imagery, so it would
25 510 be interesting to see which type of splash has the most effect. In addition, the applicability of these
26 511 effects in different product categories from that of fruit juices should be tested, as well as the ability of
27 512 the imagery depicting implied motion to affect not only product liking during taste but also the
28 513 consumer-expected behaviour. Thus, while it may be tempting to assume that the positive effects on
29 514 liking reported here imply a greater willingness to buy or a greater willingness to pay (Delgado *et al.*,
30 515 2013; Mueller and Szolnoki, 2010), further testing is needed to confirm whether this is the case and
31 516 to investigate and understand the possible boundary conditions. Additionally, the results of this study
32 517 may suggest that packaging images with implied motion can be used to nudge consumers towards
33 518 healthier food choices by increasing both their liking and their appeal (Coulthard *et al.*, 2017;
34 519 Purnhagen *et al.*, 2016; Vecchio and Cavallo, 2019). Given that implied motion imagery has been
35 520 shown to raise healthiness expectations (Amar *et al.*, 2021), further research could empirically
36 521 investigate this effect. Furthermore, previous research has shown that individual consumer
37 522 differences such as sensitivity to design (Becker *et al.*, 2011), gender (Lidón *et al.*, 2018), or health
38 523 consciousness (Machiels and Karnal, 2016) moderate the effects of packaging cues on consumer
39 524 perception and response, and that in the case of implied motion imagery, factors such as the
40 525 consumers' consumption goal (health or hedonic; Li and Liu, 2022), the situational context (Xiong *et al.*,
41 526 2023), or the food valence (Xiong *et al.*, 2023) may also play a role. Thus, the role of other
42 527 possible moderators should also be considered.

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Table 1

t-test for paired data of the difference between the packaging without implied motion (i.e., the still visual) and the packaging with implied motion (i.e., the splash visual)

Attributes	Difference of means still visual – splash visual	N	t-test	p-value	Cohen's d_z
Liking	-0.439	66	-2.288	0.025	-0.282
Design appeal	-1.803	66	-10.110	<0.001	-1.244
Naturalness	-0.697	66	-3.779	<0.001	-0.465

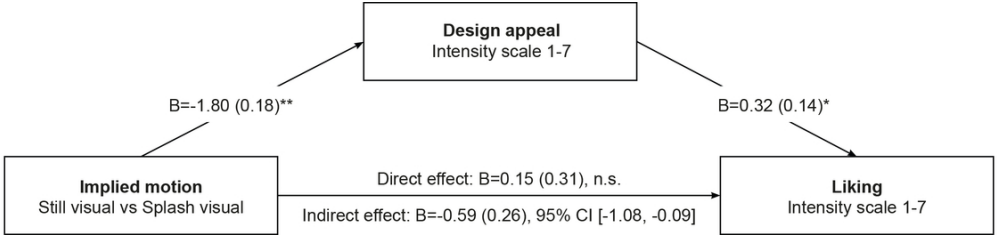
British Food Journal



Stimuli designed for this investigation: packaging imagery with implied motion (splash visual, left) and packaging imagery without implied motion (still visual, right)

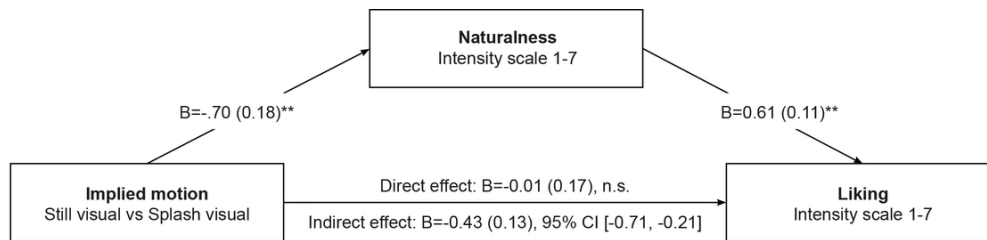
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Mediation of the perceived packaging appeal between the implied motion depicted on packaging imagery and product liking (MEMORE 2.1, number of bootstraps=5,000; Montoya & Hayes, 2017). Note: Negative values in the dependent variable represent a higher value of product liking, while the opposite is true for positive values. Coding=still visual (1), splash visual (0); B (SE)=path coefficient (standard error); *p < 0.05, **p < 0.01

189x44mm (150 x 150 DPI)



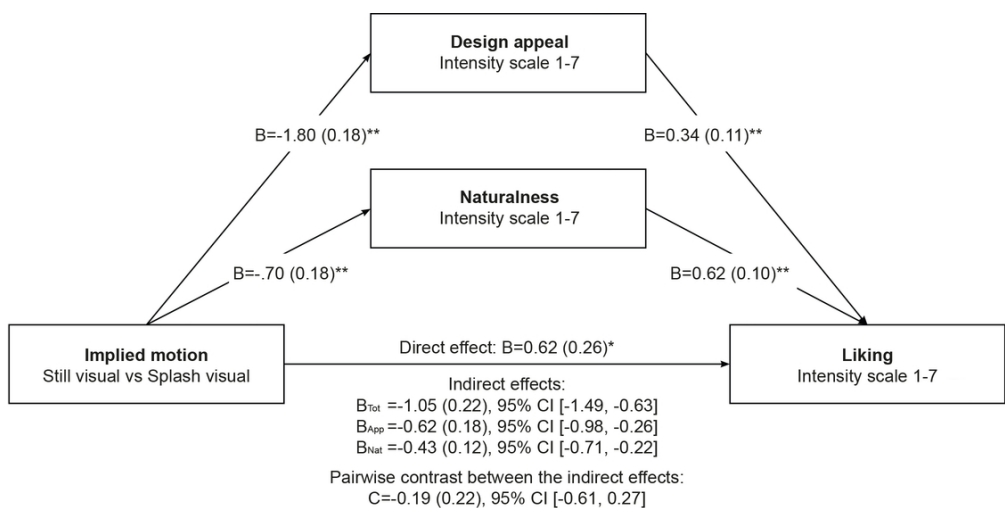
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Mediation of the juice perceived naturalness between the implied motion depicted on packaging imagery and product liking (MEMORE 2.1, number of bootstraps=5000; Montoya & Hayes, 2017). Note: Negative values in the dependent variable represent a higher value of product liking, while the opposite is true for positive values. Coding=still visual (1), splash visual (0); B (SE)=path coefficient (standard error); *p < 0.05, **p < 0.01

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Parallel mediation of the packaging design appeal and the juice perceived naturalness between the implied motion depicted on packaging imagery and product liking (MEMORE 2.1, number of bootstraps=5000; Montoya & Hayes, 2017). Note: Negative values in the dependent variable represent a higher value of product liking, while the opposite is true for positive values. Coding=still visual (1), splash visual (0); B (SE)=path coefficient (standard error); *p < 0.05, **p < 0.01

189x94mm (150 x 150 DPI)