Investigating the influence of colour, weight, and fragrance intensity on the perception of liquid bath soap: An experimental study

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1. Introduction

Over the last decade or so, research interest in trying to understanding the factors determining how consumers perceive everyday products has grown in several fields, including in the areas of marketing and product design (Schifferstein & Hekkert, 2007). Researchers and marketers have extensively studied those factors that drive the consumers' perception of products, and how a product's sensorial and semantic attributes can alter a user's perception of the product itself. Typically, these studies have involved the use of psychophysical and/or psychological testing methods, investigating both the perception of the products as a function of the stimulation delivered to one or more of the user's senses (see Schifferstein & Spence, 2007, for a review), and the effect of the packaging on the perception of the product itself (Malnar, 2004; Pickton & Broderick, 2005, Chapter 29, pp. 599–612; Piqueras-Fiszman, Velasco, Salgado-Montejo, & Spence, 2013; see Spence & Piqueras-Fiszman, 2012, for a review). For example, Piqueras-Fiszman and Spence (2012a) recently investigated the influence that the weight of food containers, cutlery, and packaging has on feelings of satiety (before and after tasting the food, in their case, a yogurt), and/or on the perception of density of the food itself. These researchers reported that increasing the weight (of the packaging/plateware/cutlery) influenced the perceived density of the product contained within. These researchers also confirmed the weight-density illusion originally proposed by Piqueras-Fiszman, Harrar, Alcaide, and Spence (2011). The participants in this study also expected the contents of a heavier container to be more satiating than when exactly the same contents were presented in a visually-identical, but physically lighter, container.

A number of other studies have focused on investigating the visual features of products and their containers. The appearance of the product and the colour of its packaging also exert a significant influence on consumer perception, behaviour, and preferences (e.g., Marshall, Stuart, & Bell 2006; Spence & Piqueras-Fiszman, 2012). So, for example, Piqueras-Fiszman, Velasco, and Spence (2012) recently demonstrated that the taste of the food (crisps or potato chips) seems to depend, at least to a certain extent, on the colour of the packaging. Meanwhile, Ares and Deliza (2010) conducted a study to investigate the influence of the container on people's perception of food, using word association and conjoint analysis techniques. These researchers evaluated how the sensory characteristics of the packaging (in their study, they varied both the colour and size of the packaging) altered their participants' willingness to purchase the product (a milk dessert) and their liking for it. Meanwhile, Parise and Spence (2012) have measured people's performance in a modified version of the Implicit Association Test (see Greenwald, McGhee, & Schwartz, 1998) in order to assess the semantic attributes associated with the shape of

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different bottles of mouthwash. Their results revealed that the shape of the bottle in which the mouthwash was contained suggested certain specific characteristics and attributes to the consumer, expressed in terms of adjectives such as "gentle" or "powerful".

The majority of the studies on the product perception that have been cited so far can be considered in terms of the notion of crossmodal correspondences. Crossmodal correspondences' refer to a series of dimensions of experience that are shared across sensory modalities (see Spence, 2011, 2012, for reviews). Crossmodal correspondences have often been studied by means of relatively simple mappings (or correspondences) between stimuli presented in the visual and auditory modalities (e.g., Marks, 1975, 2004), vision and olfaction (Demattè, Sanabria, & Spence, 2006a; Gilbert, Martin, & Kemp, 1996; Maric & Jacquot, 2013; Schifferstein & Tanudjaja, 2004), touch and olfaction (Demattè et al., 2007; Demattè, Sanabria, Sugarman, & Spence, 2006b), etc.

However, the potential impact of crossmodal correspondences in the field of design is clear in terms of interpreting and satisfying the customer's preferences (and expectations) for a given product. The idea here is that people will, generally-speaking, prefer a product when different sensory attributes of the product suggest the same concept to the consumers' mind (see Spence, 2012; though see also Piqueras-Fiszman & Spence, 2012c; Schifferstein & Spence, 2007, for limited exceptions). Furthermore, designers could potentially use input from different sensory modalities in order to enhance and diversify the customer's experience while using a product (Schifferstein & Spence, 2007).

1.1. On the crossmodal perception of fragrance and its application to bathing/cleaning products

Among those studies that have investigated crossmodal associations in the design and packaging of products, the ones that have involved the sense of smell (of olfaction) occupy a prominent role, given the aim of the present study. The nature of crossmodal correspondence between olfaction and the other senses has recently been reviewed by Stevenson, Rich, and Russell (2012). These researchers evaluated the crossmodal correspondence to both sensorial and semantic aspects of 20 different odours, concluding that both semantic and perceptual mechanisms underpin cross-modal matches involving odours. They also suggested an important role of the hedonic characteristics of the odour, as a further dimension of stimuli that is capable of underpinning the crossmodal correspondences documented behaviourally to date. One of the most frequently reported crossmodal correspondences involves the matching of olfactory to visual stimuli (specifically the colour, or hue, of visual stimuli). Additionally, it is well known that changing the colour can influence the perceived odour of a substance. Robust interactions between olfaction and colour have, for example, been reported by Zellner and Kautz (1990). They observed an interaction between odour intensity and the colour of a series of solutions that participants were evaluating. Specifically, coloured solutions were rated as smelling stronger than uncoloured solutions. However, Zellner and Kautz failed to observe any specific relation (or crossmodal congruency) between the hue of a colour and its effect on the perceived intensity of the odour. Interestingly, though, Arao, Suzuki, Katayama, and Yagi (2012) recently demonstrated that a congruent colour can help people to pick out a fragrance in an odour mixture, at least in liquid solutions. Finally, it is noteworthy that crossmodal correspondences between odour and colour appear to be fairly stable over prolonged periods of time: So, for instance, Gilbert et al. (1996) were able to demonstrate odour–colour mappings that were stable over the two years that separated successive testing sessions.

Crossmodal interactions between touch and olfaction have also been shown to constitute an important element in the product experiences of consumers (e.g., Churchill, Meyners, Griffiths, & Bailey, 2009; Demattè, Sanabria, Sugarman et al., 2006b; Laird, 1932). Significant crossmodal interactions between this pair of modalities have been reported by Demattè and her colleagues: They tested the perceived softness of a series of fabric swatches when scented with different fragrances. In their two experiments, they demonstrated the existence of an interaction between olfaction and touch. They also demonstrated that the perception of softness can be influenced by the pleasantness of the odour. Moreover, Krishna, Elder, and Caldara (2010) have shown that the semantic congruency between the olfactory and tactile properties of a product can enhance people's haptic perception of texture and temperature, not to mention their evaluation of the product itself (see also Churchill et al., 2009).

Despite the fact that all products provide some form of multisensory stimulation to the consumer, in the present study we focused specifically on soaps and body lotions where, as reported in the literature (e.g., Churchill et al., 2009), the role of olfaction in product evaluation is crucial. This kind of product offers users different kinds of sensory features (such as colour, weight, texture, and fragrance) through vision, touch/haptics, and olfaction. According to Schroiff (1991), a product's fragrance can affect people's product purchasing decision in a number of different ways: Confirming the product's likely performance, determining the customer's likely overall satisfaction when using the product, impacting on the brand, and ultimately affecting their purchase behaviour. Churchill et al. demonstrated that the fragrance exerted a significant effect on the perceived texture of the shampoo itself, and also on the perceived texture of a person's hair after washing. Finally, in older research, from Millward-Brown (2002) reported on a study of the evolution of soap packages and on the interaction between colour and smell. This report highlighted the importance of both fragrance and colour in driving the choice of consumers when it came to soap products. Interestingly, according to this report, colour assumes a greater importance when the fragrance is not available (e.g., when the consumer could not smell the fragrance through the product's packaging).

1.2. Aims of the present study

Given the results of previous research on the crossmodal correspondences that exist between olfaction and the other senses, and their applications to a variety of different real-world product categories, the present study was designed to provide some preliminary information concerning how people merge the inputs from different sensory modalities in order to perceive a multisensory product, in this case a liquid soap. In fact, our aim was to provide suggestions for the benefit of designers and marketers concerning some of the factors that should be taken into account when exploring novel multisensory solutions for packaging. We varied the concentration of the fragrance contained in the bottle, which itself varied in terms of its colour and weight. In fact, the "intensity" of the product's attributes was varied along three different sensory dimensions (i.e., olfaction, touch/haptics, and vision). Previous research has related the perceived intensity of a given fragrance to congruent, null, or incongruent colouring (e.g., Zellner & Kautz, 1990). Furthermore, other studies have related the perceived intensity of a fragrance to a variation in intensity suggested only by a variation in the colour brightness of the odorous solution (Zellner & Whitten, 1999). In the present study, we wanted to investigate the influence of the variation of the psychological construct of "*intensity*", suggested by different sensory modalities, such as different levels of a congruent colour applied to the packaging, different weights of the container, and by varying the intensity of the fragrance. In particular,

Fig. 1. (A) The 12 stimuli presented in the present study; and (B) The entire set of stimuli displayed on a table at the start of the experiment (note that the actual arrangement of the bottles was randomised across participants).

we wanted to assess whether salient variation along this dimension would affect the perceived weight of the packaging itself, and the expected efficacy and perceived intensity of the fragrance of the liquid soap contained within.

2. Methods

2.1. Participants

20 Healthy participants (12 male) aged between 19 and 34 years (mean of 26 years) took part in the experiment. The participants were not given any recompense, and all gave their informed consent prior to taking part in the study. The small sample size was considered sufficient for a preliminary experimental study designed to provide suggestions to designers and marketers concerning what sensory attributes they might want to take into account in exploring packaging solutions for soap and body-care products. The experiment was performed in accordance with the ethical guidelines provided by the academic ethical code of the Politecnico di Milano, Italy.

2.2. Stimuli

A set of 12 identical soap bottles were painted in one of three different colours using coloured aerosol spray paint. The liquid soap contained in the bottles was not visible through the opaque packaging. The colours for the bottles were chosen to present different intensities of the colour red (see Fig. 1, left). In particular, the characteristics of the colours used to paint the bottles are summarized in Table 1.

It is important to note that there was little difference between the hues of the pink and red colours used to paint the bottles, while the hue of the white paint could be considered irrelevant given the very low level of saturation. The three colours also presented a similar level of brightness (see Table 1). The variable that differed most among the three colours was the saturation. We considered the white bottles as the null intensity for the attribute "colour", the red bottles as having the maximum intensity, and the pink bottles as having an intermediate level of colouring. Two different levels of perfume were added to the soaps contained in the bottles. The lower concentration consisted of three drops of a strong perfume essence ("Dragon's Blood[1]"), whereas the higher concentration consisted of the addition of 7 drops per bottle. The essence was thoroughly mixed with the soap in the bottle.

Table 1
Chromatic characteristics of the coloured bottles.

Colour	Red	Green	Blue	Hue	Saturation (%)	Brightness (%)
Red	241	0	0	0°	100	95
Pink	253	204	205	359°	19	99
White	250	251	253	220°	1	99

A preliminary test conducted on 14 participants (7 males) using a white bottle revealed that all of the participants were able to detect the presence vs. absence of 3 drops of fragrance, when mixed with the liquid soap (100% correct). In this test, once the participants had recognised the bottles containing the scented soap, they then had to associate the fragrance with a specific colour range expressed by a chromatic scale. In particular, the participants rated the concordance between the odour and a series of colour palettes (see Fig. 2A), on a scale ranging from 0 to 10 (where a score of 0 indicated the absence of any match between the odour and the colour, and 10 was considered as a perfect match between the colour palette and the fragrance). The results of this preliminary study are shown in Fig. 2A. The participants exhibited a clear preference (average rating 7, Wilcoxon test, $p < .05$) for the red-coloured palette, providing an indication concerning the colour range that was best associated with the fragrance presented in the present study.

The weight of the heavier bottles (bottles 7–12, Fig. 1) was increased by inserting 100 g of lead weight into the soap container (thus resulting in these bottles being approximately 23% heavier than the lighter bottles). Prior to the start of the main experiment, a 500 g weight was lifted by the participants as familiarisation, in order to provide a common reference point for their subsequent weight judgments (see below). In fact, providing a baseline both for the smell and the weight stimuli, we expected to reduce the variability of responses amongst participants. Moreover, in the data analysis, participants have been included in the ANOVA and regression error terms, in order to further account for any inter-individual variability. Note here also that the differences between weight levels, and fragrance levels were selected in order to be clearly perceptible by the participants. This allowed us to obtain

[1] Dragon's blood is a bright red resin that is obtained from Croton lechleri tree. The essence used in the study was 100% pure liquid resin, purchased from EhartHerbs® (http://www.eartherbs.com/).

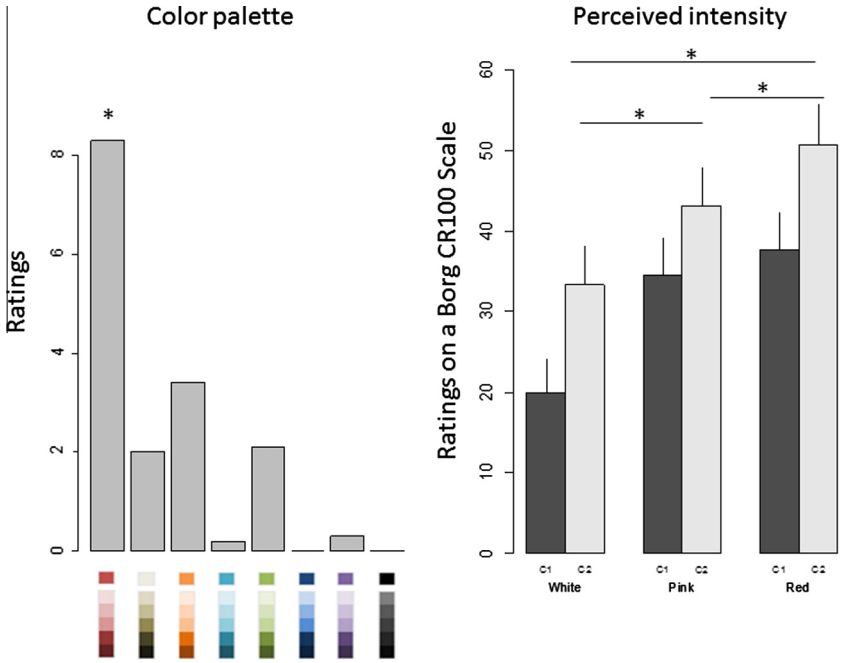

Fig. 2. (A) The results of the preliminary study highlighting a preference for the red palette of colours as corresponding to the fragrance. The rating on the Y axis (from 0 to 10) indicates how much the colour palette matched the sniffed fragrance, according to the judgment of the participants. The ∗ refers to statistically significant differences between the three palettes that received a rating different from zero from the participants ($p < .05$). (B) Perceived fragrance intensity means ± SE. Data are shown for each colour (white, pink, red) and fragrance concentration (L: low concentration, H: high concentration). The ∗ refers to a statistically significant difference between fragrance ratings ($p < .05$), highlighting the effect of the colour on the perceived intensity of the fragrance.

clear results about the main effects of each single sensory modality.

2.3. Task and experimental procedure

The participants were seated at a table on which all 12 of the bottles were arranged in a randomised order. All of the participants took part in a brief familiarisation phase, in order to instruct them about the fragrance that they would have to judge. Subsequently, the participants were given instructions concerning the task that they would have to perform. The participants started by lifting the first bottle placed on the far left of the display with their dominant hand. Subsequently, they had to open the bottle and sniff the fragrance of the liquid contained within. Finally, the participants were required to answer a series of questions regarding the characteristics of the product. The first question concerned the perceived intensity of the fragrance. The participants used a Borg CR100 (Borg, 2007) response scale.[2] The participants used a pencil to make a mark on the scale printed on a sheet of paper, in order to indicate the perceived intensity of the fragrance, paying particular attention to the verbal descriptors. Next, the participants were instructed to rate how efficacious they expected the product to be. (The experimenter explained to the participants that efficacy referred to the soap's "cleaning ability".) Once again, the participants were required to mark their response on the CR100 Borg scale. Finally, the participants estimated the weight of the bottle (in grams) by lifting it for a second time. This procedure was repeated for each of the 12 bottles (starting from the leftmost bottle and with the participants working their way rightward through the sequence of bottles). As far as possible, the action sequence was kept constant for each of the bottles. After the participant had evaluated the first six bottles (i.e., in the middle of the experiment), they were allowed to take a short break. The experiment lasted anywhere between 15 and 25 min, depending on the speed of the participant.

[2] Note that this scale has been shown to be effective in the estimation of subjective perception and, more relevant in the case of the present study, for estimating the intensity of odours (see Cortez-Pereira, Baby, Kaneko, & Velasco, 2009).

3. Results

We separately investigated the effect of colour, weight, and fragrance on the liquid soap's perceived fragrance intensity, the perceived weight of the bottles, and the expected efficacy of the product. We performed an analysis of variance (ANOVA) on each of the variables and, when considered useful or necessary, we integrated our analysis by fitting a mixed model to the data, using the R package "nlme". Table 2 summarizes the analyses that were performed on the different variables.

Conceptually, these analyses can be interpreted as being constituted by two separate steps. In the first step, there is an assessment of the perceived sensorial characteristic of the soap bottles (perceived weight and perceived fragrance), manipulated by changing their weight, fragrance concentration, and colour (therefore considered as independent variables in the model). In the second step, we assessed how the perceived characteristics of the product affected the user's expectations about the efficacy of the product itself, and therefore the actual perception of the user is tested, considering the perceived fragrance and the perceived weight as independent variables in the models.

3.1. Perceived fragrance intensity

To test for any effects of colour, fragrance intensity, and product weight on the perceived intensity of the liquid soap contained within the bottles, an analysis of variance (ANOVA; $\alpha = 0.05$) was performed on the data ($p < .001$). Post-hoc comparison (Bonferroni corrected: $\alpha = .05/3$) revealed statistically significant differences in the perceived intensity of the fragrance of the soap, as a function of the colour of the bottle (all ps < .001).

In particular, the liquid soap presented in the red bottles was perceived (on average) as having a fragrance that was significantly

Table 2
Summary of the analysis performed on participants' ratings of the soap's perceived fragrance intensity, the bottles' perceived weight, and the expected efficacy of the product.

Inspected variable	Model	Independent variables	Results
Perceived fragrance intensity	ANOVA	Colour of the bottles Inserted weight Inserted fragrance	See Table 3
	Mixed Linear Model	Saturation of the bottle's colour Inserted weight Inserted fragrance	See Table 4
Perceived weight	ANOVA	Colour of the bottles Inserted weight Inserted fragrance	See Table 6
Expected efficacy	ANOVA	Colour of the bottles Inserted weight Inserted fragrance	See Table 9
	Mixed Linear Model	Saturation of the bottle's colour Perceived weight Perceived fragrance	See Table 7

Table 3
ANOVA results for the perceived intensity of the fragrance.

	Df.	Sum. Sq.	Mean Sq.	*F* value	Pr (>*F*)
Colour	2	10,235	5117.4	14.81	$p < .01$
Weight	1	1553	1552.7	5.3	$p < .05$
Fragrance	1	7648	7648.2	23.4	$p < .01$

Table 4
Coefficient value and significance for the perceived intensity of the fragrance.

	Saturation	Weight	Fragrance	Σb	$\Sigma \varepsilon$
Coefficient value	5.6	0.14	11.7	12.4	19.2
Significance	$p < .001^*$	$p < .05^*$	$p < .001^*$		

more intense than that seen in the other bottles ($M = 46.6$). That is, the participants rated the fragrance sniffed from red bottles as being 16% more intense than the fragrance sniffed from the pink bottles, and as being 44% more intense than the fragrance sniffed from the white bottles. Meanwhile, the fragrance of the soap contained in the pink bottles was rated as 30% more intense than the perfume of the soap contained in the white bottles. As expected, the bottles containing the more intense fragrance were rated as having a smell that was 30% stronger than the bottles containing the weaker fragrance ($p < .001$). Interestingly, the liquid soap contained in the heavier bottles was also rated, on average, as having a fragrance that was 15% more intense than the soap contained in the lighter bottles ($p < .05$; see Tables 1 and 2 for a summary of the results concerning the perceived intensity of the soap). No statistically significant effects of the interactions between the considered factors were observed.

Given the crossmodal effect of the colour and of the weight on the perceived fragrance intensity, a mixed model including participants as a random variable was fitted to the data, in order to obtain information concerning the influence of each variable on the perceived intensity of the liquid soap (Pinheiro & Bates, 2000). We included colour as a continuous variable in the model, referring only to its level of saturation. (This was the only variable that obviously changed from one bottle to the next and the only variable that changed consistently with the reported pattern of results (where the white bottles were perceived has having the least intense smell, and the red the most intense smell). The mixed regression was performed using the "lme" function, defined in the package "nlme" of the R statistical software (Pinheiro & Bates, 2000). The results are summarized in Table 3.

The fragrance coefficient was the highest one (12.6), followed by the saturation of the bottle's colour (5.6), and finally by the weight (0.15). The error associated with each subject (Σb), and the residual error of the model ($\sigma \varepsilon$) are reported in Table 3 as well. Once again in this case, no statistically significant interactions were observed between the experimental variables. Table 4 shows means and standard deviations for the perceived fragrance intensity for each factor.

Table 5
Mean ± SE of perceived fragrance ratings.

		Fragrance concentration		
		3 drops	7 drops	
Weight (350 g)	White	15.3 ± 3.9	33.9 ± 4.9	33.8 ± 4.8
	Pink	27.7 ± 4.4	39.7 ± 4.8	
	Red	36.7 ± 4.6	48.9 ± 5.1	
Weight (450 g)	White	24.3 ± 4.3	32.8 ± 4.8	39.8 ± 4.9
	Pink	41.3 ± 4.8	46.5 ± 5	
	Red	38.6 ± 4.7	52.5 ± 5	
		30.7 ± 4.6	42.4 ± 5	

3.2. Perceived weight

An ANOVA ($\alpha = 0.05$) was also performed in order to test for the effects of colour, fragrance intensity, and weight on the perceived weight of the bottles. No effect of the other sensory modalities was found on the estimated weight. Indeed, the only effect that was documented related to the weight inserted into the bottles. Indeed, as expected, the heavier bottles were indeed rated as significantly heavier ($p < .001$, average estimated weight ± standard deviation: 462 ± 175 g) than the bottle without lead weight inserted (average estimated weight ± standard deviation: 271 ± 107 g). Moreover, no interaction effects were found. Table 5 reports a summary of the ANOVA results.

3.3. Expected efficacy

In the second step of the data analysis, we were interested in participants' expectations concerning the efficacy of the liquid soap product. Consequently, we utilised as independent variables, the participant's response related to the perceived weight and perceived fragrance of the liquid soaps and their containers. We relied on the assumption that participants would base their judgments concerning the expected efficacy of the soap samples on how they actually perceived the product (more, perhaps, than on its physical weight). We used the saturation of the colour in which the bottles were painted as an additional variable. Once again, a mixed model

Table 6
ANOVA results for the perceived weight.

	Df.	Sum. Sq.	Mean Sq.	*F* value	Pr (>*F*)
Colour	2	4577	2288	0.29	$p = .74$
Weight	1	2,316,738	2,316,738	299.1931	$p < .001$
Fragrance	1	7362	7362	0.95	$p = .33$

Table 7
Coefficient value and significance of the linear mixed regression for the expected efficacy.

	Saturation	Perceived weight	Perceived fragrance	Σb	$\sigma\varepsilon$
Coefficient value	−0.007	0.03	0.29	12	16
Significance	N.S	$p < .001$	$p < .001$		

Table 8
Mean ± SE of the expected efficacy of the product.

		Weight		
		350 g	450 g	
Fragrance	3 drops	29.9 ± 4.4	42.3 ± 4.6	36.1 ± 4.6
	7 drops	38.6 ± 4.5	44.3 ± 4.9	41.4 ± 4.7
		34.3 ± 4.5	43.3 ± 4.7	

Table 9
ANOVA results for the expected efficacy of the product.

	Df.	Sum. Sq.	Mean Sq.	*F* value	Pr (>*F*)
Colour	2	838	838.0	1.79	p = .18
Weight	1	4811	4810.7	10.33	$p < .01$
Fragrance	1	1697	1696.8	3.64	$p = .05$

was used to fit the data, including the participant as a random factor (in order to account for any between-participants variability). The interaction predictors and the suitability of including more (or different) variables were studied by means of likelihood ratio tests, comparing models including new predictors with a simpler reduced model (Pinheiro & Bates, 2000). No significant interaction was found in any of the models tested. Statistical analyses were also performed using the R software's "lme" function. When calculating *p*-values for comparing different models, the 'ANOVA' function was used. However, after comparing several models, the model chosen to analyse the participants' expected efficacy was:

$$\mathrm{Eij} = \mathrm{F} + \mathrm{W} + \mathrm{S} + \mathrm{bi} + \varepsilon\mathrm{ij} \quad (1)$$

where "Eij" is the expected efficacy, "F" and "W" are fixed effects expressing the perceived fragrance and weight, "S" expresses the colour saturation, "bi" is the random effect accounting for the between-participant variability and "εij" is the error term accounting for the within participant variability.

The analysis of the data revealed statistically significant main effects of perceived weight and perceived fragrance (both $p < .001$), showing that varying these two factors modified the expected efficacy of the liquid soap. No effect of colour saturation was observed.

An ANOVA that included weight and fragrance as predictors was also applied to the data. According to this analysis, the soap contained in the heavier bottles was rated as having a higher expected efficacy ($p < .01$). This analysis did not, however, reveal any significant effect of bottle colour saturation or fragrance intensity on perceived efficacy, even though the mean expected efficacy for the bottles with the lower fragrance intensity was lower than that for the bottles with the higher fragrance intensity (for a summary of the results of fragrance and weight on expected efficacy, see Table 8).

The fit of the ANOVA model was also compared to the fit of the mixed model, showing a statistically significantly higher AIC ($p < .05$). Moreover, a likelihood ratio test between the two models confirmed the better fit of the mixed model to the data ($p < .05$). Since the mixed model explained the data better than the ANOVA, this result can be interpreted as confirmation of the suggestion that participants based their judgments about the expected efficacy of the product on the perceived fragrance intensity and perceived weight, rather than on the actual amount of fragrance that had been added and the weight that had been inserted (i.e., the predictors taken into account in the ANOVA). Indeed, while the inserted fragrance turned out to constitute a non-significant factor in the ANOVA, the perceived fragrance in the mixed model was statistically significant. Table 3 reports the results of the ANOVA analysis.

4. Discussion

The results of the present study revealed a significant main effect of the colour of the packaging on the perceived fragrance intensity of the contents. Importantly, the fragrance of the liquid soap contained in the white bottles was rated by participants as being significantly less intense than the fragrance contained in the pink bottles, which, in turn, was rated as significantly less intense than the fragrance of the liquid soap contained in the red bottles, despite the fact that exactly the same concentration of fragrance was added to all of the bottles used. It is worth noting that in the present study, brightness and hue were relatively stable across the different stimuli. Thus, colour saturation was the characteristic that varied most across the different colour levels, and it is reasonable to explain the colour effect on the perceived fragrance intensity as an effect of this variable.

The results reported here support previous findings demonstrating the existence of robust crossmodal correspondence between colour and fragrance (Demattè et al., 2006a; Gilbert et al., 1996; Maric & Jacquot, 2013; Schifferstein, & Hekkert, 2007; Schifferstein, & Tanudjaja, 2004; Stevenson et al., 2012; Zellner & Kautz, 1990; Zellner & Whitten, 1999).

Moreover, our results are conceptually similar to previous reports concerning people's perception of the contents of drinks (carbonated beverages) contained in coloured cans. Indeed, it is by now well-established that people's perception of the contents can be changed simply by changing the colour of the can in which the product happens to be served/consumed (see Esterl, 2011; Spence & Piqueras-Fiszman, 2012). As mentioned previously, the crossmodal congruency between colour and fragrance (Gottfried & Dolan 2003; Koza, Climi, Dolese, & Zellner, 2005; Petit, Hollowood, Wulfert, & Hort, 2007; Spence, Levitan, Shankar, & Zampini, 2010) has been shown to augment the perceived intensity of the fragrance, especially when substances are sniffed orthonasally. Moreover, in certain cases, the fragrance of a coloured solution has been shown to be perceived as more intense as a function of the brightness of the solution itself (i.e., the brighter the solution, the more intense the fragrance is rated as being, Zellner & Whitten, 1999).

The present results also highlighted a significant effect of the variation in weight on the perceived intensity of the fragrance, thus supporting the notion of there being a crossmodal correspondence based on stimulus "intensity", rather than a correspondence based

only on the hue of the colour (confirming, to some extent, the results reported previously by Zellner & Whitten, 1999).

However, it is important to note here that the effect of varying the weight of the container was weaker than the effect of varying the colour of the packaging, as it is possible to see from the regression coefficient shown in Table 3. A possible explanation for this difference is that the 23% variation in the weight of the containers (from 350 to 450 g) was (in percentage terms) smaller than the variation in the saturation of the three colours. Moreover, there is a possibility that, in estimating the perceived intensity of the fragrance of the liquid soap, the participants may have been more influenced by the sensory channel that provided them with more (or with more reliable) information (in this particular case, the visual channel). This idea is conceptually similar to the work of Schifferstein and Desmet (2007). They demonstrated that in many cases vision is the sense that, if lacking, impairs most severely a person's ability to perceive/recognise a product. Moreover, given the particular experimental set-up utilised in the present study, the participants would have had less information regarding the weight of the liquid soap containers, as compared with the continuously available information concerning their colour. Indeed, the full range of variation in terms of the colour of the bottles was immediately apparent to the participants, and constantly available for comparison with the bottle that the participant happened to be holding in their hand at any given time during the course of the present study. By contrast, the same cannot be said for the weight of the containers. The participants would only have had direct access to the weight of the bottle that they were currently evaluating, and for comparison, only their memory of the weights of the bottles that they had already lifted.[3] That is, they presumably would not have known the true range of weights that were going to be used until they had picked up the last of the 12 bottles in the sequence.

We analysed the effect of fragrance and colour in the estimation of the bottles' weight. Despite the fact that previous researchers have, on occasion, reported that people's judgments of the weight of an object can be influenced (albeit minimally) by its colour (e.g., Alexander & Shansky, 1976; De Camp, 1917; Payne; 1961; Walker, Francis, & Walker, 2010; Wright, 1962), the perceived weight of the bottles was not significantly affected by the colour of the bottles in the present study. Moreover, inserted fragrance did not show any effect on the perceived weight either.

Finally, we analysed the expected efficacy of the product, as rated by the participants, for each of the bottles of liquid soap tested in the present study. As might have been expected, the perceived intensity of the soap's fragrance exerted a significant effect on participants' rating of the expected efficacy of the product. This is probably due to the fact that the perceived cleanliness of an object (or person) has been reported to depend to some extent on its (or their) fragrance (Kerr, Rosero, & Doty, 2005; Sitaram, 2001). Thus, it might be expected that a more intense fragrance would be semantically associated with a more effective cleaning product.

One particularly intriguing aspect of the present results was the observation that the expected efficacy of the liquid soap was influenced by the weight of the bottle (or container) in which the soap happened to be packaged (Zhang & Li, 2012). In particular, participants rated the soap as likely to be more efficacious (by 29%) when sniffed from the heavier container as compared to the light container. Given that the product's fragrance was the only attribute of the liquid soap that the participants were able to assess directly, it would certainly be interesting in future research to investigate whether adding further weight would have modulated the perceived efficacy of the product even further. The low value of the weight coefficient in the mixed model used to fit the data may be attributable to there being a smaller variation in the weight of the stimuli, despite the importance of the weight in the estimation of product efficacy (see Spence & Piqueras-Fiszman, 2011). If so, it is possible that an illusion similar to the weight-density illusion occurred when the participants had to estimate the efficacy of the contents of the liquid soap bottles. A denser soap might also be suggestive of a more effective soap (cf. Shana'a, 1998).

It is worth bearing in mind here that heavier products are usually considered by users as having a higher quality, as compared to lighter ones (e.g., Lindstrom, 2005; Piqueras-Fiszman & Spence, 2012b). Therefore, if we consider product efficacy as a proxy for product quality in the present study, products perceived to be of higher quality would probably (though not necessarily) be perceived as being more efficacious, as well. This means that, to some extent, heavier products could be considered as being more efficacious, because of their higher perceived quality. Finally, it should be remembered that the participants never tried out the soap during the experiment. Our results concern only people's expectation prior to the use of the soap. Future research will therefore clearly be needed in order to determine whether people's expectations about product efficacy that are based on the packaging would carry over to influence their perception of the product's qualities while in use.

Finally, expected efficacy has also been shown to depend on the perceived intensity of the smell, but not on the different concentration of fragrance. This is particularly interesting in terms of crossmodal correspondences, since these results seem to indicate that people actually rely for their judgments on their actual crossmodal perception, rather than on the experimental manipulation.

The results discussed thus far suggest insights into multisensory product experience that may be relevant in terms of the design of packaging and containers for liquid body soap, for products for personal hygiene and, more generally, body care and beauty (in other words, fast-moving consumer goods, FMCG, products). Similar research conducted on different kind of products, has also documented the effect of colour (Labrecque & Milne, 2012; Piqueras-Fiszman & Spence, 2012d) and weight (Spence & Piqueras-Fiszman, 2011) on people's product evaluation. The present results may suggest interesting ideas for product and packaging designers. Indeed, given the well-established effects of the packaging on product perception, companies could might want to think aout changing the colour of the packaging, as well as its weight, in order to achieve different experiences in users using product with the same amount of fragrance. Moreover, to give the impression of an efficacious product, companies might consider it useful to augment its weight and the perceived smell of the FMCGs (note that the benefits of inserting fragrance into washing product were reported by Stalmans for P&G back in 2008). In fact, it is well-known that the packaging of perfumes is composed, to a large extent, of relatively heavy containers, such as glass and metallic bottles. It is worth considering this choice of packaging as driven by consumer preference. If so, the reason that brought users to prefer glass bottles over lighter materials for perfumes, and consequently perfume producers to adopt glass bottles in order to distribute their product, could be the enhancing of the intensity of the fragrance, given by a heavier package.[2]

5. Conclusions

The results of this preliminary study represent a starting point for companies interested in maximising the sensorial feedback of

[3] It could also be noteworthy to consider this conclusion in light of the suggestion that there is a relationship between weight and perceived quality (Lindstrom, 2005). Indeed, at least in the case of perfumes, it is possible that consumers consider the intensity of the perfume, that the present research shows to be perceived as stronger if contained in heavier bottles, as an index of quality, and then, that they rated heavier bottles as having more quality than the lighter ones.

their products through packaging and sensory design innovation. The sample size is limited to 20 participants (12 male, aged between 19 and 34 years) but is considered sufficient for an experimental study. Future development will focus on achieving more data from different population of interest, increasing the relevance of the results for industries and marketers.

The results of the study suggest that varying the colour and weight of a FMCG container can be used to change the consumer's perception of the intensity of the fragrance of the contents, in this case, a liquid soap, while the expected efficacy (i.e., cleaning ability) of the product depends on its weight and on the intensity of its fragrance. These results are potentially of relevance for those who are working in the fields of packaging and product design. Indeed, knowing that the expected efficacy depends upon weight and fragrance, and, in turn, that the perceived fragrance of a liquid soap depends on the colour of the packaging, product designers will be able to vary colour and weight of the packaging in order to create catchy product able to better communicate their efficacy to the consumers. However, further studies are needed in order to assess the optimal combination between intensity of fragrance and weight able to maximise the concept of efficacy (and, more in general, the idea of "overall quality of the product") and avoid the possibility of reversal effects given by too to heavy or strong-perfumed products.

Further studies focusing on the effects of the weight of the packaging will also consider different levels of weight, in order to determine whether the expected efficacy on a product depends on an absolute, rather than relative, augmenting of the weight of the bottles. Furthermore, the effect of fragrance and colour on the perception of the efficacy of the product will be further investigated. In particular, we hope to test further smells and colours on different products, in order to investigate the effect that they can have according to their compatibility with the product semantics.

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