

The Effect of Olfactory and Tactile Cues on the Evaluation of Prescription-Free Pharmaceutical Packaging: Behavioural and Psychophysiological Modulations

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ABSTRACT

Olfactory and tactile cues are considered two relevant aspects of product evaluation. The main aim of the study was to investigate the effects of these sensory modalities on the perception of four different over-the-counter prescription-free pharmaceutical products presented to participants in their packaging. We also aimed at comparing behavioural and physiological measures in assessing the participants' reactions to the stimuli presented. In two experiments, we asked our participants to evaluate the products on a number of perceptual and semantic dimensions: reference market (male vs. female oriented), activation level (arousal), sensuality, pleasantness, and pharmaceutical/not pharmaceutical, using visual analogue scales (VAS). As a measure of physiological arousal, electrodermal activity was also measured. The results of our analysis showed significant modulatory effects of olfactory information over the participants' behavioural responses. In particular, all the products were considered less reliable, less desirable, less sensual and less pleasant when presented together with the smell of truffle, as compared to conditions where they were combined with no scent or with the scent of strawberry. Intriguingly, the olfactory stimuli also affected the attribution of the reference market to the product. In particular, Durex Play Gel presented with truffle odour was evaluated by participants as more oriented to a feminine market, as compared to when presented with no odour or strawberry odour (the opposite effect was found with Antidry Calm). The experimental condition in which participant's adopted a visual-tactile exploration of the prescription-free pharmaceutical products did not show significant effects. The analysis of the skin conductance responses showed different physiological patterns, compatible with certain perceived characteristics of the product presented (e.g., being more or less

arousing).The latter results shows that physiological measures may not be always aligned with behavioural data.

KEYWORDS: visuo-olfactory perception, visuo-tactile perception, multisensory interactions, olfaction, sensory marketing, electrophysiological measures

INTRODUCTION

It has often claimed that sight is the main sensorial modality to drive people's buying choices (Clement, 2007). In fact, a number of studies have shown that the visual aspects of products affect consumer evaluations across different dimensions (e.g., Jansson-Boyd & Kobescak, 2019; Fenko, de Vries and van Rompay, 2018; Briand Decré & Cloonan, 2018). For example Wan, Woods, Salgado-Montejo, and Spence (2015) demonstrated in an online study that the colour and shape of pharmaceutical pills affected sensory, hedonic, and efficacy expectations of their participants.

In the last few decades consumer neuroscience research has shown that the associations between different sensorial attributes of a stimulus can have profound effects in modulating our perceptual experience of to-be-purchased goods. Within this context, vision should be considered only one of the aspect that can drive consumers' decisions. For example, it was demonstrated that consumers prefer products with which they can also have tactile experiences (Gallace, 2015; Gallace & Spence, 2014; Spence & Gallace, 2011). For this very reason, advertisements, more frequently than ever before, have begun to make use of images that can evoke sensations like tactile softness or even brand names that are semantically linked to the sense of touch (Nelson, & Hitchon, 1995; Nelson, & Hitchon, 1999; Spence & Gallace, 2011; Spence, 2019). Interestingly, Schifferstein and Desmet (2007) have found that the perception of a product 'familiarity' is mainly based on tactile, rather than on visual attributes. Importantly, the skin appears to be specialised in coding the affective responses of stimuli (Field, 1997; Spence, 2002). As a consequence, a change in the tactile perception of a product might transfer the affective response to another of its sensory input, a process that has been defined 'affective ventriloquism' (e.g., Spence & Gallace, 2011).

The packaging of a product is certainly one of the elements that might affect the most people's evaluations of the product. Despite of this consideration, this element has been poorly considered from a scientific point of view by scientists and designers (see Maffei and Schifferstein, 2017 for a detailed review which retraces the general history of packaging design).The large majority of marketing strategies in the last few years have focused on the improvement and optimization of the visual aspects of products and of their packaging (with a few exceptions; see Spence & Gallace, 2011; Johnson, 2007; Lindstrom, 2005; Velasco & Spence, 2019). However, as previously noted, the evaluation of a product should be considered based on multisensory, rather than unisensory information processing. As such, also the olfactory characteristics of a given good or of its packaging should be considered. As far as this point is concerned, olfaction has been proved to be a very powerful system in evoking emotions and emotional memories, two important aspects in the evaluation of pleasant experiences (Herz, Eliassen, Beland, & Souza, 2004; Royet, Plailly, Delon-Martin, Kareken, & Segebarth, 2003; Soudry, Lemogne, Malinvaud, Consoli, & Bonfil, 2011). Importantly, the neural substrates of the olfactory system are anatomically close to several structures of the limbic system (such as amygdala and hippocampus; Savic, 2001; Shipley & Ennis, 1996; Zelano & Sobel, 2005) related

to memory processing and emotional reactions. Herz and Cupchik (1995) demonstrated that odours evoke memories that are emotionally most salient than those evoked by visual images or words. The emotional characteristics of olfactory cues and their effects on imagination (Fiore, Yah, & Yoh, 2000) would therefore seem to be particularly suited for marketing purposes (Schifferstein & Michaut, 2002). In this vein, odours coupled with a product can be integrated in a trademark and registered as a part of it (Goosen, 1998). An odour may lead the consumers to mentally associate it to a whole selection of personal care products of the same brand (Schifferstein & Michaut, 2002). Nevertheless, several issues have been raised regarding the negative effects of the olfactory branding, as well as, regarding the ethical and legal disputes related to it (Bradford & Desrochers, 2010; Nørsgaard & Rasmussen, 2013).

It is worth noting that people's purchasing choices, can also depend on the degree of congruence/incongruence between their different sensorial characteristics (e.g., touch may or may not confirm expectations gathered through vision, and vice-versa). For example, a fabric that visually appears as very soft is thought to have the same characteristic also to the tactile modality. This is likely due to the fact that, under multisensory congruent conditions of stimulus presentation, the different sensory signals coming from the product might activate and/or reinforce the same memory trace in the mind of the consumer (and the opposite might occur for incongruent situations).

However, expectancies are not always crossmodally confirmed: a cell phone which seems to be made of plastic might actually be made of aluminium (something that becomes apparent only through the direct tactile interaction with the product). In this case, consumer's purchase attitude might be positively or negatively modulated by the sensory disconfirmation depending on the 'personality' of the product's brand (being exciting/novelty seeking or rather sincere/classic; see Aaker, 1997). Specifically, in the case of the aluminium phone, the benefits of sensory disconfirmation for 'exciting' brands would depend on the fact that the product quality experienced by touch is superior to that perceived by sight (Sundar & Noseworthy, 2016). Similar considerations also apply to other different combinations of sensory and/or semantic attributes of the stimuli. For example, Krishna, Elder, and Caldara, (2010) demonstrated that the presence of semantic congruence between the perceived gender of a perfume (Hanae Mori White) and the perceived gender of a concurrently-presented paper texture lead to a more positive haptic evaluation of the paper itself. A number of studies have also shown that, when products are presented in a scented environment, consumers are willing to pay a higher price when the odour is semantically congruent with the product itself, and a lower price when the odour is incongruent with the product (Fiore et al., 2000). Bone and Jantrania (1992) also showed that consumers evaluated a household cleanser as more pleasant when associated to a lemon odour (that is generally used in cleansers and therefore congruent with a 'house cleansing schema' in the mind of the consumer), as compared to a coconut odour (i.e., generally associated to body cleansing products or food experiences). The opposite effects were found when people had to evaluate a sunscreen lotion (though see Schifferstein & Blok, 2002). Demattè, Sanabria, Sugarman and Spence, (2006) showed that fabric swatches were rated as softer when presented with a lemon odour, as compared to when they were presented together with an animal-like odour (see also Laird, 1932, Byrne-Quinn, 1988; Cox, 1967 for older studies in this field). It is important to highlight that the way of using odours can differently modulate products perception and evaluation. For example, a smell can be released in a shop environment, can exhale from a packaging or from the product itself. With respect to this latter

modality, Churchill, Meyners, Griffiths and Bailey (2009) demonstrated that several odours differentially affect a product (shampoo) texture characteristics perception, as well as, the texture characteristics perception of the hair. More recently, De Luca and Botelho (2020) in five experiments investigated the role of olfactory priming in consumer's behavior. The authors showed that people's response to odours involve both affective and semantic mechanisms. These mechanisms would be able to influence specific responses in buyer's categorization, recall, and choice of the products (see also a detailed review in which consumers response to odour it is conceptualized within the emotion-cognition approach framework; De Luca and Botelho, 2019). Interestingly, Errajaa, Daucé and Legohérel (2019) explored the effects of olfactory congruence on brand imagine. They showed that a high level of congruence between odours and brand imagine have positive effect upon spending, attitude, pleasure, arousal, and perception of the store atmosphere (Fischer, 2015; Gosling & Ric, 1996; Herrmann, Zidansek, Sprott, & Spangenberg, 2013; Roschk and Hosseinpour, 2020; Sandell, 2019).

Sensorial aspects of products and objects in the environment not only form the basic elements of perceptual processes and evaluations, but also modulate specific states of psychophysiological activation defined as arousal (Jeong & Biocca, 2012). Arousal is characterized by an activation of the autonomic nervous system (ANS) due to affective and cognitive processes and it allows people (as well as animals) to react more effectively to external stimuli (Benedek & Kaernbach, 2010; Boucsein, 2012; Gould & Krane, 1992). For example, different studies demonstrated that an augmented arousal level facilitates memories formation and long-time retention (Jeong & Biocca, 2012). At the same time, arousal has been shown to improve the recognition and recall of emotionally connoted stimuli, as compared to neutral ones (Bradley, 1994; Christianson, 1992; Heuer & Reisberg, 1990). More in general, it has been suggested that a greater arousal activation, at least up to a certain level (see Yerks, & Dowdson, 1908), generates a deeper processing of the stimuli, that in turn allows for a better memorisation of the stimuli (Bradley, Greenwald, & Lang, 1992).

On a more applied point of view, the results of a few recent studies highlighted that, an increase of arousal caused by visually-presented advertisements can affect consumers aptitude, brand memory and purchase probability (Belanche, Flavian & Perez-Rueda, 2014; Boucsein, & Schaefer, 2008; La Barbera, & Tucciarione, 1995). That is, products or packaging that are able to better modulate arousal levels might be more effective than product that do not elicit such effects. Threatening and negative stimuli have been shown to cause higher levels of physiological activation (Lang, Greenwald, Bradley, & Hamm, 1993) that might impair people's performance, memory, and cognitive functions. Moreover, it is worth nothing that not necessarily physiological responses can be used to predict behaviours and explicit responses by the participants (Harris, Giorciari, & Gountas, 2018).

The aim of the present study is to investigate the effects of some specific tactile packaging characteristics, as well as, of some specific odours attributes on the evaluations of prescription-free pharmaceutical products. In particular, the study aimed to verify whether variables different from the aesthetic aspect of odors (e.g., cognitive evaluations related to odor gender attribution) can modulate people's products evaluations. While, with respect the aesthetic elements of odor (pleasantness/unpleasantness), the aim is to investigate whether the results can be connected to a unique theoretical framework (i.e., affective ventriloquism; Spence & Gallace, 2011), or declinable in a more fluid set of theoretical references according to the

specific products characteristics. A pre-test was administered in order to identify through questionnaires and skin conductance measures, the pleasantness, the gender attribution and generated arousal level of the olfactory stimuli to be administered during the experiment. That is, both behavioural and physiological measures were adopted for the selection of the stimuli to be used in the study.

In the first experiment, the prescription-free pharmaceutical products adopted were showed to participants simultaneously to the presentation one out of three possible combination of odours' attributes (pleasant-strawberry, unpleasant-truffle, no odour and masculine-truffle, feminine-strawberry, no odour). The odour was presented by placing the bottle containing the volatile chemicals, 3 cm under the participants' nostrils. We expect that the concurrent presentation of a pleasant odour will lead to higher evaluations of pleasantness and sensuality (a variable highly correlated with the pleasantness of the products; Chrea, Grandjean, Delplanque, Cayeux, Le Calvé, Aymard, Velazco, Sander & Scherer, 2009; see Spence, 2011 for a detailed review), by the participants. If these expectations are confirmed, it might be assumed that the evaluation of the stimuli are affected by an 'affective ventriloquism' phenomenon (see Spence & Gallace, 2011). As far as the 'gender' attributed by the participants to the odour is concerned (more masculine or more feminine odours), we would expect that this variable will only result into a variation of people's evaluations, of the reference market of the product itself (this might also vary as a function of the participants' gender). That is, the simultaneous presence of a feminine odor might push the participants to identify a more female-oriented market for the product to-be-evaluated. As far as this aspect is concerned, Krishna et al. (2010) suggested that such an effect might due to the congruence between the participant's implicit (i.e., not explicitly manipulated by researcher) reference market attribution of each product presented, with the gender explicitly attributed to each smells (note however that in Krishna et al.'s study both tactile and olfactory stimuli underwent an explicit gender manipulation while here no information regarding the gender of the odour was provided).

In the second experiment, we analysed the effect of directly exploring the products via the sense of touch on people's evaluations. We expect more positive evaluations of product pleasantness when the participants are able to touch the product as compared to a condition where they cannot touch the product. In fact, it has been shown that tactile contact often results into more positive evaluations of product and services (Crusco & Wetzel, 1984; Gallace & Spence, 2010; Spapé, Harjunen, & Ravaja, 2017) as well as higher levels of physiological activation (Etzi & Gallace, 2016). Note, however, that more positive evaluations following tactile contact are often related to 'social' forms of touch, something known as the 'Midas touch effect' (see also Gallace, 2012; Gallace & Spence, 2010, for reviews).

As far as, the theoretical frameworks with which our results can be primarily compared among those mentioned above, of particular relevance seem to be the meta-analysis by Roschk and Hosseinpour (2020) regarding the link between the situational contingencies and the effects of pleasant ambient scents.

In all the experiments has also been evaluated the role of gender. The hypothesis is that there may be specific genders differences in the modulation of product evaluations related to the perceived reference market of the product itself (e.g., being more female or male customer oriented). Differences are expected on the basis of studies suggesting that olfactory sensitivity

is different between male and female (Sorokowski, Karwowski, Misiak, Marczak, Dziekan, Hummel & Sorokowska, 2019) for a meta-analysis on this topic). The same might be hypothesised for touch, given some claims in the literature about possible difference in tactile sensitivity between male and female (Peters, Hackeman & Goldreich, 2009). Finally, the study aimed at investigating if participant's behavioural responses differ from the physiological data collected (skin conductance measures; Boucsein, 2012). Such result might be suggestive of a difference between implicit and explicit mechanisms of product evaluation (see Caruelle, Gustafsson, Shams & Lervik-Olsen, 2019 for a detailed review).

EXPERIMENT 1

Participants

Thirty-one participants, with a mean age of 24.77 years ($SD = 5.81$, 21 female), took part in this study. The participants, all right-handed, were graduate and undergraduate students. They received course credits for their participation in the study, and all gave written consent prior to their participation. The sample size was a priori determined by means the statistical power analysis software Gpower 3.1. During the data analysis nine participants had to be replaced for technical problems with SC measurement recordings. Three candidate participants were instead excluded before the beginning of the experiment (and do not contribute to the participants count) because they had olfactory limitations due to mild respiratory conditions (e.g., cold). The experiment described here was performed in accordance with the ethical standards described in the 2008 Declaration of Helsinki and was approved by the local ethics committee. The experiment lasted approximately 50-60 minutes. People who claimed to be affected by any olfactory dysfunction as well as those affected by temporary conditions known to alter the sense of olfaction (i.e., cold or flu) were excluded from taking part in the experiment.

Stimuli

On the basis of the results of a pre-test two odours (strawberry, truffle) were selected among a series of nine odours (Lemon, Strawberry, Almond, Violet, Truffle, Licorice, Vanilla, Leather, Coffee) belonging to the training kit for sommelier 'Le Nez du Vin'. The odours chosen were those belonging to the opposite poles of the following dimension: gender (male/female), activation level (not at all relaxing/very much relaxing), sensuality (not at all sensual/very much sensual), pleasantness (not at all pleasant/very much pleasant), and pharmaceuticals (not at all pharmaceuticals/very much pharmaceuticals). The dimension of temperature also taken into account in the pre-test, did not reveal any significant difference among odours and therefore did not contribute to the initial selection. The participant's evaluation regarding the nine odours were ranked on each dimension from the smallest to the largest assigned value. The smells ranked at the opposite side of the two dimensions of interest (pleasantness and gender) were used in the present experiment. The same above mentioned dimensions were then used to judge the products presented to the participants during Experiment 1 and 2. In this pre-test skin conductance responses were also measured, when the participants smelled each of the ten olfactory stimuli presented. The odour to be used in Experiment 1 were then selected among those that elicited similar levels of skin conductance (although belonging to the opposite side of the evaluation scales). It is important highlight here, that the intensity of the odours presented was not controlled in the present study (just as in the majority of studies in this field; Heatherly, Dein, Munafo, & Lockett, 2019). This was due to the fact that a complete control of intensity is rather complex to be achieved without accurate psychophysics measurements and technical equipment (e.g., accurate olfactometers). As far as this point is

concerned, we have no direct information from the producer on whether the olfactory stimuli 'Le Nez du Vin' are matched in terms of their perceived intensity.



Fig. 1 (A, B, C, D). The four over-the counter prescription-free pharmaceutical products used during Experiment 1: A) Antidry Calm; B) Bepanthen Plus; C) Sportusal Gel; D) Durex Play Gel

Four over-the-counter prescription-free pharmaceutical products were selected as stimuli to be evaluated during the experiment: Antidry Calm 200 ml (Merz Pharma, lotion in cardboard box for dry skin and itching; Bepanthen Plus crème 30 gr (Bayer, tube in cardboard box, disinfectant and healing; Sportusal gel 50 gr (Permamed, tube in cardboard box, analgesic, decongestant and anti-inflammatory); Durex Play Gel 200 ml (Durex, for massage and lubricant in plastic package) (see Fig. 1A, B, C, D). The choice of the product to be used was based on the criterion that no medical prescription had to be necessary for their purchase and that they had to be representative of a wide range of uses. By contrast, all the dimensions adopted for the evaluation were chosen taking also into consideration some basic marketing aspects (e.g., related to willingness to buy and market segmentation). The Visual analogue scales were reproduced on A4 sheets of paper (one for each scale).

Procedure

The procedure followed a within-participant design. The participants were seated comfortably in front of the experimenter, resting both arms on a desk. Two Ag-AgCl electrodes (Model 1081 FG) with constant voltage (0.5 Volt) were attached to the medial phalanges of the index and the ring fingers of the non-dominant hand. SCR was recorded by means of a SC2071 device (BioDerm, UFI, Morro Bay, California). Saline conductor gel was used to improve the signal-to-noise ratio. The gain parameter was set at 10 μ Siemens (μ S)/Volt, the analog-to-digital (A/D) resolution was 12 bit, allowing to record responses ranging from 0.1 to 100 μ S, with a sample rate of 10 Hz. The investigator, after preparing the electrodes for the skin conductance showed for 6 seconds one of the four prescription-free pharmaceutical products at about 50-60 cm of distance. Simultaneously, the small bottle containing one of the olfactory stimuli, or no odour was placed 3 cm under the participant's nostrils by a second experimenter. The interval between trials was set at 1 minute. The duration of stimulus presentation (product plus odours) was set at 6 seconds, just to avoid habituation problems with longer presentation times. Immediately after the presentation of the stimuli, the participants were asked to rate the product along seven dimensions: estimated efficacy (not at all-very efficient), estimated price

(low–high), purchase intention (not at all–very much), sensuality (not at all–very much), reliability (not at all–very much), pleasantness (not at all–very much), reference market (masculine–feminine). The evaluations were recorded by means of 150mm long visual analogue scales (VAS), anchored with the terms related to each investigated dimension and printed in the centre of an A4 sheet of paper. The participants used a pen (with their dominant hand) to mark the point on the scale that best represented their judgments. Each prescription-free pharmaceutical product was presented 3 times in each olfactory condition for a total of 36 (4 products x 3 odours x 3 repetitions) products to be evaluated. The olfactory conditions (strawberry, truffle, no odour) were presented in three separated blocks. The presentation of the prescription-free pharmaceutical products was completely randomized and the olfactory conditions were counterbalanced every three participants.

The SC data were analysed by using LEDALAB (version V3.4.7), a software implemented in MATLAB (version R2011b), by using a continuous decomposition analysis approach (Benedek & Kaernbach, 2010). The sum of SCR-amplitudes of significant SCRs within response window was considered as measure for the analysis. The response window was set from 2 sec to 6 sec after the offset of the stimulation. As recommended by Venables and Christie (1980), the SC data were logarithmically transformed with the following formula: $y = \log(1+x)$ before the statistical analysis.

Results

Table 1: Experiment 1 repeated-measures ANOVA results

Experiment 1 - Seven Mixed Repeated Measures ANOVA: test of within-subjects' effects (product and odour), test of between-subjects' effects (gender)

Dependent variables: estimated efficacy, estimated price, purchase intention, sensuality, reliability, pleasantness, reference market scales

Dimension evaluated	Sum Square	of df	MS	F	p -value	Partial eta-squared
Estimated efficacy						
Gender	237.18	1	237.183	0.085	0.773	0.00291
Product	4086.26	3	1362.086	1.774	0.158	0.05766
Interaction: Product x Gender	2969.18	3	989.727	1.289	0.283	0.04257
Odour	9971.89	2	4985.947	10.407	0.000	0.26409
Interaction: Odour x Gender	579.45	2	289.723	0.605	0.550	0.02043
Interaction: Product x Odour	2185.49	6	364.249	2.012	0.066	0.06489
Interaction: Product x Odour x Gender	665.82	6	110.970	0.613	0.720	0.02070

Estimated Price

Gender			748.39	1	748.385	0.156	0.696	0.00535
Product			2692.43	3	897.477	1.576	0.201	0.05154
Interaction:	Product	x	449.40	3	149.798	0.263	0.852	0.00899
Gender								
Odour			2448.28	2	1224.140	4.930	0.011	0.14530
Interaction:	Odour	x	204.31	2	102.155	0.411	0.665	0.01399
Gender								
Interaction:	Product	x	1941.54	6	323.590	2.305	0.036	0.07364
Odour								
Interaction:	Product	x	1093.75	6	182.291	1.299	0.260	0.04286
Odour x Gender								

Purchase intension

Gender			90.41	1	90.415	0.039	0.846	0.00133
Product			26672.55	3	8890.851	4.730	0.004	0.14023
Interaction:	Product	x	8748.04	3	2916.014	1.551	0.207	0.05078
Gender								
Odour			22245.49	2	11122.744	12.037	4.654	0.29332
Interaction:	Odour	x	500.21	2	250.103	0.271	0.764	0.00925
Gender								
Interaction:	Product	x	2287.10	6	381.183	1.295	0.262	0.04273
Odour								
Interaction:	Product	x	429.87	6	71.646	0.243	0.961	0.00832
Odour x Gender								

Sensuality

Gender			6213.92	1	6213.915	2.515	0.124	0.07981
Product			185301.18	3	61767.061	60.064	0.000	0.67439
Interaction:	Product	x	3381.28	3	1127.095	1.096	0.355	0.03642
Gender								
Odour			27322.06	2	13661.030	16.964	0.000	0.36907
Interaction:	Odour	x	187.45	2	93.724	0.116	0.890	0.00400
Gender								
Interaction:	Product	x	11147.97	6	1857.995	11.575	0.000	0.28528
Odour								
Interaction:	Product	x	363.20	6	60.533	0.377	0.893	0.01284
Odour x Gender								

Reliability

Gender			31.04	1	31.039	0.014	0.908	0.00047
Product			28198.06	3	9399.355	7.405	0.000	0.20340
Interaction:	Product	x	1649.50	3	549.833	0.433	0.730	0.01472
Gender								
Odour			28141.34	2	14070.669	12.179	0.000	0.29576
Interaction:	Odour	x	23.62	2	11.810	0.010	0.990	0.00035
Gender								

Interaction: Product	x	28002.21	6	4667.034	7.211	0.000	0.19915
Odour							
Interaction: Product	x	1498.42	6	249.736	0.386	0.887	0.01313
Odour x Gender							
Pleasantness							
Gender		8491.48	1	8491.479	2.060	0.162	0.06632
Product		72989.80	3	24329.935	26.340	0.000	0.47597
Interaction: Product	x	2888.56	3	962.852	1.042	0.378	0.03470
Gender							
Odour		55222.63	2	27611.316	22.186	0.000	0.43344
Interaction: Odour	x	596.26	2	298.129	0.240	0.788	0.00819
Gender							
Interaction: Product	x	6001.54	6	1000.257	4.375	0.000	0.13110
Odour							
Interaction: Product	x	1384.27	6	230.711	1.009	0.421	0.03363
Odour x Gender							
Reference market							
Gender		30.91	1	30.906	0.043	0.837	0.00148
Product		140875.66	3	46958.552	47.987	0.000	0.62331
Interaction: Product	x	7614.58	3	2538.193	2.594	0.058	0.08210
Gender							
Odour		292.97	2	146.485	0.517	0.599	0.01752
Interaction: Odour	x	1214.42	2	607.208	2.144	0.126	0.06884
Gender							
Interaction: Product	x	14244.43	6	2374.072	6.411	0.000	0.18105
Odour							
Interaction: Product	x	1617.17	6	269.528	0.728	0.628	0.02448
Odour x Gender							

The mean participant VAS-based evaluations were analysed by means of seven separated mixed repeated-measures ANOVA with the within factor of product (Antidry Calm, Bepanthen Plus, Sportusal Gel, Durex Play Gel), and odour (no-odour, strawberry, truffle) and with the between factor of participant's gender (Male, Female). This analysis performed on the scale of estimated efficacy revealed a significant main effect of odour [$F(2,58) = 10.407, p < 0.001; d = 0.264$; see Table 1]. A Newman-Keuls corrected post hoc test on the effect of odour revealed that people expected all products to be less effective when presented together with the truffle odour than in the no-odour ($p < 0.001$) and strawberry ($p = 0.001$) conditions. The main effect of gender [$F(1,29) = 0.084, p = 0.77; d = 0.003$], product [$F(3,87) = 1.774, p = 0.16; d = 0.058$] and the interaction between product and gender [$F(3,87) = 1.30, 0.28; 0.042$], odour and gender [$F(2,58) = 0.604, p = 0.55; d = 0.020$], product and odour [$F(6,174) = 2.012, p = 0.07; d = 0.064$], product, odour and gender [$F(6,174) = 0.613, p = 0.72; d = 0.021$] did not reveal any significant effect.

The ANOVA on the scale measuring the estimated price showed a significant main effect of odour [$F(2,58) = 4.93, p = 0.1; d = 0.145$] and of the interaction between product and odour

[$F(6,174) = 2.305, p = 0.04; d = 0.74$] (see Table 1). A Newman-Keuls post hoc test on the significant main effect of odour revealed that participants tend to attributed to all products a lower price when presented together with the smell of truffle, as compared to the no-odour ($p = 0.02$) or strawberry ($p = 0.02$) odour conditions. A post hoc test (Newman-Keuls) on the interaction between product and odour showed that truffle odour lowered the estimated price of the Durex Play Gel, as compared to no odour ($p = 0.05$) and strawberry ($p = 0.01$) (see Fig. 2). The main effect of gender [$F(1,29) = 0.156, p = 0.70; d = 0.005$], product [$F(3,87) = 1.575, p = 0.20; d = 0.051$], product and gender [$F(3,87) = 0.263, p = 0.85; d = 0.009$] and the interaction between odour and gender [$F(2,58) = 4.411, p = 0.66; d = 0.013$], and product, odour and gender [$F(6,174) = 1.298, p = 0.26; d = 0.042$] did not show any significance.

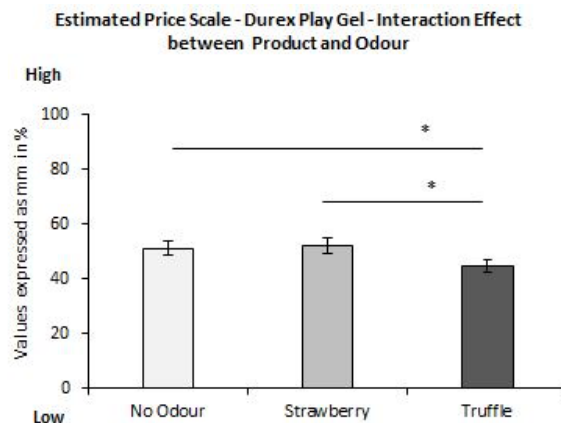


Fig. 2. Experiment 1, the participants' mean judgments on the scale of estimated price expressed as mm in percentage, as a function of the different odour conditions. Error bars represent the standard errors of the means. Asterisks represent Newman-Keuls significant differences at: * = $p < .05$

The ANOVA on purchase intention scale showed a significant main effect of product [$F(3,87) = 4.73, p < 0.001; d = 0.140$] and odour [$F(2,58) = 12.037, p < 0.001; d = 0.293$] (see Table 1). A post hoc test (Newman-Keuls) on the significant effect of product revealed that participant's purchase intention is higher for Durex Play Gel than for Antidry Calm ($p = 0.01$). A Newman-Keuls corrected post hoc test on the main effect of odour showed that truffle scent lowers people purchase intentions for all the products to be evaluated with respect to no-odour ($p < 0.001$) and strawberry odour ($p < 0.001$). The main effect of gender [$F(1,29) = 0.039, p = 0.85; d = 0.001$], and the interactions between product and gender [$F(3,87) = 1.551, p = 0.76; d = 0.051$], odour and gender [$F(2,58) = 0.270, p = 0.76; d = 0.009$], product and odour [$F(6,174) = 1.294, p = 0.26; d = 0.043$] product, odour and gender [$F(6,174) = 1.294, p = 0.96; d = 0.008$] did not result to be significant.

The ANOVA on the scale of sensuality revealed a significant main effect of prescription-free pharmaceutical product [$F(3,87) = 60.063, p < 0.0001; d = 0.621$], odours [$F(2,58) = 19.963, p < 0.0001; d = 0.314$] and of the interaction between product and odour [$F(6,174) = 11.575, p < 0.0001; d = 0.423$] (see Table 1). A Newman-Keuls post hoc test on the effect of the prescription-free pharmaceuticals products showed that participants evaluated Durex Play Gel as more sensual than Antidry Calm ($p < 0.001$), Bepanthen Plus ($p < 0.001$), and Sportusol ($p < 0.001$). A Newman-Keuls corrected post hoc test on the main effect of odour revealed that all the products were evaluated as less sensual when participants simultaneously smelled the odour

of truffle, as compared to no-odour ($p = 0.001$) and strawberry odour ($p < 0.001$). A post hoc test (Newman–Keuls) on the interaction between product and odour revealed that Antidry Calm was judged as less sensual when presented together with truffle odour, as compared to the no-odour condition ($p = 0.01$) and when it was presented with strawberry odour ($p < 0.0001$); moreover, the same product was also judged as less sensual when associated with no odour than when associated with strawberry ($p < 0.001$). Instead, participants evaluated Bepanthen Plus as less sensual when presented together with truffle odour than when presented with strawberry odour ($p < 0.001$) and when presented with strawberry as compared to no odour ($p = 0.01$). Moreover, Sportusal was considered less sensual when presented together with truffle odour, than with strawberry odour ($p < 0.001$) and when presented with strawberry as compared to no odour ($p < 0.001$). Lastly, Durex Play Gel was evaluated as less sensual when presented together with truffle odour, than with no-odour ($p < 0.0001$) or strawberry odour ($p < 0.0001$) (see Fig. 3). The main effect of gender [$F(1,29) = 2.52$, $p = 0.12$; $d = 0.080$], as well as, the interaction between product and gender [$F(3,87) = 0.12$, $p = 0.36$; $d = 0.036$], odour and gender [$F(2,58) = 0.12$, $p = 0.90$; $d = 0.001$] and product, odour and gender [$F(6,174) = 0.377$, $p = 0.90$; $d = 0.012$] did not revealed any significant effect.

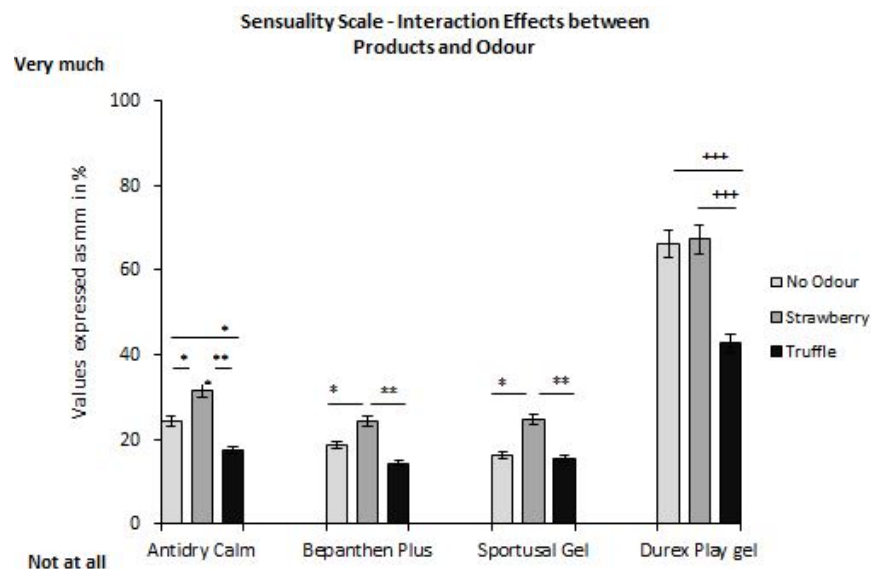


Fig. 3. Experiment 1, the participants' mean judgments on sensuality scale expressed as mm in percentage with respect the four products: Antidry Calm, Bepanthen Plus, Sportusal Gel, Durex Play Gel, as a function of the different odour conditions. Error bars represent the standard errors of the means. Asterisks represent Newman-Keuls significant differences at: * = $p < .05$; ** = $p < .001$; * = $p < .0001$**

The ANOVA on reliability scale showed a significant main effect of the product [$F(3,87) = 7.405$, $p < 0.001$; $d = 0.203$], odour [$F(2,58) = 12.179$, $p < 0.0001$; $d = 0.296$] and of the interaction between product and odour [$F(6,174) = 7.21$, $p < 0.0001$; $d = 0.199$] (see Table 1). A Newman–Keuls corrected post hoc test on the significant main effect of product revealed that participants considered Durex Play Gel more reliable than Antidry Calm ($p < 0.001$), Bepanthen Plus ($p < 0.001$) and Sportusal ($p < 0.001$). A post hoc test (Newman–Keuls) on the main effect of odour showed that truffle odour led to lower people's reliability judgements of all the products in general as compared to no-odour ($p < 0.001$) and strawberry odour ($p < 0.001$). A Newman–

Keuls post hoc test on the significant interaction between product and odour revealed that Durex Play Gel was evaluated to be less reliable when presented together with truffle odour than when presented with no-odour ($p = 0.03$) or with strawberry odour ($p < 0.0001$) (see Fig. 4) and when presented with strawberry, as compared to no odour ($p < 0.0001$). The main effect of gender [$F(1,29) = 0.014, p = 0.91; d = 0.0001$], the interaction between product and gender [$F(3,87) = 0.433, p = 0.73; d = 0.015$], odour and gender [$F(2,58) = 0.010, p = 0.99; d = 0.0003$] and product, odour and gender [$F(6,174) = 0.386, p = 0.89; d = 0.013$] did not result to be significant.

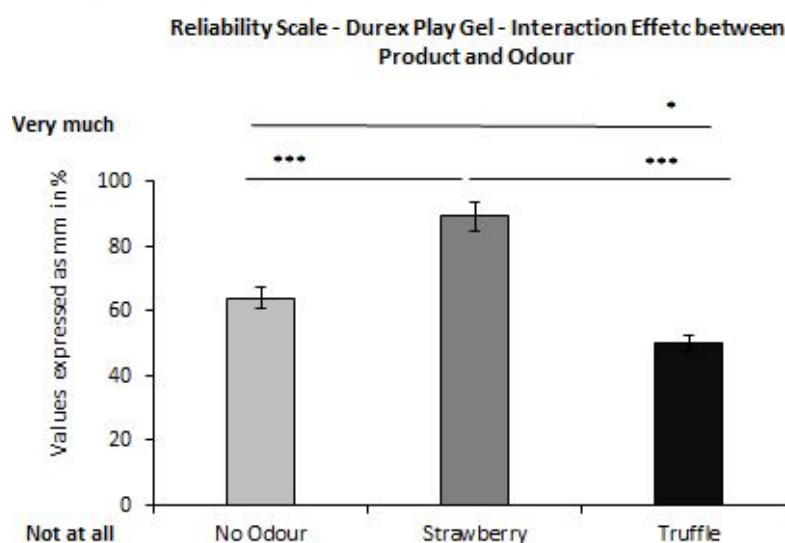


Fig. 4. Experiment 1, the participants' mean judgments on the scale of reliability expressed as mm in percentage with respect Durex Play Gel, as a function of the different odour conditions. Error bars represent the standard errors of the means. Asterisks represent Newman-Keuls significant differences at: * = $p < .05$; * = $p < .0001$**

The ANOVA performed on the scale of pleasantness revealed a significant main effect of product [$F(3,87) = 26.340, p < 0.0001; d = 0.476$], odours [$F(2,58) = 22.186, p < 0.0001; d = 0.433$] and the interaction between product and odour [$F(6,174) = 4.376, p < 0.001; d = 0.199$] (see Table 1). A Newman-Keuls corrected post hoc test on the main effect of product showed that Durex Play Gel was evaluated as more pleasant than Antidry Calm ($p < 0.001$), Bepanthen Plus ($p < 0.001$) and Sportusol ($p < 0.001$). A post-hoc test (Newman-Keuls) on the main effect of odour revealed that all the products taken as a whole were evaluated as more pleasant with strawberry scent, as compared to no-odour ($p < 0.001$) and truffle odour ($p < 0.001$), and more pleasant with no-odour as compared to truffle odour ($p = 0.001$). A Newman-Keuls post hoc test on the main interaction between product and odour showed that participants evaluated Antidry Calm as more pleasant when presented with strawberry odour than with no-odour ($p = 0.03$) or truffle odour ($p < 0.0001$), and more pleasant when presented with no-odour than with truffle odour ($p < 0.0001$). Bepanthen Plus was evaluated as more pleasant when presented together with strawberry odour, than with truffle odour ($p < 0.0001$) and no-odour ($p < 0.0001$). Moreover, Sportusol was evaluated as more pleasant when presented together with strawberry odour, as compared to when presented with truffle odour ($p < 0.0001$) and no-odour ($p < 0.0001$). Lastly, Durex Play Gel was evaluated as less pleasant when presented together with truffle odour, as compared to no-odour ($p < 0.0001$) and strawberry odour ($p <$

0.0001) (see Fig. 5). The main effect of gender [$F(1,29) = 2.060, p = 0.16; d = 0.066$], the interaction between product and gender [$F(3,87) = 1.042, p = 0.788; d = 0.008$] and product, odour and gender [$F(6,174) = 1.01, p = 0.42; d = 0.034$] did not show significant results.

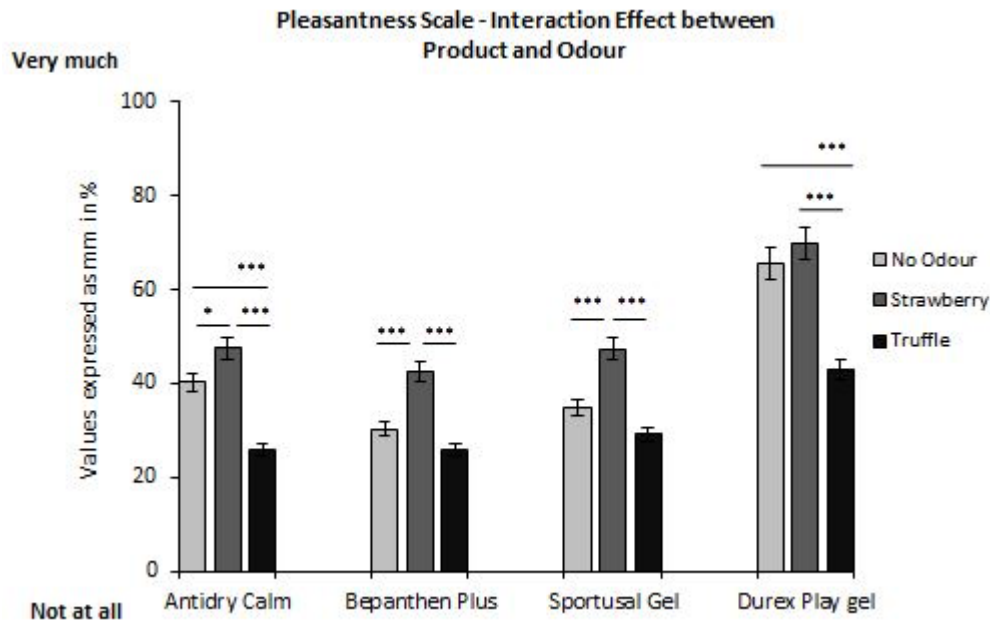


Fig. 5. Experiment 1, the participants' mean judgments on the scale of pleasantness expressed as mm in percentage with respect the four products: Antidry Calm, Bepanthen plus, Sportusal Gel, Durex Play Gel, as a function of the different odour conditions. Error bars represent the standard errors of the means. Asterisks represent Newman-Keuls significant differences at: * = $p < .05$; * $p < .0001$**

The ANOVA performed on reference market scale revealed a significant main effect of product [$F(3,87) = 47.987, p < 0.0001; d = 0.623$] and of the interaction between product and odour [$F(6,174) = 6.411, p < 0.0001; d = 0.181$] (see Table 1). A Newman-Keuls post hoc test on the main effect of product showed that participants evaluated Sportusal Gel to be more oriented to a male reference market than Antidry Calm ($p = 0.001$), Bepanthen Plus ($p < 0.001$) and Durex play Gel ($p < 0.001$). Moreover, Bepanthen Plus was judged to be more oriented to a male reference market than Antidry Calm ($p < 0.001$) and Durex Play Gel ($p = 0.03$). Durex Play Gel was evaluated as more oriented to a male reference market than Antidry Calm ($p < 0.001$). A Newman-Keuls post hoc test on the interaction between product and odour revealed that participants considered Antidry Calm as more oriented to a male reference market when presented with truffle odour, as compared to no-odour ($p = 0.01$) or strawberry odour ($p < 0.001$). Durex Play Gel was evaluated more oriented to a female reference market when presented with truffle odour than when presented with no-odour ($p < 0.0001$) or strawberry odour ($p < 0.001$) (see Fig. 6). The main effect of gender [$F(1,29) = 0.043, p = 0.84; d = 0.001$], odour [$F(2,58) = 0.517, p = 0.60; d = 0.017$], product and gender [$F(3,87) = 2.594, p = 0.058; d = 0.082$], odour and gender [$F(2,58) = 2.144, p = 0.126; d = 0.069$] and product, odour and gender [$F(6,174) = 0.728, p = 0.63; d = 0.024$] did not result to be significant.

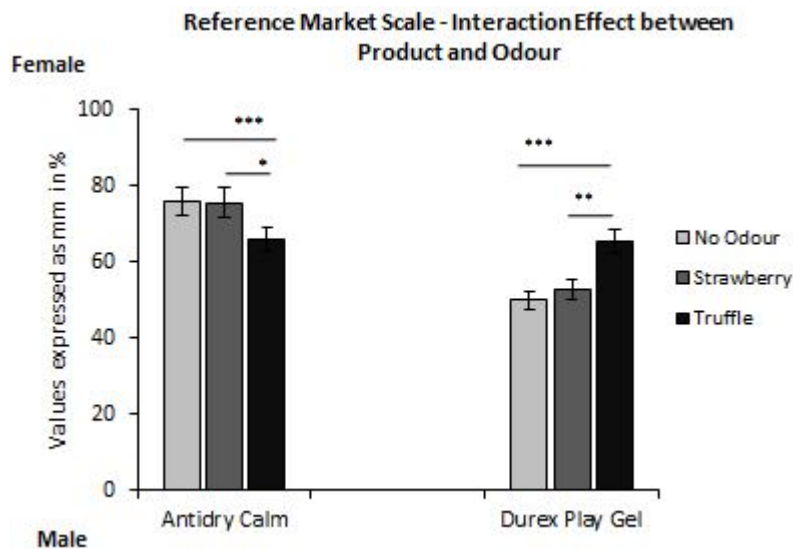


Fig. 6. Experiment 1, the participants' mean judgments on the scale of reference market expressed as mm in percentage with respect the four products: Antidry Calm, Bepanthen Plus, Sportusol Gel, Durex Play Gel, as a function of the different odour conditions. Error bars represent the standard errors of the means. Asterisks represent Newman-Keuls significant differences at: * = $p < .05$; ** = $p < .001$; * = $p < .0001$**

Table 2: Experiment 1 repeated-measures ANOVA SCR results

Experiment 1 - SCR Mixed Repeated Measure ANOVA: test of within-subjects' effects (product and odour), test of between-subjects' effects (gender)

Dependent variable:	SCR			measures		
	Sum Square	of <i>df</i>	MS	<i>F</i>	<i>p</i> -value	Partial eta-squared
Gender	0.015	1	0.015	0.206	0.653	0.00705
Product	0.030	3	0.010	2.448	0.069	0.07786
Interaction: Product x Gender	0.018	3	0.006	1.432	0.239	0.04705
Odour	0.031	2	0.016	1.679	0.196	0.05472
Interaction: Odour x Gender	0.045	2	0.022	2.395	0.100	0.07629
Interaction: Product x Odour	0.014	6	0.002	0.875	0.515	0.02928
Interaction: Product x Odour x Gender	0.036	6	0.006	2.213	0.044	0.07091

**Decomposition of
ANOVA male**

Product	0.007	3	0.002	1.172	0.339	0.11522
Odour	0.055	2	0.028	1.583	0.233	0.14958
Interaction: Product x Odour	0.033	6	0.006	3.059	0.012	0.25367

**Decomposition of
ANOVA female**

Product	0.060	3	0.020	3.925	0.013	0.16405
Odour	0.001	2	0.001	0.120	0.887	0.00597
Interaction: Product x Odour	0.009	6	0.002	0.492	0.813	0.02403

At a physiological level, the participant means of the skin conductance responses were subjected to mixed repeated-measures ANOVA with product (Antidry Calm, Bepanthen Plus, Sportusal Gel, Durex Play Gel) and odour condition (no-odour, strawberry, truffle) as within factors, and participant's gender (Male, Female) as between factor. The results revealed a significant interaction between product, odour and gender [$F(6,174) = 2,213, p = 0.04; d = 0.07$] (see Table 2). The main effect of gender [$F(1,29) = 0.21, p = 0.65; d = 0.007$], product [$F(3,68) = 1,431, p = 0.07; d = 0.078$], odours [$F(2,58) = 1.68, p = 0.20; d = 0.055$], and the interaction between product and gender [$F(3,87) = 1.431, p = 0.24; d = 0.047$], odour and gender [$F(2,58) = 2.40, p = 0.10; d = 0.076$], product and odour [$F(6,174) = 0.874, p = 0.51; d = 0.029$] did not show any significant effect. The interaction between scale, product, odour and gender was analysed by means of two separate ANOVAs, one for each gender considered. The ANOVA performed on male participants with product (Antidry Calm, Bepanthen Plus, Sportusal Gel, Durex Play Gel) and odour condition (no-odour, strawberry, truffle) as within factors, revealed a significant main effect of the interaction between product and odour [$F(6,54) = 3.06, p = 0.01; d = 0.254$; see Table 2]. The main effect of product [$F(3,27) = 1.172, p = 0.34; d = 0.115$] and odour [$F(2,18) = 1.582, p = 0.23; d = 0.150$] did not show any significant effect. A Newman-Keuls post hoc test on the interaction between product and odour revealed that males skin conductance responses was higher when Antidry Calm was presented simultaneously to no odour, as compared to strawberry odour ($p = 0.02$) and when Durex Play Gel was presented simultaneously to truffle odour, as compared to no odour ($p = 0.02$) or strawberry odour ($p < 0.01$) (see Fig. 7).

The ANOVA performed on female participants with the factors of product (Antidry Calm, Bepanthen Plus, Sportusal Gel, Durex Play Gel) and odour (no-odour, strawberry, truffle) showed only a significant main effect of product [$F(3,60) = 3.925, p = 0.01, d = 0.164$; see Table 2]. The main effect of odour [$F(2,40) = 0.120, p = 0.89; d = 0.006$] and the interaction between product and odour [$F(6,120) = 0.492, p = 0.81; d = 0.024$] did not result to be significant. A Newman-Keuls post hoc test on the significant main effect of product showed that female skin conductance measures were higher when Durex Play Gel was presented, as compared to Antidry Calm ($p = 0.01$).

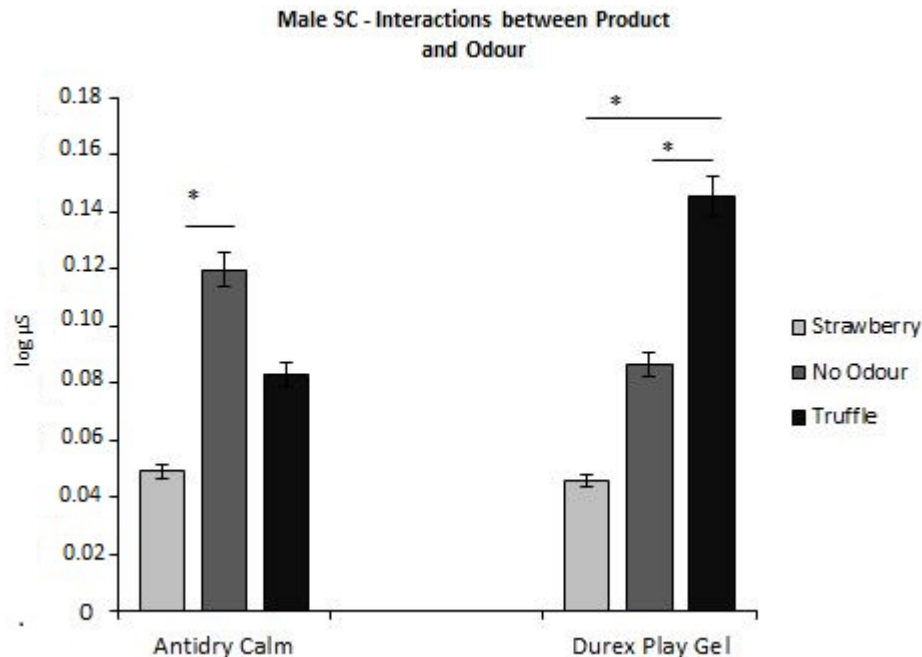


Fig. 7. Experiment 1, mean SCRs (log μ S) to the visuo-olfactory presentation of the four products. Error bars represent the standard error of the means and asterisks indicate significant differences at: * = $p < .05$

Discussion

The results obtained in the present experiment show that the effects of odour on people's evaluation depends on both the to-be-evaluated dimension and on certain aspects of the odour itself. That is, the participants' evaluations of Pleasantness and Sensuality seemed to be modulated by the degree of pleasantness/unpleasantness of the olfactory stimuli presented for 3 of the products presented (Antidry Calm, Bepanthen Plus and Sportusol Gel). As reported by Roschk and Hosseinpour (2020) in their meta-analysis study, the effect of a pleasant ambient odour is likely related to congruency, unidimensional aroma structure and familiarity of a scent. Here we can exclude that congruency may be the basis of the effects found: in fact, no apparent semantic or sensorial congruency would seem to exist between the odour and the product presented. Moreover, it is important highlight that our results were obtained in a laboratory setting, hence in a deeply different highly controlled situation with respect an in-store experiences (where congruency with the environment might be facilitated by a number of environmental and cognitive features).

As far as the results of Durex Play Gel evaluated on the Pleasantness and Sensuality scales are concerned the effects may be interpreted in term of a lack of olfactory congruence between the smell of truffle (evaluated as unpleasantness) and the brand image of the product associated with pleasant/hedonic activity (Errajaa et al., 2020). That is, a weak olfactory congruence which would cause the participant's reaction of avoidance. An alternative interpretation is an 'affective ventriloquism' effect (Spence & Gallace, 2011), that is, the negative emotional reaction elicited by the unpleasant odour led to a negative evaluation of the product.

An interesting result of Experiment 1 regards the effects of the gender attributed to the odour by participants on the evaluations along the Reference Market scale. In particular, Antidry Calm was evaluated as more oriented to a male market when presented with truffle odour than when presented with strawberry odour or with no odour. By contrast, Durex Play Gel was evaluated as more oriented to a feminine market when presented together with the truffle odour than when presented with strawberry odour or no odour. As far as the results of Antidry Calm are concerned, the presentation of a smell (truffle) that is not congruent with the gender target of the product (female in this case) could have affected the participants evaluation. This shift could be related to an explicit or implicit association between the truffle odour and a more male-oriented market. That is, the presentation of a more 'masculine' perceived odour could have facilitate a shift in people's evaluation of the reference market, overcoming other product cues (indicating a more feminine oriented market) (see De Luca & Botelho, 2019 for a detailed review on 55 empirical studies on olfaction to integrate the emotion-cognition approach to scent marketing). This effect would certainly need to be further investigate in the future.

The skin conductance measurements, unlike behavioral results, revealed a difference in participants responses based on their gender. Specifically, male participants SCR measures with Antidry Calm were significantly higher when the product was presented together with no odour, as compared to the strawberry odour. Conversely, male participants SCR measures elicited by the presentation of Durex Play Gel were significantly higher when the product was presented together with truffle odour, as compared to strawberry odour or no odour. Moreover, SCR measures of female participants showed only a general higher physiological activation when Durex Play Gel was presented. The effects found highlight that, although at the behavioral level no gender effects were found, at a more implicit level male and female were differently activated during the Experiment 1. The nature of this gender-related implicit effects certainly deserve to be investigated in depth in future studies. More in general, this result would seems not to be fully congruent with some previous studies where olfactory stimuli failed to modulate participants' electrophysiological responses (Møller & Dijksterhuis, 2003).

Experiment 2

The aim of the Experiment 2 is to investigate the effect of visual and visuo-tactile cues on the evaluations of prescription-free pharmaceutical products. Moreover, we wanted to investigate the effect of these sensory cues on the participants' arousal responses (measured by means of skin conductance; Boucsein, 2012) in order to understand if physiological variables can support behavioural data or offer additional insight for their interpretation. We hypothesize more positive evaluations of product pleasantness when the participants are able to touch the product as compared to a condition where they cannot touch the product. We also expect Higher levels of physiological activation during the tactile interaction with the products due to the claim that touch carries a higher arousal value as compared to vision (Etzi & Gallace, 2016; Field, 2014; Gallace & Spence, 2014).

Participants

Twenty-four participants, with a mean age of 23.08 years ($SD = 1.64$, 13 female), took part in this study. The participants, all right-handed were graduate and undergraduate students. The sample size was computed by means of the statistical software Gpower 3.1. They received course credits for their participation in the study, and all gave written consent prior to their participation. The experiment described here was performed in accordance with the ethical

standards described in the 2008 Declaration of Helsinki and was approved by the local ethics committee. The experiment lasted approximately 40-50 minutes.

Stimuli

In Experiment 2 were used the same visual stimuli of Experiment 1. No odours were adopted and the tactile stimuli consisted of the actual products' packaging used in Experiment 1, haptically explored by the participants.

Procedure

The procedure followed a within-participant design. The four products were presented in two different experimental conditions: visuo-tactile and visual only. The participant's skin conductance was measured throughout the experiment by means the same procedure of Experiment 1. In the visuo-tactile condition the experimenter passed the product to the participant's dominant hand. He/she was then allowed to touch and watch the item for 6 seconds. After that, the experimenter took the product and the participant was requested to evaluate it along the same seven dimensions and using the same procedure adopted in Experiment 1. The visual condition procedure was identical to the visuo-tactile procedure with the sole exception that the participants merely watched the product held by the researcher without any additional tactile interaction. Each type of product was presented 3 times in every conditions for a total of 24 (4 products x 2 conditions x 3 repetitions) products to be evaluated. The two experimental conditions (visuo-tactile and visual) were separated by an interval of 60 seconds. The presentation order of the stimuli was completely randomised and the experimental conditions were counterbalanced every three participants. SC data were analysed with the same procedure of Experiment 1.

Results

Table 3: Experiment 2 repeated-measures ANOVA results

Experiment 2 - Seven Mixed Repeated Measures ANOVA: test of within-subjects' effects (product and visual or visual-tactile condition), test of between-subjects' effects (gender)
Dependent variables: estimated efficacy , estimated price, purchase intention, sensuality, reliability, pleasantness, reference market scales

Dimension evaluated	Sum Square	of df	MS	F	P value	Partial eta- squared
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Estimated efficacy

Gender	1199.596	1	1199.596	0.579	0.455	0.02566
Product	7181.344	3	2393.781	3.814	0.014	0.14774
Interaction: Product x Gender	6923.003	3	2307.668	3.676	0.016	0.14318
Visual or Visual-Tactile	83.449	1	83.449	0.228	0.638	0.01027
Interaction: Visual or Visual-Tactile x Gender	47.917	1	47.917	0.131	0.721	0.00592
Interaction: Product x Visual or Visual-Tactile	351.108	3	117.036	0.782	0.508	0.03432
Interaction: Product x Visual or Visual-Tactile x Gender	350.310	3	116.770	0.780	0.509	0.03424

Estimated Price

Gender	106.564	1	106.564	0.053	0.820	0.00240
Product	2297.736	3	765.912	0.807	0.494	0.03540
Interaction: Product x Gender	4396.797	3	1465.599	1.545	0.211	0.06562
Visual or Visual-Tactile	252.598	1	252.598	1.410	0.248	0.06023
Interaction: Visual or Visual-Tactile x Gender	1.002	1	1.002	0.006	0.941	0.00025
Interaction: Product x Visual or Visual-Tactile	538.574	3	179.525	1.359	0.263	0.05818
Interaction: Product x Visual or Visual-Tactile x Gender	46.357	3	15.452	0.117	0.950	0.00529

Purchase intension

Gender	7063.597	1	7063.597	2.348	0.140	0.09644
Product	24222.865	3	8074.288	5.401	0.002	0.19710
Interaction: Product x Gender	19533.123	3	6511.041	4.355	0.007	0.16525
Visual or Visual-Tactile	363.503	1	363.503	1.226	0.280	0.05280
Interaction: Visual or Visual-Tactile x Gender	1097.960	1	1097.960	3.704	0.067	0.14410
Interaction: Product x Visual or Visual-Tactile	333.211	3	111.070	0.578	0.631	0.02561
Interaction: Product x Visual or Visual-Tactile x Gender	445.598	3	148.533	0.773	0.513	0.03395

Sensuality

Gender	4958.277	1	4958.277	3.165	0.089	0.12575
Product	247752.960	3	82584.320	95.186	0.000	0.81226
Interaction: Product x Gender	39.034	3	13.011	0.015	0.997	0.00068
Visual or Visual-Tactile	0.205	1	0.205	0.001	0.974	0.00005
Interaction: Visual or Visual-Tactile x Gender	3.098	1	3.098	0.016	0.901	0.00072
Interaction: Product x Visual or Visual-Tactile	61.587	3	20.529	0.303	0.823	0.01358
Interaction: Product x Visual or Visual-Tactile x Gender	339.254	3	113.085	1.669	0.182	0.07051

Reliability

Gender	2.249	1	2.249	0.001	0.972	0.00006
Product	5802.891	3	1934.297	3.232	0.028	0.12810
Interaction: Product x Gender	3297.217	3	1099.072	1.837	0.149	0.07705
Visual or Visual-Tactile	100.505	1	100.505	0.244	0.626	0.01097
Interaction: Visual or Visual-Tactile x Gender	1062.391	1	1062.391	2.578	0.123	0.10490
Interaction: Product x Visual or Visual-Tactile	55.457	3	18.486	0.187	0.905	0.00845
Interaction: Product x Visual or Visual-Tactile x Gender	244.644	3	81.548	0.827	0.484	0.03622

Pleasantness

Gender	460.603	1	460.603	0.133	0.719	0.00601
Product	76655.537	3	25551.846	23.670	0.000	0.51828
Interaction: Product x Gender	3505.456	3	1168.485	1.082	0.363	0.04689
Visual or Visual-Tactile	1.285	1	1.285	0.004	0.952	0.00017
Interaction: Visual or Visual-Tactile x Gender	46.823	1	46.823	0.133	0.719	0.00602
Interaction: Product x Visual or Visual-Tactile	254.802	3	84.934	0.477	0.699	0.02122
Interaction: Product x Visual or Visual-Tactile x Gender	574.442	3	191.481	1.075	0.366	0.04660

Reference market

Gender	2406.981	1	2406.981	4.511	0.045	0.17016
Product	72664.738	3	24221.579	29.464	0.000	0.57251
Interaction: Product x Gender	499.655	3	166.552	0.203	0.894	0.00912
Visual or Visual-Tactile	3.242	1	3.242	0.021	0.887	0.00093
Interaction: Visual or Visual-Tactile x Gender	9.823	1	9.823	0.062	0.805	0.00282
Interaction: Product x Visual or Visual-Tactile	479.903	3	159.968	1.944	0.131	0.08119
Interaction: Product x Visual or Visual-Tactile x Gender	1149.979	3	383.326	4.658	0.005	0.17474

Decomposition ANOVA Reference Market dimension – male

Product	38631.685	3	12877.228	18.653	0.000	0.65100
Visual or Visual-Tactile	0.821	1	0.821	0.024	0.881	0.00235
Interaction: Product x Visual or Visual-Tactile	511.375	3	170.458	2.644	0.067	0.20912

Decomposition ANOVA Reference Market dimension - female

Product	34160.073	3	11386.691	12.219	0.000	0.50453
Visual or Visual-Tactile	13.282	1	13.282	0.051	0.825	0.00423
Interaction: Product x Visual or Visual-Tactile	1173.702	3	391.234	4.027	0.014	0.25128

The participants' judgments regarding the products were submitted to a seven separated mixed repeated-measures ANOVA with the within factors of product (Antidry Calm, Bepanthen Plus, Sportusol Gel, Durex Play Gel) and experimental conditions (visuo-tactile, visual) and with the between factor of participant's gender (male, female).

The analysis performed on the estimated efficacy scale revealed a significant main effect of product [$F(3,66) = 3.814, p = 0.01; d = 0.148$] and of the interaction between product and gender

[$F(3,66) = 3.676, p = 0.02; d = 0.143$] (see Table 3). The main effect of gender [$F(1,22) = 0.579, p = 0.45; d = 0.026$], experimental condition [$F(1,22) = 0.228, p = 0.64; d = 0.010$], as well as the interaction between experimental condition and gender [$F(1,22) = 0.131, p = 0.72; d = 0.006$], product and experimental condition [$F(3,66) = 0.781, p = 0.51; d = 0.034$] and product, experimental condition and gender [$F(3,66) = 0.780, p = 0.51; d = 0.034$] did not revealed any significant effect. A Newman-Keuls post hoc test on the significant main effect of product showed that participants evaluated Antidry Calm as less effective than Bepanthen plus ($p = 0.46$) and Durex Play Gel ($p = 0.47$). A post hoc test (Newman-Keuls) on the interaction between gender and product showed that only males judged Antidry Calm less effective than Bepanthen Plus ($p = 0.01$) and Durex Play Gel).

The ANOVA on the scale measuring the estimated price did not show any significant effect of gender [$F(1,22) = 0.053, p = 0.82; d = 0.002$], product, [$F(3,66) = 0.807, p = 0.49; d = 0.035$], of the experimental condition [$F(1,22) = 1.42, p = 0.25; d = 0.060$], of the interaction between product and gender [$F(3,66) = 1.545, p = 0.21; d = 0.066$], experimental condition and gender [$F(1,22) = 0.006, p = 0.94; d = 0.0002$], product and experimental condition [$F(3,66) = 1.36, p = 0.26; d = 0.058$] and product, experimental condition and gender [$F(3,66) = 0.117, p = 0.95; d = 0.005$] (see Table 3).

The ANOVA on purchase intention scale showed a significant main effect of product [$F(3,66) = 5.401, p < 0.01; d = 0.197$] and product and gender [$F(3,66) = 4.355, p = 0.01; d = 0.165$] (see Table 3). The main effect of gender [$F(1,22) = 2.348, p = 0.14; d = 0.096$], experimental condition [$F(1,22) = 1.226, p = 0.28; d = 0.053$], as well as, the interaction between experimental condition and gender [$F(1,22) = 3.704, p = 0.7; d = 0.144$], product and experimental condition [$F(3,66) = 0.578, p = 0.631; d = 0.026$] and product, experimental condition and gender [$F(3,66) = 0.773, p = 0.51; d = 0.034$] did not showed any significant effect. A Newman-Keuls post-hoc test on the main effect of product revealed that participant's expressed higher purchase intentions for Durex Play Gel with respect Sportusol Gel ($p = 0.02$) and Antidry Calm ($p = 0.02$). A post hoc test (Newman-Keuls) on the interaction between gender and product demonstrated that male lower purchase intentions for Antidry Calm, as compared to Bepanthen Plus ($p = 0.01$), Sportusol Gel ($p = 0.05$) and Durex Play Gel ($p < 0.001$).

The ANOVA on the scale of sensuality revealed a significant main effect of product [$F(3,66) = 95.186, p < 0.0001; d = 0.812$; see Table 3]. The main effect of gender [$F(1,22) = 3.165, p = 0.09; d = 0.125$], experimental condition [$F(1,22) = 0.001, p = 0.97; d = 0.00004$], the interaction between product and gender [$F(3,66) = 0.015, p = 0.99; d = 0.0006$], experimental condition and gender [$F(1,22) = 0.016, p = 0.90; d = 0.0007$], product and experimental condition [$F(3,66) = 0.303, p = 0.82; d = 0.014$] and product, experimental condition and gender [$F(3,66) = 1.669, p = 0.18; d = 0.071$] did not demonstrated any significant effect. A Newman-Keuls post-hoc test on the main effect of product revealed that Durex Play Gel was judged as more sensual than Antidry Calm, (Antidry Calm was evaluated as less sensual with respect Bepanthen Plus ($p < 0.001$), Bepanthen Plus ($p < 0.001$) and Sportusol Gel ($p < 0.001$). Moreover, Antidry Calm was evaluated as more sensual than Sportusol Gel ($p = 0.05$).

The ANOVA on reliability scale showed a significant main effect of the product [$F(3,66) = 3.232, p = 0.30; d = 0.128$; see Table 3]. The main effect of gender [$F(1,22) = 0.001, p = 0.97; d = 0.00006$], experimental condition [$F(1,22) = 0.243, p = 0.63; 0.011$], the interaction between

product and gender [$F(3,66) = 1.837, p = 0.15; d = 0.077$], experimental condition and gender [$F(1,22) = 2.578, p = 0.12; d = 0.105$], product and experimental condition [$F(3,66) = 0.187, p = 0.90; 0.008$] and product, experimental condition and gender [$F(3,66) = 0.827, p = 0.48; d = 0.036$] did not demonstrated any significant effect. A Newman-Keuls post-hoc test performed on the main effect of product did not revealed any significant effect.

The ANOVA performed on the scale of pleasantness revealed a significant main effect of product [$F(3,66) = 23.67, p < 0.0001; d = 0.518$; see Table 3]. The main effect of gender [$F(1,22) = 0.133, p = 0.72; d = 0.006$], experimental condition [$F(1,22) = 0.004, p = 0.63; d = 0.0001$], the interaction between product and gender [$F(3,66) = 1.024, p = 0.36; d = 0.047$], experimental condition and gender [$F(1,22) = 0.133, p = 0.72; d = 0.0001$], product and experimental condition [$F(3,66) = 0.477, p = 0.70; d = 0.021$] and product, experimental condition and gender [$F(3,66) = 1.075, p = 0.37; d = 0.047$] did not showed any significant effect. A Newman-Keuls post-hoc test performed on the product effect showed that participant's evaluated Durex Play Gel as more pleasant than Antidry Calm ($p < 0.001$), Bepanthen Plus ($p < 0.001$) and Sportusal Gel ($p < 0.001$).

The ANOVA performed on reference market scale revealed a significant main effect of gender [$F(1,22) = 4.511, p = 0.05; 0.991$], product [$F(3,66) = 29.464, p < 0.0001; d = 0.661$] and of the interaction between product, experimental condition and gender [$F(3,66) = 4.67, p = 0.01; d = 0.409$] (see Table 3). The main effect of experimental condition [$F(1,22) = 0.021, p = 0.89; d = 0.001$], product and gender [$F(3,66) = 0.203, p = 0.89; d = 0.010$], experimental condition and gender [$F(1,22) = 1.944, p = 0.13; d = 0.003$] and product and experimental condition [$F(3,66) = 1.944, p = 0.13, d = 0.081$] did not revealed any significant effects.

The interaction between product, experimental condition and gender was analysed by means of two separate ANOVAs, one for each gender condition. This analysis performed on male participants revealed a significant main effect of product [$F(3,30) = 18.653, p < 0.0001; d = 0.651$; see Table 3]. The main effect of experimental condition [$F(1,10) = 0.024, p = 0.88; d = 0.002$], as well as, the interaction between product and experimental condition [$F(3,30) = 2.644, p = 0.07; d = 0.210$] did not showed any significant effect. A post-hoc test (Newman-Keuls) performed on the main effect of product revealed that male participants judged Antidry Calm as more oriented to a female market, as compared to Bepanthen Plus ($p < 0.001$), Sportusal Gel ($p < 0.001$) and Durex Play Gel ($p < 0.001$). Instead Sportusal Gel was evaluated as more oriented to a male market with respect Antidry Calm ($p < 0.001$), Bepanthen Plus ($p = 0.03$) and Durex Play Gel ($p = 0.02$).

The ANOVA performed on female participants showed a significant main effect of product [$F(3,36) = 12.219, p < 0.0001; d = 0.505$] and of the interaction between product and experimental condition [$F(3,36) = 4.027, p = 0.01, d = 0.251$] (see Table 3). The main effect of experimental condition [$F(1,12) = 0.051, p = 0.82; d = 0.004$] failed to reveal any significant effect. A Newman-Keuls corrected post-hoc test on the main effect of the product revealed that female participants judged Antidry Calm as more oriented to a female market as compared to Bepanthen plus ($p < 0.01$), Sportusal Gel ($p < 0.001$) and Durex Play Gel ($p < 0.01$). Instead, female participants evaluated Sportusal Gel as more oriented to a male market as compared to Antidry Calm ($p < 0.01$), Bepanthen Plus ($p = 0.03$) and Durex Play Gel ($p = 0.04$). A post hoc test (Newman-Keuls) on the interaction between product and experimental condition

demonstrated that female evaluated as more oriented to a female market Antidry Calm in the visual condition with respect the visuo-tactile presentation ($p = 0.05$) (See Fig. 8).

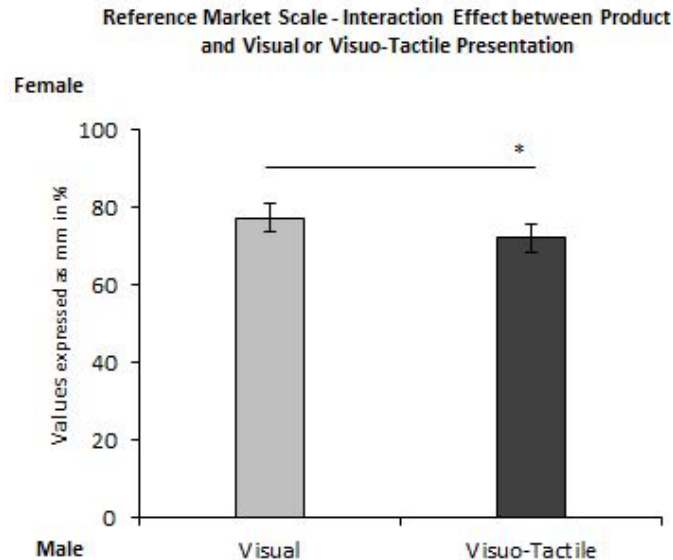


Fig. 8. Experiment 2, the female mean judgments on the scale of reference market expressed as mm in percentage with respect the four products: Antidry Calm, Bepanthen Plus, Sportusal, Durex Play Gel, as a function of the different experimental condition. Error bars represent the standard errors of the means. Asterisks represent Newman-Keuls significant differences at: * = $p < .05$

Table 4: Experiment 2 repeated-measures ANOVA SCR results

Experiment 2 - SCR Mixed Repeated Measure ANOVA: test of within-subjects' effects (product and visual or visual-tactile condition), test of between-subjects' effects (gender)

Dependent	variable:		SCR			measures
	Sum of Square	df	MS	F	p-value	Partial eta-squared
Gender	0.055	1	0.055	2.193	0.156	0.10860
Product	0.041	3	0.014	5.413	0.002	0.23120
Interaction: Product x Gender	0.003	3	0.001	0.398	0.755	0.02165
Visual or Visual-Tactile condition	0.025	1	0.025	4.903	0.040	0.21408
Interaction: Visual or Visual-Tactile condition x Gender	0.036	1	0.036	7.070	0.016	0.28200
Interaction: Product x Visual or Visual-Tactile condition	0.015	3	0.005	2.303	0.087	0.11343
Interaction: Product x Visual or Visual-Tactile condition x Gender	0.008	3	0.003	1.266	0.295	0.06572

The SC data were submitted to a mixed repeated measures ANOVA with product (Antidry Calm, Bepanthen Plus, Sportusal Gel, Durex Play Gel) and condition (visual, visuo-tactile), as within factors and gender (male, female) as between factor. The analysis revealed a significant main effect of product [$F(3,54) = 5.413, p = 0.002; d = 0.231$], condition (visual, visuo-tactile) [$F(1,18) = 4.903, p = 0.04; d = 0.214$] and of the interaction between condition (visual, visuo-tactile) and gender [$F(1,18) = 7.07, p = 0.016; d = 0.282$] (see Table 4). The main effect of gender [$F(1,18) = 2.192, p = 0.16; d = 0.109$], as well as, the interaction between product and gender [$F(3,54) = 0.398, p = 0.75; d = 0.021$], product and condition (visual, visuo-tactile) [$F(3,54) = 2.302, p = 0.09; d = 0.113$] and product, condition (visual, visuo-tactile) and gender [$F(3,54) = 1.266, p = 0.30; d = 0.066$], did not reveal any significant effect. A post-hoc test (Newman-Keuls) on the main effect of the product showed that participant's SCR measures were higher with the Durex Play Gel than Sportusal Gel ($p = 0.02$), Bepanthen Plus ($p < 0.001$) and Antidry Calm ($p = 0.01$). A Newman-Keuls post-hoc test on the main effect of the interaction between product and gender revealed that in general male's SCR measures were higher in the visual condition, as compared to the visuo-tactile condition ($p < 0.001$) (see Fig. 9). The Newman-Keuls post-hoc test on the main effect of condition (visual, visuo-tactile) did not showed any significant effect.

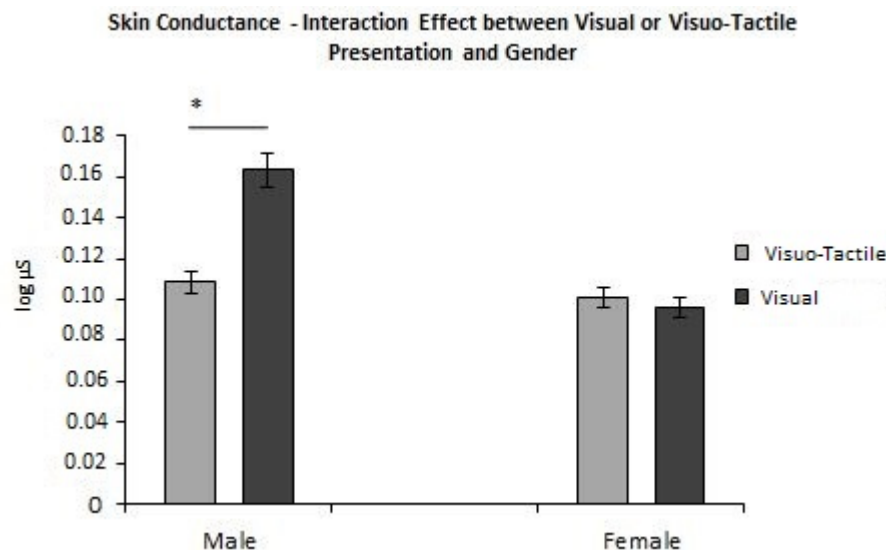


Fig. 9. Experiment 2, mean SCRs (log μ S) to the visual plus visuo-tactile presentation of the four products taken together. Error bars represent the standard error of the means and asterisks indicate significant differences $* = p < .05$

Discussion

The only effect found in Experiment 2 was related to the Reference Market scale. In particular, female participants evaluated Antidry Calm as more oriented to a feminine market when visually presented then when it was presented in a bimodal way (visuo-tactile interaction). This outcome would seem to be partially inconsistent with the previous literature showing that tactile contact often results into more positive evaluations of product and services (Crusco & Wetzel, 1984; Gallace & Spence, 2010; Spapé, Harjunen, Ravaja, 2017). Note, however, that most of the above mentioned studies relates to an interpersonal administration of touch. By contrast, in the present study only individual's tactile interaction were concerned. The few studies that have found an effect of human-to-object (rather than human-to-human) touch on product/services evaluation show that participants' evaluations can be pushed toward either

positive or negative values as a function of certain tactile qualities of the product (Gallace & Spence, 2014; Spence & Gallace, 2011). It is worth to considering here that, with the exception of Durex Play Gel, the packaging of the other products presented have rather similar tactile qualities (see Maggioni, Risso, Olivero & Gallace, 2015; Risso, Maggioni, Etzi & Gallace, 2019; Wang & Spence, 2018). That is, there are not differences between the packaging glossiness that could have influenced the haptic perception of the stimuli or the participants' expectations about it (Briand Decré & Cloonan, 2019). In addition, there were no visual metaphor (such as, a human figure in a particular part of the packaging), or textual claim (except for Antidry Calm, which has some writing on the packaging in pink) capable of influencing people's assessments on the different product dimensions investigated (Fenko, de Vries, van Rompay, 2018).

The results of this study also showed that the participants provided higher evaluations regarding estimate efficacy, purchase intention, sensuality and pleasantness for Durex Play Gel, as compared to the other products, regardless of the sensory modality of presentation. This result is probably due to a cognitive association between the product packaging and the brand, well known to develop sexually-related pharmaceutical products.

The measures of skin conductance of Experiment 2 showed significantly greater physiological activation for Durex Play Gel, as compared to all the other products. In addition, male's SCR was higher for visual than visuo-tactile presentation of the stimuli, while female's SCR did not differ between these two conditions of stimulus presentation. Future research is certainly needed in order to further investigate this aspect.

GENERAL DISCUSSION AND CONCLUSION

In the present experimental design we investigated whether participants' evaluations of four prescription-free pharmaceutical products presented in their packaging, as well as, the physiological arousal induced by the sensory interaction with them, can be modulated by different types of olfactory stimuli (Experiment 1) or by the haptic information available (Experiment 2). In Experiment 1 (visuo-olfactory condition), the participants evaluated Antidry Calm, Bepanthen Plus, Sportusal Gel as more pleasant when presented together with strawberry odour as compared to the other odours conditions. Moreover, Durex Play Gel was judged as less pleasant when the participants smelled the odour of truffle than when no odour or strawberry odour were presented. Note that all the products presented were evaluated at the lowest level of the pleasantness scale when presented together with the truffle odour. Similar results were found on the sensuality scale (e.g., participant's evaluated Antidry Calm, Bepanthen Plus, Sportusal Gel and Durex Play Gel as more sensual when these products were presented together with strawberry odour as compared to the other odours conditions). No differences between female and male participants were reported in this study.

The effects related to pleasantness and sensuality scales involved all the products tested, however the very nature of these results might be different for each product. As far as Antidry Calm, Bepanthen Plus and Sportusal Gel are concerned, the effects found would seem to be more related to the major or minor degree of pleasantness/unpleasantness of the experimental odours (note that strawberry was evaluated during the pre-test as the most pleasant odour) presented together with the products. That is, the degree of odour pleasantness might have been somehow transferred to the participant's evaluations of the product itself (congruently to what we predicted on the expectations regarding these characteristics). The effects found might

thus be related to an 'affective ventriloquism' phenomenon (see Spence & Gallace, 2011). That is, the pleasant/unpleasant feeling of the odours might have modulated the emotional value of the to-be-evaluated products on the scales of pleasantness and sensuality (see also Mehrabian and Russell, 1974).

Similarly to our finding, Kirk-Smith and Booth (1990) reported that people are judged more positively when a pleasant fragrance is presented in the environment. Fiore et al.'s (2000) also demonstrated that a pleasant environmental fragrance can affect the attitude toward a product and the relative customers' purchase intentions. However, the latter study highlighted that an important role in modulating the participants' evaluations was played by the appropriateness of the odour to the product more than to the pleasantness of the fragrance by itself. For example, specific fragrances generally used in the lingerie section of a store negatively affected the sale of fashion products dedicated to business woman. Finally, Demattè et al.'s (2006) demonstrated that participants feel fabric swatches softer when presented together with a lemon odour, than when presented with an animal-like odour (unpleasant). On the basis of a number of considerations, the authors concluded that the effect was not modulated by the pleasantness of the odour per se, but rather by the learned experience that associates specific olfactory stimuli to particular tactile stimuli. However, it should be considered here that prescription-free pharmaceutical products do not necessarily have a clear association with previously experienced odours. This aspect, related to people's expectation about the associations between smell and commercial products, should be certainly investigated in the future.

Bearing in mind the above considerations, from a theoretical point of view, it remains difficult attribute the results obtained to one specific conceptual paradigm that consider certain characteristics of ambient where the scent is present essential for the effectiveness of their pleasantness (Roschk & Hosseinpour, 2019). In fact, the present study was implemented and administered in a laboratory setting where environmental influences are minimized as much as possible.

The results related to Durex play Gel differed with respect to the other products evaluated. That is, only the unpleasant odour (truffle) modulated the participant's evaluation on the pleasantness and sensuality scales, but no modulation was found by presenting a pleasant odour (that is the presentation of strawberry odour did not differ from the condition of no odour presentation). This effect might be related to the fact that the evaluations of this product are generally very high among the participants. That is, the pleasant odours presented were probably unable to further increase people evaluations along this direction (already high in the no odour condition). By contrast, the unpleasant odours might have generated a cognitive dissonance between the information delivered through the sense of smell and the association in the mind of the consumer between the Durex Play Gel and the perception of pleasure (note that the product has a strong association with sexual activities).

Alternatively, the effect found could be attributed to the lack of congruence between the product and the truffle smell. In particular, the Durex Play Gel is currently sold (as also advertised in current commercial campaigns) in various pleasant fragrances, not comprising truffle odour. It is thus possible that such odour resulted to be congruent with the participants' previous memories (due to direct use of exposition to commercial campaigns) about it. In this case, a sensory disconfirmation of the usual association between the olfactory and visual quality

of the product could have negatively affected the participants' judgements (see also Sundar & Noseworthy, 2016, for a similar result in a visual-haptic condition of stimulus presentation).

Our data would seem to be consistent with the results of a previous study in which it was demonstrated that people evaluated male faces to be less attractive when presented together with an unpleasant odours (rubber and body odour), than when presented with a pleasant odour (geranium and a male fragrance), or no odour (Demattè, Österbauer & Spence, 2007; see also Mehrabian and Russell, 1974; see Croy, D'Angelo, & Olausson, 2015 for the evidence that unpleasant odours reduce touch pleasantness).

A very interesting result found in Experiment 1 was that when Antidry Calm was presented together with truffle odour it was judged more oriented to a male market than when presented with strawberry odour or no odour. By contrast, Durex Play Gel was evaluated more oriented to a feminine market when presented together with truffle odour, as compared to when presented with strawberry odour or no odour. Intriguingly, the evaluation on both products were provided by both male and female participants. It is worth nothing here that, Antidry Calm was also evaluated as the most feminine product among the four experimental stimuli and that truffle odour was evaluated as the more masculine odour. That is, the simultaneous presentation of truffle odours (masculine) with Antidry Calm (feminine) was able to detour the participant's market gender attribution of the product itself. Likewise, this result suggests that truffle odour might be effective in reducing the impact of the visual features of the packaging, where a large use of pink colour was adopted (a colour often associated to a female market and used for market segmentation; Koller, 2008). In this case, it seems unlikely that the effect found can be solely due to the odour unpleasantness (e.g., see Demattè et al. 2007), given that not necessarily an unpleasant odour is expected to be related to a masculine market.

As far as Durex Play Gel is concerned, the participants evaluated this product as more oriented to a feminine reference market. Nevertheless, it is worth considering that the participant's evaluations were quantitatively close by the line that separates a masculine or a feminine attribution to the product (unlike the Antidry Calm whose evaluation fall on the highest part of the scale). That is, Durex Play might be considered a gender-neutral product in people's evaluation. Therefore, it might be said that the presentation of truffle odour shifted a neutral evaluation towards the feminine side of the scale. This result is rather unexpected considering that the opposite effect was found when the same odour was presented with the Antidry Calm. This result is certainly difficult to be interpreted without further data, and will need to be better explored in the future.

The effects found with Antidry Calm could be partly interpreted within the theoretical framework associated to smell congruence (Errajaa et al., 2020). That is, when the gender of the odour presented corresponds to the product gender (feminine), this might further enhance participant's attribution of reference market in the direction of the association (female oriented). By contrast, when the odour is not congruent with the main reference market of the product, the participants' evaluations are reversed. This might suggest that within an incongruent visuo-olfactory condition people's attention might be captured by the odour rather than by the visual quality of the product. As a consequence, the characteristics of the odour become more important for the evaluation of the reference market. This hypothesis should certainly be further investigated in future studies. Given our findings, the most important

question to be answered becomes why humans consistently associate certain odours to the concept of gender, and how this association can modulate their visual judgments. For example, one might hypothesized that some odours (like that of spices or musk) are more often presented inside male more than female fragrances. Alternatively, one might wonder if the compounds that characterize male and female body odours have some chemical similarities with specific odours and/or lead to similar physiological effects. As far as the latter aspect is concerned, a number of studies have shown that the presentation of certain odours or chemicals can result into a number of automatic reactions related to human mate selection behavior (Gangestad and Thomhill 1997; Rikowski and Grammer 1999; Theodouridou, Row, Penton-Voak, & Rogers 2009). In particular, previous research has shown a direct relationship between odours and sexual arousal both in men and women (Hirsch and Gruss 1999; United States Patent Hirsch, 2006). Note, however, that in our study the SC measures collected in the pre-test did not reveal significant differences between truffle and strawberry odour. That is, it is unluckily that the two odours exerted their modulatory effect on the participants' evaluations of visual stimuli only in term of changing the participants' physiological arousal.

Interestingly, our results showed that truffle odour, significantly lowered the estimated price of Durex Play Gel, as compared to the other odour conditions. In this case, it is possible to hypothesize that the effect found are due to the participant's implicit association of odour unpleasantness with the perception of a lower quality/value of the product. This hypothesis is in line with the idea that odours might exert a direct effect on cognitive processes (Laird, 1932; Mitchell, Kahn & Knasko, 1995). The lack of effects with the other products, may have been determined by the fact that the participants (on average quiet young), probably had less knowledge and/or previous experiences with them. Durex Gel is in fact the only product adopted here that has an international appeal and maintain exactly the same name and packaging design across different countries. By contrast, the other products are less known by participants and this might have made more difficult to estimate their prices. Another interesting result is that the strawberry odour increased the perceptual reliability of Durex Play Gel with respect to the others odour conditions. In this case, given that the product is widely advertised also with strawberry flavour/scent, the presence of this odour could have facilitated the activation of pleasant memories in the participants (once again mediated by previous direct experience with the product or commercial campaigns). It will be certainly of interest in the future to study if these effects can be different in usual consumers vs. participants who never used or know the products. As far as the lack of effects with the other products is concerned, it might be worth considering the same assumptions advanced for the results obtained in the estimated price scale.

The analysis of skin conductance responses of Experiment 1 demonstrated that SCR of male participants to the exposition of Durex Play Gel were higher when the truffle odour was concurrently presented with the product as compared to the other odour condition. By contrast, the SCR of the same participants measured when Antidry Calm was presented resulted in higher values when no odour was concurrently presented to the product, as compared to the strawberry odour condition.

The results obtained with Durex Play Gel, may have been determined by the interaction between the odour gender attribution and the association with the sexual activity evoked by the product. In particular, it is possible that males, have been implicitly aroused by the

androstenedione, a pheromone contained in truffles which could have an effect on human socio-sexual behavior (Claus, Hoppen, & Karg, 1981; Precone, Paolacci, Beccari, Dalla Ragione, Stuppia, Baglivo et al., 2020). Unfortunately, however, this hypothesis cannot be verified, given that no data on the exact composition of odours adopted is available from the producer (note however that they are claimed to be composed with about 50% of natural essences). The fact that the SCR measures elicited by Antidry Calm were higher in the condition where no odour was presented than in the condition where strawberry odour was presented could be related to a lack of associations between the product and any odour adopted here. That is, truffle or strawberry are unlikely to be associated with Antidry Calm (a product generally used to soothe dry skin and itching).

It cannot be excluded that a perceived difference in intensity between the olfactory stimuli may be the basis of the effects found. Since, the lower or higher intensity of an odour can determine a significant modulation of its pleasantness (Doty, 1975). Nevertheless, it is not clear how odour intensity might be linked to the odour-gender attribution effects. Future studies should also address the link between intensity of odours and their attributed gender.

SCR measure of female participants only showed a general higher physiological activation when Durex Play Gel was presented but not modulated by the odour presented. This general effect is, at least in part, expected outcomes of the study, considering that participants likely associated Durex Play Gel to sexual activities. In previous literature, it was demonstrated that electrodermal activity is augmented by sexually-characterised visual stimuli, even if, also unpleasant or unexpected visual stimuli enhanced human arousal in a similar way (Bradley et al., 2001; Zuckerman, 1971). That is, the results of Experiment 1 showed that behavioural data are aligned at least for what concern the Durex Play Gel (especially in the reference market scale).

The results of Experiment 2, showed that in reference market scale female participants evaluated Antidry Calm as more oriented to a feminine market when visually presented than when it was presented in a bimodal way (visuo-tactile interaction). No other differences between sensory conditions were reported. This is an unexpected outcome, since it has been shown that tactile contact often results into more positive evaluations of product and services (Crusco & Wetzel, 1984; Gallace & Spence, 2010; Spapé, Harjunen, Ravaja, 2017). However, it is necessary to emphasize that in our experiment the packaging characteristics that are more useful for the attribution of the reference market were likely visual (e.g., a wide pink graphic element on the product cardboard). By contrast the tactile attribute of the cardboard box was identical among Antidry Calm, Bepanthen Plus and Sportusal Gel. That is, tactile attributes were unlikely to exert any effect in driving expectations or perceptions about the appropriate market for the products presented.

The results concerning the other scales showed that the participants provided higher evaluations regarding estimate efficacy, purchase intention, sensuality and pleasantness for Durex Play Gel, as compared to the other products, regardless of the sensory modality of presentation. These results are similar to those obtained in Experiment 1 even if we also found some interactions between the products and the type of odour presented (e.g., the rating of Durex Play Gel also depended on the simultaneously presented odour).

The result obtained with skin conductance measures in Experiment 2 partially differ from those obtained in Experiment 1. In both experiments we found significantly greater physiological activation for Durex Play Gel, as compared to all the other products. However, we also found that male's SCR was higher for visual than visuo-tactile presentation of the stimuli, while female's SCR did not differ between these two conditions of stimulus presentation. We will certainly need to investigate further this effect in the future given the lack of consistent literature on gender-based differences in sensory dominance under multisensory conditions of stimulus presentation.

The fact that SCR responses could not differentiate the product as a function of the modality of exploration might also be due to the similarity of the packaging across the stimuli adopted (except for Durex Play Gel). This could have made the tactile processing scarcely salient for the participants. Such a result, can be also taken as a valuable suggestion for future marketing strategies (to try and differentiate more the tactile qualities of packaging among similar products). This hypothesis is only in part confirmed by the results of the skin conductance measurements, where no differences were found for 3 out of 4 products (except once again for Durex Play Gel). In fact, physiological and behavioural data resulted to be aligned for females participants, but not for males where different level of activation were found depending on the modality of presentation (visual vs. visuo-tactile). It is also worth mentioning here that the contribution of touch to the evaluation and physiological responses to the product could have been limited by the fact that the visual appearance of the packagings used could have been predictive of their tactile characteristics. That is, nothing additional was provided by the haptic interaction with the stimuli.

It is important to note that a previous study by Etzi and Gallace (2016) showed that tactile presentation resulted into higher arousal responses and higher evaluation of pleasantness as compared to visual presentation of textures. However, it is worth noting that in Etzi and Gallace experiments participants did not simultaneously perform visual and tactile explorations, but were exposed to two separate unisensory conditions (visual or tactile). That is, in our visuo-tactile condition, vision could have dominated the participants' perception (Hartcher O'Brian, Gallace, Krings, Koppen, & Spence, 2008; Gallace, Auvray & Spence, 2007) reducing the effect of haptic exploration. Moreover, the texture adopted in Etzi and Gallace's study were passively presented on the participants' arms by stimulating the skin at a velocity that elicits a strong response of C-tactile fibres (partly responsible of pleasantness in tactile perception; see Gallace & Spence, 2016; Olausson, Cole, Rylander, McGlone, Lamarre, Wallin, Krämer, Wessberg, Elam, Bushnell, & Vallbo, 2008). In the present experiment, participant's actively explored the stimuli by holding them in their hands, therefore without eliciting the C-tactile afferents response, since the hands palms are hairless (C-tactile afferents were found only in hairy skin). That is, all of these differences would seem to justify the apparent incongruence between the results obtained in the present experiment and those reported by Etzi and Gallace (2016).

Another aspect that is worth mentioning here, in order to interpret the partial lack of effect of touch on participants evaluations could be given by the presence of inter-individual differences. That is, it has been shown that people differ in term of their desire to touch or to be touched (Peck & Childers, 2003). Different results might be expected for participants who differ in their need for touch. For this very reason, future experiments should also take into consideration this aspect and use the "need for Touch" scale (Peck & Childers, 2003), in order to classify the

participants in terms of their response to tactile interactions. Note however that the latter scale has no current Italian translation.

In summary, our study contributes to show that behaviours related to goods selection processes are not only modulated by the visual and tactile aspects of the stimuli (Clement, 2007; Field, 1997; Schifferstein & Desmet, 2007; Spence & Gallace, 2011; Spence, 2002), but also by common odours. Specifically, the results of Experiment 1 showed that the often-discussed visual advantage in sensory perception can be modulated by olfactory information processing. For what concern the theoretical backgrounds at the basis of the results obtained, it should be emphasized that not all the observed outcomes are in agreement with current theories relating to the effects of the product packaging on potential consumers evaluations. Nevertheless, the issues related to the effects of crossmodal interaction between odour, touch and products characteristics are certainly relevant to contribute to understand people behaviours modulated by non-verbal multisensory cues.

The results of the present study have also important practical applications in the field of marketing and product design. In particular, perfume, body care and food industries might benefit from the presence of crossmodal correspondences between gender and odours. Specifically, they might use these associations as an 'intuitive' strategic tool for market segmentation, just as it occurs for colors (Koller, 2008).

As far as the comparison between the results obtained by means of behavioral measures and those obtained by collecting skin conductance data are concerned, we observed a difference between Durex Play Gel, and the other three products. It is possible, that both the visual and tactile aspect of the other three packagings, as well as, the mental representation of their use did not elicit in participant's mind emotions or reactions intense enough to determine a significant modulation of their arousal. In particular, the characteristics of the packagings (except Durex Play Gel), probably did not allow to significantly differentiate the arousal modulation among several conditions of stimuli presentation (visuo-olfactory, visuo-tactile, visual) in the different dimensions investigated. By contrast, it is worth noting here that the explicit reference to the sexual activity linked to the Durex Play Gel, likely activated the emotional and physiological state of the young participants in the experiment. That is, in this case the physiological data related to the sensuality of the product are aligned with people's evaluations. This result might be taken to suggest that skin conductivity in product evaluation is effective in supporting behavioural data, only when large differences between the products (in terms of at least one dimension investigated) are expected. This would also suggest that packaging designers might want to use more the potentialities offered by different sensory modalities in order to elicit not only behavioural but also physiological responses by consumers.

In conclusion, the results of the present study show that participant's gender attribution to odours, as well as their pleasantness, can affect the evaluation of prescription-free pharmaceuticals products under conditions of multisensory (visual-olfactory) stimulus presentation. By contrast we failed to find a strong effect of tactile information processing on people's evaluations. Further investigations should be directed to identify the origins and neurocognitive mechanisms at the basis of the associations between odours and cognitive evaluations of stimuli, such as their perceived gender.

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