

Aphantasia affects liking more than beauty judgments in visual evaluation of tactile aesthetics of textures

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ABSTRACT

Touch provides crucial information about the physical world, including hedonic aspects. In certain contexts, such as online shopping, the absence of tactile sensation renders the multisensory experience incomplete, though mental imagery may compensate for this absence. However, 2 to 4% of the population is affected by aphantasia, a condition characterized by reduced or absent mental imagery. This study examined the impact of aphantasia on the tactile aesthetics of textures presented visually. An aphantasic group (N=22) and a control group (N=22) evaluated the tactile aesthetics of textures presented visually in terms of liking and beauty, and completed questionnaires (VVIQ, Psi-Q, NFT, BFI). Results showed that aphantasia affects all sensory dimensions, reducing openness to experience and leading to lower aesthetic judgments. Our findings confirm that aphantasia impacts aesthetic judgments when the multisensory experience is incomplete.

Keywords : aphantasia, liking, tactile perception

L'aphantasie affecte davantage les jugements d'appréciation que de beauté dans l'évaluation visuelle de l'esthétique tactile des textures.

RÉSUMÉ

Le toucher transmet des informations cruciales sur le monde physique, notamment des aspects hédoniques. Dans certains contextes, tels que les achats en ligne, l'absence de sensation tactile rend l'expérience multisensorielle incomplète, mais l'imagerie mentale peut compenser cette absence. Néanmoins, 2 à 4 % de la population est atteinte d'aphantasie, une

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condition caractérisée par une réduction ou une absence d'imagerie mentale. Cette étude a examiné l'impact de l'aphantasie sur le jugement esthétique tactile de textures présentées visuellement sans être touchées. Un groupe aphantasique (N=22) et un groupe témoin (N=22) ont évalué des textures présentées visuellement en termes « d'appréciation » et de « beauté » tactile, et ont complété des questionnaires (VVIQ, Psi-Q, NFT, BFI). Les résultats montrent que l'aphantasie affecte toutes les dimensions sensorielles, réduisant l'ouverture à l'expérience et entraînant des jugements esthétiques inférieurs. Nos observations confirment que l'aphantasie impacte les jugements esthétiques lorsque l'expérience multisensorielle est incomplète.

Mots clés : aphantasie, jugement d'appréciation, perception tactile

INTRODUCTION

Touch conveys important information about the world, including hedonic aspects (Gallace & Spence, 2010). In everyday life, our multisensory experiences are occasionally incomplete, as the example of online shopping shows (Spence, 2008). Nevertheless, it is well-known that touch plays a vital role in real-life and online purchasing decisions (Brasel & Gips, 2014; Kühn, Lichters, & Krey, 2020; Peck & Childers, 2003a). Using the NFT scale (Need for Touch; Peck & Childers, 2003a), Duarte (2020) demonstrated that the NFT score does not directly influence the propensity to purchase items online. However, a high NFT can lead to greater use of imagery (Krishna, Luangrath, & Pech, 2024), which appears to be the preferred strategy for compensating for the absence of physical touch (Ruusunen, Hallikainen, & Laukkanen., 2023). The visual preview model (Klatzky, Lederman, & Matula, 1993) also suggests that individuals in a purchasing situation first visualize an object before deciding to explore it haptically. Together, these findings highlight the importance of sensory simulation and mental imagery in the tactile experience.

Sensory simulation is a cognitive process through which individuals mentally recreate sensations in the absence of direct sensory input. This mechanism relies on the activation of brain regions similar to those involved in real perception, allowing the recreation of sensory experiences based on memories or mental imagery (Kosslyn, Ganis, & Thompson, 2001). For instance, when an individual imagines the softness of a texture (resp. the taste) of a food item, they activate neural circuits associated with touch (resp. taste) (Yoo, Freeman, McCarthy, & Jolesz, 2003). It is also essential for generating appropriate emotional responses, as it links imagined sensations to affective memories and learned perceptual models

(Holmes, Geddes, Colom, & Goodwin, 2008; Pearson, Naseleris, Holmes, & Kosslyn, 2015). Sensory simulation, relying on mental imagery, thus plays a pivotal role in aesthetic judgments when multisensory experiences are incomplete or absent, such as online shopping or the visual evaluation of textures (Peck & Childers, 2003a; Ruusunen *et al.*, 2023).

Mental imagery can be defined as the capacity to visualize objects and events through the process of thought (Kosslyn, 1975; Nanay, 2020; Pearson, 2019). It enables us to make sense of our environment, consolidate memories (Holmes *et al.*, 2008), and flexibly and adaptively interpret experienced events (Moulton & Kosslyn, 2009), thereby facilitating our capacity to plan and make decisions. Visual imagery thus plays an essential role in cognitive functions, including episodic memory (Greenberg & Knowlton, 2014), visual working memory (Pearson & Keogh, 2019), and dreaming (Horikawa, 2013). This suggests that all cognitive functions (voluntary or involuntary) that involve a visual component are likely to be impaired in individuals with visual imagery deficits. It has been established that 2% to 4% of the population self-report reduced or absent mental imagery, a phenomenon known as aphantasia (Zeman, 2020; Zeman, Dewar, & Della Sala, 2015; 2016). As a result of this deficit, individuals with aphantasia may experience difficulties in a number of domains, including episodic (Dawes, Keogh, Andrillon, & Pearson, 2020) and autobiographical memory abilities (Dawes *et al.*, 2020; Zeman, 2020). However, little is known about the impact of aphantasia on aesthetic experience, especially when the multisensory experience is incomplete and needs to be compensated for by mental imagery.

Mental imagery is not exclusive to visual experiences; it also encompasses other sensory modalities, including auditory, olfactory, gustatory, and tactile imagery. Furthermore, positive correlations have been identified between the various sensory modalities of imagery (Andrade, May, Deeprase, Baugh, & Ganis, 2014; Lima *et al.*, 2015). Non-aphantasic individuals are thus capable of generating tactile mental images (Yoo *et al.*, 2003) which plays an important role in compensating for the lack of physical touch (Ruusunen *et al.*, 2023). However, what about individuals with aphantasia? Although aphantasia was initially defined as the exclusive absence of visual imagery (Milton *et al.*, 2021), Zeman *et al.* (2020) revealed that 54% of the 2,000 aphantasics they surveyed reported low or absent imagery in all sensory modalities. Moreover, Dance *et al.* (2021) demonstrated that 97% of the aphantasics they surveyed exhibited deficits in visual imagery and in at least one other sensory domain. Impaired mental imagery makes it more difficult to mentally visualize products and

imagine using them, thereby affecting their evaluation (Dahl & Hoeffler, 2004). Muraki *et al.* (2023) also showed that individuals with aphantasia exhibit limitations in their ability to mobilize bodily simulations to process abstract concepts or perform judgments involving controlled cognitive processes. This suggests that aphantasia may primarily impact the controlled aspects of mental imagery, which involve sensory memory retrieval and deliberate simulation of sensations. However, recent findings suggest that individuals with aphantasia might also exhibit impaired automatic imagery skills (Krempel & Monzel, 2024; Purkart, Delem, Ranson, Andrey, Versace, Cavalli, & Plancher, 2025). Mental imagery does indeed involve both automatic and controlled mechanisms. Automatic mechanisms, which operate involuntary and require minimal attentional resources, are closely tied to early sensory processing and are primarily associated with rapid emotional responses. Controlled mechanisms, on the other hand, require deliberate attention and engage higher-order cognitive processes, such as memory retrieval and imagery construction (Pearson *et al.*, 2015). Consequently, our working hypotheses must consider the automatic versus controlled nature of the processes involved in aesthetic experience (Leder, Belke, Oeberst, & Augustin, 2004; Graf & Landwehr, 2015), as will be discussed below.

Given the literature cited above, it is reasonable to posit that individuals with aphantasia may find it difficult to compensate for the incomplete sensory experience of touch. The aim of the present experiment is therefore to examine the impact of aphantasia on the aesthetic experience of textured materials by sight alone, without the experience of touch. It is therefore necessary to consider the possible impact of aphantasia on aesthetic experience. One hypothesis is that the absence of imagery may impact the accuracy of judgments, resulting in an underestimation of the positive and negative valences of the textures. In this case, they would produce more neutral judgements for positive and negative textures, compared to those made by the control group. An alternative assumption is that the aphantasics would globally rate textures less positively than the control group. This would be due to the misattribution of the less positive feeling that accompanies aphantasics' dysfluent processing of incomplete sensory situations that elicit their impaired imagery skills. Processing fluency refers to the ease with which information is processed, which has been shown to positively influence hedonic and aesthetic judgments (Reber, Schwarz, & Winkielman, 2004). The fluency effect results from the attempt of the perceiver to generate explanation about his experience of ease or difficulty during processing. As claimed by Chang (2013): *"people apply different naïve theories to reach this explanation. For example,*

they might assume, I experience fluency and therefore, this information must be... true/aesthetic/popular. In each case, processing fluency influences judgments differently, depending on the domain, including judgments of truth (Reber & Schwarz 1999), aesthetic pleasure (Reber et al., 2004), or fame (Weisbuch & Mackie 2009)." Chang (2013) also pointed out that fluency arises from different cognitive processes, including perceptual, conceptual and imagery fluencies, but that the ease to generate imagery when processing information, namely imagery fluency, has attracted only sparse attention. Given that mental imagery contributes to processing fluency by facilitating the retrieval of sensory and conceptual information (Chang, 2013), aphantasics may experience reduced imagery fluency when compensating for incomplete sensory input. This may result in the erroneous attribution of processing difficulty to the intrinsic properties of the textures to be judged. Because the difficulties experienced by aphantasics appear to be more related to the controlled mechanisms, even though we could not rule out potential difficulties in automatic mechanisms of mental imagery (Krempel & Monzel, 2024; Purkart et al., 2025), the subsequent stage of the introduction must therefore entail the distinction between automatic (aesthetic pleasure) vs. processes controlled (aesthetic evaluation) involved in aesthetic experience (Leder et al., 2004; Graf & Landwehr, 2015), as well as the determination of the contexts in which they are elicited respectively. This could help to better estimate the cognitive challenges faced by aphantasic individuals in the different components of aesthetic experience.

Aesthetic experience is a fundamental aspect of human cognition because we are constantly evaluating objects, situations, events, emotions or physiological states. These evaluations play an essential role in decision-making, comparisons, selection of alternatives and prioritization of actions (Berridge & Kringelbach, 2015). Aesthetics has historically focused on visual perception, in particular the properties of works of art or artistic stimuli (Leder et al., 2004). Other senses, such as touch, taste and smell, have been neglected (Roberts, 2022). It seems reasonable, therefore, to apply the same models of aesthetics that have been developed primarily in connection with the visual domain to the other senses.

Studies on aesthetics have mostly used liking and beauty rating tasks and suggest that liking and beauty judgments engage different processes, reflecting the dual-process perspective generally adopted in theoretical accounts of aesthetics. For example, Leder et al. (2004)'s model of aesthetic appreciation and aesthetic judgments differentiates between "aesthetic pleasure" and "aesthetic evaluation" as two types of output. According to this definition, although liking and beauty judgments derive from a

common hedonic value, they refer to different components of aesthetic experience. Graf and Landwehr (2015) also proposed a dual-process perspective of aesthetics in which aesthetic experience can be the product of two distinct processes that differ fundamentally in the way the perceiver engages in the processing of the stimulus. Specifically, the Pleasure-Interest Model of Aesthetic Liking (PIA Model) posits that “aesthetic pleasure” arises automatically from stimulus-driven processing and corresponds to a Liking judgment, while “aesthetic interest” elicits controlled and elaborate perceiver-driven processing and corresponds to a Beauty judgment (Graf & Landwehr, 2015). In the more specific context of haptic aesthetics, different levels of processing are also postulated. For example, Carbon and Jakesch (2012) claimed that haptic aesthetic processing encompasses three levels : a low-level of perceptual and unspecific analyses, a mid-level of specific and more elaborate perceptual analyses, and a high-level of deeper cognitive and emotional evaluations of the stimuli. The present model of haptic aesthetic is thus also structured as a series of processing stages marked by a continuous increase in specificity, complexity and elaborateness. For the sake of clarification, we adopt in the present work the distinction proposed by Leder *et al.* (2004) between aesthetic pleasure, to refer to the automatic and emotional response to stimuli (engaged in judgments of liking), and aesthetic evaluation, to refer to the controlled and reflective evaluation of the stimuli (engaged in judgments of beauty).

We must now explain why we expect more automatic and emotional processing when perceivers are asked to make judgments of liking, whereas we expect more controlled and elaborated processing when they are asked to make judgments of beauty. This claim is based on several lines of experimental evidences which are summarized in a recent paper by Jiang *et al.* (2024). Jiang *et al.* (2024) report that studies on aesthetic judgment have mostly used liking and beauty rating tasks and that unexplained contradictions in this domain may result from the confounding of liking and beauty judgments. In support of this hypothesis, the authors list a number of studies that suggest different effects of complexity (Marin *et al.*, 2016), fluency (Reber *et al.*, 2004), or working memory load (Che, Sun, Skov, Vartanian, Rosselló, & Nadal, 2021; Mullennix *et al.*, 2013) on liking and beauty judgments. For example, Che *et al.* (2021) showed that maintaining information in working memory (working memory load) delayed Beauty judgments but not Liking judgments, confirming that Beauty judgments are more demanding in terms of cognitive resources than Liking judgments. These studies suggest that beauty judgments engage additional cognitive processing involved in the comparison

between the perceptual properties of the studied objects with learned models of beauty (“aesthetic evaluation”), and thus require more resources than the automatic emotional processing involved in liking judgments (“aesthetic pleasure”). Given that the judgment of Beauty, which requires the evocation of both the sensations associated with the target to be judged and those associated with the reference models, elicits more controlled mental imagery than the automatic emotional response involved in the judgment of Liking, this distinction provides a valuable framework for understanding the cognitive challenges faced by aphasic individuals. We thus hypothesized that individuals with aphasia would encounter more difficulties than non-aphasic individuals when evaluating tactile aesthetic of textures presented visually, especially when instructed to evaluate Beauty rather than Liking.

However, it was important to make sure that the difference between aphasic and non-aphasic individuals did not result from a higher NFT in the non-aphasic group, since this can lead to greater use of imagery (Krishna *et al.*, 2024). For this reason, we decided to assess NFT in the present experiment. At the same time, there could have been a difference in openness to experience between the two groups. Openness to experience is a personality trait that has been positively associated with aesthetic attitudes, such as appreciation of aesthetic quality (McManus & Furnham, 2006) and aesthetic emotions (e.g. pleasure; Fayn, MacCann, Tiliopoulos, & Silvia, 2015). Greater openness to experience is also associated with a stronger preference for unconventional art forms (Chamorro-Premuzic, Reimers, Hsu, & Ahmetoglu, 2009; Cleridou & Furnham, 2014; Furnham & Avison, 1997; Furnham & Rao, 2002), and this could be the case for all unusual aesthetics contexts, such as the visual evaluation of textures, as in the present experiment. Milton *et al.* (2021) reported that hyperphantasics are more open to experience than aphantasics, suggesting that mental imagery skills could be associated with openness. We thus assume that aphantasics should have reduced openness to experience. Personality traits were therefore also measured in the present experiment.

In short, the aim of the present experiment was to test the following assumptions :

H1: People with aphasia should have a mental imagery deficit in at least one sensory modality other than visual imagery (Dance *et al.*, 2021).

H2: Aphantasics should also exhibit to be less open to experience, this personality trait being particularly associated with aesthetic emotions (Fayn *et al.*, 2015).

H3: People with aphantasia should find it more difficult to express Beauty than Liking judgments, due to the greater amount of information to be mentally represented and the more controlled nature of the processes involved in the former case when compared to the more automatic emotional process elicited by the Liking judgment (Graf & Landwehr, 2015).

METHOD

Participants

A total of 44 participants were included in this study, divided into two groups: 22 aphantasic participants (17 women, $M_{\text{age}} = 25.18$, $SD = 3.4$) and 22 control participants (15 women, $M_{\text{age}} = 21.04$, $SD = 2.45$). For the aphantasic group, inclusion criteria required a score on the Vividness of Visual Imagery Questionnaire (VVIQ; Marks, 1973, 1995) between 16 and 32, indicating absent or very vague mental imagery (Zeman *et al.*, 2015). For the control group, inclusion criteria required a VVIQ score above 40, indicating normal or vivid mental imagery.

Participants in the aphantasic group were recruited through the *Aphantasia Club*, a French association dedicated to the understanding of aphantasia. Control group participants were recruited from psychology students at the University of Bourgogne-Europe. VVIQ scores ranged from 16 to 32 for the aphantasic group ($M_{\text{VVIQ}} = 18.54$, $SD = 4.34$) and were consistently higher for the control group ($M_{\text{VVIQ}} = 65.13$, $SD = 7.01$). Exclusion criteria for both groups included self-reported neurocognitive or sensory disorders likely to affect tactile or aesthetic evaluations, incomplete data, or failure to comply with experimental instructions. There was no exclusion on these criteria, so the analyses were carried out on the total sample.

Materials

The participants performed the experiment individually online using LimeSurvey software (version 2.65.0). They evaluated 18 photographs of everyday materials (referred to as “texture”) on four criteria : the frequency with which they encountered the textures, the ability to imagine

themselves touching the textures, the aesthetic evaluation of the textures (judgment of Beauty) and the aesthetic pleasure provided by the textures (judgment of Liking). They also completed 4 questionnaires : the VVIQ, the Plymouth Sensory Imagery Questionnaire (Psi-Q; Andrade *et al.*, 2014), the Need for Touch (NFT; Peck & Childers, 2003) and the Big Five Inventory-10 (Rammstedt & John, 2007; Courtois *et al.*, 2020).

The VVIQ was completed before the experiment in order to assign the participants to the Aphantasic or the Control group. The other questionnaires were then completed in a randomized order during the main experiment.

- **VVIQ**: Participants imagine a series of 4 scenarios (e.g., “*Imagine sunrise*”) and rate the vividness of their image on a scale from 1 (“*No image is visible*”) to 5 (“*The image is perfectly clear, as sharp and precise as true perception*”). Scenarios are evaluated with eyes open and then eyes closed. Participants achieve a total score of between 16 and 80.

- **Psi-Q**: This questionnaire covers the sensory domains (visual, auditory, olfactory, gustatory, tactile, bodily sensation and emotional feeling). Each item is rated on a scale from 0 (“*No image at all*”) to 10 (“*Image as clear and vivid as in real life*”), with scores from 0 to 50 per sensory domain.

- **NFT**: Assesses the need for touch with 12 items on a scale from 1 (“*Not at all true*”) to 7 (“*Absolutely true*”). A distinction is made between autotelic (aNFT) and instrumental (iNFT) needs.

- **BFI-10**: Contains 10 items on a scale of 1 (“*Strongly Disapprove*”) to 5 (“*Strongly Approve*”) to measure five personality traits: openness, conscientiousness, extraversion, agreeableness and neuroticism.

The 18 textures (cf., Table 1 and Figure 1) were selected through a preliminary online study based on 58 photographs of everyday materials collected online. These materials were preselected based on a review of the scientific literature related to the haptic perception of textures (e.g. Essick *et al.*, 2010; Hollins, 1993; Hollins, Bensmaïa, Karlof, & Young, 2000; Iosifyan & Korolkova., 2019). For each of the 58 photographs, participants were asked to imagine themselves touching the material and to rate its pleasantness using a Likert scale ranging from 1 (very unpleasant) to 5 (very pleasant). For the present study, 18 textures were selected : 6 textures from pleasant materials ($M_{\text{pleasant}} = 4.41$, $SD = 0.39$), 6 textures from neutral materials ($M_{\text{neutral}} = 3.03$, $SD = 0.4$) and 6 textures from unpleasant materials ($M_{\text{unpleasant}} = 2.16$, $SD = 0.4$).

Table 1. Descriptive statistics of the “pleasantness” judgment of the 18 photographs of materials selected

Tableau 1. Statistiques descriptives du jugement « agréable » des 18 photographies de matériaux sélectionnés

Pleasant materials		Neutral materials		Unpleasant materials	
	<i>M (SD)</i>		<i>M (SD)</i>		<i>M (SD)</i>
Silk	4.84 (.42) ***	Rubber	2.86 (.76) ^{NS}	Burlap	2.09 (.85) ***
Cupro	4.81 (.39) ***	Plastic	2.88 (.57) ^{NS}	Snake-scales	2.09 (1) ***
Velvet	4.61 (.57) ***	Glass	3.04 (.71) ^{NS}	Concrete	2.02 (.79) ***
Cotton	4.34 (.68) ***	Sponge	3.18 (.86) ^{NS}	Sandpaper	1.86 (.95) ***
Suede	4.18 (.89) ***	Tennis ball	3.20 (1) ^{NS}	Styrofoam	2.65 (1.14) ^{NS}
Denim	3.63 (.86) ***	Leather	2.97 (.76) ^{NS}	Slate	2.25 (.99) ***

Note. NS = non-significant ($p < .05$) * $p < .05$, ** $p < .01$, *** $p < .001$, t-test between observed and theoretical neutrality scores after Bonferroni's correction (corrected alpha level = .00086) (M = mean; SD = standard deviation). Full descriptive data for the 58 textures identified in our literature review is available in supplementary material.

Figure 1. Photographs of materials gathered in Valence categories

Figure 1. Photographies des matériaux rassemblés dans les catégories Valence



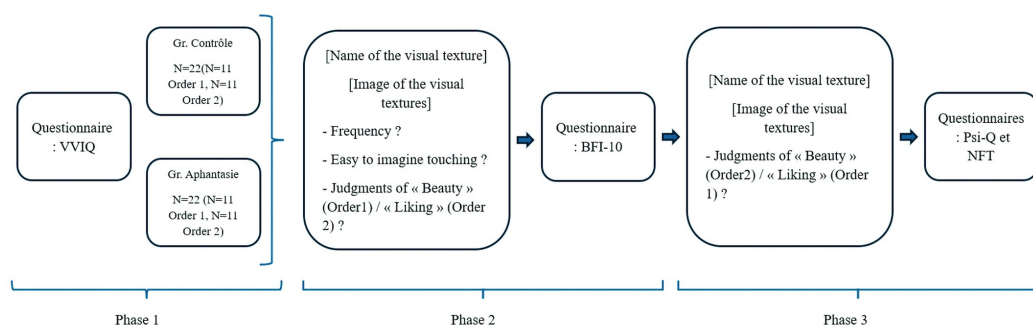
Procedure

After agreeing to take part in the experiment, participants were given one week to complete the online activities. The experiment was divided into 3 phases (see Figure 1). In the first phase, the participants completed the VVIQ to validate their assignment to the “aphantasic” or “control” group. The second phase began with the evaluation of the frequency with which the texture was encountered (on a scale of 1 to 4), the ease of imagining the sensation associated with the texture (on a scale of 1 to 7) and the aesthetic judgments of Liking or Beauty (depending on the order to which the participant was assigned). This phase ended with the completion of the BFI-10 scale. For the evaluation of the aesthetic experience, the focus was placed on the tactile aspect of the task by presenting the following evaluation instructions : *“Imagine that you are caressing this texture. Try to feel the sensations it usually gives you”*. Then, for the Liking judgment, the instruction was built so that it related to an automatic and emotional process (aesthetic pleasure). It is formulated as follows : *“When you feel the usual sensations, rate on a scale from 1 to 5 the sensation you have of this texture”*, from 1 *“I don’t like this texture at all”* to 5 *“I like this texture a lot”*. For the Beauty judgment, the instruction was built so that it related to a controlled process (aesthetic evaluation). It is formulated as follows : *“When you feel the usual sensations, rate on a scale from 1 to 5 the sensation you have of this texture”*, from 1 *“Not at all pleasant to touch”* to 5 *“Extremely pleasant to touch”*. These instructions aimed to distinguish between immediate judgments related to aesthetic pleasure (Liking) and more cognitive and controlled judgments related to aesthetic evaluation (Beauty), while leveraging participants’ tactile memory. To facilitate this memory retrieval, the name of each texture was displayed at the top of the screen (for a detailed discussion on the adaptation of liking and beauty instructions to the tactile domain, see the discussion section). The participants then completed the BFI-10 questionnaire before starting the third phase. The third phase started with the second aesthetic evaluation (Liking or Beauty judgment depending on the instructions received for this item in the second phase). For each aesthetic evaluation (phases 2 and 3), the 18 images of textures were presented in random order, with the name of the texture displayed at the top of the screen. Half the participants (11 participants in each group) first evaluated all the textures in response to a Beauty instruction and then a Liking instruction.

The other half of the participants evaluated all the textures starting with the Liking instruction and then the Beauty instruction. The third phase ended with the completion of the Psi-Q and NFT questionnaires (order counterbalanced between participants).

Figure 2. Course of the Experiment for each group of participants (Aphasic and Control).

Figure 2. Déroulement de l'expérience pour chaque groupe de participants (aphasiques et contrôles).



RESULTS

Characterization of populations through self-questionnaires

Psi-Q

To test hypothesis H1, we performed a 2 X 7 ANOVA on the Psi-Q scores (imagery capacity) of the groups (2: Control vs. Aphasic) according to sensory modality (7: visual, auditory, tactile, olfactory, gustatory, feeling, body sensation). The ANOVA revealed that aphasics had significantly lower imagery abilities than the control group, $F(1,21) = 289.85$, $p < .001$, $\eta^2_p = .932$. There was also an effect of modality, $F(6,126) = 6.02$, $p < .001$, $\eta^2_p = .223$, with the imagery capacity varying from one modality to another. Furthermore, the Group x Modalities interaction was significant, $F(6,126) = 4.07$, $p < .001$, $\eta^2_p = .162$. Tukey's tests showed that

control participants outperformed aphantasic participants on all senses; aphantasics had a lower imagery capacity for each one of the sensory modalities ($p_s < .001$, see Table II). However, the interaction revealed that the degree of impairment in imagery capacity in aphantasics is consistent across all modalities, with no significant differences between them. In contrast, the control group showed significantly better visual imagery than olfactory imagery, $t(21) = 5.269$, $p = .002$, better visual imagery than auditory imagery, $t(21) = 4.727$, $p = .006$, better bodily sensation imagery than olfactory imagery, $t(21) = 5.169$, $p = .002$, and better tactile imagery than olfactory imagery ($t(21) = 5.614$, $p < .001$).

Table 2. Table of means and standard deviations of the sensory domains evaluated by Psi-Q.

Tableau 2. Tableau des moyennes et des écarts-types des différents domaines sensoriels évalués par Psi-Q.

	Groups		Student's t test
	Control	Aphantasic	
Visual	43.8 (4.65)	3.23 (5.33)	$t(42) = 26.9$, $p < .001$
Auditory	42.4 (5.74)	8.59 (12.3)	$t(42) = 11.64$, $p < .001$
Olfactory	35.1 (7.4)	3.23 (7.89)	$t(42) = 13.84$, $p < .001$
Gustatory	38.8 (7.62)	2.59 (6.43)	$t(42) = 17.01$, $p < .001$
Bodily sensation	41 (6.02)	6.68 (10.1)	$t(42) = 13.68$, $p < .001$
Tactile	40.6 (6.42)	4 (7.11)	$t(42) = 17.94$, $p < .001$
Emotional feeling	39.5 (7.55)	10.8 (15.2)	$t(42) = 7.92$, $p < .001$

In addition, the VVIQ score and the Psi-Q score associated with the tactile modality revealed a positive correlation ($r = .921$, $p < .001$). Global imagery ability (VVIQ) and touch-specific imagery (PSIQ-touch) are therefore strongly associated.

Personality traits and attitude toward touch

Big-Five Inventory-10

Although our hypothesis focuses only on openness to experience (H2), we administered the entire big-five test to ensure its psychometric validity. So, in addition to analyzing the interaction between group and personality

traits factors, we conducted post-hoc tests to specifically analyze the personality trait on which our hypothesis focuses, openness to experience. To test hypothesis H2, A 2 (Group: Control vs. Aphantasic; between_subjects) $\times$ 5 (Personnality traits: Extraversion, Agreeableness, Conscientiousness, Neuroticism, Openness; within_subjects) mixed ANOVA was conducted on BFI-10 personality scores. Results revealed a main effect of Group, $F(1.42) = 9.69$, $p = .003$, $\eta^2_p = .19$, and of Personality traits, $F(4.168) = 7.24$, $p < .001$, $\eta^2_p = .15$, but an absence of interaction between Group and Personality traits, $F(4.168) = .82$, $p = .51$, $\eta^2_p = .019$. More specifically, the aphantasic participants were less open to experience than the control participants, ($p = .025$; see Table 3). In addition, Pearson tests revealed a positive correlation between the results of the VVIQ questionnaire and the BFI_Openness score, $r = .367$, $p = .014$. The better an individual's imagery skills were, the more open that individual was.

Table 3. Descriptive Statistics and t-Tests for Personality Traits in Aphantasic and Control Groups

Tableau 3. Statistiques descriptives et tests t pour les traits de personnalité chez les groupes aphantasiques et contrôles

	Groups		Student's t test
	Control	Aphantasic	
Extraversion	5.59 (2.46)	4.73 (2.03)	t (42) = 1.27, p = .211
Agreeableness	6.73 (1.61)	6.73 (1.64)	t (42) = 0, p = 1
Conscientiousness	7.14 (1.86)	6.55 (1.95)	t (42) = 1.03, p = .309
Neuroticism	8 (2.16)	6.82 (2.34)	t (42) = 1.74, p = .089
Openness	7.23 (2.11)	5.77 (2.05)	t (42) = 2.32, p = .025

Openness is calculated on the basis of two items in the BFI-10: “Has a great imagination” and “Has little interest in anything artistic”. It is interesting to look at the details of the answers to these two questions. Although the difference between the two groups on the first question was significant, $t(21) = 5.073$, $p < .001$, with the control group reporting better imagination than the aphantasic group (Control: $M = 3.86$, $SD = 1.04$; Aphantasic: $M = 2.18$, $SD = 1.40$), there was no difference between the two groups on the second question, $t(21) = -.547$, $p = .59$. The difference on the Openness trait thus stems mainly from the ability to imagine.

Need for Touch

The NFT questionnaire was used as a control measure intended to check that participants did not differ in their need for touch. A 2 X 2 ANOVA on NFT scores (2 : Autotelic vs. Instrumental) as a function of Group (2 : Control vs. Aphantasic) revealed no effect of Group, $F(1, 21) = .005$, $p = .94$, $\eta^2_p = 0$, nor NFT scores, $F(1.21) = 1.609$, $p = .219$, $\eta^2_p = .071$, and no interaction between Group and NFT scores, $F(1.21) = 0.005$, $p = .94$, $\eta^2_p = .00$. The aphantasic group (NFT_Autotelic: $M = 22$, $SD = 11.3$; NFT_Instrumental; $M = 20.1$, $SD = 8.07$) and the control group (NFT_Autotelic: $M = 22.3$, $SD = 11.1$; NFT_Instrumental: $M = 20.2$, $SD = 10.5$) did not differ in their need for touch. This suggests that any further differences between the two groups did not result from a difference in the need to use imagery or other strategies to compensate for the lack of sensations usually provided by touch.

Evaluation of images of textures

Frequency of texture encounters

We performed a 2 X 3 ANOVA on the reported frequency of encounter as a function of Group (2: Control vs. Aphantasic) and Texture valence (3: Pleasant, Neutral or Unpleasant). Aphantasics reported encountering these textures less often in their daily lives than the control group, $F(1.21) = 11.83$, $p = .002$, $\eta^2_p = .36$. Texture valence was also significant, $F(2.42) = 12.48$, $p < .001$, $\eta^2_p = .85$, whereas the interaction between Group and Texture valence was not, $F(2.42) = 0.69$, $p = .51$, $\eta^2_p = .032$. Pleasant textures (Control, $M_{\text{pleasant}} = 3.27$, $SD = 0.41$; Aphantasic, $M_{\text{pleasant}} = 2.95$, $SD = 0.39$) were reported to be encountered more frequently than unpleasant textures (Control, $M_{\text{unpleasant}} = 2.37$, $SD = 0.49$; Aphantasic, $M_{\text{unpleasant}} = 2.14$, $SD = 0.47$). In addition, a positive correlation was observed between the VVIQ score and the average frequency of texture encounters, $r = 0.453$, $p = .002$.

Ability to imagine touching textures.

Participants indicated whether they were able to imagine touching each of the textures. We performed a 2 X 3 ANOVA on the ability to

imagine touching textures as a function of group (2: Control vs. Aphantasic) and Texture valence (3: Pleasant, Neutral or Unpleasant). Aphantasics reported more difficulties in imagining touching textures ($M_{\text{all}} = 2.26$, $SD = 1.53$) than the Control Group ($M_{\text{all}} = 5.84$, $SD = 0.63$), $F(1,21) = 88.5$, $p < .001$, $\eta^2_p = .81$. We also observed a main effect of Texture valence, $F(2,42) = 19$, $p < .001$, $\eta^2_p = .475$, with participants reporting that they found it easier to imagine themselves touching pleasant textures (Control, $M_{\text{pleasant}} = 6.23$, $SD = 0.59$; Aphantasic, $M_{\text{pleasant}} = 2.34$, $SD = 1.67$) than unpleasant textures (Post-hoc Tukey: $t(21) = 4.846$, $p < .001$; Control, $M_{\text{unpleasant}} = 5.08$, $SD = 1.07$; Aphantasic, $M_{\text{unpleasant}} = 2.11$, $SD = 1.38$). Finally, a significant interaction effect was observed between Group and Texture Valence, $F(2,42) = 16.4$, $p < .001$, $\eta^2_p = .439$, indicating that the control group demonstrated a greater capacity to imagine touching pleasant textures than unpleasant textures, $t(21) = 5.216$, $p < .001$, whereas aphantasics did not report any difference in their ability to imagine touching pleasant or unpleasant textures.

Aesthetic evaluation: Beauty vs. Liking judgments

To test hypothesis H3, we performed a $2 \times 3 \times 2$ ANOVA on the aesthetic judgments of textures as a function of Group (2 : Control and Aphantasic), Valence of textures (3 : Pleasant, Neutral or Unpleasant) and Instructions (2 : Beauty vs. Liking). The ANOVA revealed a main Group effect, $F(1,21) = 7.37$, $p = .013$, $\eta^2_p = .260$. The aphantasics evaluated the textures more negatively (Aphantasic, $M_{\text{all}} = 3.05$, $SD = .8$) than the participants in the Control group (Control, $M_{\text{all}} = 3.25$, $SD = .86$). The results also revealed a main effect of Valence, $F(3,63) = 197.5$, $p < .001$, $\eta^2_p = .904$. Pleasant textures were evaluated more positively than neutral textures ($p < .001$) and unpleasant textures ($p < .001$, see Table 4). However, there was no main effect of Instructions, $F(1,21) = .23$, $p = .630$, $\eta^2_p = .011$, and no interaction between group and instructions, $F(1,21) = 1.33$, $p = .260$, $\eta^2_p = .060$. Finally, the three-way interaction did not reach significance, $F(2,42) = .08$, $p = .915$, $\eta^2_p = .004$.

Table 4. Table of means and standard deviations of the texture scores.
Tableau 4. Tableau des moyennes et des écarts-types des scores de texture.

	Pleasant		Neutral		Unpleasant		All	
	Liking	Beauty	Liking	Beauty	Liking	Beauty	Liking	Beauty
Control	4.3	4.26	3.11	3.11	2.41	2.31	3.27	3.22
Group	(.49)	(.46)	(.41)	(.34)	(.54)	(.45)	(.26)	(.21)
Aphantasic	3.97	3.98	2.95	3	2.2	2.2	3.04	3.06
Group	(.65)	(.61)	(.34)	(.43)	(.6)	(.52)	(.32)	(.32)

Nevertheless, a comparison of the aphantasics’ and the control group’s evaluations of all the textures using a Liking-type question reveals a significant difference, $t(21) = 2.86, p = .009$. In response to a Liking question, aphantasics rated textures more negatively than participants in the control group (Control: $M_{All_Liking} = 3.27, SD_{All_Liking} = 0.26$; Aphantasic: $M_{All_Liking} = 3.04, SD_{All_Liking} = 0.32$). In response to the Beauty question, aphantasics also rated textures more negatively than control participants ($t(21) = 2.19, p = .04$; Control: $M_{All_Beauty} = 3.22, SD_{All_Beauty} = 0.21$; Aphantasic: $M_{All_Beauty} = 3.06, SD_{All_Beauty} = 0.32$). Furthermore, correlations between VVIQ scores and the evaluation of textures revealed a positive and significant relationship for the Liking instruction, $r = .348, p = .021$, but only a marginal relationship for the Beauty instruction, $r = .293, p = .053$.

DISCUSSION

The objective of the present experiment was to investigate the impact of aphantasia, i.e., a deficit of mental imagery, on the aesthetic evaluation of textures that were displayed only visually and for which the sensation provided by touch had to be imagined. Three hypotheses were posited: (H1) aphantasic individuals should demonstrate a deficit in mental imagery in at least one sensory modality other than visual imagery; (H2) they should be less open to experience; and (H3), compared to non-aphantasic individuals, they should find it more difficult Beauty judgments than Liking judgments due to the greater demand for mental imagery in the former type of judgment.

The results confirmed that aphantasics have imagery-related difficulties across all sensory modalities (H1). This result is in line with the

findings of Dance *et al.* (2021) and Zeman (2020). This significant reduction in imagery in all sensory modalities suggests that imagery can occur and be impaired in all the senses, thus supporting the claim that imagery is fundamentally multisensory, even though it has been most widely investigated in the visual and motor domains (Muraki *et al.*, 2023). The results also demonstrated that the degree of impairment in sensory imagery among aphantasics is equivalent across all modalities, showing no significant differences between them. In contrast, the control group exhibited a more nuanced pattern, with significantly better imagery in the visual, touch and bodily sensory modalities compared to other senses. This suggests that while aphantasics experience a uniform deficit across all sensory modalities, the control group demonstrates distinct strengths in certain sensory modalities. Our results also showed that, in terms of personality traits, aphantasics were less open to experience than the participants in the control group (H2), a finding that is consistent with the results reported by Milton *et al.* (2021). It is however imperative to contextualize these findings by acknowledging the absence of a statistically significant interaction between group factors and personality traits. This observation warrants further examination, as it may be indicative of two distinct explanations. First, the non-significant interaction could be attributed, at least in part, to the interdependence of Openness to Experience with other personality traits, such as Extraversion. This hypothesis is consistent with prior research in the field, as evidenced by the works of Garcia *et al.* (2005). Secondly, a lack of statistical power could also explain why this interaction fails to reach significance. A sample size estimation revealed that with a significance criterion of $\alpha = .05$ and power = .80, the minimum sample size needed with the observed effect size (.11) is $N = 92$ (46 aphantasics and 46 controls). This rational sample suggests that it is reasonable to conclude that individuals with aphantasia exhibit a reduced openness to experience in comparison with the control group. In addition, the BFI-10 openness score indicated that the discrepancy was attributable to imagination rather than sensitivity to art. This result might help shed more light on previous findings reporting that aphantasics are over-represented in mathematics- and computer-related professions, while hyperphantasics tend to work in creative industries (Zeman, 2020). To further investigate this result, a future study could explore personality traits using the full BFI scale. More interesting, aphantasics reported greater difficulty in imagining themselves touching textures, irrespective of their valence, while the control group reported that pleasant textures were easier to imagine than unpleasant textures. These results can be

attributed to the greater prevalence of pleasant textures in our daily experiences, thereby facilitating the mental representation of such textures, at least for non-aphantasic individuals. This also suggests that aphantasia affect imagery irrespective of the familiarity of the stimuli to be imaged. In addition, Aphantasics reported a lower frequency of encounters with textures in their daily lives compared to the control participants. All these results may be attributed to reduced episodic memory capacities in this population (Dawes, Keogh, Robuck, & Pearson, 2022).

Finally, aphantasics evaluated textures more negatively than control participants (H3), irrespective of the valence of the texture. Reber *et al.* (2004) explained aesthetic pleasure in terms of processing fluency. The more fluently an object is processed, the more positive the associated aesthetic response. The resulting concept of fluency corresponds to the feeling of ease in processing a task and its associated stimuli, which should consequently be judged more positively. In our study, the feeling of task-related dysfluency seems to be attributed by aphantasics to the appreciation of the stimuli rather than to the task itself. Due to their poor imagery skills, the participants in the aphantasia group probably processed the stimuli less fluently, and thus evaluated them more negatively, than the control participants. In addition, aphantasics evaluated textures more negatively regardless of the type of evaluation, Liking or Beauty. This finding confirms that aphantasics experience less aesthetic pleasure and engage less in certain activities, such as touching textures (Hashim, Pulcini, Jansari, Küssner, & Omigie, 2024). This finding may shed some light on the observation of a reduced openness to experience in aphantasia. If a task that elicits imagery skills is experienced as dysfluent and is evaluated negatively, then it is to be expected that the related activities will be engaged in less.

In the present experiment, the instructions were developed to differentiate between aesthetic pleasure (liking) and aesthetic evaluation (beauty) judgments in the tactile aesthetic domain. However, the use of terms such as “pleasant to touch” to adapt the concept of beauty—traditionally associated with visual judgments—to a tactile context warrants further discussion. Although the instructions for the judgment of liking did not request particular adaptation from the visual domain to the tactile domain, with 1 corresponding to “*I do not like this texture at all*” and 5 to “*I like this texture very much*”, more consideration was given to adapting the instructions for the judgment of beauty. It was not possible to ask participants “*how beautiful is this texture*”, 1 corresponding to “*very*

ugly” and 5 to “very beautiful”, because we were interested in the evaluation of the tactile aesthetic, not in the visual aesthetic, of textures. Preliminary investigations suggested that the more direct adaptation for beauty instructions corresponded to “*how this texture is soft to touch*”, 1 corresponding to “*absolutely not soft to touch*” and 5 to “*very soft to touch*”. However, first attempts revealed that most participants reported feeling uncomfortable using the word soft to evaluate textures that could be pleasant or unpleasant to touch, regardless of their relative softness. After having explained to perceivers (during pilot investigations to fix this problem) what a “beauty” instruction means (which engages object-oriented evaluation that elicits comparison with previous experiences and models of “beauty”) and how it differs from a “liking” instruction, a consensus was reached on the instruction “*how pleasant to touch is this texture*” as a valid instruction for the judgment of beauty. Importantly, this experiment on aphantasia is part of a doctoral dissertation in which the same instructions were successfully applied to address the distinction between the judgments of liking and beauty. In several attempts, we observed differential effects of working memory load, perceptual fluency and conceptual fluency, using the present operationalization of beauty and liking instructions. For example, we observed that increasing working memory load delayed both liking and beauty judgments but selectively increased beauty judgment (Torres *et al.*, 2025, in preparation). The same findings have been reported by Jiang *et al.* (2023), using classical liking and beauty instructions in the visual domain. In other words, our adaptation of liking and beauty instructions to the haptic domain has been validated experimentally.

Our results also indicated a significant correlation between the VVIQ and the Liking scores, while the correlation between the VVIQ and the Beauty scores remained marginal. This latter result did not support our main hypothesis (H3). Indeed, we assumed that individuals with aphantasia would encounter more difficulties in connection with the Beauty judgment, which required more imagery, than the Liking judgment, which is thought to be more automatic and emotional. The fact that VVIQ is more strongly associated with Liking than with Beauty tends to suggest that aphantasia could impact the judgment of Liking at least as much, if not more, than it does that of Beauty. One explanation may be that the automatic emotional process or the maintenance of emotional information during the Liking judgment was impaired in aphantasic individuals. Liking judgments do indeed make it necessary to actively maintain emotions in working memory (Jiang *et al.*, 2024). Working memory, which permits the maintenance of short-term information, is not impacted in

aphantasia in the case of simple tasks (Knight & Milton, 2022). However, Pounder *et al.* (2022) showed that aphantasics take longer to respond during tasks requiring fine visual working memory resources. Because the task in the present experiment was fairly simple, we cannot infer that the difficulty was due to a problem in maintaining emotional information. However, working memory is composed of different cognitive subsystems, including affective working memory (AWM), which is specialized in the active maintenance of emotions (LeDoux & Brown, 2017), and we know that aphantasics present difficulties with emotional processing (Speed, Eekhof, & Mak, 2024; Wicken, Keogh, & Pearson, 2021). The hypothesis we put forward is that although maintenance mechanisms in working memory are preserved in aphantasia, the content of AWM probably differs between individuals with and without aphantasia when they have to express Liking judgments.

One function of mental imagery is to make thoughts more emotionally evocative through sensory simulation. Mental imagery can help predict thoughts by linking them to emotions (Pearson *et al.*, 2015). It has been highlighted as a key driver of emotions (Holmes *et al.*, 2005) and may be considered to be an “*emotional amplifier*” of mental content (Holmes *et al.*, 2008). A reduced or absent mental imagery capacity could result in impaired emotional processing in aphantasics. For example, Vuoskoski and Eerola (2015) argue that the visual imagery evoked by a sad piece of music reinforces the feeling of sadness, as claimed by the emotional amplifier hypothesis. However, it has also been shown that aphantasics experience less emotional engagement and less sympathy for fictional characters (Speed *et al.*, 2024), exhibit a lower fear response (Wicken *et al.*, 2021), and achieve lower empathy scores (Monzel *et al.*, 2023). These results suggest that people with aphantasia exhibit less intense emotional responses (Dawes *et al.*, 2020). In addition, aphantasics did not exhibit less negative scores for unpleasant textures and less positive for pleasant textures than control participants. They exhibited lower scores for all textures; pleasant, neutral and unpleasant. Again, the reduced emotional response when asked to judge Liking is probably perceived as a dysfluent processing of the stimuli, leading aphantasics to misattribute the task-related dysfluency to the evaluation of the stimuli.

CONCLUSION

The present experiment provides initial insights into how aphantasia influences aesthetic evaluation in an incomplete multisensory context which necessitates the imagination of absent sensations. To the best of our knowledge, this is the first experiment to specifically investigate the impact of aphantasia on tactile and haptic imagery. The key findings indicate a diminished emotional response to tactile imagery, accompanied by a detrimental impact on aesthetic evaluations, and confirm a diminished openness to experience in aphantasia. In future research, it would be beneficial to employ more implicit methods of measuring sensory experiences. For instance, pupillary dilation measurement (Kay, Keogh, Andrillon, & Pearson, 2022) could be used in relation to the sense of touch. An alternative approach would be to use electrodermal measurement, which has previously revealed attenuated emotional responses to fear in aphantasics (Wicken *et al.*, 2021).

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