The Influence of Mental Imagery Ability Across Sensory Modalities on Aesthetic Appreciation in Terms of Emotional Impact and Immersion

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Abstract

Previous studies investigating the role of mental imagery on aesthetic appreciation have predominantly focused on visual and auditory sense modalities. This current study investigates the influence of mental imagery across sensory modalities on aesthetic appreciation, particularly focusing on emotional impact and immersion. It aims to ascertain the relationship between mental imagery and aesthetic appreciation, while also examining whether emotional impact and immersion mediate this relationship. Using a longitudinal diary study with an online self-report survey, 236 participants, drawn from a convenience sample, recorded aesthetic experiences over four weeks. Variables measured included self-perceived appreciation, emotional impact, immersion, mental imagery, and seven mental imagery sensory subscales. Mediation Analysis was conducted via the Baron-Kenny method (1986). The results revealed a significant effect of mental imagery on aesthetic appreciation, with no significant mediating effect observed for emotional impact and immersion. Notably, bodily sensations imagery and taste imagery showed significant correlations with aesthetic appreciation, with subsequent exploratory analysis demonstrating their predictive capability. This research contributes new insights into the role of mental imagery in aesthetic appreciation, emphasizing the importance of considering diverse sensory modalities and embodied cognition within aesthetics.

Keywords: Mental Imagery, Multimodal, Bodily Sensations, Taste.

The Influence of Mental Imagery Ability Across Sensory Modalities on Aesthetic Appreciation in Terms of Emotional Impact and Immersion

Aesthetic experiences are common in our lives, from watching movies to attending musical performances. Consider the enjoyment of seeing a musical, where visuals, music, and dialogue combine for a rich sensory experience. Now, imagine missing sight or sound. Just as this diminishes enjoyment, studying mental imagery in aesthetics without all senses limits understanding. To fully grasp its impact, we must explore mental imagery's complete sensory aspect, like experiencing a musical.

Aesthetic experiences (AE) involve the interaction of sensory-motor, emotion-valuation, and meaning-knowledge neural systems (Chatterjee & Vartanian, 2014). Conceptually, AEs possess three dimensions: phenomenological (subjectively felt, drawing attention), evaluative (valuing an object), and semantic (meaningful, not just sensation) (Marković, 2012).

AEs denote personal encounters with ‘art’, while aesthetic appreciation (AEP) involves their evaluation. Leder et al.'s (2004) model outlines the process leading to AEP within a few iterative stages, these stages are from left to right: perceptual analysis, implicit memory integration, classification, cognitive mastery, and evaluation. The evaluation stage measures the success of cognitive mastering by either revealing satisfying understanding or expected changes in ambiguity level leading to the pleasurable feeling. The combination of this understanding and pleasure is called AEP. If evaluation fails, individuals can iterate stages until achieving cognitive mastery and thus AEP or they may give up.

Why satisfying understanding or expected changes in ambiguity lead to pleasure can be explained by the predictive coding approach. This approach is based on the assumption that we all evolved to have internal models of the world that constantly make predictions and adapt these models based on the outcome of them. When what we perceive or sense doesn’t

align with our internal models, we call that an prediction error. We are adapted to perfect our internal model and thus adapted to minimize prediction errors (uncertainty). Our mind developed two main ways to do that, namely exploration, which involves actively seeking out novel experiences or information, leading to change in our internal models. And assimilation which is the process of integrating new information into existing mental frameworks or models, akin to fitting pieces in an already existing puzzle. too much exploration would lead to too much uncertainty, which may result in avoidance or repetitive, rigid behaviors to reinstate expected rates of uncertainty. And too much assimilation would limit our chances for growth. Therefore we strive to balance these approaches for optimal survival.

Van De Cruys and Wagemans (2011) argue that the predictive coding approach can be used to understand aesthetic appreciation. They point out that when art aligns with our predictions (expectations), it confirms our models, leading to that 'warm feeling of familiarity'. While this can be pleasurable, the more pleasurable aesthetic appreciation arises when art deviates from our expectations, surprises us, triggering emotional responses and heightened attention, prompting exploration. This process of resolving uncertainty or ambiguity as it is called in the evaluation stage of Leders model (2004), is crucial for aesthetic appreciation as it involves interpreting and making sense of the art or experience, which leads to pleasure. Essentially humans like to be challenged a bit, work for our understanding.

According to predictive coding theory for AEP, this prediction process is essential for understanding and appreciating art (Mortu, 2023). When an artwork deviates from our predictions (expectancies), it surprises us, triggering emotional responses and heightened attention. Think for example about when watching a movie and finding out it wasn't the butler, but the innocent character who was the culprit. You are on the edge of your seat trying to figure out how this unexpected twist can reconciled with the rest of the story. Artists often play with our expectations like this in order to yield the highest reward (pleasure), but again,

finding the right balance between uncertainty and predictability is crucial. Too much uncertainty might lead the beholder to stop the evaluation process prematurely, not leading to understanding and thus no AEP. Too much predictability and the art becomes boring. We therefore experience the most aesthetic appreciation when the right amount of uncertainty is elicited for us to feel like the only option is to further explore the experience.

This concept is supported by research indicating that unexpected or novel stimuli in art elicit stronger emotional reactions and increase cognitive engagement. For example, studies on music-induced "chills" or "shivers-down-the-spine" demonstrate how surprising elements in art capture our attention and evoke intense emotional experiences (Blood & Zatorre, 2001; Huron, 2006).

Aesthetic appreciation makes us feel good, therefore it not weird at all that studies show that it increases our well-being. Finding ways to increase the amount of aesthetic appreciation people encounter is therefore a good plan. Studying aesthetic appreciation however is hard, Humans differ in their past experiences and therefore in their internal models differ as well, emphasizing the subjective nature of aesthetic experiences. This makes it difficult to study aesthetic appreciation, because solely focusing on static perceptual features, is neglecting the subjectivity inherent to aesthetic experiences, therefore it can be argued that, in order to better understand aesthetic responses, we should look at processes that are bidirectional, focusing both inward and outward, subjective and perceptual. According to Starr (2015) these processes might be able facilitate aesthetic responses

One such bidirectional mechanism is Mental imagery. Mental imagery is the internally generated perceptual experience which is not triggered directly by sensory input (Kosslyn et al., 2001).

Mental imagery

Mental imagery simulates by imitating and recombining information from episodic and semantic memory, therefore not only facilitating prediction making, but also in memory recall, goal-directed behavior and imagination (Bulley & Irish, 2018; Conti & Irish, 2021). (Felisberti & King, 2021; Pearson, 2019). Mental imagery forms a sort of ‘mental landscape’ where we can safely try things out (Dijkstra et al., 2019; Nanay, 2010; Thomas, 2009).

Even though most psychological research has focused on visual imagery, mental imagery is multimodal and can thus be described as 'seeing with the mind's eye', 'hearing with the mind's ear', and so on (Kosslyn et al., 2001).

Greater mental imagery use was associated with greater increases in anticipatory pleasure (Ji et al., 2021). Additionally preliminary evidence of (Renner et al., 2019). Ji et al. (2021) showed that mental imagery-based episodic simulation of planned reward activities may amplify motivation and promote greater behavioral engagement, particularly for activities with high motivational barriers. This suggest that mental imagery might play a role in facilitating exploration within aesthetic experiences and therefore facilitate the chance at AEP.

According to (Moulton & Kosslyn, 2009) all imagery can be considered a mental emulation, Emulations, as second-order simulations, go beyond mere imitation of content to replicate the processes that modify the content itself. For instance, simulating conversations involves placing oneself in the "mental shoes" of the conversationalists, predicting dialogue based on emotional responses and triggered associations in their respective situations.

Mental imagery potentially contributes to theory of mind and empathy. As shown by Monzel et al. (2023) who found that mental imagery ability correlates positively with empathy, particularly with verbal material. Piaget (1962) suggested that pretend play involves mental imagery, as objects trigger mental images to represent absent ones. Theory of mind, or

mindreading, involves understanding others' intentions and motivations, extending to fictional characters in various forms of artistic expression (Corballis, 2003; Frith & Frith, 2005; Turner & Felisberti, 2018). Empathy, crucial for interpreting social cues and fostering prosocial behavior, involves not only recognizing others' emotions, but also imagining their experiences (Davis, 1980, 1983).

Mental Imagery, Aesthetic Appreciation, and, Emotional Impact

Aesthetic appreciation's connection to emotions is therefore widely acknowledged (Rusu, 2017; Gerger et al., 2017; Hitsuwari & Nomura, 2021). Additionally, mental imagery exerts a profound influence on emotions. When engaging in mental imagery, the brain's sensory processing regions become activated, leading to sensory-like experiences (Holmes & Mathews, 2010). For instance, envisioning a forest in a book may evoke the sensation of its scent. Moreover, mental imagery can induce physiological responses mirroring real-life experiences, as evidenced by increases in heart rate, respiration rate, and skin conductance (Lang et al., 1993). Notably, a study by Iosifyan (2021) revealed that individuals who reported understanding the intentions and emotions of characters in films and pictures exhibited heightened aesthetic appreciation. Additionally, mental imagery can access and elicit emotional memories from the past (Holmes & Mathews, 2010). Focusing on emotional aspects rather than physical traits (e.g. colour, shape, etc) enhances aesthetic appreciation when watching film(s) or picture(s) (Iosifyan, 2021). Given the relationships among aesthetic appreciation, mental imagery, and emotion, it’s apparent they are interconnected. Although research on the connection between mental imagery and aesthetic appreciation is limited, Hitsuwari & Nomura (2021) explored this relationship in the context of haikus. Their findings revealed that vivid imagery influenced participants' emotional experiences, subsequently affecting their aesthetic appreciation. Notably, vivid imagery was particularly effective in enhancing positive emotions and, consequently, the haiku's aesthetic appreciation.

Mental Imagery, Aesthetic Appreciation, and, Immersion

The term immersion frequently emerges in discussions about engagement in aesthetic experiences (Claessens, 2023). This is likely because when individuals are fully immersed in observing art, their experiences mirror the characteristics of flow, described as optimal states where they feel completely absorbed in the moment or 'in the zone'(Wanzer et al., 2020). Michailidis et al. (2018) propose that immersion and flow aren't conceptually distinct. Therefore, in this paper, these terms will be used interchangeably.

Immersion involves total absorption in an experience, including sensory stimulation, balance between challenge and skill, and connection to the narrative (Mäyrä & Ermi, 2011) leading to heightened focus, enjoyment, and a distorted perception of time (Csikszentmihalyi, 1990). As will be explained, these key components of immersion—absorption, sensory stimulation, and challenge-skill balance—are inherently linked to mental imagery and aesthetic appreciation.

Absorption. Absorption, as described by Rosen et al. (2021), involves intense focus on mental imagery, sensory stimuli, and vivid imagination, leading to decreased self-awareness and altered consciousness. Research linking absorption to aesthetic appreciation has mainly focused on visual and auditory senses. For instance, Vroegh (2016) found a connection between absorption and liking in music, while Lange et al. (2022) observed a similar relationship in audiobooks. Additionally Combs et al. (1988) discovered that absorption correlated with liking for abstract paintings but not representational ones, highlighting its role in visual aesthetics.

Sensory Stimulation. Transitioning from absorption, we turn to another key aspect of immersion: sensory stimulation, and its connection to mental imagery. Sensory stimulation, whether perceptual or through mental imagery, heightens immersion (Harvey et al., 1998).

Additionally mental imagery can adjust detection thresholds, intensifying attention to sensory stimuli (Stein & Peelen, 2015), thereby likely enhancing immersion. Mental imagery is especially relevant for immersion within books (Mak et al., 2020; Leopold et al., 2019). When reading a book, mental imagery helps you inhabit the perspective of the main character, experiencing their triumphs and tribulations, feeling their emotions, and seeing the world through their eyes, thereby enhancing your enjoyment of it (Green et al., 2004; Oatley, 1995).

Its common knowledge that increased sensory stimulation enhances immersion in perception, suggesting a similar effect across different mental imagery modalities. However, research has predominantly focused on visual imagery, neglecting other senses (Juslin, 2019; Taruffi & Küssner, 2019; Osborne, 1981; Quittner & Glueckauf, 1983). This overlooks the potential of senses like smell and taste in aesthetic immersion, which may be more relevant than vision in integrating the body into the environment, especially since vision, of all senses, can distance us from our surroundings, making us more observers rather than active participants in the experience (Adams, 2018; Brady, 2019).

Skill and Challenge: Fluency. While the predictive coding theory suggests that optimal aesthetic appreciation arises from a balance between uncertainty (challenge) and predictability (skill), there's merit in enjoying what one is proficient at. For instance, individuals typically find it easier to understand and appreciate romantic writing if they have a preference for romance, as opposed to those who typically favor horror genres.

Our preferences, shaped by past experiences, contribute to the subjective nature of aesthetic experiences. Through exposure via past experiences, our internal models refine predictions, resulting in a sense of familiarity and the development of preferences. Information aligned with our preferences is processed more ‘fluently’, reflecting the ease of subjective information processing (Csikszentmihalyi, 1990). This fluency, integral to

measuring flow, thus reflects more skill (predictability) in the skill to challenge (uncertainty) balance. Research indicates that higher fluency is pleasurable and results in favorable aesthetic evaluations (Reber et al., 2004). One study even suggests that fluency enhances aesthetic appreciation, liking, positive emotions, and the perceived meaning of paintings, with the level of abstraction moderating this effect (Belke et al., 2010).

Since fluency is associated with flow and is driven by our internal predictive abilities, mental imagery, as a facilitator of predictions, likely enhances fluency and immersion. This claim seems supported by research indicating that mental imagery improves reading comprehension and fluency (Suggate & Lenhard, 2022), as well as studies showing that musicians often report more vivid auditory imagery compared to non-musicians (Talamini et al., 2022).

The Present Study

Numerous studies have independently explored aesthetic appreciation and mental imagery. However, there is a lack of research on the specific relationship between mental imagery and aesthetic appreciation (Felisberti & Cropper, 2023; Hitsuwari & Nomura, 2021). In addition, previous studies are limited because predominantly focus on visual and audiotory imagery as opposed to mental imagery across sensory modalities. Moreover, their research exclusively centers on one or two types of aesthetic experiences excluding other forms of aesthetic experiences. For instance, Felisberti and Cropper (2023) focused on paintings and photos and Hitsuwari & Nomura (2021) only focused on haiku poetry. Finally, it is noteworthy that previous research has primarily used preselected artworks to showcase to the participants, this while aesthetic appreciation is a deeply subjective experience (Felisberti & Cropper, 2023).

The aim of this study is to investigate the influence of mental imagery ability across sensory modalities on aesthetic appreciation in terms of emotional impact and immersion. To this end, an online diary study has been conducted, where participants reported their aesthetic experiences in response to real-life encounters with various stimuli over a four week period.

In light of the literature explored, we expected that Individual's mental imagery ability is positively correlated with emotional impact, immersion and the aesthetic appreciation of those experiences. Furthermore, we expect that the relationship between mental imagery ability and aesthetic appreciation is mediated by emotional impact, immersion, and intensity. Finally, we expected that different sensory modalities of mental imagery would exhibit varying degrees of influence on aesthetic appreciation.

Methods

On the basis of a checklist developed by the EC-BSS at the University of Groningen, the study was exempt from full ethical review (PSY-2324-S-0031).

Participants

A total of $N = 236$ participants voluntarily participated in the study. Sample demographics can be found in Table 1. The sample study consists of 60 participants who met the final criteria for this study. Respondents who failed to fully complete the experiment by December 19 2023 were excluded from the analysis of the present study. The study required participants to be 16 years of age or older and to be fluent in Dutch, English, or German. Each participant submitted at least two entries to the diary study excluding pre- and post-questionnaires ($M_{entries} = 3.53$, $SD_{entries} = 1.05$), accumulating to a total of 212 journal entries, thus, separate aesthetic experiences.

Recruitment methods included – i) targeted advertisement via research panel website (SONA) aimed at first-year psychology students at the University of Groningen, Netherlands; ii) public advertisement on the communication/social media platforms (e.g.: Facebook, Instagram, LinkedIn, Twitter, WhatsApp group chats); and iii) flyer distribution at local centres for leisure, culture and educational activities (e.g.: Dat Bolwerk Museum in Zutphen, Usva, bookstores, literary cafes, etc.).

Table 1

Sample demographics

Participant n = 60		Frequency	Percent (%)
Age in years	Under 18	2	3.3
	18-24	55	91.7
	35-44	2	3.3
	55-64	1	1.7
Gender	Female	51	85.0
	Male	8	13.3
	Non-binary	1	1.7
Sex assigned at birth	Female	51	85.0
	Male	9	15.0
Survey language chosen	English	34	55.7
	Dutch	21	34.4
	German	5	8.2
Being a first-year student	Yes	59	98.3
	No	1	1.7

Power

An a priori power analysis was conducted using G*Power version 3.1.9.7 (Faul et al., 2007) to determine the minimum sample size required to test the study hypotheses. Results indicated the required sample size to achieve 80% power for detecting a medium effect, at a significance criterion of ($\alpha = .05$), was $N = 52$ for Linear multiple regression. Thus, the obtained sample size of $N = 60$ is adequate to test the study hypothesis.

Materials

The present study is part of a larger research initiative, utilizing a Qualtrics (https://www.qualtrics.com/) questionnaire with multiple measures (see Appendix A). In this

section, we focus on a detailed explanation of the measures specifically employed in the present study.

The Plymouth Sensory Imagery Questionnaire (Psi-Q)

To measure mental imagery vividness across sensory modalities, we employed the 35-item Plymouth Sensory Imagery Questionnaire (Psi-Q; Andrade et al., 2013)**.** This tool comprises five sensory subscales (vision, sound, smell, taste, touch, bodily sensation, and emotion), each containing five items, along with a global score reflecting overall mental imagery ability. An example item is 'imagine the appearance of a bonfire'. Higher scores indicate greater mental imagery ability, while lower scores suggest less ability. Participants rated vividness on an 11-point scale (0 = *No image at all*, 10 = *Perfectly clear and as lively as experiencing it in reality*) for specific sensory modalities (e.g., vision, sound, smell).

To enhance clarity, rating options were tailored to each subscale (e.g., for smell: 0 = *No smell at all*, 10 = *Perfectly clear and as lively as smelling it for real*). The questionnaire demonstrated strong internal consistency for the English version (α = .97) (Andrade et al., 2013), Dutch version (α =.96) (Woelk et al., 2022), and German version (α =.92) (Jungmann et al., 2022). Test-retest reliability was good as well (r =.71).

Aesthetic Appreciation

Aesthetic appreciation was measured by 1-item asking 'How much did you appreciate the experience?'. Participants were asked to rate their appreciation on a scale from 0 *not at all appreciated* to 7 *highly appreciated*.

The Geneva Wheel of Emotion (GEW)

We used the 2.0 version of the Geneva Emotion Wheel (GEW; *Scherer, 2005*) to measure emotional impact in our study. Recognized for its utility in time-pressured scenarios and repeated measurements (Sacharin et al., 2012), the GEW 2.0 organizes emotions along dimensions of negative valence-positive valence and high control/power-low control/power.

Participants, for every reported aesthetic experience, rated the intensity of one or two emotions from 20 distinct emotion families on a 6-point scale. Higher scores reflected greater intensity, while lower scores indicated less intensity during the aesthetic experience. The upper half circle labeled "None" and the lower half circle labeled "Other" provided options for participants who didn't feel any emotion or experienced one not in the wheel. For the present study, we only looked at the highest reported intensity out of the two emotions to ensure a focus on the most salient emotional experience within each participant.

For psychometric attributes, we employed English, Dutch, and German versions of the GEW. The GEW has been used before in a museum study and art contexts (Tinio & Gartus, 2018).

The Flow Short Scale (FSS, Rheinberg et al., 2023)

In order to measure the immersion during an aesthetic experience we used The Flow Short Scale (FSS, Rheinberg et al., 2023). It comprises 16 items, including Fluency, Absorption, and Worry subscales. To focus on immersion, we excluded worry items and used only items 1-10 about Fluency and Absorption. Items such as "*I am totally absorbed in this aesthetic experience*. " were rated on a seven-point Likert scale ranging from "*strongly disagree*" to "*strongly agree*." High scores indicate both high Fluency and Absorption, while medium values suggest medium-high subscale scores. The FSS is valued for its time efficiency and adaptability to various contexts, such as rock climbing and computer game evaluation (Schüler & Nakamura, 2013; Weibel & Wissmath, 2011). Furthermore, the FSS demonstrates good to very good internal consistency (Total Score, $\alpha = .90$, Fluency, $\alpha = .92$, Absorption $\alpha = .80$).

Stimuli

We asked participants what kind of stimulus causes the aesthetic experience. Participants were given the following options to indicate the type of stimulus: Nature, Social

Situation, Human-made environment, Visual Art, Music, Literature, Other media, Culinary, and Other.

Research Design and Procedure

The online self-report survey was designed collaboratively with the research team to assess several personal attributes of participants both outside of and in relation to their AE. The survey was made available to participants in an app and a website format designed with Qualtrics (https://www.qualtrics.com/), and was accessible for four consecutive weeks, from November 9 to December 10, 2023. This longitudinal design allowed participants to choose freely when to add entries to report naturally occurring AE. Participants were prompted to report at least five entries relating to separate AE. Participants gave their email addresses as identifiers to link their separate entries together, and email reminders to add an entry were sent once per week. The questionnaire was set up in three phases that are described here after:

1. Pre-questionnaire. The pre-questionnaire included Informed Consent and Information Form, a short definition of AE, and demographics. Additionally, questions adapted from the Recalled Aesthetic Experiences - abridged version (RAE) were included to assess participants' self-perceived occurrence, frequency, and importance of AE (Buzzo & Sayim, 2023). Furthermore, measures of self-perceived stress level, art knowledge and interest, current mood, and self-reflection were assessed.
2. Entries. Upon completion of the pre-questionnaire, participants could access the journal entry phase of the survey. Each entry included a reminder of the definition of AE and several questions in relation to the specific AE participants chose to report on. This included the time at which the experience occurred, the perception of time during the experience, and the stimulus that initiated the experience.

Furthermore, 7-point Likert-scale measures were used to assess the self-perceived appreciation, intensity, and meaningfulness of the AE. Other measures were used to assess current mood, emotions evoked by the experience, mind-wandering, and immersion. Additionally, participants were prompted to describe the self-perceived meaning of the AE in their own words as per think-aloud protocols by Tenbrink (2015). Participants were given the same questions each time they chose to report a new experience.

3. Post-questionnaire. After the last journal entry, the post-questionnaire could be accessed. It included measures of self-perceived stress level and capability of mental imagery.

Results

Preliminary Analysis

Participants were linked to unique IDs (‘pID’) and any other link with their identity was removed. Nine out-of-bounds observations in the Geneva Emotion Wheel (GEW) were removed. Entries with '0' scores in Aesthetic Appreciation were removed, and double entries were deleted, retaining the earlier one for improved recall assumption. The FSS scale, originally ranging from 40 to 46, was recoded to a 1–7 scale. Averages were calculated for Aesthetic Appreciation (AEP), Emotional Impact (EI) from the GEW, Immersion (FSS) and for Imagery Manipulation (Psi-Q) the Global-Psi-Q, and the 7 mental imagery subscales for each participant. Correlational analyses were conducted to explore hypotheses 1 and 3, and Baron and Kenny mediation (1986) was proposed for hypothesis 2 using IBM SPSS (version 27). The descriptive values of the variables are presented in Table 2, and the correlations between the variables are shown in Table 3 and 4.

Table 2

Descriptive Statistics

	Mean	*Std. Deviation*
Mean AEP	5.81	0.83
Mean EI	.70	.11
Immersion	5.16	0.62
Mean Visual	7.53	2.10
Mean Sound	6.45	2.03
Mean Smell	5.08	2.44
Mean Taste	6.67	2.20
Mean Touch	7.10	2.09
Mean Bodily	6.62	2.09
Mean Feeling	6.74	2.09
Global-Psi-Q	6.60	1.82

Note: N = 60, AEP (1-7), EI (0-1), Immersion (1-7), Psi-Q (0-10)

Note: Aesthetic Appreciation (AEP), Emotional Impact (EI), Immersion, Mental Imagery (Global-Psi-Q)

All linear regression assumptions were met. Normality checks, including normal probability plots and QQ-plots, indicated approximate normality for most variables, with some deviations in emotional impact. Despite these violations, the large sample size (n = 60) should minimize the potential impact (Ernst & Albers, 2017). The assumption of independence was assessed using Durbin-Watson statistics for each regression. The Durbin-Watson values ranged from 2.32 to 2.43, indicating no significant autocorrelation in the residuals.

Outliers were examined using residual statistics (< ±3) and Cook's distance, ranging from 0.14 to 0.43, showed no significant influence on the model. The analysis shows no significant multicollinearity among the predictor variables, as indicated by Pearson correlation coefficients, with tolerance ranging from 0.96 to 0.10 and VIF ranging from 1.00 to 1.04.

Additionally, it should be addressed that the variables utilized are ordinal; however, existing studies, including those by Jamieson (2004), Norman (2010), and Carifio and Perla (2007), assert that parametric tests remain sufficiently robust for analyzing Likert scale responses, especially when other assumptions are satisfied. Nonetheless, the results should be interpreted with caution.

Main Analysis

Hypothesis 1

To test the first hypothesis that Global-Psi-Q positively correlates with Aesthetic Appreciation, Emotional Impact, and Immersion a correlational analysis was conducted. Table 2 displays the correlations between the variables. Pearson's coefficient for Global Imagery showed weak positive correlations with Aesthetic Appreciation and Emotional Impact, and a negligible negative correlation with Immersion. All correlations were found non-significant with exception of a significant positive correlation between Global-Psi-Q and Aesthetic Appreciation. Therefore, the hypothesis is only partially supported.

Table 3

Correlations with Psi-Q

	AEP	EI	Immersion
EI	.30*	-	
Immersion	.34**	.15	-

Psi-Q	.28*	.18	-.04

Note: Aesthetic Appreciation (AEP), Emotional Impact (EI), Global Imagery (Psi-Q)

*$p < .05$

**$p < .01$

Hypothesis 2

The second hypothesis, proposing that the relationship between Aesthetic Appreciation and Global Imagery is mediated by Emotional Impact (M1) and Immersion (M2) was tested using the Baron and Kenny method for mediation (1986). Using the default Enter Method in SPSS (version 28) regression. Three separate SLR analyses were conducted to establish associations between variables. Then a multiple linear regression (MLR) was performed to determine the influence of any potential mediator.

First, a significant positive effect was found between Global Imagery (IV) and AEP (DV) ($F(1,57) = 4.689$, $\beta = .127$, $t = 2.224$, $p = .03$, *95%CI* [.013; .241]), indicating that Global Imagery explained 7.9% of the variance in Aesthetic Appreciation ($R^2 = .079$). This finding met the pre-requisite for continuing subsequent steps of mediation analysis. Although the proposed mediators did not exhibit significant correlations with Global Imagery, we proceeded with the initial simple linear regressions following the Baron and Kenny method. The SLR's revealed non-significant relationships between the independent variable (Global-Psi-Q) and the proposed mediators Emotional Impact and Immersion. Therefore, we have to reject the hypothesis that the relationship between Global Imagery and Aesthetic Appreciation is mediated by Emotional Impact and Immersion.

Hypothesis 3

In order to test the third hypothesis, which proposed that the influence on Aesthetic Appreciation varies per sensory subscale of mental imagery Global-Psi-Q, a second correlational analysis was conducted. Table 3 displays the correlations between the variables. Pearson's coefficient for Global-Psi-Q's sensory subscales showed weak positive correlations with Aesthetic Appreciation, with only the taste and bodily sensations subscales significantly correlating with Aesthetic Appreciation. Supporting our hypothesis that the mental subscales differ in their influence on Aesthetic Appreciation.

The results support the third hypothesis, indicating that the influence of Global-Psi-Q on Aesthetic Appreciation indeed varies across sensory subscales, with only the bodily sensations and taste subscale showing a significant positive correlation with Aesthetic Appreciation.

Table 3

Correlations

	Visual	Sound	Smell	Taste	Touch	Bodily	Feeling
AEP	.24	.24	.24	.28*	.11	.31*	.23

Note: Aesthetic appreciation (AEP)

*$p < .05$

**$p < .01$

Explanatory Analysis

To further explore the significant correlation between the two Global-Psi-Q subscales, bodily sensation and taste, on Aesthetic Appreciation two post-hoc regression analysis have been performed. For taste imagery, the linear regression model showed that taste ($F(58, 1) = 4.948$, $\beta = .105$, $t = 2.224$, $p = .030$, *95%CI* [.011; .199]) significantly explains 7.9% of the variance ($R^2 = .079$) in AEP. The linear regression model for bodily sensations showed that

bodily sensations ($F(58, 1) = 6.346$, $\beta = .124$, $t = 2.519$, $p = .015$, *95%CI* [.025; .222]) significantly explains 9.9% of the variance ($R^2 = .099$) in AEP.

Discussion

Previous studies

The primary aim of this study was to assess the influence of mental imagery across sensory modalities on aesthetic appreciation. To achieve this objective, we conducted an online diary study. Specifically, we examined if (i) Global mental imagery ability was associated with aesthetic appreciation, emotional impact, and immersion. (ii) Whether global imagery ability positively predicts aesthetic appreciation, with this relationship being mediated by immersion and emotional impact. (iii) And if the different imagery subscales differ in their association on aesthetic appreciation across different sensory modalities.

Our findings revealed that global imagery predicted 7.9% of the variance in aesthetic appreciation. This suggests that the ability to vividly imagine things across various senses may significantly influence individuals' appreciation of aesthetic experiences. This idea finds support in previous studies showing the predictive power of visual imagery in various aesthetic domains, including haiku poetry, music, and visual art (Hitsuwari & Nomura, 2021; Belfi, 2019; Frame et al., 2024; Mehl et al., 2023). Additionally, Hitsuwari et al. (2023) found that olfactory imagery positively influenced the perceived beauty of haikus, further supporting our results.

Notably, we found no association between immersion and global imagery. This suggests that although people can vividly imagine things across their senses, it doesn't necessarily mean they'll feel more immersed in the experience. This result differs from other studies that found certain types of imagery could deepen immersion, such as Hitsuwari et al. (2023) who observed that olfactory imagery deepened immersion in haikus, and Jeong (2012),

who linked specific imagery types to flow experience in dancers. Consequently, this result means we couldn't confirm whether immersion plays a role in explaining how mental imagery influences aesthetic appreciation, suggesting that the relationship between mental imagery and aesthetic appreciation may be more direct and not mediated by immersion. Interestingly, immersion did show a slight positive connection with aesthetic appreciation. Suggesting that when people feel more immersed in an experience, they also tend to appreciate it more. We conclude that while immersion may not mediate the relationship between mental imagery and aesthetic appreciation as hypothesized, it still plays a role in enhancing aesthetic appreciation.

Our study found no direct link between mental imagery and emotional impact in aesthetic appreciation, suggesting that vivid imagination across senses may not necessarily heighten emotional intensity during the experience. This contrasts with previous findings, which indicated that engaging in imagery can amplify emotional responses (Holmes & Mathews, 2005). However, emotional impact was significantly associated with aesthetic appreciation, consistent with Hitsuwari & Nomura (2021), highlighting emotions' role in appreciating aesthetic experiences. Nevertheless, our study did not confirm emotional impact as a mediator between mental imagery and aesthetic appreciation, suggesting that other factors may be involved. One potential explanation for this could be mental imagery's ability to induce relaxation effects (Koivisto & Grassini, 2022), which might offset any increase in emotional intensity. Given these findings, additional emotional measures like valence or arousal may be necessary in future studies to gain a deeper understanding of this relationship. Overall, our findings suggest that while mental imagery significantly predicts aesthetic appreciation, its relationship with emotional impact and immersion may be more nuanced than initially hypothesized.

In line with our third hypothesis, we found differences among various mental imagery subscales in their impact on aesthetic appreciation. Specifically, bodily sensations imagery,

which involves imagining internal physical sensations like warmth and movement, and taste imagery, which involves imagining flavors and taste without actual stimuli, showed weak but significant associations with aesthetic appreciation. This suggests that individuals who are better at vividly imagining bodily sensations or taste tend to experience higher levels of aesthetic appreciation during aesthetic experiences as well. Subsequent exploratory analysis further confirmed that individuals who vividly imagine tastes and bodily sensations predict approximately 7.9% and 9.9%, respectively, of their level of aesthetic appreciation. To the best of my knowledge, this finding appears to be the first concrete support for the significant role of taste and bodily imagery in aesthetic appreciation. However, it's important to interpret the results of the explained variance with caution due to the exploratory nature of the analysis.

Although we only found significant results for taste and bodily imagery, studies suggest cross modal effects in mental imagery across sensory modalities (Spence, 2022; Spence & Deroy, 2012). Therefore, it's possible that the influence of taste and bodily sensations imagery on aesthetic appreciation may extend to other sensory experiences as well. These findings therefore support embodied cognition theory, which posits that perception, mental imagery, and aesthetic appraisal are closely linked to the physical body (Aglioti et al., 2012). It emphasizes experiencing art as a full-bodied encounter, integrating not only taste and bodily sensations imagery but also the entirety of individuals' embodied consciousness. This notion is supported by Nummenmaa and Hari's (2023) study, which used bodily sensation maps of aesthetic and emotional experiences while viewing art. Although our approaches differ, the shared emphasis on bodily sensations highlights the potential interconnectedness between mental imagery and bodily experiences in aesthetic appreciation.

Strengths and Limitations

Firstly, our study utilized a convenience sample, primarily composed of first-year female students aged 18 to 24 years old, potentially limiting the representation of the broader population and the diversity of aesthetic experiences across demographics. This raises questions about the generalizability of the results to more diverse populations, including individuals outside the specified age range, gender, or educational backgrounds (Nielsen & Einarsen, 2008). However due to the longitudinal nature of our study, we empowered participants to report their aesthetic experiences as they naturally unfolded over time. Additionally we didn't limit participants in the type of aesthetic experience they reported. This approach yielded a broad spectrum of real-life aesthetic encounters, providing rich and diverse data for our analysis. As a result, we were able to comprehensively explore aesthetic appreciation in authentic contexts, strengthening the depth and reliability of our findings.

Secondly, by using a diary study participants held full autonomy in when and what aesthetic experience they reported. This may have introduced bias by mostly reporting positive experiences and underreporting of negative ones, potentially leading to a ceiling effect. However, this aspect of our methodology could also be viewed as a strength. The fact that participants reported aesthetic experiences that made them happy and particularly appreciative reflects the genuine nature of the reported encounters. This authenticity adds credibility to our findings, as they are based on the experiences that individuals themselves deemed significant and worthy of reporting.

Thirdly, our 1-item measures for aesthetic appreciation raise concerns about reliability and sensitivity. However, the use of 1-item measures for aesthetic appreciation also had its advantages within the confines of our diary study by unburdening participants and enabling quick diary entries on the go. Nonetheless, the limitations of these measures suggest that our results should be interpreted with caution.

A final limitation in our study is the use of ordinal data in regression analysis, which can pose challenges in accurately interpreting the results. While linear regression with ordinal data is possible, it's not recommended due to potential inaccuracies. However, within our study, we ensured equal distances between answer options, addressing concerns about the assumption of a constant marginal effect. We also met all assumptions for regression analysis, suggesting that limitations associated with this approach may be minimized. Nevertheless, given these considerations, it's important to interpret the results with caution. Further details on this aspect can be found in the results section.

Implications & Future Directions

To my knowledge, this study stands as the first to offer evidence supporting the impact of taste imagery and bodily sensation imagery on aesthetic appreciation, marking a notable advancement in this field. Our research thereby further solidifies the role of mental imagery as a pivotal factor in shaping aesthetic appreciation. Moreover, our findings underscore the importance of embodied cognition and affirm the relevance of global mental imagery as a measurement tool in assessing aesthetics, highlighting the interconnectedness of human cognition. Moving forward, it is imperative for future research to explore additional sensory modalities beyond visual and auditory imagery to achieve a more nuanced understanding of mental imagery's impact on aesthetics. Additionally, future research should look into cross modality among the senses to deepen our understanding of aesthetic perception.

Conclusion

In this study we have examined the influence of mental imagery on aesthetic appreciation in terms of immersion and emotional impact by utilizing a diary study approach. Our findings suggest that all sense modalities of mental imagery, but specifically taste and bodily imagery significantly influence aesthetic appreciation. Our results shed light on the

importance of taking a holistic approach in studying aesthetic appreciation, emphasizing the role of embodied cognition.

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Appendix A

Inventory table of all D.E.A.R. Study instruments

Inventory/Scale	Source	Purpose	Items/Method	Used in
Perceived Stress Scale (PSS-10)	Lee (2012)	Measuring self-perceived stress levels of the last month	Likert scale (anchored at 1 = never, 5 = very often)	Pre and Post
Pick-a-mood	Desmet et al. (2016)	Assessing state mood	8 facial expressions represent different moods, one neutral option	Diary entries
Vienna Art and Interest Knowledge	Specker et al. (2020); Specker et al. (2023)	Assessing participants' art knowledge and interest	Scale Interest: 7 Likert items (anchored at 1 = not at all, 7 = very much), 4 Likert items (descripted across levels); Scale Knowledge: 6	Pre

			multiple-choice items	
Self-reflection and Insight Scale (SRIS-12)	Silvia (2021)	Capturing engagement tendencies in self-reflection, need for self-reflection and internal state awareness	Shortened version, Likert scale (anchored at 1 = strongly disagree, 7 = strongly agree)	Pre
BSM	GEMMA SCHINO	Capturing areas of perceived bodily activation and deactivation	Distributing up to 10 clicks across body areas	Diary entries
The Geneva Wheel of Emotion 2.0 (GEW 2.0)	Scherer, K. R. (2005)	Assessing emotions constituting the experience	Placement of up to two emotion indictor points inside the wheel	Diary entries
Flow Short Scale	Laakuso et al. (2022)	Assessing flow levels of the experience by subscales capturing	Likert scale (anchored at 1 = strongly	Diary entries

		absorption and fluency levels	disagree, 7 = strongly agree)	
Questionnaire for Mind-Wandering	Composed of 3 items adopted from Taruffi (2021), 4 items from Deil et al. (2022), 1 item from the Mind-Wandering Inventory (MWI) (Gonçalves et al., 2020)	Capturing MW occurrence and assessing its components	1 multiple-choice item; 6 Likert items (anchored individually but ranging from low to high); 2 multiple-choice items	Diary entries
The Plymouth Sensory Imagery Questionnaire (Psi-Q)	Andrade et al. (2013)	Assessing participants' mental imagery ability across 7 sensory modalities and one global score (e.g. visual, sound, smell, taste, touch,	35 items with 5 items making one of 7 subscales. Response ranging from	Post

bodily

sensation,

feeling)

Note: Pre-test (Pre), Post-test (post)