

**The Development of Aesthetic Appreciation:
A Progressive Shift from Simple Emotion to Complex Cognition?**

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Abstract

Aesthetic appreciation is a distinctive feature of human life that begins in early childhood. Nevertheless, existing theories on aesthetic appreciation largely lack a developmental perspective. This study employed a mixed and multi-method approach to investigate whether aesthetic appreciation progresses from simple emotional processing in childhood toward increasingly complex cognitive processing in adolescence. Our sample consisted of 58 participants that were divided into the sub-groups of children ($N = 39$) and adolescents ($N = 19$). While the hypothesis that positive emotional valence plays a more significant role in children than in adolescents was not supported, important insights were revealed. Significantly higher arousal levels were observed in adolescents during aesthetic appreciation, indicating that emotion remains an important component of aesthetic appreciation in this age group. Additionally, the study demonstrated that adolescents exhibited a greater tendency to engage in conceptual cognition, pointing toward a development of complex cognitive processing in aesthetic appreciation. Findings on analytical cognition did not support this notion however, and need to be further investigated in the future. We concluded that conceptual cognition develops in aesthetic appreciation from childhood to adolescence, but considering this a shift from simple emotional processing to complex cognition might be an oversimplification of the intricate nature of emotion in aesthetic appreciation.

Keywords: aesthetic appreciation; children; adolescents; emotion; semiotic cognition

The Development of Aesthetic Appreciation:

A Progressive Shift from Simple Emotion to Complex Cognition?

Aesthetic appreciation is widely recognized as a fundamental aspect of human life, with humans engaging in aesthetic activities such as the decoration of tools for over 100,000 years (Nadal & Vartanian, 2019). Aesthetic appreciation already begins in early childhood, expressed for example through children's appreciation of visual art, music, and objects (Goldstein, 2020). Acknowledged as an important component of childhood development, aesthetic appreciation encourages children to contemplate and reflect on their sensory perceptions (Eisner, 2002; Heid, 2005). Despite this significance, research on aesthetic appreciation has predominantly focused on adults, leaving the development of aesthetic appreciation from childhood to adolescence largely unexplored (Freeman & Parsons, 2001; Goldstein, 2020).

Aesthetic Appreciation

Aesthetic appreciation refers to the positive hedonic response to a sensory stimulus (Skov & Nadal, 2020a). Contrary to common misconceptions, aesthetic appreciation is not only limited to art but encompasses a wide variety of experiences, such as the appraisal of artifacts, natural objects, and environments (Pearce et al., 2016; van Heusden, 2022). It is therefore a broader concept than art appreciation, which only constitutes a sub-component of aesthetic appreciation (Skov & Nadal, 2020a). This distinction is crucial as previous accounts on aesthetic appreciation in children and adolescents have predominantly focused on art appreciation, particularly in visual arts (Parsons, 1978) and music (Nieminen et al., 2011). While these discussions may incorporate general elements of aesthetic appreciation, they also involve domain-specific aspects exclusive to art stimuli (Goldstein, 2019).

During aesthetic appreciation, a combination of emotional and cognitive processes influences the positive evaluation of a stimulus (Brosnan & Ashwin, 2023). Aesthetic

appreciation is a highly complex process, affected by many other factors apart from emotion and cognition, such as cultural background and individual differences (Jacobsen, 2006). To investigate these complex intertwined factors, multiple theoretical frameworks on aesthetic appreciation have been proposed. Many of these frameworks adopt a two-factor perspective, emphasizing the interplay between emotion and cognition in aesthetic appreciation (e.g., Chatterjee & Vartanian, 2014; Leder et al., 2004; Lindell & Mueller, 2011). These theories are supported by findings in empirical aesthetics, highlighting the importance of processing-fluency, cognitive mastery, and emotions in aesthetic appreciation (Leder et al., 2012; Reber, 2021). Neuroaesthetic research further reveals that emotional and cognitive brain systems collaborate to facilitate the evaluation of sensory information during aesthetic appreciation (Vartanian & Skov, 2014).

Emotions in Aesthetic Appreciation

Emotions are affective states that involve both psychological and physical changes (Ekman, 1970). It is largely unknown how emotions in aesthetic appreciation develop across childhood and adolescence (Goldstein, 2020). In non-aesthetic contexts, emotion regulation, emotional control, as well as the understanding and recognition of emotions, tend to improve from childhood to adolescence (Crone & Dahl, 2012; Denham, 1998; Zelazo et al., 2008). Among adults, aesthetic emotions have been proposed to constitute a distinct class of emotions that predict aesthetic appreciation (Menninghaus et al., 2019). Other theorists argue against considering aesthetic emotions as a separate class, suggesting that they might be the same as emotions experienced in non-aesthetic contexts (Skov & Nadal, 2020b). Emotions are acknowledged as multidimensional, with researchers generally agreeing on the two main dimensions of valence and arousal (Baas et al., 2008; Russell, 1980).

Emotional Valence

Emotional valence describes the distinction between positive and negative emotions (Barrett et al., 2008). According to Parsons' (1987) developmental theory of children's appreciation of visual art, preschool children mainly experience positive emotional valence in their art appreciation. Positive emotional valence appears to be a crucial factor in appreciation of visual artworks in both preschool and elementary school children, with the most substantial impact observed in preschoolers (Schabmann et al., 2015). Considering the general developmental trend of diminishing positive emotional states from childhood to early adolescence, it is anticipated that the influence of positive emotionality will continue to decrease as children move towards adolescence (Larson & Lampman-Petratis, 1989; Larson et al., 2002; Moneta et al., 2001).

For adults, aesthetic appreciation is not dependent on positive emotional valence. Even negative emotions like sadness can be experienced as pleasurable in aesthetic contexts, as viewers are able to distancing themselves psychologically from the stimuli, maintaining a sense of control (Menninghaus, Wagner, Hanich et al., 2017). The point at which children develop the cognitive ability to distance themselves from negative emotions in aesthetic appreciation remains uncertain (Menninghaus, Wagner, Hanich et al., 2017). The inability to achieve psychological distance may lead children to avoid stimuli that evoke negative emotions in aesthetic contexts. A general trend in adolescence toward heightened negative emotionality (Reitsema et al., 2022) suggests that negative emotions may indeed play a role in aesthetic appreciation among adolescents.

Emotional Arousal

Emotional arousal refers to the degree to which a physiological or psychological response is induced by a stimulus (Russell, 1980). Emotions in aesthetic appreciation involve both high arousal (e.g., excitement; Schindler et al., 2017) or low arousal (e.g., melancholia;

Armstrong & Detweiler-Bedell, 2008). Optimal arousal levels have been found to be predictive of aesthetic appreciation in adults, suggesting that emotional arousal may serve a self-rewarding function (Berlyne, 1971, 1974; Salimpoor et al., 2009). This function appears to be independent of emotional valence, as evident in the enjoyment of horror films (Menninghaus, Wagner, Wassiliwizky et al., 2017; Hanich et al., 2014). Artworks may also evoke strong emotional arousal, even when not associated with traditional high-arousal emotions like horror. Physiological responses such as chills, goosebumps, or tears have been found for example in the response to music and poems (Menninghaus, Wagner, Wassiliwizky et al., 2017).

Research has shown that higher arousal levels have a stronger effect on appreciation of visual art in elementary school children than in preschool children (Schabmann et al., 2015). Whether the connection between arousal and aesthetic appreciation intensifies in the transition from childhood to adolescence remains uncertain. Support for the increasing importance of arousal in aesthetic appreciation is given by Parsons (1987), who viewed the quality of the produced experience as the determining feature of aesthetic appreciation in adolescents. According to his developmental theory, an interesting and intense experience contributes to a positive perception of the artwork. This is in line with the findings of Schabmann et al. (2015) of a shift from an emotional to a progressively cognitive knowledge-based understanding of aesthetics, which still underline the fundamental significance of emotional processing in aesthetic appreciation.

Bodily Sensations

Major emotion theories posit that subjective emotional feelings arise from the perception of changes in emotion-related bodily sensations (Hietanen et al., 2016; James, 1884). Bodily sensations are seen as an important component of emotions (Ekman, 1970). Different basic emotions can be visualized on bodily sensation maps (BSMs) and are

associated with distinct and discernible patterns of bodily activations (Nummenmaa et al., 2014). BSMs are shown to be a resourceful tool in investigating subjective emotional feelings and bodily sensations in art contexts (Schino et al., 2021). When visualizing art-elicited emotions on bodily sensation maps (BSMs), frequent activation in the head area becomes apparent (Schino et al., 2021). Increased head activation may be due to physiological changes in the facial area, as well as mental contents triggered by the emotional stimulus (Costa, 2010; Nummenmaa et al., 2014). Delight and happiness are the most common emotions in response to artworks, primarily characterized by bodily activations in the head, followed by the chest (Schino et al., 2021).

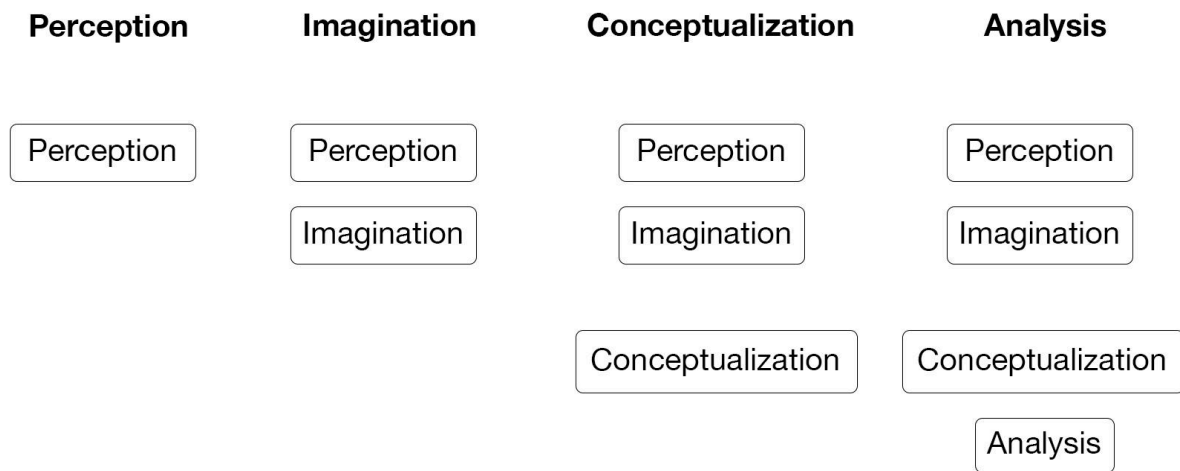
Bodily sensation maps have been studied in children and adolescents, showing that specific basic emotions are already associated with discrete bodily sensations in preschool-aged children (Hietanen et al., 2016). During development towards adolescence, these emotion-related bodily sensations become increasingly discrete and approximate those of adults (Hietanen et al., 2016).

Semiotic Cognition in Aesthetic Appreciation

Semiotic cognition refers to the use and interpretation of signs, such as images, gestures, or sounds, to make sense of one's current experience (van Heusden, 2009). In the sense-making process, four *semiotic strategies*, namely perception, imagination, conceptualization, and analysis, are employed (van Heusden, 2009). The semiotic strategies build upon one another, and the application of some strategies presupposes the use of others (van Dorsten, 2015; see Figure 1). Even though young children already utilize a range of semiotic strategies, older children may have the ability to use more advanced semiotic strategies (van Dorsten, 2015).

Figure 1

Overview of the Four Semiotic Strategies



Note. The figure illustrates how the semiotic strategies build upon one another, adapted from van Dorsten (2015).

Perception and Imagination

Perception and imagination are both forms of concrete semiotic cognition, meaning they involve seeing the object as is without abstraction and can be considered early components of aesthetic appreciation (Leder et al., 2014; van Heusden, 2009). During *perception*, objects are perceived quickly and automatically by sensory information on their color, texture, and shape (Cassirer & Manheim, 1953; Leder et al., 2014). Preschool and elementary school children primarily employ perceptive strategies in aesthetic appreciation (van Dorsten, 2015). Parsons (1987) developed a developmental stage theory of visual art appreciation, which suggests that preschool-aged children intuitively prefer artworks, and mainly focus on perceptions of color, whereas elementary school-aged children prefer representational and realistic artworks. Research in empirical aesthetics supports his theory of a focus on color in preschool and realistic depiction in elementary school children (Kuscevic et al., 2014; Machotka, 1966; Pariser et al., 2008). Young elementary school children

intuitively like artworks with subjects that are appealing to them, which suggests an intuitive positive reaction to aesthetic appreciation (Pariser et al., 2008).

During *imagination*, an object is still perceived in its existing form, but an alternative use is envisioned, such as crafting a wooden toy from a piece of wood (van Heusden, 2009). According to Parsons (1987), the primary purpose of art in adolescence is considered to be the expression of subjective experience by the artist, serving as inspiration for introspection in the viewer. Imagining the artist's subjective experience involves the use of imaginative strategies (van Dorsten, 2015). However, imaginative strategies in aesthetic appreciation may also be employed by children. For instance, 4-year-old children tend to match paintings based on color, while 7-year-olds match them based on the story that the paintings tell, suggesting a shift from a predominant use of perception to that of imagination (Winner, 2006). This is supported by the finding that imagination undergoes changes throughout development, initially being strongly influenced by perception and later by language (Egan, 2005).

Conceptualization

During *conceptualization*, an arbitrary term to describe the perceived object is agreed upon, enabling more effective communication. The term is separated from the original meaning and is therefore part of abstract thinking (van Heusden, 2009). The use of this strategy requires a sufficient development of language (van Heusden, 2009) and the ability to manipulate reality through imagination (van Dorsten, 2015).

The application of conceptual strategies emerges in adolescence, where prefrontal cortex maturation is accompanied by major improvements in information-processing skills and executive functions (Keating, 2012). The development of higher psychological functions enables adolescents to grasp the logical and taxonomic connections between a category and its subcategories (Piaget, 1959; Vygotsky, 1962). During art appreciation, the medium and style

of the artwork are considered, and it is placed into a cultural context, which implies conceptualization (Parsons, 1987).

Analysis

During *analysis*, a theoretical analysis of the object is built upon perception, imagination, and conceptualization (van Heusden, 2009). This could be an analysis of the physical and chemical properties of the piece of wood. Similar to conceptualization, analysis involves abstract thinking (van Heusden, 2009). The understanding and use of abstract concepts, such as informal abstractions, like society or culture, begin in adolescence (Ruck et al., 1998). Adolescents experience major cognitive improvements in logical and relational reasoning, enabling the use of analytical strategies (Dumontheil, 2014).

Adolescents engage in increased reflection upon cultural influences on their aesthetic judgment, as well as the transcendence of traditional viewpoints. However, the extent of this engagement is also influenced by art education (Parsons, 1987). Analytical strategies are being used as the adolescent critically reflects upon their aesthetic appreciation (van Dorsten, 2015). Their approach is more analytical, hypothesizing about art. The development of metacognition enables adolescents to become aware of their own art experiences and to question cultural influences (Parsons, 1987). Developmental research supports this, indicating improved awareness in adolescents of their thinking processes, dispositions, and cognitive biases (Klaczynski, 2005). In adults, cognitive understanding is seen as a predecessor to aesthetic appreciation (Leder et al., 2004). Research shows that cognitive understanding is increasingly associated with art appreciation across childhood development for modern artworks (Schabmann et al., 2015). In line with these findings and developmental theory, adolescents may show an increased use of conceptualization and analysis strategies during aesthetic appreciation when compared to children.

The Present Study

This study investigates whether aesthetic appreciation progresses from simple emotional processing in childhood toward increasingly complex cognitive processing in adolescence. As opposed to most of the previous literature, a broad approach not only involving visual art, but also other art forms, and non-art objects is taken (Skov & Nadal, 2020a). This study holds significant implications for advancing our understanding of the development of cognitions and emotions in aesthetic appreciation, which remains an underexplored area of research (Goldstein, 2019). To answer my research question, three individual hypotheses are investigated:

(1) *Children experience stronger positive valence of emotions during aesthetic appreciation than adolescents.* Simple emotional processing in childhood is expected to be reflected in the increased association between positive emotional valence and aesthetic appreciation, based on previous accounts in the literature (Parsons, 1987). Positive valence of emotion has been identified to be more strongly associated with art appreciation in preschool children than in school children (Schabmann et al., 2015). I expect that positive emotional valence is also more strongly correlated in children as a general group when compared to adolescents. I anticipate observing higher ratings for positive emotional valence and increased bodily activations in the head, chest, abdomen, upper limbs, and lower limbs in children, which are associated with positive emotions in aesthetic processing, specifically happiness and delight (Schino et al., 2021)

(2) *Adolescents experience higher emotional arousal during aesthetic appreciation than children.* Even though I expect positive emotional valence to decrease in importance during the process of aesthetic appreciation in adolescents, emotions continue to constitute a crucial component of aesthetic appreciation throughout development (Leder et al., 2004; Menninghaus et al., 2019). Based on previous literature, this emotional component is

expected to be reflected by increased emotional arousal in adolescents, independent of emotional valence (Parsons, 1987; Schabmann et al., 2015).

(3) Adolescents apply more conceptual and analytical cognition during aesthetic appreciation than children. Adolescents appear to take an increasingly complex cognitive approach to aesthetic appreciation compared to children (Parsons, 1987; Piaget, 1952; Schabmann et al., 2015). This is expected to be reflected by the increased use of abstract semiotic cognition, more specifically conceptual and analytical strategies (van Dorsten, 2015; van Heusden, 2009), and increased head activation during aesthetic appreciation (Costa, 2010; Schino et al, 2021).

Methods

Participants

The final sample comprised a total of 58 participants divided into two age groups. The first group consisted of 39 children (ages 6-12), and 19 adolescents (ages 13-17). Out of the participants, 21 identified as male, 35 identified as female, and 2 did not specify their assigned sex at birth. Their ages ranged from 6 to 17 ($M = 10.98$, $SD = 3.552$). 50 participants spoke Dutch as a first language and 8 spoke English or another language. Participants were recruited through snowball sampling, volunteer sampling, and convenience sampling. Recruitment methods included advertisement through the Zpannend Zernike festival, contacting parents within the social network of the research group, and collaborating with elementary and high schools in the northern Netherlands. A reward to participate was given in the form of a Pimm voucher of 10 euros offered to the participant or their legal guardians if the child was under 16 years of age. Alternatively, participants were given the choice to donate the money to a participating school.

Materials

My hypotheses were investigated in the broader context of a research project exploring aesthetic sense-making in children and adolescents. Taking into account the complex factors that interplay in aesthetic sense-making, a mixed and multi-method approach was employed. Variables were assessed qualitatively through a conversation between participants and quantitatively via a pre-conversation questionnaire and post-conversation questionnaire, created on Qualtrics (<https://www.qualtrics.com>). The entire qualitative data from the conversation and certain quantitative variables from the questionnaires were not relevant to my research question, which exclusively focused on the transition from emotion to cognition in aesthetic appreciation across development. As a result, these aspects are omitted in the materials section (see Appendix A).

Emotional Valence and Arousal

Emotional valence, arousal, and intensity in aesthetic appreciation were measured using the Geneva Emotion Wheel (GEW; Scherer, 2005), which was adapted to be age-appropriate. The GEW demonstrates moderate agreement among adult viewers regarding their emotional responses in aesthetic appreciation, both with each other and with the characteristics of artworks (Tinio & Garts, 2018). A combination of two validated tools, Plutchik's Wheel with emoji and the GEW was used (De Angeli et al., 2020) that shows 8 rather than 20 emotions, and includes verbal labels as well as emojis that indicate the intensity of the emotion. The tool has been validated as a measure of emotions elicited by museum experiences in children (De Angeli et al., 2020). Participants could identify two consecutive emotions on the GEW to indicate that multiple emotions were experienced.

Bodily Sensations

Bodily Sensation Maps (BSMs, Nummenmaa et al., 2014) were used to assess bodily sensations that accompany emotions during aesthetic processing. Two dimensions of bodily interoception were assessed, namely the intensity and location of bodily sensations. BSMs as a tool have been validated in children and adolescents ranging from 6 to 17 (Hietanen et al., 2016) as well as in art contexts (Nummenmaa & Hari, 2023; Schino et al., 2021, 2022).

Semiotic Strategies

Semiotic strategies were assessed through an adapted version of the theory-based questionnaire designed to empirically assess cultural consciousnesses in school children (van Klaveren et al., 2023; see Appendix B). The tool has been evaluated by experts as well as school children and was determined to be employable in the context of cultural education practice (van Klaveren et al., 2023). Our questionnaire was a short version of it including 10 items (van Dorsten & van Heusden, 2023). Semiotic strategy use was assessed on a 3-point Likert scale for the children group, and a 5-point Likert scale for the adolescent group.

Design and Procedure

Preparation Phase

The study was approved by the Ethics Committee Behavioural and Social Sciences of the University of Groningen (PSY-2223-S-0252) and was in line with the Dutch ethical standards for scientific research. Participants were asked to invite a peer (friend, family member or fellow student) to participate jointly in the experiment. They were instructed to each bring an item of choice that they considered meaningful (e.g., paintings, pictures, movie scenes, self-made objects) and not to share it with their co-participant before the experiment. Informed consent was given by the participants or their parents through the registration form.

Experimental Phase

The experiment was conducted in multiple locations, namely the university laboratory, the participants' homes, and collaborating schools. The experiment took around 45 to 60 minutes, and breaks were offered to the participants if necessary. (see Figure 2)

In the first part of the experiment, two participants were positioned some distance apart from each other and instructed to observe and interact with either their own significant object or their co-participant's significant object for at least 10 seconds and a maximum of 2.5 minutes. To avoid order effects, randomisation was applied and some participants started by appreciating their own object, while others began with their co-participant's object (Coolican, 2006). Then, the pre-questionnaires created on Qualtrics (<https://www.qualtrics.com>) were administered on tablets. First, age, sex, and general preferences for media use (van Klaveren et al., 2023) were assessed. Afterwards, Bodily Sensation Maps (BSMs; Schino et al., 2021, 2022), the Geneva Emotion Wheel (GEW; Tinio & Gartus, 2018), and a short questionnaire (van Klaveren et al., 2023) on preferred semiotic strategies were administered. Then, the steps were repeated for the respective own or other significant object. This part of the experiment lasted for a maximum of 10 minutes.

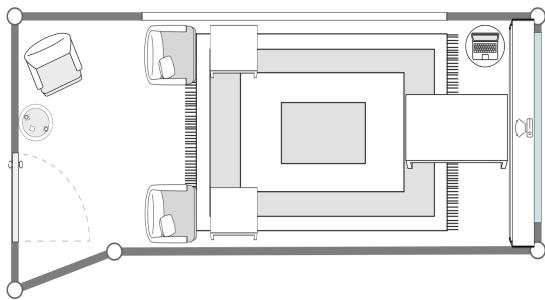
In the second part of the experiment, participants were asked to sit in front of each other and a video recording was started. During a semi-structured conversation, open questions were posed to initiate a conversation between participants about the significant object. Two minutes were given to discuss each of the 6 conversational prompts (see Appendix C). Then, the same was repeated for the own/other significant object. This part of the experiment lasted for a maximum of 20 minutes and was recorded via a 2-Logitech BRIO webcam.

In the last part of the experiment, participants filled in the post-questionnaire, which included the BSMs (Schino et al., 2021, 2022) and the GEW (Tinio & Gartus, 2018) for the

first significant object and the second significant object individually. Additionally, personality traits on Openness to Experience (Denissen et al., 2008; Muris et al., 2005) and expression of femininity and masculinity (8 items; adapted from Spence & Helmreich, 1978) were assessed.

Figure 2

Picture of the Experimental Setting



Note. This picture depicts our experimental setting in the university laboratory.

Results

In total, data from 63 participants was collected. However, six participants' data was disregarded due to incomplete data and invalid data. Thus, the final sample consists of 57 participants. In total, measurements were taken four times (pre/post-questionnaire; own/other object), but only data from the pre-questionnaire concerning the other participant's object was used to assess the initial process of aesthetic appreciation, uninfluenced by personal meaningfulness of the object. Participants brought a diverse assortment of non-art objects, visual art, video-clips, photos, and music, that aligned with my conceptualization of aesthetic appreciation, encompassing a variety of artifacts.

Emotion

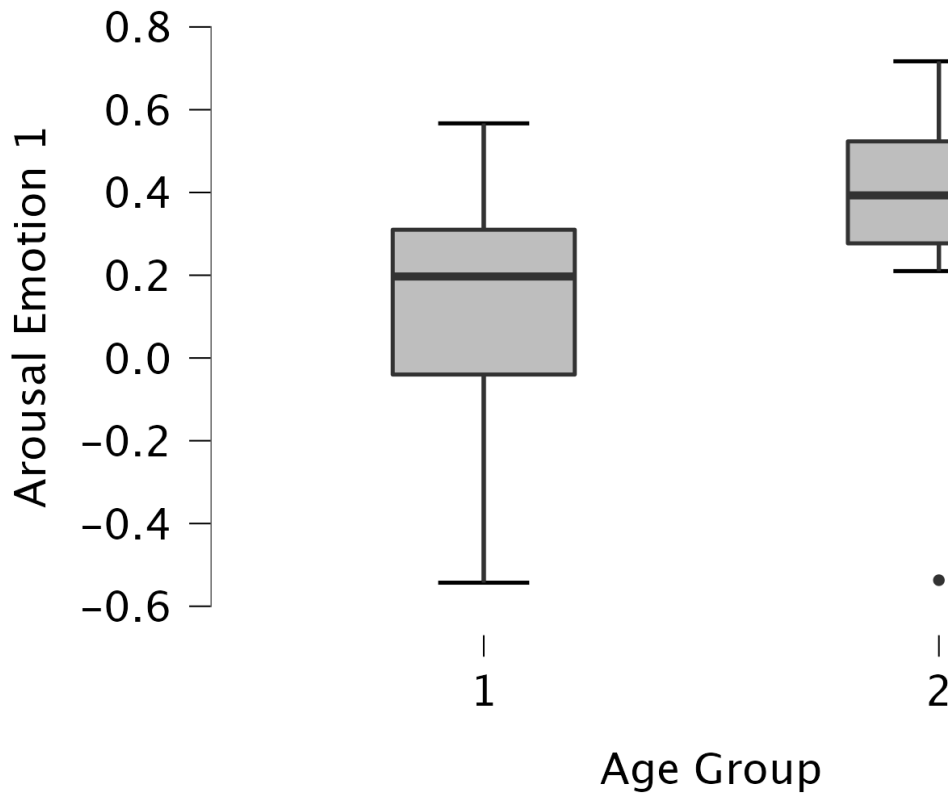
Valence and Arousal

The valence and arousal of the first emotion and second emotion indicated on the GEW (Tinio & Gartus, 2018) were analyzed using the protocol of Coyne et al. (2020). A Student's t-test was employed in all analyses except for emotional arousal in emotion 2. In all analyses, a Levene's test for equality of variances was administered to check for homogeneity of variances (Fein et al., 2022). Normality of the dependent variable was investigated by Q-Q Plots, box plots, histograms, and a Shapiro-Wilk test (Fein et al., 2022; Mishra et al., 2019). In the analysis of emotion 2, only data from 40 out of the 58 participants was included because 16 participants did not indicate a second emotion. Out of the participants, 67% of the children and 89% of the adolescents indicated a second emotion.

Valence. A two-sample t-test was performed to compare the valence of emotion 1 in children and adolescents. The statistical assumptions of homogeneity of variances and normality of the data in both age groups were met (Fein et al., 2022; Mishra et al., 2019). There were no statistically significant differences in emotional valence between children ($M = .4$, $SD = .248$) and adolescents ($M = .393$, $SD = .268$; $t(56) = .093$, $p = .463$). Another two-sample t-test was administered to compare the valence of emotion 2 in children and adolescents. Assumptions of homogeneity of variances and normality were met (Fein et al., 2022; Mishra et al., 2019). The results indicated no statistically significant difference in the emotional valence between children ($M = .303$, $SD = .298$) and adolescents ($M = .365$, $SD = .231$; $t(40) = -.711$, $p = .241$).

Arousal. A two-sample t-test was administered to investigate whether emotional arousal differed between age groups. Homogeneity of variances was met, but a visual inspection of the data and the Shapiro-Wilk test indicated violations of normality (Mishra et al., 2019). Because our total sample size of 58 was sufficiently large, the t-test procedure was

robust to these violations of normality (Moore & McCabe, 2016). The mean value of emotional arousal in children ($M = .125$, $SD = .326$) was significantly lower than the mean value of arousal in adolescents ($M = .385$, $SD = .275$; $t(56) = -2.993$, $p = .002$; see Figure 3). Differences in arousal of emotion 2 between the two age groups were analyzed using a two-sample t-test. Levene's test for equality of variances indicated that the statistical assumption of homogeneity of variances was not met (Fein et al., 2022). Thus, a Welch's t-test was conducted instead of a Student's t-test (Delacre et al., 2017). Violations of normality were present, but Welch's t-test is robust to such violations (Delacre et al., 2017; Mishra et al., 2019). There was no statistically significant difference in arousal between children ($M = .228$, $SD = .304$) and adolescents ($M = .033$, $SD = .447$; $t(23.604) = 1.535$, $p = .069$).

Figure 3*Differences in Mean Emotional Arousal in Children and Adolescents*

Note. Arousal is significantly higher in the adolescents compared to the children.

^a Group 1 refers to the children and group 2 to the adolescents

Bodily Sensations

Bodily activation counts in the combined body parts of the head, chest, abdomen, upper limbs, and lower limbs, reflecting happiness and delight, were collected through BSMs (Schino et al., 2021, 2022). A two-sample t-test was conducted to assess the differences in mean bodily activations of the two age groups. Homogeneity of variances was met, but violations of normality were present. Again, our sample size was sufficiently large for the two-sample t-test to be robust to the violations (Moore & McCabe, 2016). There was no statistically significant difference in bodily activation counts between children ($M = 2.23$, $SD = 2.897$) and adolescents ($M = 3.26$, $SD = 3.016$; $t(56) = -1.257$, $p = .107$).

Cognition

Semiotic Strategies

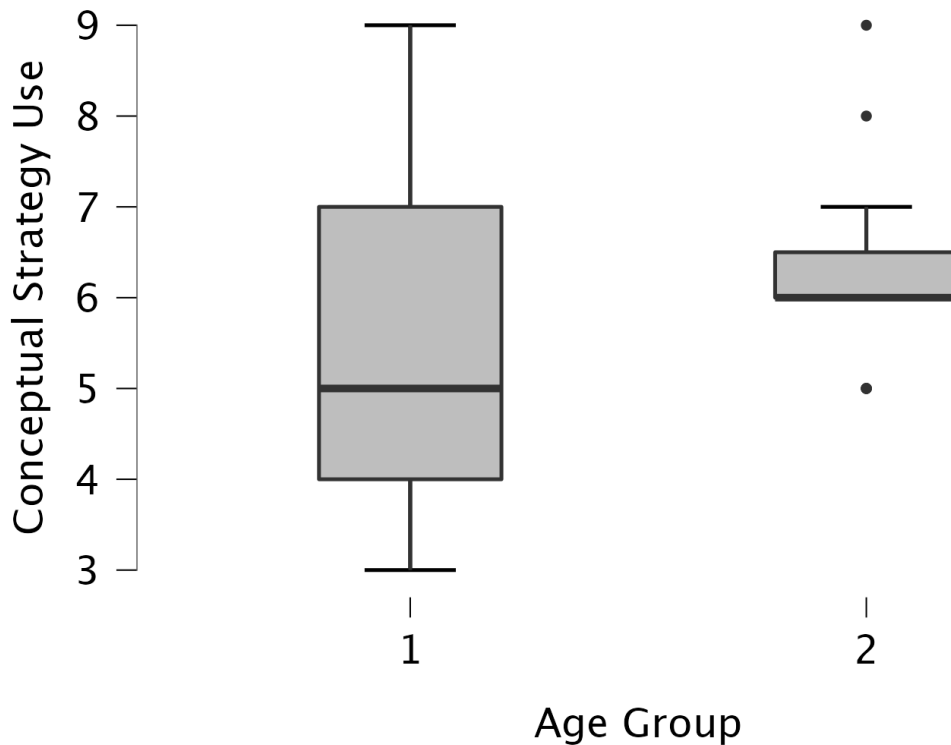
Semiotic strategy use was assessed on a 5-point Likert scale for adolescents and a 3-point Likert scale for children. To ensure comparability, z-scores were employed to transform the scores from the 5-point Likert scale of the adolescents to a standardized 3-point Likert scale. A sum score of the items was used to assess the usage of conceptual and analytical strategies.

Due to the data being treated as ordinal, a Mann-Whitney U test was performed to evaluate whether the use of conceptual strategies differed by age group (Fein et al., 2022). The results indicated that children's use of conceptual strategies ($Md = 5$) was significantly lower than that of adolescents ($Mdn = 6$; $U = 245.5$, $z = -2.105$, $p = .035$; see Figure 4) with a medium effect size of $r = 0.28$ (Cohen, 1988).

Another Mann-Whitney U test was employed to compare the use of analytical strategies in children and adolescents. The results indicated that there was no statistically significant difference between the use of analytical strategies of children ($Md = 4$) and adolescents ($Md = 4$; $U = 353.5$, $z = -.289$, $p = .773$).

Figure 4

Mean Conceptual Strategy Use Divided by Age Group.



Note. Conceptual strategy use is significantly higher in adolescents compared to children.

^a Group 1 refers to the children and group 2 to the adolescents

Head Activations

A two-sample t-test was conducted to compare head activation counts on BSMs (Schino et al., 2021, 2022) in children and adolescents. Homogeneity of variances was met, as checked by Levene's test for equality of variances (Fein et al., 2022). A visual inspection of the data and the Shapiro-Wilk tests showed violations of normality (Mishra et al., 2019). Three outliers were identified and they were kept in the data as they seemed to reflect realistic variation in the population (Moore & McCabe, 2016). The sample size of 58 participants ensured robustness of the two-sample t-test (Moore & McCabe, 2016). There was a

statistically significant difference in head activation counts between children ($M = 1$, $SD = 1.947$) and adolescents ($M = 2.37$, $SD = 2.166$; $t(56) = -2.422$, $p = .009$).

Discussion

This study explored whether aesthetic appreciation progresses from simple emotional processing in childhood toward increasingly complex cognitive processing in adolescence. In line with previous literature, I hypothesized that positive emotional valence plays a more important role in aesthetic appreciation of children than of adolescents (Parsons, 1987; Schabmann et al., 2015). Conceptual and analytical cognition were expected to occur more prominently in the aesthetic appreciation of adolescents, reflecting an increasingly complex aesthetic processing (Parsons, 1987; van Heusden, 2009). Moreover, I expected that emotional arousal would be more pronounced in aesthetic appreciation of adolescents compared to children, highlighting that emotion remains an important factor in aesthetic appreciation throughout development (Parsons, 1987; Schabmann et al., 2015; van Dorsten, 2015; van Heusden, 2009).

Emotional Valence and Arousal

Concerning emotion, the most noteworthy finding was that adolescents displayed markedly higher arousal levels than children during aesthetic appreciation. This provides support for my hypothesis that the significance of emotion in aesthetic processing manifests itself through heightened arousal in adolescents. My observation also aligns with the conclusions drawn by Schabmann et al. (2015), underscoring the increasing significance of emotional arousal in art appreciation across childhood development. A critical implication of my findings regarding heightened arousal in aesthetic appreciation of adolescents is the growing significance of emotional arousal as individuals progress to adulthood.

In adults, optimal arousal levels have been identified as a predictive factor for aesthetic appreciation, as they potentially serve a self-rewarding function (Berlyne, 1971, 1974; Salimpoor et al., 2009). My findings suggest that analogous processes may apply to adolescents, which should be investigated by future studies. An alternative explanation for my results is that the social context of our experiment may have contributed to the heightened emotional arousal levels, as these have been linked to increased social reactivity during adolescence (Somerville, 2016). The intensified emotional arousal observed in adolescents during could have been influenced by factors such as the presence of a co-participant and researchers during the experiment. Another intriguing aspect would then be the social function of aesthetics, and whether it relates to the heightened arousal levels observed in adolescents (Mechner, 2018).

A significant difference in emotional arousal was however only observed only for the first indicated emotion. It is plausible that this emotion reflected an immediate response to the stimulus, while the second emotion indicated a subsequent feeling—a mental representation of the physiological sensations experienced in the initial emotion (Damasio, 2004). Therefore, arousal may be strongest in the initial indicated emotion, which has also been supported by other research (e.g., Bradley et al., 2008).

Furthermore, it is worth mentioning that a higher proportion of adolescents than children indicated a second emotion. This aligns with my hypothesis that emotion still plays an important role in adolescents and my expectation that individuals progress from simple emotional processing as they develop. In accordance with this, earlier developmental studies suggest an increase in the number of emotions experienced simultaneously during childhood (Wintre & Vallance, 1994) and highlight that adolescents experience more volatile emotions than children (Arnett, 1999; Guyer et al., 2016).

Against my initial hypothesis, the emotional valence observed during aesthetic appreciation in children was not more positive than in adolescents. This outcome contrasts with broader developmental research that typically suggests a decline in positive emotionality from childhood to adolescence (Larson et al., 2002; Reitsema et al., 2022). Nevertheless, my findings align with the results of Schabmann et al. (2015), which indicate that positive emotions are more strongly associated with aesthetic appreciation in preschool children than in elementary school children. In our study, I combined these two subgroups into a broader group of children and compared them to adolescents. It is plausible that positive valence during aesthetic appreciation does decrease from late childhood to adolescence. This observation corresponds with Parsons (1987), who highlights the significance of positive valence specifically in preschool children. Nevertheless, my findings contrast the hypothesis of aesthetic appreciation as a progressive shift from simple emotion to complex cognition. Such a view may therefore represent an oversimplification of reality, especially concerning the complex role that emotion plays in aesthetic appreciation.

Moreover, bodily activations, indicative of positive emotions like happiness and delight, did not show higher levels in children compared to adolescents (Schino et al., 2021). This aligns with the notion that positive emotional valence may not be a more significant factor in the aesthetic appreciation of this age group. However, it is worth considering that the results might be influenced by a possible covariation of bodily activations with the embodiment of aesthetic appreciation (Gallese, 2017). Perception is strongly associated with the reliance on bodily senses, and the use of perceptual strategies in aesthetic appreciation may relate to bodily sensations connected to tactile sensory perception such as the hands and feet, which were part of our assessment (Piaget & Inhelder, 1969; van Heusden, 2009; van Klaveren et al., 2023). Such findings show the complexity of bodily sensations in aesthetic appreciation, and that merely relating them to the positive emotions of happiness and delight

may be too simple. In light of this, future studies will have to investigate the role of bodily sensations in positive emotional valence in the development of aesthetic appreciation.

Semiotic Cognition

My results show greater use of conceptual strategies in adolescents compared to children. This aligns with my expectation that adolescents increasingly engage in complex cognitive processing during aesthetic appreciation. These findings correspond with Parsons' (1987) view that adolescents consider cultural context, medium, and style during art appreciation, engaging in conceptualizing the artwork. The observed increase in complex cognition is furthermore supported by the higher frequency of head activations during aesthetic appreciation among adolescents compared to children. However, this should be interpreted cautiously, as head activation also appears to be related to guided mental imagery, suggesting a link between head activation and the use of imaginative strategies, which are already applied by children (Schino et al., 2021; Winner, 2006). Hence, further investigation is needed to explore the specific relationship between abstract thinking, particularly the use of conceptual and analytical thinking, and head activation.

Lastly, there was no significant difference in the use of analytical strategies between children and adolescents. This contrasts with my hypothesis of increased complex cognition in adolescence, as well as general developmental findings of large developments in analytical thinking from childhood to adolescence (Keating, 2012). It also contrasts theories on art appreciation that suggest an increasingly analytical approach to aesthetic appreciation, questioning cultural influences, and the transcendence of traditional viewpoints (Parsons, 1987; Piaget, 1952). Additionally, it does not align with my findings that conceptual thinking and head activation increase in adolescents, which does indicate an increase in complex cognition during aesthetic appreciation in adolescence.

In the light of this, a potential explanation for the non-significant results in my study could be the variation in the number of items related to semiotic strategy use in our adapted questionnaire from van Klaveren et al. (2023). Specifically, our version of the questionnaire included a total of 2 perceptual, 3 imaginative, 3 conceptual, and 2 analytical items. The reduced number of analytical items might have led to fewer opportunities for participants to indicate the use of analytical strategies, potentially resulting in lower reported usage among adolescents. Furthermore, we employed a 5-point Likert scale for assessing semiotic strategy use in adolescents and a 3-point Likert scale for children. The variations in assessment methods and subsequent recoding of answers may have introduced a potential influence on our results regarding semiotic strategy use. Future studies should thus explore whether there is indeed no difference in analytical thinking between the aesthetic appreciation of children and adolescents.

Strengths, Limitations and Future Directions

Our study's major strengths lie in its adoption of a mixed and multi-method approach, offering a comprehensive exploration of various aspects of aesthetic appreciation in children and adolescents. Contrary to much of previous research on aesthetic appreciation, we extended our focus beyond visual artworks to encompass all objects with aesthetic potential. We assessed two dimensions of emotion, namely valence and arousal, and the incorporation of bodily sensation maps added another valuable dimension, particularly considering the embodied nature of emotions (Ekman, 1970) and the aesthetic experience (Gallese, 2017).

A limitation of our study was that we did not control for participants' levels of aesthetic education and aesthetic experience. Research suggests that art experts exhibit distinct processing patterns in visual stimuli, indicating less extreme emotional valence and increased appreciation of negative art (Leder et al., 2014). Art expertise has also been linked to heightened positive emotional valence and arousal in the appreciation of visual artworks

(Leder, 2012). The lack of assessment for aesthetic education and experience in our study may have influenced emotional valence ratings and acted as a potential moderating factor.

Additionally, the level of aesthetic education and experience could impact the utilization of conceptual and analytical thinking in aesthetic appreciation (Leder, 2012; Parsons, 1987). Findings by Augustin and Leder (2006) support the idea that higher expertise increases style-related processing, a component of conceptual cognition. Other evidence suggests that expertise alters preferences for abstract over representative art (Gardner et al., 1975; Machotka, 1966) and enhances comprehension of visual artworks (Leder et al., 2012), indicating a potential influence on increased cognitive complexity in aesthetic appreciation.

While our study did assess the variety of media types participants regularly engaged with, this measure did not adequately capture the participant's level of aesthetic education and experience, which depends not only on quantity but also on quality. As a result, I did not control for this variable in my analysis, and future research should explore how aesthetic education and experience influence positive emotional valence and abstract cognition in aesthetic appreciation.

A final limitation of our study was the absence of an assessment of the participants' affective states before the experiment. This omission may have influenced our results, given that a negative affective state prior to the experiment has been shown to impact assessments of emotion in aesthetic appreciation (Leder et al., 2004).

Conclusion

In conclusion, this study aimed to investigate the progression of aesthetic appreciation from simple emotional processing in childhood to more complex cognitive processing in adolescence. While my hypothesis that positive emotional valence plays a more important role in children than in adolescents was not supported, the findings revealed important insights. A notable finding was the significantly higher arousal levels observed in adolescents

during aesthetic appreciation, supporting the hypothesis that the significance of emotion expresses itself through heightened arousal in this age group. Moreover, the study demonstrated that adolescents exhibited a greater tendency to employ conceptual strategies, indicating a shift toward more complex cognitive processing during aesthetic appreciation. However, the contrasting absence of a significant difference in the usage of analytical strategies poses a challenge that warrants further exploration in future research. To conclude, conceptual cognition develops in aesthetic appreciation from childhood to adolescence, yet considering this a shift from simple emotional processing to complex cognition might be an oversimplification of the intricate nature of emotion in aesthetic appreciation.

References

- Armstrong, T., & Detweiler-Bedell, B. (2008). Beauty as an emotion: The exhilarating prospect of mastering a challenging world. *Review of General Psychology, 12*, 305–329. <http://dx.doi.org/10.1037/a0012558>
- Arnett, J. J. (1999). Adolescent storm and stress, reconsidered. *American Psychologist, 54*(5), 317–326. <https://doi-org.proxy-ub.rug.nl/10.1037/0003-066X.54.5.317>
- Augustin, D., & Leder, H. (2006). Art expertise: A study of concepts and conceptual spaces. *Psychology Science, 48*, 135–157.
- Baas, M., De Dreu, C. K. W., & Nijstad, B. A. (2008). A meta-analysis of 25 years of mood-creativity research: Hedonic tone, activation, or regulatory focus? *Psychological Bulletin, 134*(6), 779–806. <https://doi.org/10.1037/a0012815>
- Berlyne, D. E. (1971). *Aesthetics and psychobiology*. Appleton-Century-Crofts.
- Berlyne, D. E. (Ed.). (1974). *Studies in the new experimental aesthetics: Steps toward an objective psychology of aesthetic appreciation*. Hemisphere.
- Bradley, M. M., Miccoli, L., Escrig, M. A., & Lang, P. J. (2008). The pupil as a measure of emotional arousal and autonomic activation. *Psychophysiology, 45*(4), 602–607. <https://doi-org.proxy-ub.rug.nl/10.1111/j.1469-8986.2008.00654.x>
- Brosnan, M., & Ashwin, C. (2023). Differences in art appreciation in autism: A measure of reduced intuitive processing. *Journal of Autism and Developmental Disorders, 53*(11), 4382–4389. <https://doi-org.proxy-ub.rug.nl/10.1007/s10803-022-05733-6>
- Chatterjee, A., & Vartanian, O. (2014). Neuroaesthetics. *Trends in Cognitive Sciences, 18*(7), 370–375. <https://doi.org/10.1016/j.tics.2014.03.003>
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Routledge. <https://doi.org/10.4324/9780203771587>

- Coolican, H. (2006). *Introduction to research methods in psychology* (3rd ed.). Hodder Arnold.
- Coyne, S. M., Rogers, A. A., Zurcher, J. D., Stockdale, L., & Booth, M. (2020). Does time spent using social media impact mental health?: An eight year longitudinal study. *Computers in Human Behavior, 104*, Article 106160.
<https://doi.org/10.1016/j.chb.2019.106160>
- Crone, E. A., & Dahl, R. E. (2012). Understanding adolescence as a period of social–affective engagement and goal flexibility. *Nature Reviews Neuroscience, 13*(9), 636–650.
<https://doi.org/10.1038/nrn3313>
- Damasio, A. R. (2004). Emotions and feelings: A neurobiological perspective. In A. S. R. Manstead, N. Frijda, & A. Fischer (Eds.), *Feelings and emotions: The Amsterdam symposium* (pp. 49–57). Cambridge University Press.
<https://doi.org/10.1017/CBO9780511806582.004>
- De Angeli, D., Kelly, R.M. & O’Neill, E. (2020). Beyond happy-or-not: Using emoji to capture visitors’ emotional experience. *Curator, 63*, 167–191.
<https://doi.org/10.1111/cura.12352>
- Delacre, M., Lakens, D., & Leys, C. (2017). Why psychologists should by default use Welch's t-test instead of student's t-test. *International Review of Social Psychology, 30*(1), 92–101. <https://doi.org/10.5334/irsp.82>
- Denham, S. A. (1998). *Emotional development in young children*. Guilford Press.
- Denissen, J. J. A., Geenen, R., van Aken, M. A. G., Gosling, S. D., & Potter J. (2008). Development and validation of a Dutch translation of the Big Five Inventory (BFI), *Journal of Personality Assessment, 90*(2), 152–157,
<https://doi.org/10.1080/00223890701845229>

- Dumontheil, I. (2014). Development of abstract thinking during childhood and adolescence: The role of rostral lateral prefrontal cortex. *Developmental Cognitive Neuroscience, 10*, 57–76. <https://doi-org.proxy-ub.rug.nl/10.1016/j.dcn.2014.07.009>
- Ekman, P. (1970). Universal facial expressions of emotion. *California Mental Health Research Digest, 8*(4), 151–158.
- Eisner, E. W. (2002). *The arts and the creation of mind*. Yale University Press.
- Egan, K. (2005). *An imaginative approach to teaching*. Jossey-Bass.
- Fein, E. C, Gilmour, J, Machin, T. & Hendry, L (2022). *Statistics for research students*. University of Southern Queensland.
<https://usq.pressbooks.pub/statisticsforresearchstudents>
- Freeman, N. H., & Parsons, M. J. (2001). Children's intuitive understanding of pictures. In B. T., & R. J. Sternberg (Eds.), *Understanding and teaching the intuitive mind* (pp. 73–91). Erlbaum.
- Gardner, H., Winner, E., & Kirchner, M. (1975). Children's conceptions of the arts. *Journal of Aesthetic Education, 9*, 60–77. <https://doi.org/10.2307/3331905>
- Gallese, V. (2017). Visions of the body. Embodied simulation and aesthetic experience. *Aisthesis. Pratiche, Linguaggi E Saperi dell'estetico, 10*(1), 41–50.
<https://doi.org/10.13128/Aisthesis-20902>
- Goldstein, T. R. (2020). Children's appreciation of art. In M. Nadal & O. Vartanian (Eds.), *The oxford handbook of empirical aesthetics* (pp. 770–786). Oxford Academic Books.
<https://doi.org/10.1093/oxfordhb/9780198824350.013.39>
- Guyer, A. E., Silk, J. S., & Nelson, E. E. (2016). The neurobiology of the emotional adolescent: From the inside out. *Neuroscience and Biobehavioral Reviews, 70*, 74–85.
<https://doi.org/10.1016/j.neubiorev.2016.07.037>

- Hanich, J., Wagner, V., Shah, M., Jacobsen, T., & Menninghaus, W. (2014). Why we like to watch sad films. The pleasure of being moved in aesthetic experiences. *Psychology of Aesthetics, Creativity, and the Arts*, 8, 130–143. <http://dx.doi.org/10.1037/a0035690>.
- Heid, K. (2005). Aesthetic development: A cognitive experience. *Art Education*, 58(5), 48–53. <https://doi.org/10.1080/00043125.2005.11651561>
- Jacobsen, T. (2006). Bridging the arts and sciences: A framework for the psychology of aesthetics. *Leonardo*, 39(2), 155–162. <https://doi.org/10.1162/leon.2006.39.2.155>
- James, W. (1884). What is an Emotion? *Mind*, 9(34), 188–205.
<http://www.jstor.org/stable/2246769>
- Keating, D. (2012). Cognitive and brain development in adolescence. *Enfance*, 3, 267–279.
<https://doi.org/10.4074/S0013754512003035>
- Klaczynski, P. A. (2005). Metacognition and cognitive variability: A dual-Process model of decision making and its development. In J. E. Jacobs & P. A. Klaczynski (Eds.), *The development of judgment and decision making in children and adolescents* (pp. 39–76). Lawrence Erlbaum Associates Publishers.
- Kuscevic, D., Kardum, G., & Brajčić, M. (2014). Visual preferences of young school children for paintings from the 20th century. *Creativity Research Journal*, 26(3), 297–304.
<https://doi.org/10.1080/10400419.2014.929410>
- Larson, R. W., & Lampman-Petratis, C. (1989). Daily emotional states as reported by children and adolescents. *Child Development*, 60(5), 1250–1260.
<https://doi.org/10.2307/1130798>
- Larson, R. W., Moneta, G., Richards, M. H., & Wilson, S. (2002). Continuity, stability, and change in daily emotional experience across adolescence. *Child Development*, 73(4), 1151–65. <https://doi.org/10.1111/1467-8624.00464>

- Leder, H., Belke, B., Oeberst, A. and Augustin, D. (2004). A model of aesthetic appreciation and aesthetic judgments. *British Journal of Psychology*, *95*, 489–508.
<https://doi.org/10.1348/0007126042369811>
- Lindell, A.K., & Mueller, J. (2011). Can science account for taste? Psychological insights into art appreciation. *Journal of Cognitive Psychology*, *23*, 453–475.
<https://doi.org/10.1080/20445911.2011.539556>
- Machotka, P. (1966). Aesthetic criteria in childhood: Justifications of preference. *Child Development*, *37*(4), 877–885. <https://doi.org/10.2307/1126610>
- Martindale, C. (1999). Neurobiology and aesthetics. In A. Shimamura & S. Palmer (Eds.), *Aesthetic science: Connecting minds, brains, and experience* (pp. 81–103). Oxford University Press. <https://doi.org/10.1093/acprof:oso/9780199732142.001.0001>
- Mechner, F. A. (2018). Behavioral and biological analysis of aesthetics: Implications for research and applications. *Psychological Record*, *68*, 287–321.
<https://doi.org/10.1007/s40732-017-0228-1>
- Menninghaus, W., Wagner, V., Hanich, J., Wassiliwizky, E., Jacobsen, T., & Koelsch, S. (2017). The Distancing-Embracing model of the enjoyment of negative emotions in art reception. *Behavioral and Brain Sciences*, *40*, 1–63.
<https://doi.org/10.1017/S0140525X17000309>
- Menninghaus, W., Wagner, V., Wassiliwizky, E., Jacobsen, T., & Knoop, C. A. (2017). The emotional and aesthetic powers of parallelistic diction. *Poetics*, *63*, 47–59.
<http://dx.doi.org/10.1016/j.poetic.2016.12.001>
- Menninghaus, W., Wagner, V., Wassiliwizky, E., Schindler, I., Hanich, J., Jacobsen, T., & Koelsch, S. (2019). What are aesthetic emotions?. *Psychological Review*, *126*(2), 171–195. <https://doi.org/10.1037/rev0000135>

- Moneta, G. B., Schneider, B., & Csikszentmihalyi, M. (2001). A longitudinal study of the self-concept and experiential components of self-worth and affect across adolescence. *Applied Developmental Science, 5*(3), 125–142.
https://doi.org/10.1207/S1532480XADS0503_2
- Moore, D. S., McCabe, G. P., & Craig, B. A. (2016). *Introduction to the practice of statistics* (9th ed.). W. H. Freeman and Company.
- Muris, P., Meesters, C., & Diederens, R. (2005). Psychometric properties of the Big Five Questionnaire for Children (BFQ-C) in a Dutch sample of young adolescents. *Personality and Individual Differences, 38*(8), 1757–1769.
<https://doi.org/10.1016/j.paid.2004.11.018>
- Myszkowski, N., Storme, M., Zenasni, F., & Lubart, T. (2014). *French Concern for Appropriateness Scale (CAS-F)* [Database record]. APA PsycTests.
<https://doi.org/10.1037/t34067-000>
- Nadal, M., & Vartanian, O. (Eds.). (2019). *The oxford handbook of empirical aesthetics*. Oxford University Press.
- Nummenmaa, L., Glerean, E., Hari, R., & Hietanen, J. K. (2014). Bodily maps of emotions. *Proceedings of the National Academy of Sciences of the United States of America, 111*(2), 646–651. <http://www.jstor.org/stable/23770093>
- Nummenmaa, L., & Hari, R. (2023). Bodily feelings and aesthetic experience of art. *Cognition & Emotion, 37*(3), 515–528.
<https://doi.org/10.1080/02699931.2023.2183180>
- Pariser, D. A., Kindler, A. M., & van den Berg, A. (2008). Drawing and aesthetic judgments across cultures: Diverse pathways to graphic development. In C. Milbrath & H. M. Trautner (Eds.), *Children's understanding and production of pictures, drawings, and*

- art: Theoretical and empirical approaches* (pp. 293–317). Hogrefe & Huber Publishers.
- Parsons, M., Johnston, M., & Durham, R. (1978). Developmental stages in children's aesthetic responses. *Journal of Aesthetic Education*, *12*(1), 83–104.
<https://doi.org/10.2307/3331850>
- Parsons, M. J. (1987). *How we understand art: A cognitive developmental account of aesthetic experience*. Cambridge University Press.
- Pearce, M. T., Zaidel, D. W., Vartanian, O., Skov, M., Leder, H., Chatterjee, A., & Nadal, M. (2016). Neuroaesthetics: The cognitive neuroscience of aesthetic experience. *Perspectives on Psychological Science*, *11*(2), 265–279.
<http://www.jstor.org/stable/26358612>
- Piaget, J. (1952). *The origins of intelligence in children*. (M. Cook, Trans.). W W Norton & Co. <https://psycnet.apa.org/doi/10.1037/11494-000>
- Piaget, J. (1959). *La genèse des structures logiques élémentaires: Classifications et sériations* (5th ed.). Delachaux et Niestlé.
- Piaget, J. and Inhelder, B. (1969). *The psychology of the child*. Basic Books.
- Reber, R. (2021). Appreciation modes in empirical aesthetics. In M. Nadal & O. Vartanian (Eds.), *The oxford handbook of empirical aesthetics* (pp. 116–135). Oxford Academic Books. <https://doi.org/10.1093/oxfordhb/9780198824350.013.38>
- Reitsema, A. M., Jeronimus, B. F., van Dijk, M., & de Jonge, P. (2022). Emotion dynamics in children and adolescents: A meta-analytic and descriptive review. *Emotion*, *22*(2), 374–396. <https://doi.org/10.1037/emo0000970>
- Ruck, M. D., Abramovitch, R., & Keating, D. P. (1998). Children's and adolescents' understanding of rights: Balancing nurturance and self-determination. *Child Development*, *64*(2), 404–417. <https://doi.org/10.2307/1132174>

- Russell, J. A. (1980). A circumplex model of affect. *Journal of Personality and Social Psychology*, *39*, 1161. <http://dx.doi.org/10.1037/h0077714>
- Salimpoor, V. N., Benovoy, M., Longo, G., Cooperstock, J. R., & Zatorre, R. J. (2009). The rewarding aspects of music listening are related to degree of emotional arousal. *PLOS ONE*, *4*, e7487. <http://dx.doi.org/10.1371/journal.pone.0007487>
- Scherer, K. R. (2005). What are emotions? And how can they be measured? *Social Science Information*, *44*(4), 695–729. <https://doi.org/10.1177/0539018405058216>
- Schindler, I., Hosoya, G., Menninghaus, W., Beermann, U., Wagner, V., Eid, M., Scherer, K. R. (2017). Measuring aesthetic emotions: A review of the literature and a new assessment tool. *PLOS ONE*, *12*, e0178899. <http://dx.doi.org/10.1371/journal.pone.0178899>
- Schino, G., van Klaveren, L.-M., Gallegos González, H., & Cox, R. F. A. (2021). Applying bodily sensation maps to art-elicited emotions: An explorative study. *Psychology of Aesthetics, Creativity, and the Arts*. Advance online publication. <https://doi.org/10.1037/aca0000444>
- Schino, G., van Klaveren, L.-M., Gallegos González, H. G., Cox, R. F. A., Nori, F., & van Heusden, B. (2022). Measuring Experiences of Art in the Museum: Exploring Methodology for Getting It Right. *Itinera*, *2022*(23), 277–302. <https://doi.org/10.54103/2039-9251/18562>
- Skov, M., & Nadal, M. (2020a). A Farewell to Art: Aesthetics as a Topic in Psychology and Neuroscience. *Perspectives on Psychological Science*, *15*(3), 630–642. <https://doi-org.proxy-ub.rug.nl/10.1177/1745691619897963>
- Skov, M., & Nadal, M. (2020b). There are no aesthetic emotions: Comment on Menninghaus et al. (2019). *Psychological Review*, *127*(4), 640–649. <http://dx.doi.org/10.1037/rev0000187>

- Somerville, L. H. (2016). Emotional Development in Adolescence. In L. Feldman Barrett, M. Lewis, & J. M. Haviland-Jones (Eds.), *Handbook of Emotions*, (4th ed., pp. 350–368). Guilford Press.
- Spence, J. & Helmreich, R. (1978). *Masculinity and femininity: Their psychological dimensions, correlates, and antecedents*. University of Texas Press.
<https://doi.org/10.7560/764439>
- Tinio, P. P. L., and Gartus, A. (2018). Characterizing the emotional response to art beyond pleasure: correspondence between the emotional characteristics of artworks and viewers' emotional responses. *Progress in Brain Research*, 237, 319–342.
<https://doi.org/10.1016/bs.pbr.2018.03.005>
- van Dorsten, T. (2015). *Mirrors in the making: Culture, education, and the development of metacognition in early and middle childhood (4-10)*. [Thesis fully internal (DIV), University of Groningen]. University of Groningen.
- van Heusden, B. (2009). Dealing with Difference: From Cognition to Semiotic Cognition. *Cognitive Semiotics*, 4, 116–132. http://dx.doi.org/10.3726/81608_116
- van Heusden, B. (2022). Perception, Action, and Sense Making: The Three Realms of the Aesthetic. *Biosemitotics*, 15, 379–383. <https://doi.org/10.1007/s12304-022-09482-y>.
- van Klaveren, L. M., van Dorsten, T. & van Heusden, B. (2023). Mapping pupils' cultural consciousness: Design and evaluation of a theory-based survey. In E. Schurig, & A. Lehmann-Wermser (Eds.), *Aspects of multiculturalism in arts education: Proceedings German-Dutch colloquium on research in Arts education* (33th ed., pp. 78–89). Institute for Music Education Research Hannover University of Music Drama and Media.
<https://www.ifmpf.hmtm-hannover.de/de/publikationen/forschungsberichte/forschungsbericht-33/>

- Vartanian, O., & Skov, M. (2014). Neural correlates of viewing paintings: evidence from a quantitative meta-analysis of functional magnetic resonance imaging data. *Brain and Cognition*, 87, 52–56. <https://doi.org/10.1016/j.bandc.2014.03.004>
- Vygotsky, L. (1962). *Thought and language*. (E. Hanfmann & G. Vakar, Eds.). MIT Press. <https://doi.org/10.1037/11193-000>
- Winner, E. (2006). Development in the Arts: Drawing and Music. In D. Kuhn, R. S. Siegler, W. Damon, & R. M. Lerner (Eds.), *Handbook of child psychology: Cognition, perception, and language* (6th ed., pp. 859–904). John Wiley & Sons, Inc.
- Wintre M. G., Vallance D. D. (1994). A developmental sequence in the comprehension of emotions: Intensity, multiple emotions, and valence. *Developmental Psychology*, 30(4), 509–514. <https://doi.org/10.1037/0012-1649.30.4.509>
- Zelazo, P. D., Carlson, S. M., & Kesek, A. (2008). The development of executive function in childhood. In C. A. Nelson & M. Luciana (Eds.), *Handbook of developmental cognitive neuroscience* (2nd ed., pp. 553–574). Boston Review.

Appendix A

Additional Materials used in the Study

Experimental Conversation

To explore the affective dimension, we coded emotion-related words, sensations, moods, and feelings expressed during experimental conversation. Conversational Sentiment Analysis of voice data provided insights into emotional states and attitudes. For the behavioral dimension, we used hand gestures and body motions as indicators of speech planning and environmental attunement. Facial expressions were examined to understand emotional and conversational signals. Verbal and body behaviors were coded for well-being (Schmidt et al., 2007) and affective states (Kamphorst et al., 2020; Schulberg & Gottlieb, 2002), using the Dynamic State Tracker (DST; Den Hartigh & Holder, 2019). In terms of the physiological dimension, arousal patterns were assessed through frequency-related measures, including pitch, loudness, and tone of voice. Breathing and heart rate were additional exploratory measures of sentiment (Esrock, 2018) detected through a depth camera (Procházka et al., 2016). Finally, for the semiotic dimension (van Heusden, 2015), we coded media in terms of categories (body, artifact, language, graphic signs), engagement types (productive/receptive), and strategies (perception, imagination, conceptualization, analysis) employed during dyadic interactions.

Post-Questionnaire

To investigate the potential impact of specific personality and mood traits on art experience, its outcomes, and sense-making processes, we employed concise questionnaires that incorporated items from the Big Five Personality Questionnaires (BFQ), with a specific emphasis on Openness to Experience, as recommended by Myszkowski et al. (2014). We employed the 10 items from the Big-Five Personality Traits Questionnaire for Children and Adolescents (Denissen et al., 2008; Muris et al., 2005). These questionnaires have been

translated, utilized, and validated within the Dutch population (Denissen et al., 2008; Muris et al., 2005). Participants also indicated the nature of their relationship with their co-participant (e.g., friends, colleagues, family), and gender-related aspects (8 items, applicable only to participants aged 12 and older). Specifically, the assessment of femininity and masculinity was conducted using the short form of the Personality Attributes Questionnaire with 8 items (PAQ-8), developed by Spence et al. (1978).

Appendix B

Questionnaire on Semiotic Strategies

Table X

Items Assessing Semiotic Strategy Use

Semiotic strategies	Individual items
Perception	<p>This object invites me to observe, touch, smell, taste, or listen to it.</p> <p>This object invites me to feel and experience things.</p>
Imagination	<p>This object invites me to be in a different world.</p> <p>This object invites me to express myself in my own way.</p> <p>This object invites me to come up with new ideas or designs.</p>
Conceptualization	<p>This object invites me to share an idea or story.</p> <p>This object invites me to understand what it means in the context.</p> <p>This item invites me to show to which group/community I belong.</p>
Analysis	<p>This object invites me to discover things about myself or the world.</p> <p>This object invites me to explore how or why it was made.</p>

Appendix C

List of Conversation Prompts

In the experimental conversation, 11 conversation prompts were given by the researcher to the two participants.

1. Why did you bring these ...?
2. Why do you think your buddy brought that art object?
3. What do you notice about ...? (color, shape, texture, material, sound etc.) (Object 1)
4. What do you notice about ...? (color, shape, texture, material, sound etc.) (Object 2)
5. What color strikes you most about this work of art and why?
6. What can you do with these...?
7. What would you tell others they need to know about your object/artwork?
8. What do you think the artist wants you to feel with his art?
9. What can you learn from this ...?
10. What do you think your buddy thinks about your art object?
11. What do you think about your art object?