Openness, Emotions, and Esthetics in Children and Adolescents: An Explorative Study

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PSB3E-BT15: Bachelor Thesis

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November 01, 2023

Abstract

The relationship between trait Openness/Intellect and a sensitivity to esthetic stimuli is a well-documented phenomenon in the psychological literature. However, there is a lack of understanding in the scientific community on how it operates in developing children and adolescents. This pilot study attempts to gain a first insight into the topic by analysing the emotions that children and adolescents *(n =12, M_{Age} = 11.7)* report during and after they had an esthetic experience. We conducted sessions with six pairs of children at the subjects' houses with four rounds of questions and phases of esthetic appreciation. We analysed the responses on the questionnaires using Multiple Linear Regression for the main hypothesis and found no effect of Openness to Experience on reported arousal *(ß = -0.010, SE = 0.019, p = .646)* and emotional valence *(ß = 0.001, SE = 0.016, p = .995)*. Our secondary hypotheses on age differences and sex differences both turned out statistically non-significant *(t_{age} = -0.595, df = 10, p = .565; t_{sex} = 0.425, df = 10, p = .680)*, though descriptive plots reveal a need for further inquiry because of patterns in line with our hypotheses. Preliminary results on gender identity as a more effective predictor than biological sex were statistically non-significant and inconclusive. Results and implications for future research are discussed.

Keywords: Art, Emotion, Openness, Personality, Esthetics, Development, Child

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Humans have engaged with art for tens of thousands of years (Brumm et al., 2021). By means of artistic expression, we represent the world, ourselves, and the interaction of the two. In order to gain insight into our own self-understanding, it is crucial to investigate the mechanisms that operate within people when they encounter art works. This paper aims to address these connections between human emotions, personality, and art. This nexus presents us with a couple of mysteries that require exploration and explanation.

1) What are emotions and how can we conceptualise them?

2) How do you parameterize and measure personality attributes?

3) What is art and how do emotions and individual differences relate to it?

4) What role does age and human development play in this regard?

The subsequent paragraphs constitute a literature review which uses the questions above in order to introduce the topic and set the stage for the research study. More specifically: The questions above are *not* the research questions of the study that follows.

Biological Motivations and the Framework for Emotions

When trying to understand emotions, it is important to distinguish them from biological drives, which is no simple matter. The boundaries between the two concepts are blurry because many emotions have a biological underpinning. Jaak Panksepp, one of the most influential neuroscientists of the 20th century, describes the biological systems that underlie separate (human) emotions, for example expectancy, rage, fear, and panic. These are part of ancient physiological systems whose analogues are already present in our mammalian ancestry (Panksepp, 1982, 1998). Our biology equips us with a number of other primordial motivations like hunger, thirst, and sexuality which, roughly speaking, originate in and are regulated by the hypothalamus (Buck, 1985).

In fact, emotions seem to be more context dependent than the solely biological motivations that people are subject to. In their official dictionary, the American Psychological Association defines them as "a complex reaction pattern, involving experiential, behavioural, and physiological elements, by which an individual attempts to deal with a personally significant matter or event" (2023a, Emotion section). Within this paradigm, there is broad agreement among psychologists and affective neuroscientists that there are at least a handful of cardinal emotions: happiness, sadness, anger, disgust, fear, and arguably surprise (Ekman, 2016). Within the scope of this research study, we differentiate eight emotional categories, including *feeling love* and being *interested* (see Method Section).

Nevertheless, the specific number of emotions is under debate in the relevant literature - newer research lists as many as 27 emotional categories that can be differentiated mathematically (Cowen & Keltner, 2017). According to Russel (1980), it is not reasonable to view each of those categories as a single dimension. Instead, they can be placed on a two-dimensional plane with *valence* and *arousal* as the axes. This is also what factor analyses and multidimensional scaling studies that try to conceptualise and operationalize emotions do (Russel 1980). The former axis (*valence*) is defined as the degree to which the emotion is subjectively experienced as pleasant or unpleasant: Happiness is a positively valenced emotion, while sadness has negative valence (APA, 2023b, Emotional Valence section). The arousal facet, for all intents and purposes, refers to the sum-total of physiological activity, mediated by the reticular activation system (APA, 2023c, section 1). For example, sadness is a low arousal emotion and anger is characterised by high arousal.

Individual Differences in the Experience of Feelings

After laying out the conceptual framework for our emotions, the next relevant question is what the factors are that influence them. Apart from the more obvious fact that the situation people find themselves in influences their emotional experience, a pronounced

interrelation exists between personality and emotions (Reisenzein & Weber, 2007). The most valid model for human personality is the Big Five Trait Model or the Five Factor Model (Grice, 2023). As the name suggests, it consists of five dimensions of variability that describe human temperament. Part of what makes this model credible is the fact that it was atheoretically produced and purely a consequence of statistical analysis. What originally started with lexical analysis of thousands of English adjectives in the 1930s has become the state of the art instrument of personality research (John & Srivastava, 1999). The five categories are Extraversion (E), Neuroticism (N), Conscientiousness (C), Agreeableness (A), and Openness to Experience (O) and they are applicable cross-culturally (Schmitt et al., 2007).

The aforementioned link between emotionality and personality is expressed in two, conceivably three, of the five dimensions. The first one is Extraversion which is associated with social engagement and assertiveness. It is closely related to the incentive reward system which is dopaminergically mediated. In general, it can be viewed as the *positive emotion* dimension of personality (Depue et al., 1999). The second dimension that is associated with emotions is Neuroticism which is the tendency of individuals to experience *negative emotions*. It predisposes individuals to have a greater risk of suffering from psychopathology like depression, anxiety and substance abuse (Widiger & Oltmanns, 2017).

The third of the Big Five traits that is linked to emotions, and the one that is most relevant for this paper, is Openness to Experience - the *creativity* dimension of personality. Weisberg et al. (2011) define it as the tendency towards "imagination, creativity, intellectual curiosity, … appreciation of esthetic experiences … [and] the ability and interest in attending to and processing complex stimuli." (p. 3). Similar to trait Extraversion, it is hypothesised to have a dopaminergic neural substrate and to be associated with prefrontal cortical activity (DeYoung et al., 2005, 2011). The trait can be conceptually and even neurologically

differentiated into at least two facets. The first one, *Intellect* (interest in ideas), is associated with verbal/crystallised intelligence (Schretlen et al., 2010) and working memory capacity (DeYoung et al., 2009). The second domain, *Openness*, is much less understood on a neurological level. What we know is that it gives people the proclivity towards beauty, fantasy, and esthetics (DeYoung et al., 2007). In practice, the subdivision of the trait into its facets is not always made and factor O more broadly is still a decent predictor of creative engagement (Tan et al., 2016).

The types of emotions that Openness to Experience is related to, even without dividing it into its components, are sometimes called "esthetic emotions". It is the sense of engagement and intrinsic pleasure that people experience when they are involved in something meaningful or beautiful (Fayn et al., 2015). In their article "Aesthetic Chills as a Universal Marker of Openness to Experience", McCrae et al. (2007) point out that these experiences are often accompanied by goosebumps and are continually associated with Openness to Experience. In fact, they are deeply biologically instantiated: A recently conducted behavioural genetic study showed that over a third of the variance in the experience of esthetic chills is accounted for by heritability (Bignardi et al., 2022). This ancient physiological response is the first step, partly manifested as changes in skin conductance (McPhetres & Zickfeld, 2022), of what neuroscientists sometimes refer to as the "Orienting Reflex" (Sokolov, 1963).

Moreover, there is evidence that esthetic emotions can be measured in a similar manner as emotions more generally are measured. Just like Russel (1980), Beermann et al. (2021) suggest using *valence* and *arousal* as two out of four dimensions for measuring esthetic emotion. They also include *power* (a combination of valence and arousal; later referred to as *intensity*) and *novelty*. The present paper uses three out of the four, excluding *novelty* (see. Methods).

Personality, Emotions, and Esthetics in Children

Due to the fact that the present paper focuses on children, the three variables Openness to Experience, Emotionality, and Artistic/Esthetic Sensitivity have to be explored in the developmental context. While inquiring about the genesis of Openness to Experience in children and young adolescents, one might ask whether there are psychological (and behavioural) markers that are already present in childhood? The answer is: Yes, to some degree. Goldstein and Winner (2009) looked into the lives of 11 professional actors in their explorative, qualitative research. Unsurprisingly, these successful creatives showed early traits of immersing themselves in elaborate imaginary and fictional worlds. In the study by DeYoung et al. (2011), one of their samples consisted of maltreated children between 8 and 13. The neural correlates were even more visible here than in their adult sample, producing a main effect on trait Openness to Experience. Herzhoff & Tackett (2012) found converging evidence on the psychometric front for the construct validity of Openness to Experience in 9 to 10 year olds.

Furthermore, just like Panksepp (1982, 1998) outlined the phylogenetic beginnings of complex emotional systems, there is an extensive literature on the ontogenetic origin of those systems. All our emotional and motivational systems already form in a rudimentary way during gestation (Joseph, 2000) which is why infants can cry and express emotions when they are born. The further development of the emotional brain stretches right from infancy and/or early childhood (Thompson & Lagattuta, 2006) to late adolescence (Casey et al., 2019). However, Joseph (2000) also notes that the early expressions of affect are not "true emotionality" (p. 81) because they are not accompanied by a self-understanding of those feelings. In the paradigm used previously, this is the *experiential* aspect from the definition of emotion by the American Psychological Association (2023a, Emotion Section).

So when do children start to experience so-called "true emotions"? The answer is: Probably after a few years. Harris (2008) points out that in the first years of childhood, the child's experience of their own emotions is inextricably tied to their bond with their mother. This might be one of the reasons why autistic children have trouble regulating their emotions, because they have difficulties in attachment and bonding (Van Trigt et al., 2023). According to Harris (2008), two-year olds can already speak about their emotions but need assistance from their caregivers in doing so. Hietanen et al. (2016) found that by the time children are six years old, they can already point to bodily sensations that are associated with discrete sets of emotions like happiness, fear, and surprise.

But how about the esthetic types of emotions, how do children experience them? Barbosa et al. (2023) studied the esthetic experience of children under three years of age with a musical performance. In their case, the most prominent marker of engagement with the stimulus was visual attention through gazing. Ardizzi et al. (2023) found that in five year old children the degree of esthetic appreciation was directly linked to the degree to which they had sensorimotor interaction with the stimulus, including touching and manipulating. This potentially implies a link between the embodied experience and esthetic appreciation in children. In the 1960s, Piaget and Inhelder (1969) already pointed to this need for embodiment and sensorimotor stimulation in the appreciation of artistic productions.

The Present Study

In adults, esthetic emotions can reliably be evoked by (visual) artworks (e.g. Keltner & Haidt, 2003; Nummenmaa & Hari, 2023). This link and the additional influence of Openness to Experience is less well understood in children and adolescents. The present study tries to fill this gap by conducting exploratory research with the question: *How does Openness to Experience influence the emotions that children and adolescents feel during and after an esthetic experience?*

In our study, the definition of art is "anything that can be brought to the research lab and that you personally find meaningful, interesting or beautiful". Based on the literature review, we constructed the following hypotheses:

H1: Openness to Experience is associated with emotions that are high in arousal and positively valenced (see Fayn et al., 2015).

H2: Adolescents will report more intense emotions than children (see Hietanen et al., 2016).

H3: There are sex differences between males and females with regards to the intensity of emotions (see Weisberg et al., 2011).

H4: Gender identity is a better predictor of the intensity of emotion than biological sex (e.g. Compère et al., 2018, 2021).

The preliminary model we are trying to develop in this study is depicted below in Figure 1. It entails a schematic representation of the variables, their interactions and the hypotheses that we created.

Figure 1

Preliminary Model of the Research Study
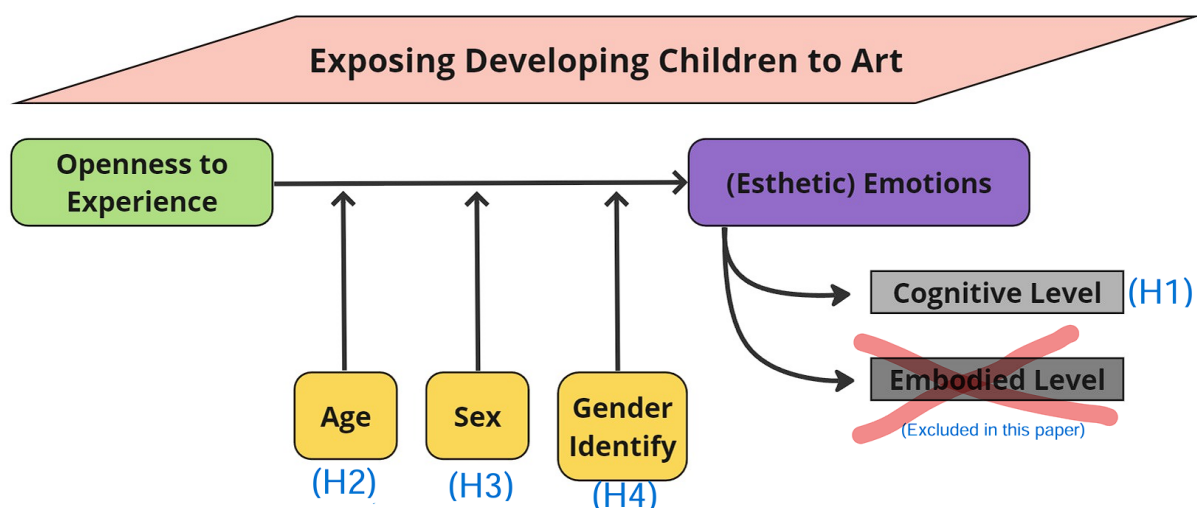
Methods

Participants

The recruitment was conducted through voluntary response sampling by spreading flyers in Groningen and Drachten in the Netherlands as well as primary and secondary schools in the area around Groningen within 100-150 kilometers. The participants needed to be between 6 and 17 years old and speak either Dutch or English. However, when the youngest participants struggled with reading the questionnaires, they were assisted in doing so by the experimenter. All participants came in pairs which they or their caregiver had chosen purposely when registering for the study. The age gap in the dyad was allowed to be as large as two years. In the case of minors under 12 years of age (children group), a legal representative had to accompany them to the experiment. No additional exclusion criteria were made and the final sample consisted of twelve (N=12) participants between the ages of 6 and 17 years old (M_{age} = 11.67, SD_{age} = 3.8; n= 5 male, n=5 female, n=2 unspecified). It is a non-probability convenience sample (See. Discussion for further implications)

Measurement Instruments

Minors under 12 years of age (children) and minors over 11 years (adolescents) were administered different versions of the questionnaire used in the present study. The versions for children were aided visually and more comprehensive linguistically, but the content remained the same. Tyupa's (2011) back-translation was used in order to increase the validity of the statements in Dutch. This means translating the questions from the original language to Dutch and back two times.

The questionnaire was built with Qualtrics (https://www.qualtrics.com) and consisted of six measurement instruments. Instruments four, five, and six were only relevant for the analysis of my colleagues. Because of the scope of this paper, they are excluded in the data analysis. Apart from general questions about age (*H2*) and sex (*H3*), the instruments were:

1) *H1*. We measured the trait Openness to Experience using the Dutch translation of the *Big Five Questionnaire for Children* (BFQ-C; Muris et al., 2005). The questionnaire consists of 13 questions about *Intellect* and *Openness* on a 5-point Likert scale which are combined to yield a total score. The personality questions were the same for children and adolescents and they can be found in Appendix B.

2) *H1*. In order to gain insight into the cognitive component of emotion, we asked the participants to report their emotional experience in a *Geneva Emotion Wheel* (GEW; Scherer et al., 2013). This has already been used to assess the emotional reaction to art (Tinio & Gartus, 2018). Adapted from DeAngeli et al. (2020), the schema consisted of eight emotional categories along the dimensions of *valence* and *arousal*. It included emojis to visualise the emotional expressions and make it more accessible for children. The measurement was identical for both the children and the adolescents. The tool includes the six emotional categories by Ekmann (2016) and in addition to '*Feeling love*' and '*Interest*'. It can be found in Figure C1, Appendix C.

3) *H4*. Gender expression in teenagers from 12 onwards was measured using the *Personal Attributes Questionnaire* (PAQ-8; Hall & Halberstadt, 1980; Helmreich et al., 1981). It contains four items for assessing femininity/expressivity and four items for assessing masculinity/positive instrumentality. Answers were recorded on a 6-point Likert scale (Tibubos et. al., 2022). In children, the *Children's Personal Attributes Questionnaire* (C-PAQ) was used for the same purpose. It entails a reduced version of the PAQ-8 with a 4-point Likert scale but the psychometric properties are still acceptable (Thomson & Zand, 2005).

4) (*Excluded in the analysis of this paper*). A short *Art Preferences Questionnaire* that provided a list of eight commonly enjoyed forms of art which were

differentiated further into types (e.g., "dancing or playing theatre") and passive types (e.g., " looking at dancing or theatre") (See Gordon-Nesbitt, & Howarth, 2020).

5) (*Excluded in the analysis of this paper*). A *Semiotic Strategy Questionnaire* consisting of eight questions about perceptual, imaginative, conceptual, and analytical strategies and two general questions in relation to the object or artwork; for example "This object invites me to observe, touch, smell, taste, or listen to it." (van Klaveren et al., 2023).

6) (*Excluded in the analysis of this paper*). The embodied aspect of emotion was assessed using two *Bodily Sensation Maps* (BSMs; Nummenmaa et al., 2013) where participants could report where in the body they felt activity getting stronger (activations) or weaker (deactivations). The BSMs have already been used in a developmental study by Hietanen et al. (2016). Nevertheless, the younger portion of our sample were presented with a smaller silhouette to increase the possibility of identification with the body shape. An example can be found in Figure C2, Appendix C.

Procedure

This study was approved by the Ethics Committee of the Faculty of Behavioural and Social Sciences at the University of Groningen (Research Code: PSY-2223-S-0252). All sessions were conducted according to the Dutch ethical standards for scientific research. Informed consent has been obtained from the parents or caregivers from age six till 12 years old and the adolescents above age 12 were able to fill in themselves. The parents of the children were asked to help select the piece that the children would like to come to the experiment with. Adolescents chose the entity on their own, having had the possibility to choose either something self-made or something made by an artist.

The participants came together with a person they felt close to and each of them brought an artwork or a meaningful object with them to the lab. This was chosen because the interactive part of the study might have an interesting effect on the reaction to the stimulus by the children. For example, there is evidence that when sharing an esthetic experience, children tend to like representational art more than abstract art (Rodway et al., 2016). This aspect was studied by my colleagues (see. Ortmann, 2023)

In the first phase of the experiment, the participants filled out the questions about *art preferences*. Then they spent 30 to 120 seconds appreciating either their own or the other person's artwork - the chronology of the two was counterbalanced. After that, they filled out the *Semiotic Strategy Questionnaire*, the *Geneva Emotion Wheel* and the *Bodily Sensation Maps*. The same process (i.e. appreciation phase and questionnaires) was repeated with the second object they had not yet appreciated.

For the second phase of the experiment, the conversation took place in the form of a qualitative, semi-structured interview (Kallio et al., 2016). Every question was discussed for a maximum of 4 minutes with a general discussion phase of 4 minutes at the start. Prompts were shown on a screen and read out loud by the researcher in the room. Four prompts were used, each referring to one of the four semiotic strategies (e.g. "What can you do with these artworks?" - Imagination Strategy).

Due to difficulties in finding enough participants, we offered subjects the possibility of conducting the research in their homes. In the end, all of the participants took us up on that offer and we did the study at their home. We replicated the experimental setting which is visible in Figure 2. We also followed a project manual we put together to guide us through the experiment. It can be found in Appendix A.

Figure 2

Experimental Setting of the Study
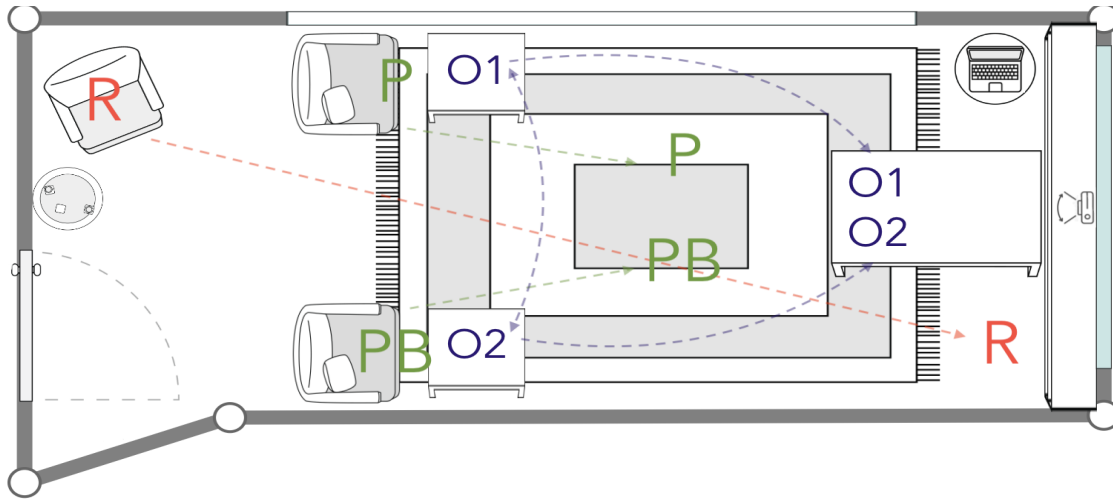
Note. The positions of the participants are indicated as "P" and "PB", the positions of the artworks are coded "O1" and "O2", and the researcher is represented as "R". The arrows demonstrate the movement of all the people in the room.

Other Materials

The participants completed the questionnaires on two iPads that we gave them. In the case that the participants brought a video or an audio file, we provided each of them a headset and laptop for watching and listening. The conversation prompts were displayed on a separate screen. The camera was a 2-Logitech BRIO that sent the video signal towards an observational laptop with the aforementioned recording software. Both the experimenter and the person in the control room had the project manual and the conversation prompt script.

Preprocessing and Analysis

The data from the GEW were transformed into three variables using the newest version of Google Sheets. These are arousal, valence, and intensity which all had eight measurements for all participants. For the analysis of this paper, we averaged across these measurements constructing avg_arousal, avg_valence, and avg_intensity. The variables, sum_openness, masculinity_score and femininity_score were computed using the appropriate

methods from the original works. The variable sex includes the standard binary sex categories and the variable group divides the age groups into children and teenagers. *Hypothesis 1* and *Hypothesis 4* will be assessed using Multiple Linear Regression (MLR). Two-Sample Independent T-tests are used for *Hypothesis 2* and *Hypothesis 3* because "sex" and "group" are categorical variables (i.e. they each have two populations).

<div align="center">

Results

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Participant Flow and Recruitment Period

Between May 14 and June 2, 2023, 12 children and adolescents participated in the experiment, who will subsequently be referred to as "P09" to "P20". All of them fully completed the experiment, though the audio and video recording of P11 and P12 is missing. The data from their questionnaires is present but they will accordingly be excluded from the qualitative analysis of my colleagues. For the scope of this paper, all participants are included in the quantitative data analysis.

Descriptive Statistics

Six teenagers (age > 12) and six children (age ≤ 12) participated in our research (M_{Age} *= 11.7, SD_{Age} = 3.8)*. They took around an hour to complete the whole study *(M = 59.0, SD = 20.3*; time in minutes) and the conversation part was on average around twelve minutes long (*M = 12.25*; time in minutes). This excludes P13 and P14, our youngest participants, who had to take breaks because of exhaustion and difficulties in reading comprehension. They scored multiple standard deviations above the mean in duration and inflated the correlation between age and duration (*r = 0.93, p < .001*). Thus, they were treated as outliers, as confirmed by independent outlier analysis, as well.

Figure 3 provides an overview of the emotions that the participants reported in the research. The most commonly felt emotion was happiness, followed by interest. After that follow surprise, sadness, feeling love, anger, and lastly neutrality.

Figure 3

Pie-Chart for the Different Reported Emotions
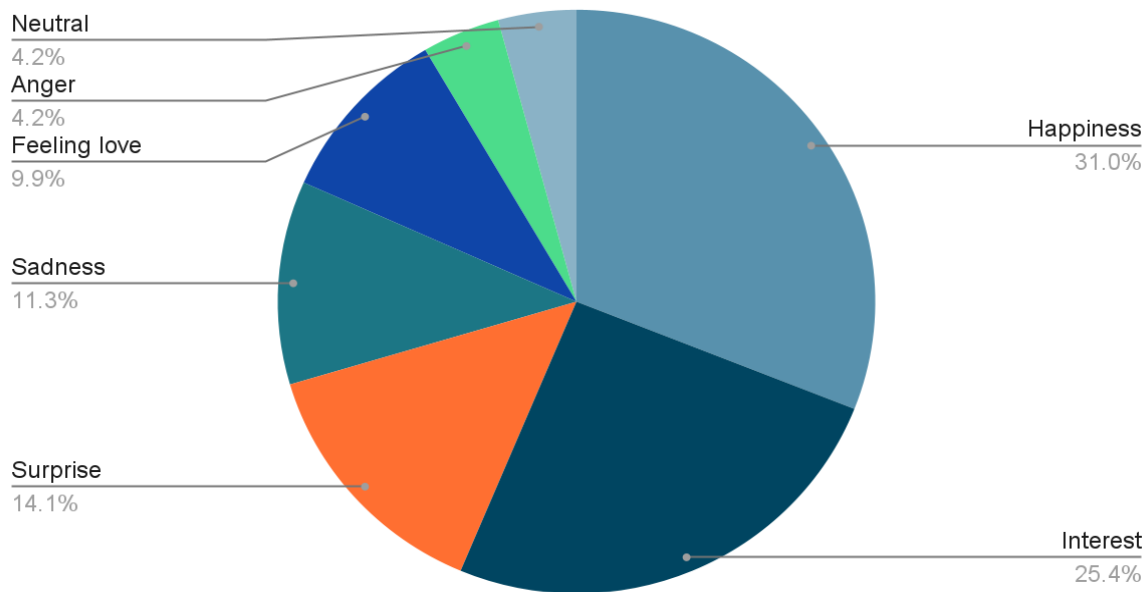
Data Analysis

Hypothesis 1 was tested with two separate MLRs, using average valence ("avg_valence") and average arousal ("avg_arousal") as the dependent variables. The independent variables were sum_openness, masculinity_score, femininity_score. Sex and age group (child vs. teen) were included as factors. The assumptions were met for both of the regression analyses. Table 1 and Table 2 depict the coefficients of the respective analyses. The other factors are added to correct for their influence when focusing on Factor O. The statistical influence of the O factor was insignificant in both the arousal analysis *(ß = -0.010, SE = 0.019, ß$_{Standardised}$ = 0.019, p = .646*) and the analysis for valence (*ß = 0.001, SE = 0.016, ß$_{Standardised}$ = 0.003, p = .995*). The other coefficients also had no statistically significant influence on the outcome variables.

Table 1

Coefficients for MLR on Average Arousal

Variable	Unstandardized	Standard Error	Standardised	t-test	p-value	95% Confidence Interval	
						Lower	Upper
Intercept	0.371	0.760		0.488	.646	-1.582	2.324
sum_openness	**-0.010**	**0.019**	**-0.266**	**-0.558**	**.601**	**-0.058**	**0.037**
masculinity_score	*0.049*	*0.073*	*0.352*	*0.671*	*.532*	*-0.138*	*0.236*
femininity_score	*-0.014*	*0.113*	*-0.068*	*-0.124*	*.906*	*-0.303*	*0.275*
sex (male)	*0.256*	*0.280*		*0.914*	*.403*	*-0.464*	*0.976*
group (teen)	*0.098*	*0.418*		*0.235*	*.824*	*-0.976*	*1.173*

Note. Standardised coefficients are only depicted for continuous variables. Results for the Openness to Experience factor are marked in bold. Results relevant for later analyses are marked in italic.

The model summaries are found in Table 3 and Table 4. The model for arousal explained 44% of the variance ($R^2 = 0.443$, Adjusted $R^2 = -0.021$) and the model for valence only explained 21% of the variance ($R^2 = 0.213$, Adjusted $R^2 = -0.442$). Both Adjusted R^2s are negative, indicating a worse prediction of the dependent variable than just taking the average in every instance. As a consequence of the analyses, we reject *Hypothesis 1* because Openness to Experience was neither associated with high arousal, nor positive valence, and the model did not contribute explanatory power.

Table 2

Coefficients for MLR on Average Valence

Variable	Unstandardized	Standard Error	Standardised	t-test	p-value	95% Confidence Interval	
						Lower	Upper
Intercept	0.521	0.645		0.807	.451	-1.058	2.099
sum_openness	**0.001**	**0.016**	**0.003**	**0.006**	**.995**	-0.040	0.040
masculinity_score	*0.039*	*0.053*	*0.339*	*0.746*	*.484*	-0.090	0.168
femininity_score	*-0.032*	*0.090*	*-0.184*	*-0.352*	*.737*	-0.252	0.189
sex (male)	*-0.162*	*0.249*		*-0.649*	*.540*	-0.771	0.448
group (teen)	*0.074*	*0.188*		*0.393*	*0.708*	-0.386	0.534

Note. Standardised coefficients are only depicted for continuous variables. Results for the Openness to Experience factor are marked in bold. Results relevant for later analyses are marked in italic.

Table 3

Model Summary for the Arousal Analysis

Model	R	R^2	Adjusted R^2
H_1	0.666	0.443	-0.021

Table 4

Model Summary for the Valence Analysis

Model	R	R^2	Adjusted R^2
H_2	0.462	0.213	-0.442

In order to test *Hypothesis 2* and *Hypothesis 3*, we performed separate Two-Sample Independent T-tests. The assumptions were met in both cases. *Hypothesis 2.* Non-significant results of the t-test about age differences in intensity of emotion ($t = -0.595$, $df = 10$, $p = .565$) are presented in Table 5. Nevertheless, a descriptive plot (see Figure 4) still indicates a possible pattern that is in line with *Hypothesis 2* because the mean for the teen population ($M = 0.532$, $SD = 0.115$) is higher than the mean of the child population ($M = 0.487$, $SD = 0.145$).
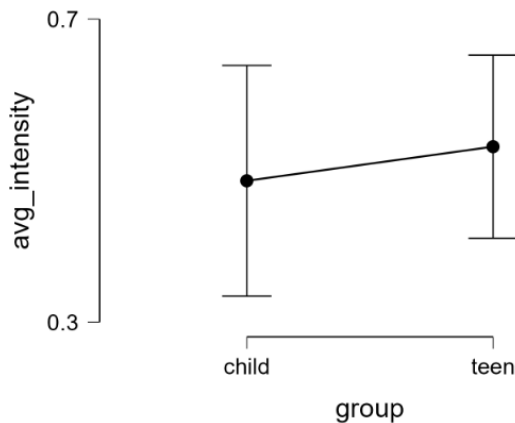
Table 5

Independent Samples T-Test for Average Intensity of Emotion and Group (Child vs. Teen)

	t	df	p
avg_intensity	-0.595	10	.565

Figure 4

Descriptive Plot for Average Intensity of Emotion and Group (Child vs. Teen)

Hypothesis 3 can now be tested in a similar manner (only switching the dependent variable). The results of the t-test ($t = 0.425$, $df = 10$, $p = .680$) are found in Table 6 and they are statistically non-significant. The descriptive plot (see Figure 5) again shows a pattern that is in line with *Hypothesis 3*: The population mean for the females ($M = 0.523$, $SD = 0.145$) is higher than the one for the males($M = 0.490$, $SD = 0.110$).

In the end, there was no evidence to substantiate *Hypothesis 2* and *Hypothesis 3* so they are rejected as well. However, there is some indication in the data that an effect might be present (see Figure 4 and Figure 5).
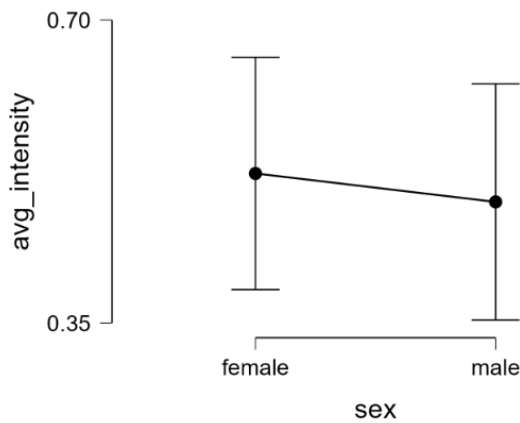
Table 6

Independent Samples T-Test for Average Intensity of Emotion and Sex

	t	df	p
avg_intensity	0.425	10	.680

Figure 5

Descriptive Plot for Average Intensity of Emotion and Sex

When constructing a residual plot (residuals vs. dependent variable) for the avg_intensity analysis in line with *Hypothesis 4*, we found that the assumptions for homoscedasticity and linearity are violated. In this case we can not perform the MLR as planned. As a substituting analysis, we are going to work again with the MLRs from *Hypothesis 1* whose assumptions were met. It is important to keep in mind that avg_intensity is a combination of avg_valence and avg_arousal so looking at the two components might give us an indication on the effect on avg_intensity.

Looking at Table 1 again, we see that sex *(ß = 0.256, SE = 0.280, p = .403)* is a better predictor for avg_arousal than masculinity *(ß = 0.049, SE = 0.073, ß$_{Standardised}$ = 0.352, p =*

.532) as well as femininity *(ß = -0.014, SE = 0.113, ß$_{Standardised}$ = -0.068, p = .906*). However, all predictors are statistically non-significant. In the case of avg_valence (see Table 2), the coefficient for the sex variable *(ß = -0.162, SE = 0.249, p = .540*) is more impactful than the one for masculinity *(ß = 0.039, SE = 0.053, ß$_{Standardised}$ = 0.339, p = .484)* and femininity *(ß = -0.032, SE = 0.090, ß$_{Standardised}$ = -0.184, p = .737)*. The predictors were statistically non-significant here as well so the evidence for *Hypothesis 4* is inconclusive at best. But there is some evidence that sex might still be better than gender identity in predicting the intensity of emotions purely from looking at the coefficients of the analyses.

In summary, we have to reject all of our hypotheses because of lack of evidence in the current data set. The Interpretations and Implications of the (preliminary) results are discussed in the following paragraphs.

Discussion

Interpreting the Results in Line With the Body of Research

Firstly, the results failed to reflect the link between Openness to Experience and esthetic emotions in children and adolescents that we expected (*Hypothesis 1*). Neither one of the emotion dimensions that Russel (1980) suggested conceptually and Beermann et al. (2021) applied practically - namely *arousal* and *valence* - were predicted by the personality trait. Even though Openness to Experience is a valid psychological construct in children and adolescents that are 9 years old or older (Herzhoff & Tackett, 2012), there were some problems with the way we measured it. In the original study that uses the Big-Five Questionnaire for Children (BFQ-C; Muris et al., 2005), the O factor was the least psychometrically rigorous in comparison to the other Big-Five Factors. In fact, 5 out of 13 items did not load significantly on Openness to Experience which is not an unheard of matter in research on this factor (see also. Barbaranelli et al., 2003). Alternative measurements with

excellent psychometric properties are often only available for adults like the Big Five Aspects Scale (BFAS; DeYoung et al., 2007).

Secondly, the effect of the age group that we hypothesised (*H2*) was essentially lacking in any of our analyses - the variable had no influence on avg_arousal, avg_valence, nor avg_intensity. Though it was statistically non-significant, it was visible in the descriptive plot (Figure 4). This second hypothesis was added because of evidence that we encountered during the literature review that adolescents may have a better internal sensitivity to their own body than children when it comes to emotions (e.g. Carroll & Steward, 1984). Hietanen et al. (2016) had found this effect previously in a developmental study using the Bodily Sensation Maps (see Appendix C, Figure C2). The present study only included the cognitive domain in order to see whether or not it is sufficient in representing emotional patterns. It turned out that it was not enough which again stresses the need for embodiment in children and adolescents as a primary aspect of emotional experiences (Piaget and Inhelder, 1969), especially when appreciating art works (Ardizzi et al., 2023).

Thirdly, we did not find the sex differences in the experience of emotion that we anticipated (*Hypothesis 3*), though they were apprehensible to some degree in the graph again (see Figure 5). With regards to adults, there has been decent evidence that women experience more emotions than men, both positive and negative (Feingold, 1994), and are more sensitive to esthetics (Weisberg et al., 2011). On that basis, it would have been expected to see sex differences. Nevertheless, it is also known that for example sex differences in Neuroticism do not show up until girls hit puberty (McCrae et al., 2002). Gender differences in Openness to Experience do not occur at all on a pure trait level, even in longitudinal studies right from preschool until adulthood (Gjerde & Cardilla, 2009). Additionally, during the literature review, we were unable to find research that differentiated the Intellect/Openness facets in

children which would have enabled a more exact prediction. Instead, we used the differences in adults to predict differences in children - with no success in terms of explanatory potency.

Lastly, *Hypothesis 4* which posited gender identity as a more powerful predictor than sex did not produce results that are in line with the theory by Compère et al. (2018, 2021). In fact, gender identity was slightly worse in predicting intensity of emotion than biological sex. This might partly be explained by the inaccuracy of the measurement instrument, the (Children's) Personal Attributes Questionnaire ((C-)PAQ). Hall & Halberstadt (1980) reported sub-standard internal consistencies of Cronbach's alpha ($a < .65$) and test-retest reliability of $r < .50$. This does not even come close to the standards of personality research which advises Cronbach's alpha of at least .75 but optimally upwards of .80 or .90 (McCrae et al., 2010). Thus, using personality measurements of agreeableness and neuroticism might have been advisable because they assess relevant gender differences and are quite psychometrically precise (Weisberg et al., 2011).

Strengths and Limitations of our Study Design

This research was a pilot study and a step into psychological and scientific territory that is only beginning to be well-understood. The way it was designed, it had a number of strengths that should be mentioned. We used only empirically validated methods and approaches that have been tested before. For example, the Geneva Emotion Wheel which, as mentioned above, has already been used in a study on art exposure (DeAngeli et al., 2020). In addition to that, our measurement instruments were specifically adapted to the different age groups like the Children's Personal Attributes Questionnaire (Thomson & Zand, 2005) and the Big Five Questionnaire for Children (Muris et al., 2005). The reliability of the translations of the instruments was increased by the Back-translation that we employed (Tyupa, 2011).

On the other hand, the study also had a number of limitations, partly due to the exploratory nature of the research. First of all, the sample size of n = 12 was exceptionally

small for quantitative research purposes (Andrade, 2020). Accordingly, post-hoc Power

Analyses using G-Power 3.1 (Faul et al., 2009) result in power values between .21 and .07

implying a margin or error of more than 80 percent. The sample was also a

non-representative convenience sample of Dutch children and adolescents. This means that

there is a substantial possibility for the sample to be biassed in a direction we do not

understand. That includes a number of demographic variables that we did not control for like

socio-economic status, religious beliefs, and even personality variables. For example, it is

likely that the children wanting to participate in the study were more extraverted and more

stable emotionally which could easily have had an effect on the emotions that they felt during

the research (see again. DeYoung et al., 2007).

Moreover, there are plausible downsides to the way we constructed the variables in

the research. The three main dependent variables avg_arousal, avg_valence, and

avg_intensity consist of eight measurements: 2 clicks on the GEW * 2 objects (own vs. other)

* 2 instances (pre-conversation vs. post-conversation). This collapse might have caused

important emotional data not to be visible anymore. For example, there may be marked

differences between each of the four conditions that, when averaged across, average out into

zero. Fluctuations in emotion caused by the nature of the object or the 20 minute long

conversations are not visible anymore.

Another possible issue with the study design is that the definition of art was

extraordinarily broad (e.g. subjects brought footballs, rubix cubes, toys, etc.). With this

definition, the variance in the emotional response to a plethora of different stimuli might be

so high that the effect of openness to experience on the emotional responses of the subjects

are not measurable, especially with an average value.

Suggestions for Further Research

Future research could mitigate against this by narrowing the definition of art to something specific like visual paintings, making the research group more homogenous and easier to study. Another way to increase homogeneity or at least to control for variability is to include the additional variables mentioned above like socioeconomic variables and a full screening on the Big Five Traits. In addition to the self report measurements they could also take physiological measurements in order to increase their accuracy (Johnson et al., 2007). In general, our study used a between-subjects design. In order to gain more insight into the developmental aspect, they could employ a within-subjects design with longitudinal observations. In this way, the development of the esthetic sense may be tracked over time. As a last suggestion, future studies should make sure to plan in enough time in the participant recruitment and data collection process. In that way, the sample size can be higher and the statistical power and accuracy as well, assuming the study uses a quantitative approach.

Conclusion

In conclusion, the present research found that esthetic stimuli can elicit a diverse set of emotions in children and adolescents which can not easily be accounted for by cognitive predictors, age, sex, or trait Openness to Experience. More research is needed to understand how we can predict the emotional reactions that are triggered when encountering such things. A better understanding of esthetic emotion and the experience of awe could prove itself valuable in a variety of practical domains such as social-psychology interventions (e.g. Jakobson & Wickman, 2007; Kliewer et al., 2011; Stamkou et al., 2023) and clinical interventions (Koch & Fuchs (2011).

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Appendix A

Project Manual

1) Fill in the participation number on the ipads. If applicable (for teens), make sure the artwork is being displayed on a laptop. Provide headphones for music pieces, etc.

2) Getting everyone from the waiting room (also parents for the consent part and afterwards ask them to wait in the waiting room).

3) Introduce yourself and ask for their names if they don't tell you by responding.

4) Explain the experiment shortly: questionnaire about own object, swap objects, questionnaire about other's object, conversation, both questionnaires again. Say: "Part of the experiment will be recorded with audio and visuals."

    a) Pre-Questionnaire (Media Preferences)

    b) Appreciation Obj. 1

    c) Questionnaire Obj. 1

    d) Appreciation Obj. 2

    e) Questionnaire Obj. 2

    f) Conversation 20 min

    g) Post-Questionnaire (+ gender and personality)

5) Get verbal consent:

    Ask: "do you still want to participate?" and tell them "you can withdraw from the experiment at any time without any repercussions and reason"

6) Politely ask the parents to wait in the waiting room.

7) Tell them to take a seat and place their own (depends on counterbalancing) object in front of them, offer help if needed.

8) Let them finish the first question about media preferences. Afterwards say: "So first, please experience the object/artwork in front of you. When you are done, fill in the

rest of the questionnaire until it says 'Wow, goed gedaan!/Wow, good job!'". Please let the researcher know when you get to this point.

9) Participants continue the questionnaire until they have to switch artworks. Look at their screen for where they are at to not miss this point. Switch objects.

- if questions about bodily sensation maps say: "for example, when looking at the object you feel that your heart starts beating faster or slower, indicate this by putting dots around where the heart would be. For an even more/less intense feeling, put multiple dots in the surrounding area."

10) Participants finish the pre-questionnaire.

11) Wave hand in front of camera so tech people know to start the recording.

12) The conversation starts, each prompt lasts up to 4 minutes. Place the objects on the table in the front and ask participants to go to the middle of the room standing.

13) Use the script for the conversation prompts and keep track of the time. Make notes if needed/wanted. Do an 'icebreaker'.

14) Let participants finish the post-questionnaire. When children get to the questions about gender and personality, read them outloud and go through them together.

Appendix B

Big-Five Questionnaire for Children (BFQ-C) With Items From the Openness Section

1) I know many things.

2) I have a great deal of fantasy.

3) I easily learn what I study at school.

4) When the teacher asks questions, I am able to answer correctly.

5) I like to read books.

6) When the teacher explains something, I understand immediately.

7) I like scientific TV shows.

8) I like to watch TV news, and to know what happens in the world.

9) I am able to create new games and entertainments.

10) I am able to solve mathematics problems.

11) I like to know and to learn new things.

12) I would like very much to travel and to know the habits of other countries.

13) I understand immediately.

Appendix C

Measurement Items That Include Important Visual Information

Figure C1

Geneva Emotion Wheel With Eight Categories and Emojis (EN, NL)

Figure C2

Bodily Sensation Maps For Children and Adolescents, Type "Activation"