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Cognitive and Historical Information Can Spark Interest in Modern and Contemporary Art

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Modern and contemporary art can be challenging for the general observer. We investigated whether aesthetic appreciation of modern and contemporary artworks can be enhanced through two types of intervention. The first, a traditional approach, provided information related to art history (historical intervention [HI]). The second, novel intervention, encouraged participants to observe the creative elements in the artworks by "thinking in terms of opposites" (cognitive intervention [CI]). We included a baseline condition with no additional information (no intervention [NI]). An online questionnaire was completed by 279 Italian adults. It began with 35 items measuring openness, curiosity, familiarity, and interest in art. Participants were presented with 15 artworks and randomly assigned to one of the three conditions: HI, CI, or NI. Six questions were then asked to assess the level of appreciation and interest in the artworks. Four final questions evaluated the participants' overall experience. HI and CI interventions were associated with improved interest and greater feelings of overall enrichment and mastery ("I now feel more capable of appreciating this kind of artwork"). Participants also reported feeling less boredom in these conditions compared to the NI condition. Interestingly, the participants' personality traits moderated responses in the HI and NI conditions but not in the CI condition. Thus, the innovative and more cognitive perspective (CI) generally produced more consistent effects.

Keywords: opposites, aesthetic pleasure/interest, historical and cognitive information, modern and contemporary art appreciation, individual differences

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Modern and contemporary art is hard to approach for the general observer. One reason may be that individuals are required to move beyond beauty and harmony and focus instead on other aspects of the art (Belke et al., 2006; Bimler et al., 2019; Boselie & Cesàgro, 1994; Levinson, 1989, 1993). Context is, therefore, crucial (Belke et al., 2006; Gude, 2004; Pietras & Czernecka, 2018). Given the challenges in defining what constitutes a "work of art," it has been suggested that the sole viable approach is based on historical narratives (Carroll, 1993) or an intentional-historical account (Levinson, 1989, 1993).

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In this article, we investigate whether nonexperts' aesthetic appreciation of a set of modern and contemporary artworks can be improved by different types of informative contexts. One group of participants was invited to focus on the creative elements displayed in the artworks and interpret them in terms of "thinking in opposites" concerning standard/expected ideas (opposites are central to both perception and cognition, as discussed in the Thinking in Opposites in Art Evaluation and Appreciation section). We call this "cognitive intervention" (CI), as it invites observers to concentrate on the imaginative processes underlying the conception of the artwork. The effects of exposing participants to this type of contextual information were compared with exposing them to a more traditional historical intervention (HI) and a control condition of no intervention (NI) where no additional information was provided beyond the name of the artist, title of the artwork, and year of creation. Both CI and HI interventions connect to the intentional-historical account (i.e., they make viewers aware that they are looking at an artifact produced with intention—see the ideas of intentional stance and design stance by Dennett, 1987).

Before detailing our study (The Study section), we will introduce the overarching approach based on the theories of Graf and Landwehr (2015, 2017) and Kubovy (1999; see the Interest as Pleasure of the Mind section). We also present the theoretical background for the two proposed interventions, which aim to stimulate interest through historical information (see the Historical Understanding in Art Appreciation section) or by encouraging participants to consider the creative elements of the artworks in terms of opposites (see the Thinking in Opposites in Art Evaluation and Appreciation section).

Interest as Pleasure of the Mind

In this article, we adopt Graf and Landwehr's (2015, 2017) distinction between pleasure and interest as proposed by their Pleasure and Interest Model or Aesthetic Liking (PIA). The PIA model is conceived as an application of the dual-process theory (Evans, 2017; Evans & Stanovich, 2013; Kahneman, 2011) to the analysis of aesthetic pleasure. We suggest that this theoretical perspective can be enriched by ideas discussed by Kubovy (1999) in his theory of the Pleasures of the Mind.

According to the PIA model, aesthetic appreciation arises from two hierarchical fluency-based processes. The first is an automatic, default process, not mediated by deliberate reasoning (Reber et al., 2004, p. 365) and leads to an affective reaction of pleasure or displeasure (Strack & Deutsch, 2004; Winkielman & Cacioppo, 2001; Zajonc, 1980). At this level, perceivers are on "autopilot"—hence Zajonc's (1980) famous assertion that "preferences need no inferences"—processing incoming information without actively adapting any aspects of their internal cognitive structures (Bargh & Chartrand, 1999). Individuals process the stimulus as a whole (Cupchik, 1995; Locher, 2015) and show a preference for certain visual aspects, such as symmetry and smooth curvature. This has been demonstrated using implicit measures, for example, the Implicit Association Test (Bertamini et al., 2013, 2016; Palumbo et al., 2015).

The second level is activated when the observer engages in controlled and effortful processing of the object (Augustin & Leder, 2006; Pelowski et al., 2016; Reber, 2022). Graf and Landwehr conceptualize this second process as involving higher-order cognitive operations, such as careful and deliberate stimulus analysis, meaning assignment, and interpretation. The motivation to process a stimulus is determined by the interplay between the first-level affective response to the stimulus and the perceiver's need for cognitive enrichment. If a person experiences a negative affective feeling (i.e., they experience disfluency in processing the stimulus and, consequently, do not like it) but simultaneously has a high need for cognitive enrichment, they will be highly motivated to activate the second phase, aiming to gain a deeper understanding of the aesthetic object and thereby reduce disfluency. Conversely, if the person has a low need for cognitive enrichment, they will stop at the first level. Likewise, the combination of a positive affective feeling at the first level and a low need for cognitive enrichment leads to low motivation to initiate further processing.

The need for cognitive enrichment connects to what other authors have modeled in terms of need for cognition (e.g., Świątek et al., 2024). Need for cognition refers to an individual's tendency to engage in and enjoy effortful cognitive processing. Individuals with a high need for cognition enjoy actively thinking about and understanding the world; they prefer complex tasks, seek to understand causes, and gather as much information as possible before drawing conclusions (Nishiguchi et al., 2018). Need for cognition correlates with fluid aspects of intelligence and traits such as openness to experience, emotional stability, and a goal-oriented attitude (Fleischhauer et al., 2010; Wanzer et al., 2020), as well as curiosity, concentration, and an inclination for analytical observation of reality (Świątek et al., 2023). Świątek et al. (2024) confirmed the mediating role of need for cognition in the formation of aesthetic competence. Individuals with a high need for cognition find their engagement with artworks more satisfying and rewarding than those with low levels of this trait. All these aspects support individuals with a high need for cognition in developing aesthetic competence.

Another relevant aspect of the second processing level of the PIA model is that during this phase observers not only become acquainted with the stimulus and learn about what they are observing (the artwork) but also learn about their own cognitive processing (Graf & Landwehr, 2015, p. 299). Metacognitive feelings about the perception of certainty and fluency are involved at this level. Conceptual fluency is at least as significant as perceptual fluency in terms of the subjective experience participants have (Ball et al., 2018; Husselman et al., 2024). Experiencing curiosity (the desire to acquire knowledge), gaining insights into the artwork (new understanding), experiencing a transformation in one's way of thinking, adopting a more analytical style of processing, and paying attention to nonsalient attributes are all aspects characterizing the approach to art that emerges at the second level (Alter et al., 2007; Bullot & Reber, 2013; Christensen et al., 2023).

According to the PIA model, this second level of processing leads to an experience of interest, boredom, or confusion, depending on whether the information that observers have discovered or learned has improved their fluency in processing the object (on these knowledge emotions, see also Silvia, 2010). In this article, we focus on the experience of interest.

We suggest that interest, as conceived in the PIA model, aligns well with the idea of pleasures of the mind as defined by Kubovy (1999). According to Kubovy, there are at least three aspects common to various pleasurable experiences, such as listening to music, reading poetry, solving puzzles, appreciating humor, gardening, and so forth: (a) stimuli and activities that induce pleasures of the mind give rise to emotional patterns characterized by an initial state of tension and a final state of relief. (b) A feeling of satisfaction

arises when a state of violated expectations triggers a search for interpretation (i.e., a change of perspective), which, in turn, leads to the resolution of a situation or problem. (c) Emotions present in most pleasures of the mind include curiosity, the joy of verification, virtuosity, as well as feelings of surprise. Interest, as described in the PIA model, fits well in these schemas. It arises from the patterned sequence of emotions outlined in (a). It is reached only when a state of violated expectations and surprise triggers a search for a change of perspective ("I came to see this exhibit, but this does not seem like art to me!"), which implies the activation of an effortful second level of processing (as outlined in [b]). The second level, observers engage in a reflective process that informs them about their cognitive activity besides providing insights into the artwork; individuals feel satisfied with learning something new (curiosity) and capable of understanding something that was previously incomprehensible (virtuosity) (as outlined in [c]). This last point connects to the idea that interest is elicited by a combination of the challenging character of an object (related properties include being new, sudden, unfamiliar, ambiguous, complex, obscure, uncertain, mysterious, contradictory, unexpected, or otherwise not understood—see Silvia, 2005, p. 122) and one's ability to cope with this challenge (Silvia, 2005, p. 122). For further insights, see also Muth et al. (2015) and the role of cognitive mastery in Leder et al.'s model (2004).

In our study design, we have maintained the distinction between pleasure and interest in mind, as two distinct levels of liking, and have used the ideas of curiosity and virtuosity as described in Kubovy's theory to operationalize the metacognitive effects of enriching participants' experiences with HI and CI about the artworks.

Historical Understanding in Art Appreciation

Following Levinson (1989, 1993), despite the surface variety and complex evolution of art-making modes, a common core of art involves a backward-looking connection to a preceding domain of art and art activities. Therefore, contextual knowledge and art history competence are essential elements for art appreciation, understanding, and evaluation.

Historical information is traditionally employed in museums to enhance visitors' experience. It can encompass both classical details about the artist, the artwork and its creation process, and insights into the artist's intentions. According to Jucker and Barrett (2011; Jucker et al., 2014), understanding the artist's intentions in creating a specific artwork is central to its appreciation by nonexpert audiences. This prediction aligns with findings indicating that people prefer artworks in which the artist's intention is easily understood (Jucker & Barrett, 2011) and that appreciation increases when participants are provided with titles that ostensibly clarify the artist's intended message in the artwork, compared to when this information is absent (Jucker et al., 2014, especially Experiments 2a and 2b).

The idea that contextual historical information may positively influence art appreciation is supported by theoretical work (Bloom, 2010; Fisher, 1984; Franklin, 1988; Levinson, 1985), but the empirical data present a mixed picture. Among the studies supporting the benefits of providing historical information, Temme (1992) demonstrated that participants exposed to texts explaining the meaning of figurative and abstract paintings rated them as more beautiful, absorbing, agreeable, and interesting than those exposed to no information. Similar evidence emerged from Millis (2001, Experiment 1), who found that visual artworks accompanied by descriptive and elaborative titles were rated higher in terms of enjoyment, interest, emotion, understanding, and elicitation of thoughts than the same artworks presented without titles. Likewise, Russell (2003, experiment 2) found that information about the style improved the perception of meaning and pleasure in abstract paintings compared to when the same paintings were presented without additional information. Providing stylistic information (in the form of short texts) to support the presentation of modern and contemporary abstract paintings also proved beneficial for perceivers relatively inexperienced in art (or for individuals in a positive mood) in Belke et al. (2006). Other studies indicated that appreciation improved when information about the author (Kirk et al., 2009), the time, and the skills required to create the artwork was provided (Hodge, 2012; Jucker et al., 2014; Kruger et al., 2004).

In contrast, Smith et al. (2006) found no benefit from exposing participants to brief texts about the artist and the artwork. Both abstract and figurative modern paintings were considered in this study, and the impact of additional information was measured using evaluative scales (such as pleasant/unpleasant and inspiring/uninspiring), activity scales (such as intense/relaxed and dynamic/calm), and potency/structure (such as simple/complex and usual/surprising). Similarly, Belke et al. (2006) concluded that style-related explanatory texts had no effect on how much a series of modern paintings was liked. Bordens (2010) found that appreciation judgments were not influenced by information about the artists and their art schools. Leder et al. (2006, Experiment 1) and Jucker et al. (2014, Experiments 2a and 2b) found that titles clarifying the artists' messages increased participants' understanding of the artworks but did not significantly enhance their appreciation.

According to Jucker et al. (2014), what is critical and may help explain these contrasting results is the type of information provided. When the additional information (offered either through interpretative titles or short texts) reduces the cognitive effort required to process the artworks, they become easier to understand and are liked more. We consider these requirements when producing the brief texts that accompany the presentation of the artworks in the HI condition of our study.

Thinking in Opposites in Art Evaluation and Appreciation

What is the rationale for proposing the second type of intervention, that is, the prompt to examine the elements of innovation in the artworks in terms of opposites? People have an intuitive understanding of what opposites are. Evidence of this ease of perceiving and thinking in opposites emerges from informal observations and scientific studies. These studies have demonstrated that opposites are a primal configuration for language and meaning (Gärdenfors, 2014; Jones, 2007; Paradis, 2016; Paradis & Willners, 2011), that people have an intuitive grasp of what constitutes the opposite of a figure (Bianchi & Burro, 2023), a posture or gesture (Bianchi & Savardi, 2008; Bianchi et al., 2014), and a transformation (Bianchi et al., 2022; Capitani et al., 2020). Opposites have also been shown to be widely used in thinking (Branchini et al., 2021; Byrne, 2018; Oaksford, 2002) and effective in overcoming fixedness in hypothesis testing (Branchini et al., 2023, 2025; Gale & Ball, 2012) and in stimulating insight in problem solving (Bianchi et al., 2020). It has been hypothesized that they might also support creative thinking in general (Bianchi & Branchini, 2023).

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We drew from this psychological literature on the ease and pervasiveness of opposites in human perception and thinking to formulate the hypothesis that opposites might represent a powerful and cognitively accessible way of conceptualizing innovation in art. This intuition enriches, in a cognitive direction, Becker's (1982) observation in an art history context that artists, when creating art, are aware of existing canons, which they have internalized from the past but often choose to violate them. When this occurs, artworks overtly reference past examples while simultaneously questioning them, and an observer who understands the artwork recognizes this violation (Becker, 1982, p. 204). This claim aligns well with Levinson's (1993) proposal that a common core of art appreciation involves a backward looking to a preceding domain of art and with Berlyne's (1974) suggestion that the appeal of a work depends on the interplay between perceiving coherence and mystery, uniformity, and variety.

We modeled the CI condition based on these premises. The text presented to participants highlighted how the artwork "does the opposite" of what one might expect.

The Study

In this study, we explored whether aesthetic appreciation of artworks from the 20th and 21st centuries could be improved (compared to a control condition where only the artist, the title of the artwork, and the year of creation were provided) by offering relevant historical context (HI) or by encouraging reflection on the innovative aspects of the artwork through thinking in opposites (CI). The study had four aims.

Aim 1: We aimed to contribute to the literature on the effects of providing historical information on art appreciation by going beyond the abstract and impressionist art movements, which are often the focus of the literature dealing with "modern art."

Aim 2: We aimed to investigate, for the first time, whether interest in modern and contemporary art could be enhanced by inviting observers to reflect on thought processes supporting creativity in terms of opposites.

Aim 3: Based on the PIA model, we operationalized appreciation as pleasure (i.e., immediate response of liking) and interest (i.e., evaluation manifesting a second, more thoughtful engagement with the artwork) and expected our HI and CI interventions to positively affect interest more than pleasure.

Aim 4: We aimed to study whether the effects of the two interventions depended on individual differences.

Previous literature suggests that aesthetic appreciation is influenced by participants' expertise and familiarity with art in general (Belke et al., 2006; Bimler et al., 2019; Leder et al., 2004, 2012; Pietras & Czernecka, 2018; van Paasschen et al., 2015) and with the specific artworks (Bornstein, 1989; van Paasschen et al., 2015). Another relevant factor may be gender (Miller & Hübner, 2023; Palumbo et al., 2021). In our survey, we collected information about these aspects. We also included questions that assess openness to experience, a trait often positively linked to art appreciation (Barford et al., 2018; Chamorro-Premuzic et al., 2009; Cotter et al., 2017; Faerber et al., 2010; Fayn et al., 2015, 2019; Feist & Brady, 2004; Furnham & Walker, 2001; Lyssenko et al., 2016; McManus & Furnham, 2006; Oleynick et al., 2017), as well as another series of questions aimed at assessing participants' perceptual and intellectual curiosity, which has also been related to aesthetic sensitivity (Fayn et al., 2019; Kashdan & Silvia, 2009). In particular, we were interested in understanding whether the effect of the CI (our novel intervention) depends on individual differences as much as the other two conditions (HI and NI). We know, for example, that the benefits of providing historical and stylistic information about artworks depend on people's level of familiarity with art; namely, it is more beneficial for nonexperts than for experts (Belke et al., 2006). We do not know, however, if familiarity would similarly impact on the benefits of providing cognitive contextual information. The approach might result "novel" for both expert and nonexpert, and therefore they might benefit to a similar extent, or conversely might result "unclear" for both experts and nonexperts.

To gain a comprehensive understanding of the impact of the two interventions, we measured appreciation concerning each artwork using six different questions, and also measured final general evaluations of the experience of being exposed to the 15 artworks in terms of four dependent variables: overall aesthetic appreciation, feeling of enrichment, feeling of mastery/virtuosity, and boredom (for details, see the Method section).

Method

Participants

A total of 279 Italian adults (189 females; 90 males; $M_{age} = 26.838$ years, $SD = 10.389$) volunteered to participate in the study after providing informed consent. They were recruited from the University of Verona, Macerata, and Padua, among undergraduate students, their families, and friends, and were randomly assigned to the three conditions. The study conforms to the ethical principles of the Declaration of Helsinki (World Medical Association, 2013), and ethical approval for the study was obtained from the University of Macerata (CER 03/05/2024).

Material

An online questionnaire in Italian was used. The questionnaire was created using LimeSurvey CE (Version 6.1.0), and responses were stored in a MySQL database. The HTTPS protocol (HTTP +SSL, Hypertext Transfer Protocol with Secure Socket Layer) were employed to encrypt all traffic. The first part of the questionnaire informed participants about the study's content, provided instructions regarding its three sections, outlined its overall duration, and requested participants' informed consent. Participants who agreed to take part accessed a new page where they were reminded that they were not allowed to complete the questionnaire from their smartphones but only using a computer or tablet. By pressing the key "proceed," they accessed the three sections of the questionnaire in fixed order (see Appendix A for the questions forming the three sections).

Section I: Individual Differences Questions

In this section, participants provided information about their gender and age and their degree of agreement/disagreement with a series of 35 statements, using a 7-point Likert scale (ranging from

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1 = *strongly disagree* to 7 = *strongly agree*). The 35 statements included:

1. Twelve items measuring open-mindedness according to the Big-Five Inventory 2 (Burro et al., 2025; Soto & John, 2017) and regarding the three facets of intellectual curiosity (four items), aesthetic sensitivity (four items), and creative imagination (four items);
2. Eight items forming the first two subscales of the Five-Dimensional Curiosity Scale Revised (Kashdan et al., 2020) that capture two distinct aspects of curiosity. The subscale joyous exploration refers to the pleasurable experience of finding the world intriguing (four items). The subscale deprivation sensitivity refers to the anxiety and frustration of being aware of information one does not know, desires to know, and devotes considerable effort to uncover (four items).
3. Fifteen items, organized in two factors, from Specker et al. (2020, Table 1, p. 175). The first factor measures art interest/familiarity (which became part A of the Vienna Art Interest and Art Knowledge Questionnaire). The four items loading on the second factor (item 1: an *artwork has to be primarily beautiful for me to like it*; item 5: *cannot stand ugly artworks*; item 6: *art has to be about an exact representation of the world*; and item 8: *art should first and foremost be decorative*) correspond to a a traditional idea of beauty in art. We called this second factor attitude toward beauty in art. These four items were not used in the final version of the Vienna Art Interest and Art Knowledge Questionnaire (Specker, 2024) but were interesting for us since the artworks presented in our study concern modern and contemporary art, which usually do not fit with a traditional idea of beauty in art. All fifteen items were formulated not as in the original version (e.g., "How often do you read books, magazines, or catalogs about art?" etc.) but transformed into a statement that could be responded to using the same 7-point agreement/disagreement scale used for all other items (i.e., "I often read books, magazines, or catalogs about art").

Section II: Artworks and Relative Questions

This section presented 15 artworks one at a time in random order at the center of the screen. The images were all 750 pixels wide, with heights varying from a minimum of 422 pixels to a maximum of 1,125 pixels in relation to the proportions of the artworks. In all conditions, the artist's name and the title and year of the artwork were displayed below the image.

In the HI and CI conditions, the images were accompanied by a brief text displayed to the right of the image. The text varied in length but was always within 150 words and had a similar length in the two conditions (CI: mean number of words = 93.73, min = 61, max = 143; HI: mean number of words = 94.13, min = 66, max = 143). The content differed in the two conditions; the texts used for each artwork are reported in Appendix B (Table B1, Column II).

A checkbox stating "I've read the text, continue" (in the experimental conditions) or "I've looked at the picture, continue" (in the control condition) was displayed at the bottom of the screen. After participants pressed the checkbox, six questions appeared. Three questions referred to the pleasure experienced when looking at the artwork ("I take pleasure in looking at this artwork"; "I find this artwork unpleasant"; "This artwork gives me an immediate positive emotion"). Three questions referred to the interest generated by the artwork ("I find this artwork trivial"; "This artwork generates interest in me"; "The author is trying to communicate something to me, to make me think"). The questions were accompanied by the 7-point scale used in the first section of the questionnaire.

The presentation of the 15 artworks was randomized among participants. The order of the questions was randomized. The examples of the artworks are shown in Figure 1; the complete sample used in the study is listed in Appendix B (Table B1), along with the HI and CI texts.

Section III: Final Questions

This section included four questions about the overall experience ("My overall judgment of the aesthetic value of these artworks is positive"), feelings of enrichment ("I feel personally enriched"), mastery/virtuosity ("I now feel more capable of appreciating this kind of artworks"), and lack of interest ("I was bored"). The order of the questions was randomized.

The questions used in Sections II and III of the questionnaire to operationalize interest and pleasure were inspired by three sources: Krapp's (1994) analyses of positive emotions and the cognitive aspects of interest and curiosity, which apply well to Graf and Landwehr's (2015) PIA model; the distinction between interest and boredom as two outcomes of the PIA's second level of engagement; and Kubovy's (1999) curiosity and virtuosity factors in his theory of the pleasures of the mind.

A final question in Section III concerned how many of the artworks the participants had seen before. Participants responded with a number from 0 (*none of them*) to 15 (*all of them*).

Procedure

Participants accessed the questionnaire online. They completed it individually from their computers or tablets. Compilation from smartphones was not allowed, as clarified in the instructions, to ensure better access to the images of the artworks presented in Section II. No time limits were set. The experiment lasted an average of 15 min in the control condition and 20 min in the two experimental conditions. A time counter was set starting from when the artwork was displayed and ending when participants checked the button "I've read it, continue."

Results

Data Analyses

All analyses were conducted using statistical software R, Version 4.4.0 (R Core Team, 2024). To assess whether the questionnaire items (referring to Sections I and II of the questionnaire) could be grouped into factors as hypothesized, we used a reliability analysis (Cronbach's α and McDonald's ω) and an exploratory factor analysis (EFA with Promax rotation), both calculated using the psych R package, Version 2.4.3 (Revelle, 2024). The effects of the three conditions (NI, CI, and HI) on the various dependent variables under study (referring to Sections II and III of the questionnaire) were analyzed using linear models (LMs) and linear mixed models (LMMs, lme4 R

Figure 1
Subset of the Artworks Used in the Study

Renato Bertelli,
Profilo continuo (1933)

Claes Oldenburg,
Stamp (1991)

Manfredo Massironi,
Struttura a quadrati ruotati (1964)

Meret Oppenheim,
Object (1936

Robert Rauschenberg,
Erased de Kooning drawing (1953)

Note. See the online article for the color version of this figure.

package, Version 1.1-35.3; Bates et al., 2015). Analysis of deviance and Bonferroni post hoc tests applied to the results of LM and LMM were calculated using emmeans R package, Version 1.10.2 (Lenth, 2024). The power of each analysis was tested using the WebPower R package, Version 0.9.4 (Zhang & Mai, 2023). The analysis of relationships between continuous variables (relating to Sections I and III) was performed through path analysis, using lavaan R package, Version 0.6-17 (Rosseel, 2012). For the analyses reported in the online supplemental materials, the following packages were used: ggplot2 (Wickham, 2016) for the boxplots and corrtable (van der Laken, 2023) for the correlation matrices.

Preliminary Analyses

Since we were interested in nonexpert participants, we initially verified if some participants were familiar with most of the artworks presented—an indicator of art expertise. Responses to the last question of Section III revealed that participants had previously seen on average 1.684 ($SD = 2.765$) out of the 15 artworks presented, and this lack of familiarity was similarly distributed across the three conditions (NI: $M = 1.462$, $SD = 2.332$; CI: $M = 1.833$; $SD = 3.072$; HI: $M = 1.770$; $SD = 2.861$). We also checked that the response time in both training conditions was compatible with participants having read the texts in the CI and HI conditions. This was indeed the case, as participants took on average around 12 s longer to respond to each artwork in the CI and HI conditions as compared to the NI condition (CI: $M = 22.361$; $SD = 5.341$; HI: $M = 23.214$; $SD = 5.146$; NI: $M = 10.899$; $SD = 3.494$), and therefore, this was not a criterion for excluding any participant. The final numerosity of participants in the three groups was as follows: NI = 90; CI = 93; HI = 90 because of the exclusion of two incomplete questionnaires and the automatic randomized assignment of participants to the three conditions (managed by the software).

Principal Analyses

We conducted three main blocks of analyses. First, we examined whether the interventions affected the judgments following each artwork (i.e., responses to Section II of the questionnaire). Second, we analyzed whether the intervention modified participants' final judgments (i.e., responses to Section III of the questionnaire). Finally, we studied whether and how the effects of the context were moderated by individual differences concerning openness, curiosity, interest/familiarity with art, and participants' ideas about beauty (i.e., responses to Sections I and III of the questionnaire).

Analyses of the Judgments Following Each Artwork (i.e., Section II)

The six questions in Section II were designed to measure reactions to the artworks in terms of pleasure (Items 1–3) and interest (Items 4–6). We explored the internal consistency of the three items for pleasure and interest. Consistency in the item scores was good for both pleasure (Cronbach's $\alpha = .835$; McDonald's $\omega = .845$) and interest (Cronbach's $\alpha = .786$; McDonald's $\omega = .792$). The EFA returned a two-factor structure, with the items distributed exactly

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as hypothesized (the factor loadings ranged from .998 to .475 for the pleasure experience factor and from .739 to .644 for the interest generated by the artwork factor). The following analyses were conducted on the total score of the two factors that emerged from the EFA; thus, the scores used to describe pleasure on the one side and interest on the other were the sum of the scores of the individual items (the boxplots in the Supplemental Material SM1 in the online supplemental materials show that the distributions are not extreme in skewness).

Two LMMs were conducted on pleasure and interest, respectively. In one model, pleasure was the dependent variable, with condition, gender, artworks, and participants as independent variables (condition and gender were the fixed effects, while artworks and participants were random effects). Since condition was studied between subjects, we had three different groups of participants, and participants were nested in condition. The same model was used to analyze interest (with condition and gender as fixed effects and artworks and participants as random effects). The main effect of condition on pleasure was not significant, $F(2, 267) = 2.465$, $p = .087$, power ($\alpha = .05$) = .999 (left panel of Figure 2). Gender was also not significant, both as main effect, $F(1, 267) = 0.645$, $p = .422$, and in interaction with condition, $F(2, 267) = 0.408$, $p = .665$.

Conversely, the main effect of condition on interest was significant, $F(2, 267) = 3.242$, $p < .040$, power ($\alpha = .05$) = .999 (right panel of Figure 2). Particularly, as revealed by post hoc tests, CI improved the interest expressed by participants compared to the control condition. No significant differences were found between CI and HI interventions. The main effect of gender was significant, $F(1, 267) = 0.629$, $p = .011$, but there was no interaction between gender and condition, $F(2, 267) = 0.032$, $p = .969$. As shown in Figure 2 (right panel), females gave in general higher interest ratings, independently of the condition (females: $M = 15.370$, $SD = 3.807$; males: $M = 14.523$, $SD = 4.072$).

Analyses of the Final Judgments (i.e., Section III)

The four final questions aimed to capture different nuances of participants' overall evaluation. We hence analyzed the effect of condition and gender for each question separately through four independent LMs, the outcomes of which are shown in Figure 3 (we are using LM and not LMMs in this case since the four final questions do not have repeated measures, as they refer to the whole set of 15 artworks).

The LM conducted to study the effect of condition on the dependent variable overall aesthetic judgment of the artworks revealed no significant effect of condition, $F(2, 267) = 2.334$, $p = .100$, power ($\alpha = .05$) = .850 (see top left panel in Figure 2). Gender was also not significant, $F(1, 267) = 0.556$, $p = .456$, nor was the interaction with condition, $F(1, 267) = 0.230$, $p = .794$.

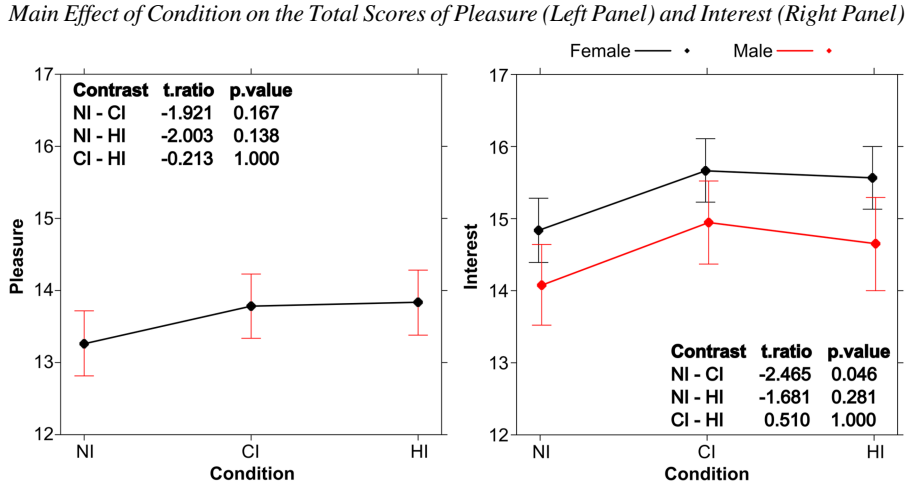
Conversely, participants reported a higher feeling of enrichment in both the HI and CI intervention conditions compared to the control condition, $F(2, 267) = 13.918$, $p < .001$, power ($\alpha = .05$) = .999 (see the top right panel in Figure 2). Post hoc tests revealed no significant difference between the two types of interventions. Additionally, gender was not significant, $F(1, 267) = 1.586$, $p = .209$, nor was the interaction with condition, $F(2, 267) = 0.182$, $p = .833$.

Similar results were observed regarding participants' feeling of mastery/virtuosity (i.e., "I feel more capable of appreciating this type of artworks"). Higher ratings of mastery were reported in the two conditions where additional information was provided (CI and HI) compared to the control condition (NI), $F(2, 267) = 18.991$, $p < .001$, power ($\alpha = .05$) = .999, with no significant difference between the two types (see bottom left panel in Figure 2). There was no significant effect of gender, $F(1, 267) = 0.072$, $p = .789$, and no interaction between gender and condition, $F(2, 267) = 0.826$, $p = .439$.

The final question asked participants to evaluate the statement "I was bored" (a reverse item for interest). The effect of condition was significant, $F(2, 267) = 4.571$, $p = .011$, power ($\alpha = .05$) = .852.

Figure 2

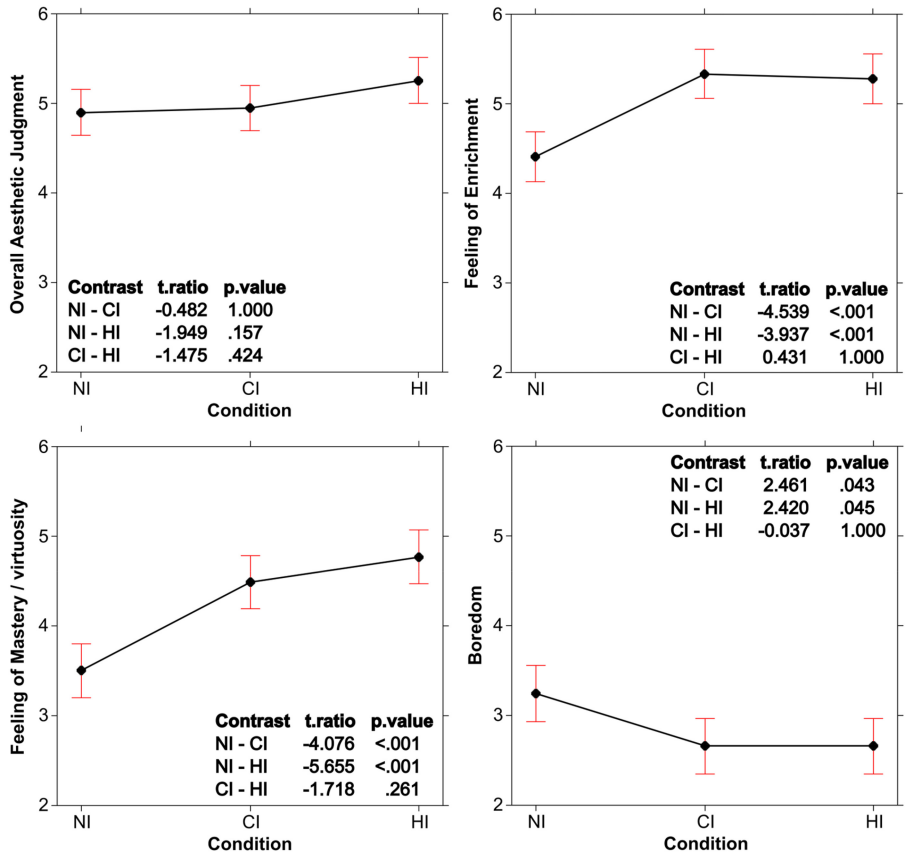
Main Effect of Condition on the Total Scores of Pleasure (Left Panel) and Interest (Right Panel)



Note. The total scores refer to the ratings provided in Section II of the questionnaire (on a Likert scale range: 1–7). Since the main effect of gender was significant for interest, females and males scores are plotted separately in the right panel. In both graphs, error bars represent the 95% confidence interval. NI = no intervention; CI = cognitive intervention; HI = historical intervention. See the online article for the color version of this figure.

Figure 3

Effects of Condition on the Overall Aesthetic Judgment of the Artworks Seen (Top Left Panel), Feeling of Enrichment (Top Right Panel), Feeling of Mastery/Virtuosity (Bottom Left Panel), and Boredom (Bottom Right Panel)



Note. The scores refer to the ratings provided in Section III of the questionnaire (on a Likert scale range: 1–7). In all graphs, error bars represent the 95% confidence interval. NI = no intervention; CI = cognitive intervention; HI = historical intervention. See the online article for the color version of this figure.

The two interventions (CI and HI) were associated with lower ratings of boredom compared to the control condition (NI) (see bottom right panel in Figure 2). Again, no difference between CI and HI emerged, and no significant effect of gender, $F(1, 267) = 0.001$, $p = .996$, or interaction between gender and condition, $F(2, 267) = 0.027$, $p = .973$.

Effect of Individual Differences on the Final Judgments (i.e., Analysis of Section III in Relation to Section I)

We explored the factor structure underlying the set of 35 questions constituting the first part of the questionnaire (Section I) using EFA. The results are reported in Appendix C. The loadings matched the structure of the scales and subscales of the original tests from which the Italian version of the items was derived. We obtained seven factors described in Appendix C. We used these seven factors in the path analyses carried out to explore the effects of individual differences on the responses to the four final questions. Since we started from subscales of standardized tests and the EFA conducted on our data confirmed the same structure, we carried out four path analyses on the total scores.

The resulting plots for each condition (NI, CI, and HI) are displayed in Figures 4–7. For each path analysis, the number of model parameters is eight, and the number of observations is 90 (for NI and HI) or 93 (for CI), resulting in a ratio of 11.625 for NI and HI and 11.250 for CI. Both ratios exceed the recommended minimum of 10:1 (as suggested by Kline, 2016). We verified that the raw correlations do not contradict the reported path coefficients found and described in Figures 4–7 (i.e., on the one hand, we can exclude the presence of suppressor effects, and on the other, whenever there are significant opposite path coefficients, the row correlations are also significantly correlated; the correlation matrices are available in the Supplemental Material SM2 in the online supplemental materials).

Figure 4 displays the seven individual differences factors on the overall aesthetic judgment in the three conditions (NI, CI, and HI). None of the individual factors influenced the rating of this variable in NI and CI conditions. However, two factors were significant in the HI condition: intellectual curiosity (the more a person is a deep thinker and interested in abstract ideas and discussions, the less positive their overall judgment of the artworks) and joyous exploration (enjoying seeking situations to learn and grow was associated with a more positive final evaluation of the artworks).

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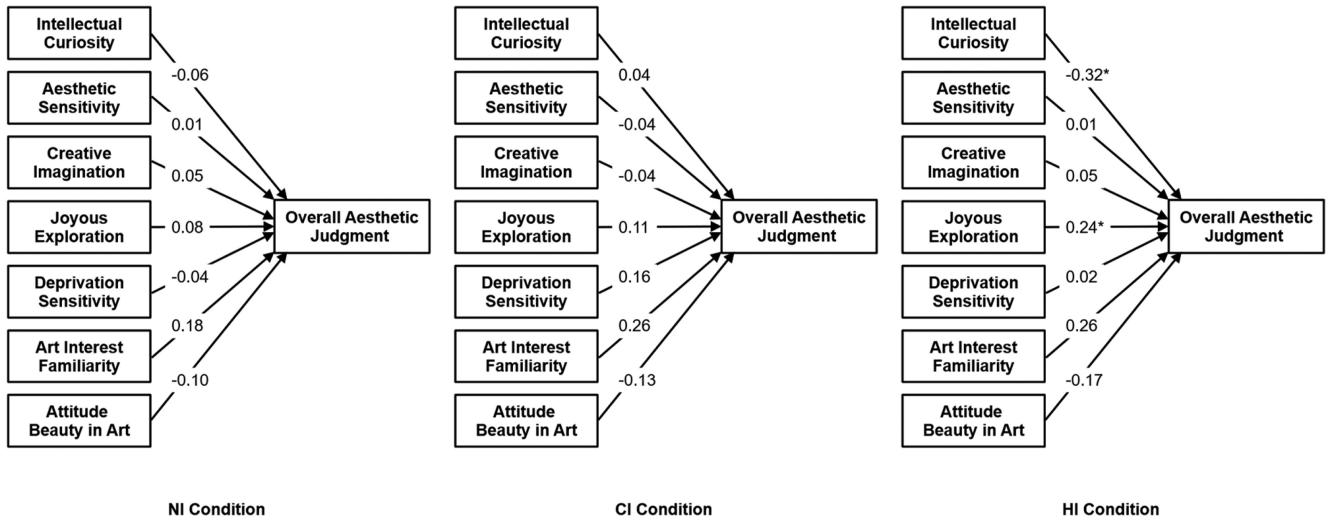
Figure 4

Path Analysis Plot Diagrams Showing the Effect of the Seven Individual Differences Factors on Responses to the Final Question Regarding the Overall Aesthetic Judgment of the Artworks Seen, for Each of the Three Conditions



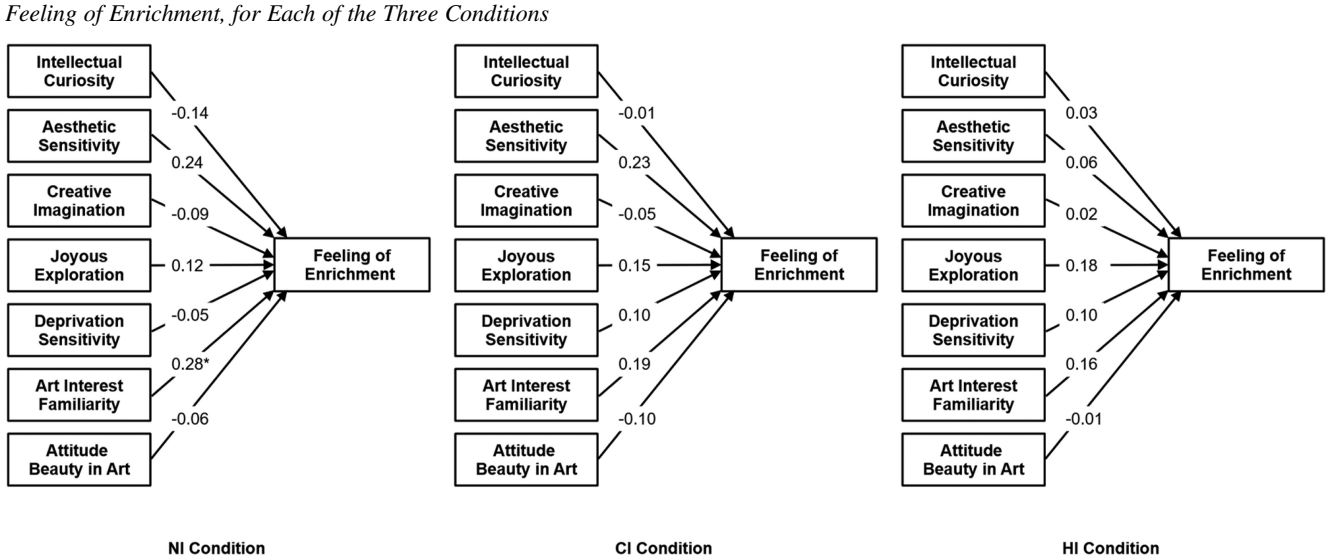
Note. NI = no intervention; CI = cognitive intervention; HI = historical intervention.
* $p < .05$.

Figure 5 shows the effect of the seven individual differences factors on the feeling of enrichment expressed at the end of the experiment. None of the factors influenced the responses from participants in the HI and CI conditions. This indicates that the feelings of enrichment experienced in these two conditions—and that we know were more positive as compared to those experiences in the NI condition (see Figure 2, top right panel)—were independent of any of the individual traits measured in our study. Conversely, in the NI condition, the feeling of enrichment was modulated by participants' interest/familiarity with art. The more familiar and interested in art a participants was, the higher their feeling of enrichment reported at the end of the study.

Figure 6 describes the effect of the seven individual differences factors on participants' evaluation of their feeling of mastery ("I now feel more capable of appreciating this type of artworks"). No effect of individual differences emerged in the CI condition, whereas two factors moderated responses in the other two conditions. In the HI condition, responses were influenced by the same two traits affecting the overall aesthetic judgment of the artworks, that is,

Figure 5

Path Analysis Plot Diagrams Showing the Effect of the Seven Individual Differences Factors on Responses to the Final Question Regarding Feeling of Enrichment, for Each of the Three Conditions



Note. NI = no intervention; CI = cognitive intervention; HI = historical intervention.
* $p < .05$.

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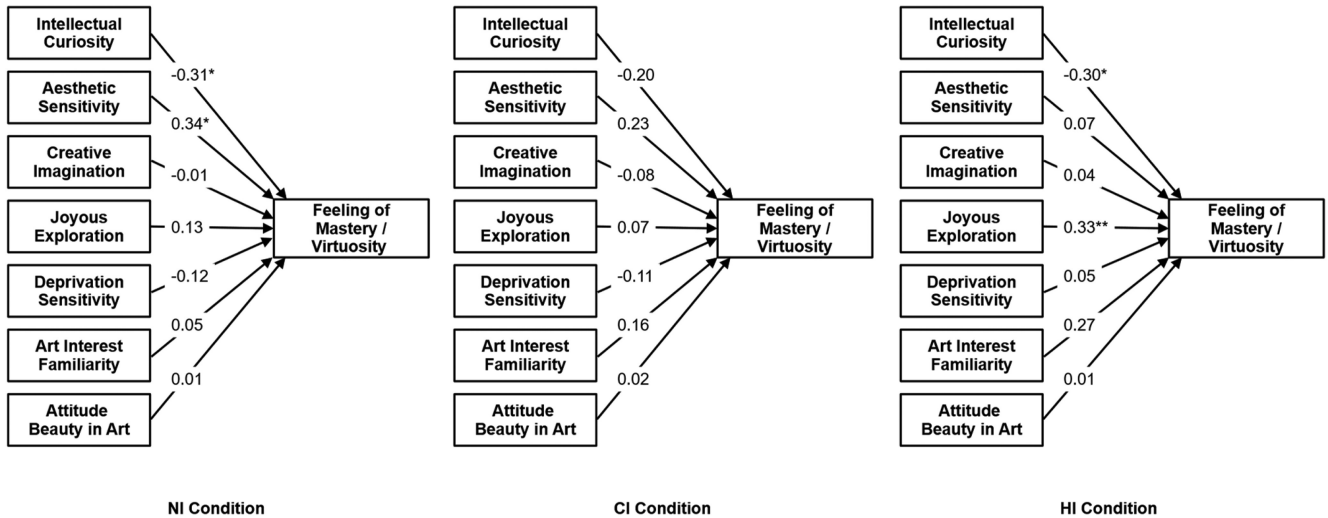
Figure 6

Path Analysis Plot Diagrams Showing the Effect of the Seven Individual Differences Factors on Responses to the Final Question Regarding Feeling Mastery/Virtuosity ("I Feel More Capable of Appreciating This Type of Artworks"), for Each of the Three



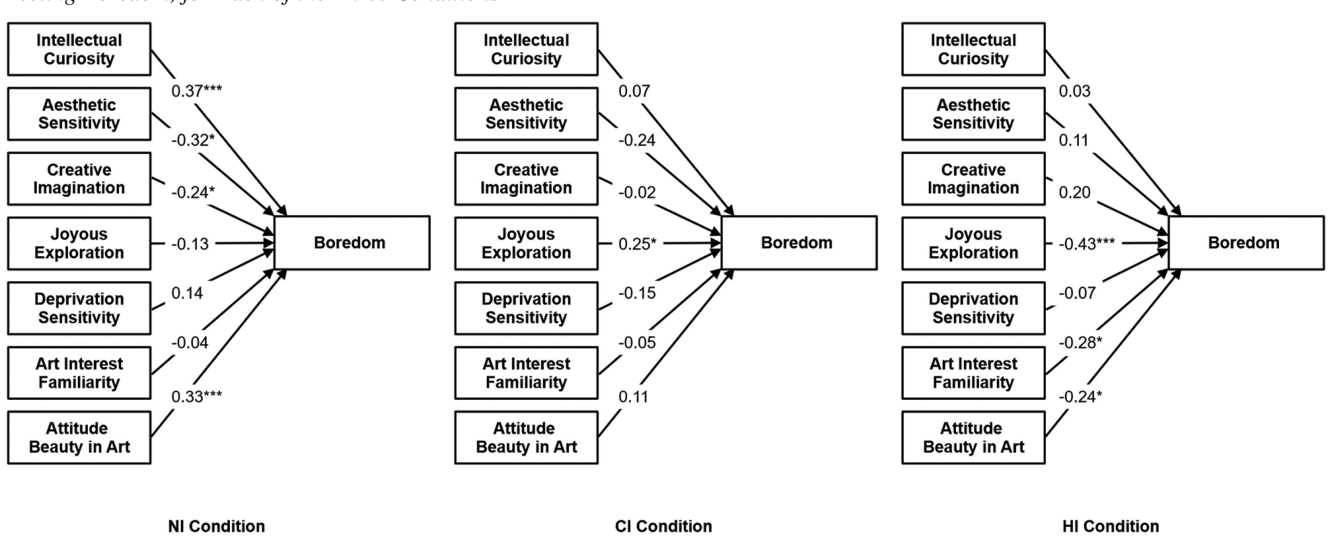
Note. NI = no intervention; CI = cognitive intervention; HI = historical intervention.
* $p < .05$. ** $p < .01$.

intellectual curiosity and joyous exploration and in the same direction (i.e., negative correlation the former, positive correlation the latter). Regarding intellectual curiosity, the more deep and abstract thinkers the participants are, the less they feel their mastery/virtuosity improved at the end of the study. Regarding joyous exploration, the more participants enjoy seeking situations to learn and grow, the more they feel their mastery/virtuosity improved after exposure to the HI. In the absence of any additional information (NI), the final feeling of mastery/virtuosity was modulated by participants' intellectual curiosity, in the same direction just described concerning the HI (i.e., the more deep and abstract thinkers the participants are, the less they feel their mastery/virtuosity improved at the end of the study). The feeling of mastery/virtuosity was also influenced by aesthetic sensitivity because participants with higher sensitivity felt more capable of appreciating this type of artworks at the end of the study.

Figure 7 displays the effect of the seven individual differences factors on the judgment of boredom. Four individual differences turned out to be significant in the NI condition. The feeling of boredom was

Figure 7

Path Analysis Plot Diagrams Showing the Effect of the Seven Individual Differences Factors on Responses to the Final Question Regarding Feeling Boredom, for Each of the Three Conditions



Note. NI = no intervention; CI = cognitive intervention; HI = historical intervention.
* $p < .05$. *** $p < .001$.

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higher for participants with a traditional idea of beauty in art and for those with higher intellectual curiosity (i.e., the deeper and more abstract thinkers). Boredom was also modulated negatively by individuals' aesthetic sensitivity and creative imagination, meaning that higher levels of aesthetic sensitivity and creative imagination were associated with less boredom. Three factors influenced judgments of boredom in the HI condition. All three factors were negatively correlated. The higher the interest/familiarity with the art of the participant and the higher the tension to seek out new experiences and learning (high joyous exploration), the lower the boredom they felt at the end of the study in the HI condition. The other significant factor was the idea of beauty in art: participants exposed to HI were less bored when they had a traditional idea of beauty in art. A possible interpretation of this last result is the following: Participants who are more attuned to a different, more traditional, type of art, may be bored without historical context. They benefitted from being exposed to the HI and felt less boredom thanks to the information they received.

A significant effect of joyous exploration emerged in the CI condition. Participants with more need to seek new experiences reported more boredom at the end of the study as compared to those scoring lower on this trait. This is the only effect of individual differences found in the CI condition in the responses given to the four final questions. In terms of reduction of boredom, the CI condition resulted more beneficial for participants who are not prone to engage alone and seek situations to learn and grow, than for participants who score high in joyous exploration.

The broad picture that emerges from Figures 4–7 is that individual differences had less impact on the final evaluations in the CI condition as compared to the other two conditions. In other words, the intervention that invited participants to consider the artworks from a cognitive perspective—specifically in terms of the artwork "doing the opposite" to default solutions—had a similar effect in terms of interest, experiencing greater feelings of overall enrichment and mastery, and feeling less boredom, as a more traditional HI had (see Figures 2 and 3). However, the effect of CI was more consistent across individuals and less sensitive to individual characteristics (for the seven traits explored in this study). Conversely, exposure to modern and contemporary artworks without any further information other than the artist, title, and year (NI), or in combination with HI produced final judgments that were in part modulated by individual factors although not uniformly across the two conditions. Only the feeling of enrichment experienced at the end of HI was robust to individual differences.

Final Discussion

In our study, people confronted with modern and contemporary art were invited to reflect on the processes involved in the generation of the artwork in terms of thinking in opposites (CI). This intervention was compared to a more traditional approach in which HI was provided. As a baseline, we also had an NI condition. The CI manipulation offers a new interpretation of the connection of any artwork to a preceding domain of art, which Levinson's (1993) historical account identifies as the core feature of the concept of art. The relevance of the historical context of art in studies on empirical aesthetics has led to contrasting results, as discussed in the introductory part (see the Historical Understanding in Art Appreciation section).

Despite commonalities between the CI and HI interventions (i.e., they share a historical perspective, assume an intentional stance, and were expected to positively affect interest), they differ substantially. The cognitive prompt to view the artworks as the result of "thinking in opposites" has the potential to be generalized beyond the specific artworks considered, offering a useful perspective for discovering innovation in any kind of artistic creation that observers might encounter. Conversely, the potential for generalization of the HI is more limited, as it remains constrained to the specific artist or artistic period/movement considered.

Based on the PIA model (Graf & Landwehr, 2015, 2017), we operationalized appreciation as pleasure (i.e., the immediate response of liking) and interest (i.e., evaluation manifesting a second, more thoughtful engagement with the artwork). The study was designed to capture the differences in the effect of the two interventions in terms of pleasure versus interest, as well as in terms of self-perception of feeling enriched, feeling an improved mastery/virtuosity in dealing with the types of artworks used in the study, and feeling boredom. Finally, the study also aimed to explore the differences in the effect of each intervention depending on participants' individual differences.

The results of the study demonstrated that participants exposed to the CI expressed higher interest in the artworks (as measured in Section II of the questionnaire) than participants exposed to the artworks in the NI condition, where only the artist, year, and title of the artwork were provided. Interest ratings were not significantly different for CI and HI, although for HI no significant difference emerged with respect to NI.

CI and NI were also associated with higher ratings of feeling enriched, feeling improved mastery/virtuosity, and less boredom than participants who received no additional information (NI). Regarding these three dependent variables, the two interventions had similar effects. While responses of feeling of enrichment, feeling of mastery/virtuosity, and boredom (as measured in Section III of the questionnaire) were consistent across gender, interest (as measured in Section II) was in general higher for females than males.

Since the effects mentioned thus far concern interest, whereas no significant differences between the CI, HI, and NI conditions were found in terms of pleasure (in Section II and in the overall aesthetic judgment measured in Section III), our results support the distinction between the two levels of aesthetic appreciation outlined in the PIA model (Graf & Landwehr, 2015, 2017). Our findings are also consistent with Pihko et al. (2011), which indicated that background information did not improve "affective" evaluations (which correspond to the pleasure level in the PIA model)—see also van Paasschen et al. (2015).

Another main outcome of our study concerned the effect of the seven individual difference factors considered in the study (intellectual curiosity, aesthetic sensitivity, creative imagination, joyous exploration, deprivation sensitivity, art interest/familiarity, and attitude toward beauty in art) on the final evaluations of the participants at the end of the study. The general result is that participants' final evaluations depended on these factors in both the HI and NI conditions, whereas the effect of the prompt to view the artworks in terms of opposites (CI) was much less influenced by individual differences.

The effects observed in HI and NI are consistent with previous findings on the appreciation of modern art—operationalized as abstract art (Bimler et al., 2019; Mullennix & Robinet, 2018; Swami, 2013; van Paasschen et al., 2015). For participants in the NI condition (i.e., observers "left alone" with the artwork, the name of the artist, the title of the artwork, and the year of creation), the more familiar/interested in art the participants were, the higher

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the feeling of enrichment they experienced at the end of the experiment. Conversely, participants scoring lower in art familiarity/interest reported lower ratings of feeling enrichment. Also feeling their mastery/virtuosity increased at the end of the study depended on individual factors. The participants with higher aesthetic sensitivity felt more enriched than those with low aesthetic sensitivity. The latter, apparently, did not find "enough" in mere exposure to the artworks and the minimal information accompanying it to feel their capability to engage with this type of artworks improved. Participants with high intellectual curiosity also did not find "enough": the more intellectual curiosity they had, the less they felt their mastery/virtuosity improved, suggesting again that mere exposure was insufficient to enhance their capability to engage with this type of art. Four factors also affected participants' final feelings of boredom in the NI condition. The higher the participants' intellectual curiosity, the more they felt bored. The higher their adherence to a traditional idea of beauty in art, the more they felt bored (possibly because of the art genres considered in the study). Conversely, the higher the participants' creative imagination and aesthetic sensitivity, the less they felt bored.

In the HI condition, none of the individual differences influenced the final evaluation of feeling personally enriched after exposure to the artworks and the accompanying historical notes. We know (from Figure 3) that feeling of enrichment was higher for participants exposed to HI for participants in the NI condition. Art curators should feel encouraged to continue providing historical texts with artwork displays, as the final evaluation of feeling enriched was "for all" and not depended on individual factors (at least with respect to the traits explored in this study). However, our results also showed that various factors influenced the other final evaluations in the HI condition. The overall aesthetic judgment was positively associated with joyous exploration and negatively associated with intellectual curiosity. Also feeling more capable of appreciating the types of works seen during the study (i.e., mastery/virtuosity) was positively associated with joyous exploration and negatively associated with intellectual curiosity. Additionally, several factors influenced the final ratings of boredom: participants lower in joyous exploration, familiarity/interest in art, and in having a traditional attitude toward beauty in art felt more boredom after the historical context than participants higher in these traits.

In contrast, all four final ratings were substantially independent of individual differences in the CI condition. The only exception was the effect of joyous exploration on boredom: the more participants enjoyed seeking learning experiences, the more bored they felt after the study. For all other evaluations, the CI intervention produced results that did not systematically vary based on the specific traits of the observers. Since we found that the CI condition increased interest (Figure 2), the result regarding the lack of influence of individual differences is relevant because it indicates that the positive effect is general and not limited to people with particular traits. All these findings are novel since (to our knowledge) no previous study has assessed the effects of offering a cognitive prompt to look at the element of opposition with respect to default ideas/objects in the artworks (CI) until now.

Some of our results in the HI condition conflict with those of Belke et al. (2006), who found that participants with high art expertise preferred paintings for which stylistic information was not provided. The authors noted that stylistic knowledge increased a rewarding feeling for naive participants, whereas, for experts, this information may have felt repetitive, leading them to prefer situations without it. In our study, participants with higher familiarity/interest in art felt less boredom after the HI intervention than those with less familiarity/interest. Notably, however, the information provided to participants in our HI condition was not stylistic. Furthermore, Belke et al. (2006) measured appreciation rather than boredom and did not assess feelings of personal enrichment or mastery/virtuosity, which, in our study, turned out to be independent of art interest/familiarity. All these considerations reaffirm the importance of exploring art appreciation at various levels and from multiple angles, while focusing on and measuring a range of variables.

Our study has some limitations that we acknowledge. One concerns the questions constituting Section I of our questionnaire. Other scales might have been used to assess individual differences rather than those chosen in this article. Following Myszkowski and Zenasni (2016), a complex aesthetic quotient factor should include measures such as sensitivity to complex stimuli and art experience (e.g., the Aesthetic Fluency scale of Smith & Smith, 2006; the Aesthetic Experience Questionnaire of Chatterjee et al., 2010), aesthetic empathy (McCrae, 2007; Silvia & Nusbaum, 2011), and exploration patterns (Nodine et al., 1993). We have been cautious in discussing our results to highlight that our conclusions apply to the seven factors measured in this article. However, it would be valuable for future research to extend the exploration of the sensitivity of the two types of interventions (HI and CI) beyond these seven factors and using other tests and scales.

We finally look at possible future directions to further develop research on the use of "thinking in opposites" to spark interest in contemporary art. One of the potential benefits of the CI that we emphasized in the introduction to the study is the ease of applying the "opposites" lens, once learned, to future occasions of exposure to art. This is, in theory, a significant potential of the strategy. However, whether participants would be able to do so effectively needs to be empirically verified. It would be interesting to assess whether participants trained to apply this viewpoint using a small set of artworks can then autonomously apply it to new artworks. Additionally, it would be intriguing to understand whether this "active search" for opposites could further enhance participant's sense of mastery and the pleasurable experience associated therewith as compared to an intervention like the one used in the present study, where the critical opposites were suggested by the experimenters in the explicatory text. We believe that all these are promising questions for future research to address.

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(*Appendices follow*)

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Appendix A

The Questions Used in the Online Questionnaire, for Each of the Three Sections

Section I: Initial Personality Questions

Genere [Gender] Età [Age]

Qui di seguito trovi una serie di affermazioni. Usa la scala vicina a ciascuna di esse per indicare il tuo grado di accordo/disaccordo con l'affermazione.

fortemente in disaccordo ☐ *in disaccordo* ☐ *un poco in disaccordo* ☐ *né in accordo, né in disaccordo* ☐ *un poco d'accordo* ☐ *d'accordo* ☐ *fortemente in disaccordo*

[Below you will find a series of statements. Use the scale next to each one to indicate the degree of agreement/disagreement with the statement.

strongly disagree ☐ *disagree* ☐ *disagree a little* ☐ *neither agree nor disagree* ☐ *agree a little* ☐ *agree* ☐ *strongly agree*]

[BF_ic 1] - Sono una persona che è incuriosita da molte cose diverse [I am someone who is curious about many different things]

[BF_ic 2] - Sono una persona che evita discussioni intellettuali, filosofiche [I am someone who avoids intellectual, philosophical discussions]

[BF_ic 3] Sono una persona complessa, che riflette molto [I am someone who is complex, a deep thinker]

[BF_ic 4] Sono una persona che si interessa poco di idee astratte [I am someone who has little interest in abstract ideas]

[BF_as 5] Sono una persona che ha pochi interessi artistici [I am someone who has few artistic interests]

[BF_as 6] Sono una persona che è affascinata dall'arte, dalla musica, o dalla letteratura. [I am someone who is fascinated by art, music, or literature]

[BF_as 7] Sono una persona che apprezza l'arte e la bellezza [I am someone who values art and beauty]

[BF_as 8] Sono una persona che pensa che la poesia e le opere teatrali siano noiose [I am someone who thinks poetry and plays are boring]

[BF_ci 9] Sono una persona che è inventiva, trova modi ingegnosi per fare le cose. [I am someone who is inventive, finds clever ways to do things]

[BF_ci 10] Sono una persona che ha poca creatività [I am someone who has little creativity]

[BF_ci 11] Sono una persona che ha difficoltà ad immaginare le cose [I am someone who has difficulty imagining things]

[BF_ci 12] Sono una persona che è originale e propone nuove idee [I am someone who is original, comes up with new ideas]

[CR_je 13] Considero le situazioni impegnative come un'opportunità per crescere e imparare [I view challenging situations as an opportunity to grow and learn

[CR_je 14] Vado alla ricerca di situazioni in cui è probabile che debba riflettere a fondo su qualcosa [I seek out situations where it is likely that I will have to think in depth about something]

[CR_je 15] Mi piace imparare a proposito di argomenti che non mi sono familiari [I enjoy learning about subjects that are unfamiliar to me]

[CR_je 16] Trovo affascinante apprendere nuove informazioni [I find it fascinating to learn new information]

[CR_ds 17] Pensare alle soluzioni di problemi concettuali difficili può tenermi sveglio la notte [Thinking about solutions to difficult conceptual problems can keep me awake at night]

[CR_ds 18] Posso passare ore su un singolo problema perché non riesco proprio a fermarmi finchè non ho trovato la risposta [I can spend hours on a single problem because I just can't rest without knowing the answer]

[CR_ds 19] Mi sento frustrato/a se non riesco a trovare la soluzione a un problema, quindi mi impegno ancora di più per risolverlo [I feel frustrated if I can't figure out the solution to a problem, so I work even harder to solve it]

[CR_ds 20] Lavoro senza sosta a problemi che ritengo debbano essere risolti [I work relentlessly at problems that I feel must be solved]

[S_ai/f 21] Mi piaceva arte quando la studiavo a scuola [I enjoyed art classes in school]

[S_ai/f 22] Mi piace parlare di arte con gli altri [I like to talk about art with others]

[S_ai/f 23] Ho molti amici-conoscenti che sono interessati all'arte [I have many friends/acquaintances that are interested in art]

[S_ai/f 24] Sono interessato/a all'arte [I'm interested in art]

[S_ai/f 25] Vado sempre alla ricerca di nuove impressioni ed esperienze artistiche [I'm always looking for new artistic impressions and experiences]

[S_ai/f 26] Nella vita quotidiana vedo abitualmente oggetti d'arte che mi affascinano [In everyday life I routinely see art objects that fascinate me]

[S_ai/f 27] Vengo da una famiglia interessata all'arte [I come from an art interested family]

[S_ai/f 28] Visito spesso musei e/o gallerie d'arte [I often visit art museums and/or galleries]

[S_ai/f 29] Leggo raramente libri, riviste o cataloghi sull'arte [I rarely read books, magazines or catalogs about art]

[S_ai/f 30] Guardo spesso immagini di opere d'arte (in cataloghi, su internet etc) [I often look at images of artworks (catalogs, internet, etc.)]

[S_ai/f 31] Ascolto raramente conferenze sull'arte o sulla storia dell'arte [I rarely visit talks about art or art history (reverse)]

[S_ab 32] Un'opera d'arte deve essere innanzitutto bella perché mi piaccia [An artwork has to primarily be beautiful for me to like it]

[S_ab 33] Non sopporto le opere d'arte brutte [I cannot stand ugly artworks]

[S_ab 34] L'arte deve essere una rappresentazione esatta del mondo [Art has to be about an exact representation of the world]

[S_ab 35] L'arte deve essere prima di tutto e soprattutto decorativa [Art should first and foremost be decorative]

Section II: Artworks and Related Questions

The following questions were displayed after each artwork, Participants had to look at the artworks, one at a time; in the two experimental conditions, they also had to read the short text beside it. When satisfied with their exploration and understanding of the text, they checked a box "I've read the text, move on," and the following six questions were displayed, each accompanied by the 7-point scale used also in the first section of the questionnaire.

(*Appendices continue*)

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1. Provo piacere nel guardare quest'opera [I take pleasure in looking at this artwork]
2. Trovo quest'opera sgradevole [I find this artwork unpleasant]
3. Quest'opera mi dà una immediata emozione positiva [This artwork gives me an immediate positive emotion]
4. Trovo quest'opera banale [I find this artwork trivial]
5. Quest'opera genera interesse in me [This artwork generates interest in me]
6. L'autore sta cercando di comunicarmi qualcosa, di farmi riflettere [The author is trying to communicate something to me, to make me think]

Section III: Final Questions

1. Il mio giudizio generale sul valore estetico di queste opere è positivo [My overall judgement of the aesthetic value of these artworks is positive]
2. Mi sento arricchito/a personalmente [I feel personally enriched]
3. Sento di essere più capace ora di guardare questo genere di opere [I now feel more able of appreciating this kind of artworks]
4. Mi sono annoiato/a [I was bored]
5. Quante di queste 15 opere avevi già visto? [How many of these artworks had you already seen?] 0–15

Appendix B

The 15 Artworks Used in the Study and the Additional Information Provided

Table B1

List of Artworks Presented in the Study (The Author, Title, and Year of Creation Were Always Presented Below the Image of the Artwork) and the Additional Information Accompanying Them in the CI and HI Conditions

Artworks presented	Additional information
Michelangelo Pistoletto, Dietrofront (1981–1984)	CI: This work by Michelangelo Pistoletto shows us two imposing white female figures. The figures retain the monumental dimensions of classical statuary (they are large, about 6 m high) as well as their material (classical white marble). But while the classical monumental statues show solemn, well-balanced and stable figures, here the position of both is, on the contrary, unstable, funny, and improbable. HI: Michelangelo Pistoletto is associated with the Arte Povera movement in Italy and combines figuration and conceptualism in a very personal way. This work consists of two 6-m tall female figures. Installed in Florence, a city of famous colossal works (such as Michelangelo's David), the work draws on the canons of statuary, but in an unconventional way, raising questions about the monumentality, commemorative aspect, and orientation of the work. The viewer is faced with the challenge of figuring out where to stand to look at it, and also of understanding how the standing figure can support the horizontal one.
Piero Manzoni, Socle du mond (1961)	CI: A base (or plinth) is typically what is underneath and supports the object you want to exhibit, which you put on display above it. But if the object you want to exhibit is the World (not a representation of it, but just the World) you cannot move it to put it "on top" of the plinth. And so, Pietro Manzoni suggests to us, it is the plinth that must be put on the contrary, on its head, and at that point the World that is below it, in a reference system relative to the base, is in the right place, that is, right "above" it. HI: This work by Piero Manzoni is a typically playful work, in which the artist reflects on the way sculpture is traditionally presented on a pedestal, prepared for display to the viewer. The artist turns the base upside down, inviting us to imagine the World as our work of art. This is typical of his conceptualism. The artist works not so much on manipulating visual elements as on asking us to rethink the very mode of artistic appreciation we typically engage in.
Claes Oldenburg, Stamp (1991)	CI: A stamp is an object characterized by being small and light, and because of this smallness and lightness, it lends itself to being handled. In this work by Claes Oldenburg, all the structural features of the original object are preserved, but it is transformed on the contrary into a huge, heavy object, heavy enough to be driven into the ground. The object is well recognizable as a stamp but, magnified, it is no longer the usual stamp and is impossible to use-it really becomes something else. HI: This work by Claes Oldenburg is one of several works by the artist in which everyday objects are enlarged beyond measure, transformed into playful visual elements. The objects chosen are usually common objects—such as a spoon, a clothespin, a saw—not worthy of special attention. By enlarging a stamp, the viewer is invited to consider its unfamiliar form and magnify its value, making it into a sculptural object. But at the same time, thus magnified, the stamp loses its function, and the work thus invites us to imagine a new use for it, in this new grand scale.
Meret Oppenheim, Object (1936)	CI: Cup and teaspoon are quintessential smooth objects: coffee slides down the walls of the cup as you pour it and then as you sip it, just as it slides off the teaspoon after you turn it; in the mouth, the smoothness of the cup and teaspoon are pleasing. The typical clinking of the teaspoon while mixing in the sugar tells of the hardness of the ceramic and metal. In this work by Meret Oppenheim, smoothness and hardness are replaced with their opposite: the hair is soft—pleasant to the touch of the hand, but not in the mouth—and the liquid does not slip, but penetrates and the hair soaks in. HI: Meret Oppenheim is related—though not closely—to the Surrealists, who liked to imagine objects in absurd contexts, revealing their obscure associations and hidden connections. In 1936/1937, the artist put two women's shoes upside down and tied them together like a chicken, creating a new shoe-bird. The work we are looking at now is also a simple work: a teacup, a saucer, and a teaspoon, but the objects are covered with gazelle fur. This is a simple transposition (one material for another), but it transforms the function of the object.

(*Appendices continue*)

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Table B1 (*continued*)

Artworks presented	Additional information
Manfredo Massironi, Struttura a quadrati ruotati (1964)	CI: This work by Manfredo Massironi is made exclusively of squares, progressively increasing in size and rotated by a defined angle. Only the first two small squares at the origin of each of the four rotating series are recognizable; all the others are impossible to see, they are masked. What we see, on the contrary, are broad curves and fans (four large central fans and eight other smaller fans) that are not physically present, however. There is no curved line in the work. The curves are generated only by the perceptual fusion of each of the edges of the squares. HI: Manfredo Massironi was a member of Gruppo N, a group that, along with others that arose in Italy and Europe around the 1960s, hooked artistic research to the study of the laws of perception. With this in mind, the artist developed visual research focusing on the perceived structure of the object, contrasting the cult of the unique personality of the artist and "his" creation with the creation of objects and environments that actively involve observers, starting from the idea that the structure of the object seen is seen by everyone in the same way. This work also shows well how the theme is really the visual structure of the object. If we look at it carefully, we realize that every curve we see is actually not a curved line. The curved shapes that appear to our eyes are a structure (a "whole") that is formed from "parts" that are squares (one inside the other, rotated).
Max Bill, Konstruction aus einem Kreisring (1942/1944)	CI: It is easy to realize, looking at this work by Max Bill, that we are dealing with a unitary object (a ring) cut in half. The shape of the ring, flared on the inside, brings attention to what would be its center. Exactly at the point where the center of the ring would have come (if the ring had been shown whole) the work makes us find another point: the point of contact between the two halves. It is a point that instead of being maximally internal (as the center of the ring would be) is, on the contrary, an external point, and instead of being a stable point (as the center of the ring would be) it is an unstable point—the half above stands up almost by a miracle. The importance of that point in the space where the center would be remains, but its characteristics are now all contrary. HI: Max Bill was a Swiss architect and graphic designer. He used severe geometry in his works, revealing the beauty and latent power of simple forms. In this work, he presents two halves of a ring together, with their outer parts in contact, positioned between them at a certain angle. By juxtaposing the two forms, the artist invites the viewer to reflect on the ring and its structure.
Claes Oldenburg, Soft Viola (2002)	CI: The viola is a solid, rigid, heavy instrument. Its sound box—hollow—has a well-defined shape, its strings are taut. Sound is produced because of this solidity and tension. The work shown here by Claes Oldenburg still shows a viola, its shape is clearly recognizable, it even retains its colors, and it is visibly hollow as is the viola we know. But in contrast to the viola we know, this one is soft, floppy. HI: Claes Oldenburg's early works include so-called "soft sculptures," which represent solid objects created from soft materials. The result is that these objects (a kitchen mixer, a light switch, a car, a typewriter, or as in this case, a viola) take on a droopy appearance. This way of treating objects makes them impossible to use and causes us to reconsider their functionality in this new guise of "ineffectiveness."
Gerrit Thomas Rietveld, Steltman Chair (1963)	CI: It has been said of the artist and designer Gerrit Rietveld that he interpreted the idea of a chair as if none had ever existed before. Indeed, in this work, we find many canons that constitute our standard idea of a chair violated. The chair generally has a symmetrical shape with respect to a central vertical axis (the left and right sides of the chair are mirrored); it has a backrest and two armrests (if it has them); it has four legs, generally straight or slightly curved, symmetrical and equidistant from each other, each with its own point of support on the ground. This chair, on the contrary, is strongly asymmetrical: it has the armrest on one side only; the legs are all straight, yes, but each one different from the other; and behind it there is actually only one leg but a double point of support (it is as if the left leg were missing and only its point of support remained). HI: Gerrit Rietvelt was a designer and architect who belonged to the De Stijl movement (along with Piet Mondrian, to mention a better-known name). In all his creations, one observes a careful scanning of geometrically exact planes, an orthogonal interweaving of lines and surfaces, and the absence of decorative elements that would distract the eye from the clean structure of planes and lines that is the architecture of each of his works. This absolute rationality and formal purity is also found in the work we are observing. Moving within a strict geometry of straight planes and lines, the artist succeeds here in creating a chair with somewhat disconcerting overall effect. The asymmetry of this chair is remarkable, from the arms to the legs. And it is a striking asymmetry in the sense that the chair produces a different image from every angle you look at it.
Renato Bertelli, Profilo continuo (1933)	CI: Central to the depiction in profile is the idea of line: the line that draws the shape of the forehead, nose, mouth, and chin. The face in profile has little depth or is even flat, as in Egyptian art. In this work by Renato Bertelli, the profile becomes, on the contrary, an all-round form: it remains profile because what stands out clearly from the background is precisely the typical line of the profile (forehead, nose, mouth, and chin); indeed, the profile information is doubled because the same profile is shown twice, left and right. But instead of being line, the profile becomes surface, surface of the whole volume. HI: Renato Bertelli thought of this work as an original version of a portrait of Benito Mussolini. His idea was to take the clearly recognizable profile of the fascist leader and sculpt him all around. Imagining a 360-degree turning head gives the work movement. However, as continuous movements become static, the work itself becomes simply an object that, from whatever direction you look at it, shows two profiles.
Ursus Wehrli, The art of clean up (2013)	CI: A bowl of soup, as we know it, with the pieces of noodles naturally disordered in the broth, is rethought by the artist Ursus Wehrli and becomes, on the contrary, an extremely neat object. The noodle pieces are all lined up, and the carrot pieces, in the bottom row, are neat as well. But while the disorder invited dipping of the spoon and eating the soup, this order paralyzes us: the soup becomes an object to be contemplated. HI: Swiss artist Ursus Wehrli is known for a series of art projects that appear to be mocking interventions to create order in life. Each of his interventions does indeed create order, but in doing so he subverts the practical purpose of the object. A sandbox is all organized by the artist, thus undoing the fun mess that attracts children and invites them to play. Chinese letters are broken down and rearranged into similar shapes, thus making communication impossible. In the work shown here, soup has been organized into rows of noodles and bits of carrot. But now it can no longer be eaten.

(*Appendices continue*)

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Table B1 (*continued*)

Artworks presented	Additional information
Albert György, Melancholia (2012)	CI: In this sculpture by Albert György, the person is sitting in a reflective pose, looking inward. To look inside means to turn to the fullest part of oneself. Here, on the contrary, the person instead of fullness finds emptiness, and the gaze that should turn to the "inside" of oneself, finds itself instead looking "outside." Inside there is nothing. HI: Throughout the 20th century sculptors experimented with making recognizable human figures with minimal elements. This is what Albert György also does in this work, to emotional effect. No rule says that the human figure must be represented with full forms, so the artist dispenses with this constraint and makes a torso that is in fact held up by the arms. But the figure, who looks depressed, in looking down forces us to a powerful conclusion: she is actually looking through herself, and the emptiness born of artistic necessity is now a metaphor for her inner emptiness, the source of her melancholy.
Tony Cragg, Self-portrait on a chair (1980)	CI: Contained in the idea of self-portrait is the idea of recognizability: the self-portrait artist shows his face, his features. The pose, in the self-portrait, is usually composed and in fact with the words "self-portrait in a chair" we expect to see the artist sitting in a chair. Here, on the contrary, Tony Cragg shows us the person standing on the chair (not sitting) and the posture is anything but posed (he soars upward almost mimicking the Statue of Liberty). In addition, the facial features are not recognizable: there is no specific identity that the face and body reveal. HI: This work by Tony Cragg takes the form of a life-size "self-portrait" of a figure standing on a chair, leaning upward. Reading the title, one wonders why the artist would have himself portrayed this way on a chair. Approaching the portrait, we notice that it is composed of dozens of common plastic objects, chosen for their shape and color and creatively juxtaposed. The objects go to form a common texture that satisfies us, at least to a certain extent, as a means of representing the figure. We are invited to move closer and farther apart, enjoying the making and unmaking of the illusion.
Robert Raushenberg, Erased de Kooning drawing (1953)	CI: When we think of a painting we think of color put by an artist on a surface (a blank canvas, a board, a sheet of paper) to generate shapes and figures that did not exist before, that the artist created. This work by Robert Rauschenberg, on the contrary, consists of erasing a painting by a famous artist that was there before. The author spent his time patiently and painstakingly removing an artist's painting instead of producing his own. HI: Robert Rauschenberg made this work early in his career. For all intents and purposes, the artist presents a nonwork to the public because he took the work of another artist he esteemed (Willem de Kooning) and proceeded to erase it. The work consists of one artist's intentional act of erasing another artist's work, making us think of both the lost work and the audacity of the act of the artist whose work consists of destroying another work.
Manfredo Massironi, Sfera negativa (1964/2007)	CI: If we think of a sphere, we think of a volume, defined by a surface—also spherical—formed by the set of points that are equidistant from the center (we can think of the surface as generated by the rotation of the radius of the sphere around its center or the union of the endpoints of all the radii of the sphere). Here, on the contrary, the sphere that Manfredo Massironi places before our eyes is a void, an immaterial volume, and is not defined by any spherical surface. The lines that form the surface are all external (not internal like the rays) and none of them are curvilinear: they are all straight lines. HI: In psychology, it is known that we can perceive an object even when it does not physically exist. In this work Manfredo Massironi plays precisely with this idea. Through the collective action of a series of external inducers, the sphere stands out prominently in the center. It is not a sphere that exists materially, a sphere produced through actual tracing by the artist, or by shaping some material substance, but a "negative" sphere, a volume produced by induction from the outside.
Michelangelo Pistoletto, I visitatori (1968)	CI: Mirrors catch the action in the moment of its unfolding: the reflection is an ever-updated image of the person being mirrored, moving, and watching. And indeed Michelangelo Pistoletto's work confronts us with a scene that seems to be unfolding in real time in a museum: two visitors in front of a painting hanging on the wall, she visually exploring it, he looking in a pamphlet for information about the work. But on the contrary, the two visitors are printed in the mirror. They will not move in the course of the observation, they will not change positions talking to each other, nor will they leave the room, as the other real visitors will. They are stuck, motionless, on the surface of the mirror. HI: In this work, Michelangelo Pistoletto finds a way to bring his art permanently into the interactive space of viewers. By painting two life-size viewers on the surface of a mirror, which optically extends the gallery space within which a museum visitor comes to find himself, the artist makes the two figures automatically place themselves in the middle of that space and become fellow visitors. The flat surface of the mirror opens and their act of looking and reading seems directed to a virtual gallery, which is actually the real gallery that is in front of the mirror. The two visitors come alive in each act of looking at them, living only in the "here and now" gazes of the observers.

Note. CI = cognitive intervention; HI = historical intervention.

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(*Appendices continue*)

Appendix C

Exploratory Factor Analyses Performed to Explore the Factor Structure Underlying the Set of 35 Questions Constituting the First Part of the Questionnaire

We performed the EFA analyses after having reversed the ratings of the reverse items.

Seven factors emerged (see Table C1) which are consistent with the facets of the three questionnaires from which the subset of items used in the present study were taken.

The three EFAs yield the following results:

1. Three-factor structure with reference to the 12 items measuring open-mindedness according to the Big-Five Inventory 2 (Soto & John, 2017; the factor loadings ranged from .781 to .468 for intellectual curiosity, from .897 to .408 for aesthetic sensitivity, and from .959 to .542 for creative imagination).
2. Two-factor structure with reference to the eight items forming the first two subscales of the Five-Dimensional Curiosity Scale Revised (5DCR; Kashdan et al., 2020; the factor loadings ranged from .857 to .490 for joyous exploration and from .956 to .636 for deprivation sensitivity).
3. Two-factor structure with reference to the 15 items referred to Specker et al. (2020); the factor loadings ranged from .826 to .439 for art interest/familiarity and from .751 to .479 for beauty in art.

Table C1

The Seven Factors Emerged From the EFA Carried Out on the Questions Forming Section I of the Questionnaire

Reference test	Factors (EFA)	Items	Reliability
Big-Five Inventory 2 (Soto & John, 2017)	Intellectual curiosity	BF_ic 1, BF_ic 2, BF_ic 3, BF_ic 4	Cronbach's $\alpha = .745$; McDonald's $\omega = .760$
	Aesthetic sensitivity	BF_as 5, BF_as 6, BF_as 7, BF_as 8	Cronbach's $\alpha = .840$; McDonald's $\omega = .855$
	Creative imagination	BF_ci 9, BF_ci 10, BF_ci 11, BF_ci 12	Cronbach's $\alpha = .792$; McDonald's $\omega = .799$
Five-Dimensional Curiosity Scale Revised (5DCR) (Kashdan et al., 2020)	Joyous exploration	CR_je 13, CR_je 14, CR_je 15, CR_je 16	Cronbach's $\alpha = .728$; McDonald's $\omega = .749$
	Deprivation sensitivity	CR_ds 17, CR_ds 18, CR_ds 19, CR_ds 20	Cronbach's $\alpha = .818$; McDonald's $\omega = .830$
Art Interest (Specker et al., 2020)	Art interest/familiarity	S_ai/f 21, S_ai/f 22, S_ai/f 23, S_ai/f 24, S_ai/f 25, S_ai/f 26, S_ai/f 27, S_ai/f 28, S_ai/f 29, S_ai/f 30, S_ai/f 31	Cronbach's $\alpha = .876$; McDonald's $\omega = .885$
	Beauty in art	S_ab 32, S_ab 33, S_ab 34, S_ab 35	Cronbach's $\alpha = .719$; McDonald's $\omega = .725$

Note. The acronyms in Column III refer to the item names as indicated in Appendix A. EFA = exploratory factor analysis.

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