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ARTICLE

The well-being benefits of virtual art galleries: Examining the roles of emotion, immersion, and individual differences

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Abstract: A wealth of research suggests that engaging with visual art and visiting art museums is beneficial to flourishing; however, less is known about the potential benefits of digital forms of engagement. An emerging literature provides preliminary evidence of the benefits of digital art engagement, but additional research on mechanisms and potential moderators of the benefits is necessary. The present study examines the impacts of repeated visitation to a virtual art gallery to address three questions: 1) Do well-being, emotion, and immersion differ between those in a digital art gallery versus those reading about art?; 2) Do personality and interest in art influence virtual art gallery visit qualities (i.e., emotion and immersion)?; and 3) Do visit qualities and individual differences predict well-being? A sample of 890 U.S. adults was recruited from Prolific. The findings suggest that: 1) People in a virtual gallery show greater well-being, immersion, and aesthetic emotion than those reading about art; 2) Openness to experience is most strongly linked with visit qualities; and 3) Immersion, positive and aesthetic emotion, extraversion, and neuroticism are associated with well-being. This work suggests that repeated engagement with art in a digital format has benefits and that future research should continue to examine the underlying mechanisms and ways digital art experiences can be best designed to be effective well-being interventions.

Keywords: art; emotion; well-being; flourishing; personality; art interest; virtual art

1. Introduction

Our flourishing can be influenced by many factors (see VanderWeele, 2017), such as our beliefs about the world (Clifton, 2020; Clifton et al., 2019), our personality (Anglim et al., 2020), and how we spend our leisure time (Appelqvist-Schmidlechner et al., 2023; Dodge et al., 2022; Hutchinson & Kleiber, 2023). One method of enhancing flourishing that has increasingly been gaining attention is engagement with the arts. One particular form of arts engagement—viewing visual art—has been associated with a range of flourishing benefits (see Cotter & Pawelski, 2022). In the present research, we examine how repeated engagement with visual art in a virtual gallery environment is related to overall flourishing and emotional well-being and the role immersion in the experience plays in this relationship.

Arts engagement across a variety of domains is a frequent leisure activity for a wide range of people (Fancourt & Finn, 2019; Weziak-Bialowolska et al., 2019). Given people's widespread engagement with the arts, it's unsurprising that a number of researchers have sought to examine the flourishing impacts of the arts (see Fancourt & Finn, 2019; Pesata et al., 2022 for review), with

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research suggesting benefits to a range of psychological, social, and physical outcomes. Greater engagement with the arts has been associated with greater subjective health (Cuypers et al., 2012; Wilkinson et al., 2007), less loneliness (Tymoszuk et al., 2020), and reduced risk of developing mental health conditions, such as depression, anxiety, or dementia (Cuypers et al., 2012; Fancourt & Steptoe, 2019; Fancourt et al., 2018; Fancourt & Tymoszuk, 2018).

As research about the benefits of arts engagement continues to proliferate, there has been particular interest in visual art engagement. A recent review found that research has consistently linked visiting art museums with benefits to physical and mental health, subjective health and well-being, emotional well-being, and social connection (see Cotter & Pawelski, 2022 for review). Specifically, research has found that viewing visual art is related to decreases in stress levels (Law et al., 2021), cortisol concentration (Clow & Fredhoi, 2006), and blood pressure (Mastandrea et al., 2019) as well as increases in subjective well-being (Wheatley & Bickerton, 2017). For older adults in particular, research suggests that art museum visitation is related to greater emotional well-being (Herron & Jamieson, 2020; Thomson et al., 2018) and quality of life (D'Cunha et al., 2019; Schall et al., 2018), as well as to lower loneliness and social isolation (Flatt et al., 2015; Schall et al., 2018). These findings indicate that engaging with visual art is important for flourishing throughout the lifespan.

A recent evolution of research has begun to consider the flourishing implications of digital engagement with visual art. Given the rise of digital art offerings and their widespread accessibility, it is important to understand the impacts of this form of art engagement. Unsurprisingly, research has found that digital art viewing is able to influence people's emotions, including reducing negative emotion (Cotter et al., in press; Trupp et al., 2022, 2023) and increasing positive emotion (Cotter et al., in press; Igdalova & Chamberlain, in press). Further, digital art engagement has been of interest within populations that may have difficulty physically going to an art museum (e.g., individuals with dementia, Tyack et al., 2017; older adults, Averbach & Monin, 2022, Murphy et al., 2021), with promising initial results.

It is important to note, however, the limitations of much of the existing evidence arguing for the flourishing benefits of engagement with the arts. Two recent critiques of the field (Clift et al., 2021; Skov & Nadal, 2023) note that recent reviews of the field do not properly contextualize limitations of the evidence base and, perhaps, overstate the robustness of research supporting the broad claims of arts engagement being beneficial to health. Specifically, they note that much of this research does not use robust designs allowing for confidence in causal links (e.g., lacking random assignment, no meaningful non-art control group, small sample sizes) and often lump together distinct forms of arts engagement (i.e., discussing "music-making" when studies focus on a range of behaviors such in-depth, high-level training vs. participating in a drumming exercise) and ignore the nuanced differences between different forms of art engagement. Further, Skov and Nadal (2023) note a lack of examination of mechanisms through which art engagement is to impact flourishing outcomes. These points identify the need for increased refinement in methods used to examine such questions and the need for specific theoretical grounding in which to base future work.

An emerging perspective and orientation toward the connection between the arts and flourishing is the new interdisciplinary field of the Positive Humanities (Pawelski, 2022). Within this field, a conceptual framework identifies five psychological mechanisms that may underlie the relationship between arts engagement and flourishing: Reflection, Acquisition, Immersion, Socialization, and Expression (RAISE; Shim et al., 2019; Tay et al., 2018; Thapa et al., 2023). Within the present work, we focus on the mechanism of immersion. In the RAISE model, immersion is defined as bringing a person into direct and immediate involvement with the arts and humanities

that enables them to be carried away and disconnected from the worries of everyday life, with specific qualities of not feeling the passage of time and finding the engagement as effortless with the loss of self-consciousness (Thapa et al., 2023). For example, experiences of flow (Csikszentmihalyi, 1990) would be considered as one way in which someone may become immersed during artistic engagement (Tay et al., 2018). It is important to note that immersion is also regarded as a first step in engaging the other mechanisms of the RAISE model as without the focused attention directed at the artistic experience it is unlikely that other impactful processes would be meaningfully engaged (Tay et al., 2018). Thus, by immersing themself first, the person obtains the fundamental key to engaging with the arts and humanities in a meaningful way that may augment their well-being through other psychological mechanisms.

Although discussion of the connection between viewing art, flow, and immersion began many years ago (e.g., Csikszentmihalyi & Robinson, 1990), research is beginning to empirically examine the role of immersion in arts experiences. For example, several scales of aesthetic experience include subscales or items around immersion and flow-like experiences (e.g., Silvia & Nusbaum, 2011; Wanzer et al., 2020) to capture individual differences in propensity to experience these states during aesthetic experiences. More recently, two studies have examined people's immersion during virtual art viewing. Both studies found that people were able to become immersed in virtual art galleries and that the level of immersion was related to a range of outcomes (Cotter et al., 2022, in press). Following a 15-minute visit to a gallery with 8 artworks, people who had greater immersion showed increases in overall well-being, self-acceptance, positive emotion, and aesthetic emotion (Cotter et al., in press). People who experienced greater immersion across 4 virtual gallery visits showed higher engagement, meaning, and autonomy one week following the final gallery visit (Cotter et al., 2022). These studies show promising evidence for the role of immersion in shaping the impact of art viewing, but more research is necessary.

In addition to examining potential mechanisms important to the relationship between art engagement and flourishing, research must also consider individual differences that may serve to moderate this relationship. A natural place to start is the consideration of art expertise and interest (Specker et al., 2020). Several studies have demonstrated the significant influence of expertise on engagement with visual art (Kozbelt, 2020). For instance, experienced artists perceive more information from paintings and show different eye scan paths than art novices (Koide et al., 2015) while greater expertise is related to greater perceived understanding of artworks (Mullennix & Robinet, 2018). Research examining the flourishing of artists has found that visual artists report experiencing symptoms of depression and high levels of stress (Daily et al., 2021) and that less desirable personality characteristics (e.g., neuroticism, low agreeableness) may be particularly important for visual artist flourishing (Chen et al., 2020). If we consider art expertise as multi-faceted (e.g., knowledge or training in art, interest in art; Specker et al., 2020), however, we may see differing relations with flourishing. Although those with training in art or being professional artists may exhibit lower flourishing, behaviors indicative of art interest, a different component of art expertise (Specker et al., 2020), such as visit art institutions have been associated with greater flourishing (e.g., Fancourt et al., 2018; Konlaan et al., 2000). Here we focus on the art interest aspect of expertise as an exploratory factor in this study.

A second set of individual differences worthy of consideration is viewers' personality traits. Personality traits have relevance both for people's engagement with visual art (Swami & Furnham, 2020) and for their flourishing (Anglim et al., 2020). Openness to experience has been most consistently linked with visual art engagement, with greater openness associated with more visual exploration of artworks (Palumbo et al., 2023), art preferences (Chamorro-Premuzic et al.,

2010; Ercegovac et al., 2015; Krajewska & Waligorska, 2015), and having mixed emotional experiences (Barford et al., 2018; Rodriguez et al., 2021). Personality associations with flourishing in general have been more wide-ranging. A recent meta-analysis by Anglim and colleagues (2020) examined the associations between personality traits from a variety of measures and dimensions of subjective and psychological well-being. They found that, overall, neuroticism and extraversion were most strongly associated with levels of well-being, with greater neuroticism associated with lower well-being and extraversion associated with greater well-being. Further, other personality traits were often more closely related with specific facets of well-being (e.g., openness to experience positively related to positive growth, conscientiousness positively related to purpose in life), aligning well with the characteristics of each trait (Anglim et al., 2020). Because personality traits have implications for how people engage with art and their flourishing, we include assessments of the Big 5 traits for exploratory analyses.

1.1 Present research

The recent surge of research examining the connections between art engagement and flourishing is important, but this work has included limitations in its conceptualization and methodological rigor. In this study we sought to expand this literature as well as address its limitations through recruitment of a large sample, the inclusion of a non-art control condition for comparison, and the examination of a theoretically meaningful mechanism underlying the relationship between art engagement and well-being.

In the present research, we completed a short longitudinal study across 4 weeks to examine changes in well-being in response to repeated visual art viewing in a virtual context with a comparison condition in which people read about, but did not view, visual art. We examined two primary outcomes of the art engagement—overall well-being and emotional responses to the engagement—and considered how immersion during art engagement, personality, and interest in visual art related to these outcomes.

This project had three aims. First, we sought to examine differences in well-being, emotion, and immersion for people completing a virtual art gallery visit versus a control condition involving reading about art. This control was designed to provide art historical information, and thus still a form of art engagement, but to be less immersive than a virtual gallery visit based on the conceptualization in the RAISE mechanism model (Tay et al., 2018). Further the inclusion of such a condition addresses critiques of art and well-being research lacking meaningful control conditions to art engagement (Skov & Nadal, 2023).

Second, we aimed to determine the relationships between visit qualities (i.e., immersion, emotion) and individual differences (i.e., personality, interest in visual art) when engaged in a virtual gallery visit. Research has yet to widely examine whether certain individual differences (e.g., personality, art expertise) are associated with propensity to experience immersion during art. Theoretical work suggests person-specific factors may be more closely linked with the likelihood of being immersed in art experiences; however, this theoretical work does not propose specific individual differences for examination (Tay et al., 2018).

Finally, we investigated how visit qualities and individual differences predict well-being derived from virtual art gallery visits. Such examination is important to understand who is more or less likely to benefit from these forms of art engagement and how individual differences can shape both the observed outcomes of art engagement as well as how they are related to the mechanisms through which art engagement is proposed to impact well-being. Underlying these aims was a further interest in how these relationships may change across multiple sessions. Given the relatively few studies that have examined changes over time in these factors in association

with art engagement, we consider this project to be exploratory and do not have specific hypotheses for these aims.

2. Method

2.1 Participants and procedure

Using Prolific's representative sampling function, a sample of 2,000 participants from the United States enrolled in a screening study to verify compatibility with the virtual gallery system on their personal computers and to verify they were able to successfully navigate the gallery. Of these participants, 1,441 were invited to enroll in the main study[1] with an enrollment limit of 1,200 participants. The final sample included 890 participants (see below for exclusion details). The final sample was, on average, middle-aged (M = 46.91, SD = 14.83, *range* = 18-79). The sample identified primarily as White (78.8%, Black: 12.8%, Asian: 6.6%, Hispanic or Latino: 5.3%, American Indian: 1.6%, Middle Eastern: 0.7%, Other: 0.8%[2]) with approximately an equal split of female and male participants (Female: 51.1%, Male: 47.4%, Other: 1.5%).

The study took place via five weekly research sessions (see Figure 1, below). In the first week, participants completed a baseline well-being measure and individual differences measures. Participants then completed an art engagement experience. Some participants (n = 100) read a brief article about topics related to visual art and art history (est. reading time 15 minutes; see https://osf.io/4n75g/ for full materials) and answered three multiple choice questions to test their understanding. This control was selected to ensure all participants were engaged with the domain of visual art but not all participants engaged with visual art stimuli. The remaining participants (n = 790) completed a 15-minute visit to a virtual art gallery[3]. Following their art experience, participants completed questions about their experience—in weeks 2-4 participants completed similar art engagements and assessments. In the final week, participants completed post-test measures not relevant for the present analyses. Participants were paid $5 for completing each session and an additional $5 if they completed all 5 sessions.

In order to be included in the final sample, participants in the control condition must have successfully completed three of the four weekly reading sessions via correctly answering at least two of three multiple-choice questions about the reading. Participants in the gallery condition must have successfully completed three of the four weekly gallery sessions by spending a minimum of 10 minutes within the virtual gallery engaging with the art.[4]

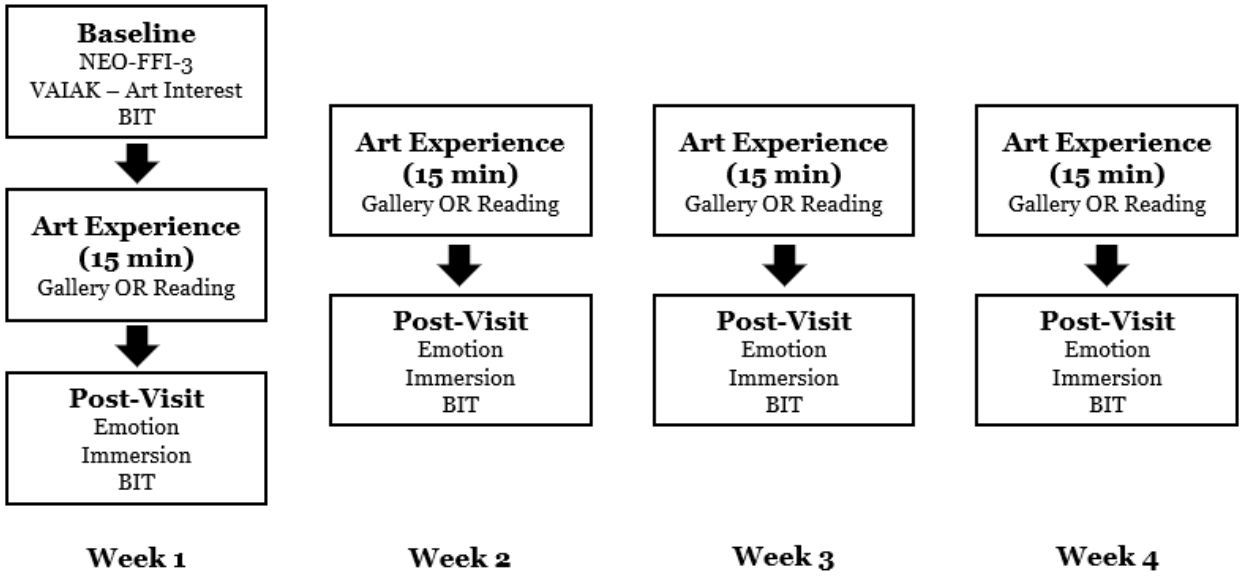
[1] Participants were invited to the full study if in the screening study they entered the gallery in full screen, navigated in the gallery for 90 s and entered both gallery rooms.

[2] Please note that participants were able to indicate belonging to more than one racial or ethnic group.

[3] Participants in the virtual art gallery group were originally randomly assigned to conditions designed to produce differing levels of immersion in the visit; however, these manipulations were not successful in impacting immersion levels, therefore participants in the virtual gallery conditions were collapsed into a single group for the purpose of the present study (see Cotter et al., 2022 for additional details regarding the original conditions).

[4] The present research draws from the same data reported in Cotter et al. (2022); however, the present research reports non-overlapping analyses addressing research questions that are distinct from those examined in the prior article.

Figure 1. Study procedure



2.2 Virtual gallery

The virtual gallery was created using the Open Gallery for Arts Research (OGAR; Rodriguez-Boerwinkle et al., 2023), which allows for the customization of gallery layouts and artwork displays for participants to explore. In each gallery visit, participants entered a four-room gallery containing 30 artworks from the Philadelphia Museum of Art's collection, with the artworks varying in contents, style, and time period (see https://osf.io/4n75g/ for full list of artworks)[5]. A different gallery was used for each week's viewing session.

2.3 Measures

2.3.1 Individual differences

Participants completed two measures of individual differences. First, participants completed the NEO-FFI (Costa & McCrae, 1992) to assess the Big Five personality traits. This instrument includes 60 items (12 items per personality trait), with participants indicating their level of agreement on a 5-pt. Likert scale (*Strongly Disagree* to *Strongly Agree*). Scale scores were obtained by averaging participant responses for each trait's items. Each trait scale showed good internal consistency—neuroticism (α = 0.93), extraversion (α = 0.87), openness to experience (α = 0.74), agreeableness (α = 0.81), and conscientiousness (α = 0.90).

Participants also completed the Art Interest subscale from the Vienna Art Interest and Art Knowledge scale (Specker et al., 2020). This 11-item scale captures both attitudes indicative of interest in visual art (e.g., talking about art with others) and behaviors related to interest in visual art (e.g., frequency of art museum visits). Scale scores were obtained by summing participant responses to each scale item, with a possible range of 11-77 (α = 0.92).

2.3.2 Well-being

Following each art experience, participants completed the Brief Inventory of Thriving (Su et al., 2014). Participants also completed a baseline measure prior to the condition assignment. This instrument contains 10 items assessing overall positive functioning, with participants indicating

[5] For details regarding artwork selection, please see Cotter et al. (2022).

their level of agreement on a 5-pt Likert scale (*Strongly Disagree* to *Strongly Agree*). Participants were asked to indicate the degree to which they agreed with each statement at that moment. The scale showed acceptable internal consistency ($\omega_{within} = 0.70$, $\omega_{between} = 0.97$).

2.3.3 Art experiences

Following each art experience, participants completed items about their experience. First, they completed four items about the degree to which they felt immersed in the experience (e.g., got lost in thought, lost track of time) on a 5 pt. Likert scale (*Strongly Disagree* to *Strongly Agree*).

Next, participants indicated to what degree they felt 18 emotions during their art experience on a 7 pt. Likert scale (*Strongly Disagree* to *Strongly Agree*). Emotions were selected to vary in both valence and arousal in accordance with the circumplex model of affect (Feldman Barrett & Russell, 1999; energetic, excited, happy, pleasant, content, relaxed, angry, irritable, nervous, tense, sad, unhappy). Additionally, several other emotions were included to assess aesthetic emotions common in the study of visual art experiences (Pelowski et al., 2017; awe, moved, chills, engaged, wonder, curious). For analytic purposes, responses to the positive, negative, and aesthetic emotions were averaged into three respective overall scores. These emotion composite scores showed acceptable internal consistency: positive emotion ($\omega_{within} = 0.76$, $\omega_{between} = 0.94$), negative emotion ($\omega_{within} = 0.82$, $\omega_{between} = 0.96$), and aesthetic emotion ($\omega_{within} = 0.69$, $\omega_{between} = 0.94$).

3. Results

Table 1 displays the descriptive statistics for all variables, and Table 2 (below) includes correlations (within- and between-person) for all variables.

Table 1. Descriptive statistics

Variable	Mean	SD (Within)	SD (Between)	ICC
BIT	3.48	0.36	0.88	0.86
Immersion	5.24	0.82	1.16	0.67
Positive Emotion	4.88	0.64	0.92	0.68
Negative Emotion	1.77	0.64	0.75	0.58
Aesthetic Emotion	4.31	0.63	1.04	0.73
Openness	3.69	---	0.53	---
Conscientiousness	3.75	---	0.70	---
Extraversion	2.94	---	0.72	---
Agreeableness	3.82	---	0.57	---
Neuroticism	2.64	---	0.96	---
Art Interest	44.46	---	14.28	---

3.1 Condition differences in well-being, immersion, and emotion

First, we examined whether participants in the gallery versus control conditions differed in their well-being, immersion, and emotion and if the rate of change across the weeks differed by condition. We conducted a series of multilevel models in R (version 4.3.1; R Core Team, 2023) using the lme4 (Bates et al., 2015) and lmerTest (Kuznetsova et al., 2017) packages. Data were visualized using ggplot2 (Wickham, 2016). For these models, each outcome was predicted by

change across week, condition, and their interaction as fixed effects with week[6] included as a random effect (see Table 3).

Table 2. Correlations among study variables

Variable	1	2	3	4	5	6	7	8	9	10	11
1. BIT	---	0.24	0.61	-0.51	0.35	0.03	0.53	0.66	0.39	-0.62	0.00
2. Immersion	0.14	---	0.61	-0.26	0.81	0.37	0.19	0.24	0.19	-0.07	-0.01
3. Positive Emotion	0.21	0.39	---	-0.62	0.73	0.18	0.47	0.57	0.32	-0.46	-0.01
4. Negative Emotion	-0.11	-0.25	-0.53	---	-0.21	-0.07	-0.50	-0.40	-0.38	0.63	-0.03
5. Aesthetic Emotion	0.15	0.48	0.52	-0.20	---	0.30	0.24	0.33	0.21	-0.11	0.00
6. Openness	---	---	---	---	---	---	0.02	0.09	0.16	0.01	-0.07
7. Conscientiousness	---	---	---	---	---	---	---	0.48	0.36	-0.59	0.02
8. Extraversion	---	---	---	---	---	---	---	---	0.37	-0.56	0.02
9. Agreeableness	---	---	---	---	---	---	---	---	---	-0.47	-0.03
10. Neuroticism	---	---	---	---	---	---	---	---	---	---	-0.05
11. Art Interest	---	---	---	---	---	---	---	---	---	---	---

Note. Correlations above the diagonal are between-person and below the diagonal are within-person.

Table 3. Gallery vs. control conditions

Outcome	Week	Condition	Week x Condition
BIT	**0.04*** (0.01)**	**0.07* (0.03)**	0.00 (0.01)
	[0.03, 0.05]	**[0.01, 0.14]**	[-0.01, 0.01]
Immersion	**0.10*** (0.01)**	**0.15*** (0.03)**	0.01 (0.01)
	[0.08, 0.12]	**[0.09, 0.21]**	[-0.01, 0.03]
Positive Emotion	-0.01 (0.01)	0.05 (0.03)	**-0.04*** (0.01)**
	[-0.03, 0.01]	[-0.01, 0.11]	**[-0.06, -0.02]**
Negative Emotion	0.00 (0.01)	-0.02 (0.03)	**0.05*** (0.01)**
	[-0.02, 0.03]	[-0.08, 0.03]	**[0.02, 0.07]**
Aesthetic Emotion	**0.02* (0.01)**	**0.11*** (0.03)**	0.00 (0.01)
	[0.00, 0.04]	**[0.05, 0.17]**	[-0.01, 0.02]

Note. β (SE), [95% CI].

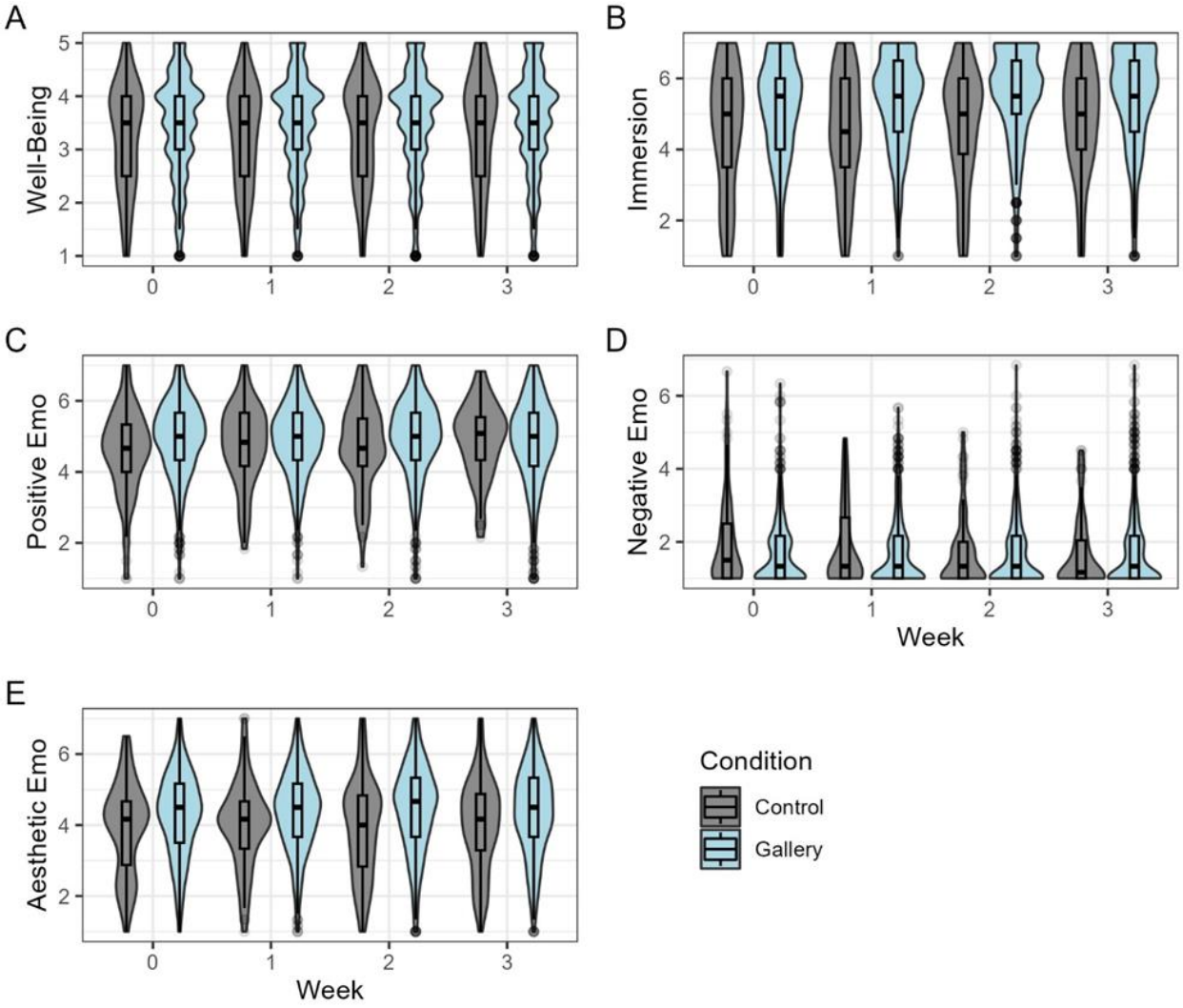
We found that well-being[7], immersion, and aesthetic emotion increased across experimental sessions, with the strongest change observed in immersion (see Figure 2, below). Further, we see that those in the gallery condition showed higher levels of well-being, immersion, and aesthetic emotion than the control condition, with the largest effect observed for immersion. None of these effects were qualified by a significant interaction.

We did observe significant interactions between time and condition for positive and negative emotion, however (see Figure 2, below). For positive emotion, those in the control condition showed an increase in positive emotion across weeks while those in the gallery condition showed a slight decrease in positive emotion across weeks. For negative emotion, those in the control condition showed a decrease in negative emotion across time while those in the gallery condition did not show a significant change in negative emotion across time.

[6] Week was not included as a random effect in the model predicting BIT scores as inclusion of this effect resulted in a singular solution due to a 0 random effect.

[7] The conditions did not differ in well-being in their baseline, pre-random assignment BIT assessment, $t = -1.37$, $p = 0.171$.

Figure 2. Change across time by condition



3.2 Predicting emotion and immersion

In the remaining analyses, we focused on the gallery condition. The next set of analyses used multilevel models to examine whether immersion during gallery visits predicted emotion. These models included change over week, immersion (group-mean centered), and their interaction as fixed effects with week and immersion included as random effects (see Table 4).

Table 4. Immersion predicting emotion

Outcome	Week	Immersion	Week x Immersion
Positive Emotion	**-0.05*** (0.01)**	**0.18*** (0.01)**	0.02 (0.01)
	[-0.07, -0.03]	**[0.16, 0.21]**	[-0.01, 0.04]
Negative Emotion	**0.04*** (0.01)**	**-0.12*** (0.02)**	-0.01 (0.01)
	[0.02, 0.07]	**[-0.15, -0.09]**	[-0.03, 0.02]
Aesthetic Emotion	-0.02 (0.01)	**0.22*** (0.01)**	**0.03* (0.01)**
	[-0.03, 0.00]	**[0.20, 0.24]**	**[0.01, 0.05]**

Note. β (SE), [95% CI].

In these models, positive emotion decreased across weeks whereas negative emotion increased over time. Immersion predicted all three types of emotion—greater immersion during the gallery visit was associated with increased positive emotion and aesthetic emotion and decreased negative emotion. Only the aesthetic emotion model contained a significant interaction between time and immersion— experiences of aesthetic emotion decreased across time for people who had lower levels of immersion but did not change across time for people with average or high levels of immersion (see Figure 3A, below).

The third set of analyses examined the role of individual differences (i.e., the Big 5 personality traits and interest in art) in predicting emotion and immersion. In these models, the Big 5 personality traits, art interest, change over time, and the interactions between individual differences and time were included as fixed effects and change over time was included as a random effect (see Table 5).

Table 5. Individual differences predicting emotion and immersion

Model	Coefficient	95% CI	SE
Positive Emotion			
Week	-0.02*	-0.04, 0.00	0.01
Openness	**0.10*** **	**0.05, 0.15**	**0.03**
Conscientiousness	**0.17*** **	**0.11, 0.23**	**0.03**
Extraversion	**0.31*** **	**0.25, 0.37**	**0.03**
Agreeableness	0.03	-0.03, 0.09	0.03
Neuroticism	**-0.11** **	**-0.17, -0.04**	**0.04**
Art Interest	-0.01	-0.06, 0.04	0.02
Week x Openness	**-0.03** **	**-0.06, -0.01**	**0.01**
Week x Conscientiousness	0.00	-0.03, 0.02	0.01
Week x Extraversion	0.01	-0.02, 0.04	0.01
Week x Agreeableness	-0.01	-0.04, 0.02	0.01
Week x Neuroticism	-0.01	-0.04, 0.02	0.02
Week x Art Interest	**-0.03***	**-0.05, -0.01**	**0.01**
Negative Emotion			
Week	0.02	-0.01, 0.04	0.01
Openness	-0.02	-0.06, 0.03	0.02
Conscientiousness	**-0.17*** **	**-0.22, -0.11**	**0.03**
Extraversion	0.01	-0.05, 0.07	0.03
Agreeableness	**-0.07***	**-0.12, -0.01**	**0.03**
Neuroticism	**0.35*** **	**0.28, 0.41**	**0.03**
Art Interest	-0.02	-0.07, 0.03	0.02
Week x Openness	**0.04*** **	**0.02, 0.07**	**0.01**
Week x Conscientiousness	0.01	-0.03, 0.04	0.02
Week x Extraversion	-0.01	-0.04, 0.02	0.02
Week x Agreeableness	0.03	0.00, 0.05	0.01
Week x Neuroticism	0.02	-0.02, 0.05	0.02
Week x Art Interest	0.01	-0.01, 0.03	0.01

Table 5. (cont.) Individual differences predicting emotion and immersion

Model	Coefficient	95% CI	SE
Aesthetic Emotion			
Week	**0.02***	**0.00, 0.04**	**0.01**
Openness	**0.20*****	**0.14, 0.26**	**0.03**
Conscientiousness	**0.16*****	**0.09, 0.23**	**0.04**
Extraversion	**0.25*****	**0.18, 0.32**	**0.04**
Agreeableness	**0.10****	**0.04, 0.17**	**0.03**
Neuroticism	**0.19*****	**0.11, 0.26**	**0.04**
Art Interest	0.03	-0.03, 0.08	0.03
Week x Openness	**-0.04*****	**-0.07, -0.02**	**0.01**
Week x Conscientiousness	-0.01	-0.04, 0.02	0.01
Week x Extraversion	0.01	-0.01, 0.04	0.01
Week x Agreeableness	0.00	-0.02, 0.02	0.01
Week x Neuroticism	-0.01	-0.04, 0.02	0.01
Week x Art Interest	-0.01	-0.03, 0.01	0.01
Immersion			
Week	**0.11*****	**0.09, 0.13**	**0.01**
Openness	**0.25*****	**0.19, 0.31**	**0.03**
Conscientiousness	**0.13*****	**0.06, 0.20**	**0.04**
Extraversion	**0.12*****	**0.05, 0.19**	**0.04**
Agreeableness	**0.11*****	**0.05, 0.18**	**0.03**
Neuroticism	**0.13*****	**0.06, 0.21**	**0.04**
Art Interest	0.03	-0.03, 0.08	0.03
Week x Openness	-0.02	-0.05, 0.00	0.01
Week x Conscientiousness	0.00	-0.03, 0.03	0.02
Week x Extraversion	0.00	-0.03, 0.03	0.02
Week x Agreeableness	-0.01	-0.04, 0.01	0.01
Week x Neuroticism	-0.01	-0.04, 0.01	0.02
Week x Art Interest	0.00	-0.02, 0.03	0.01

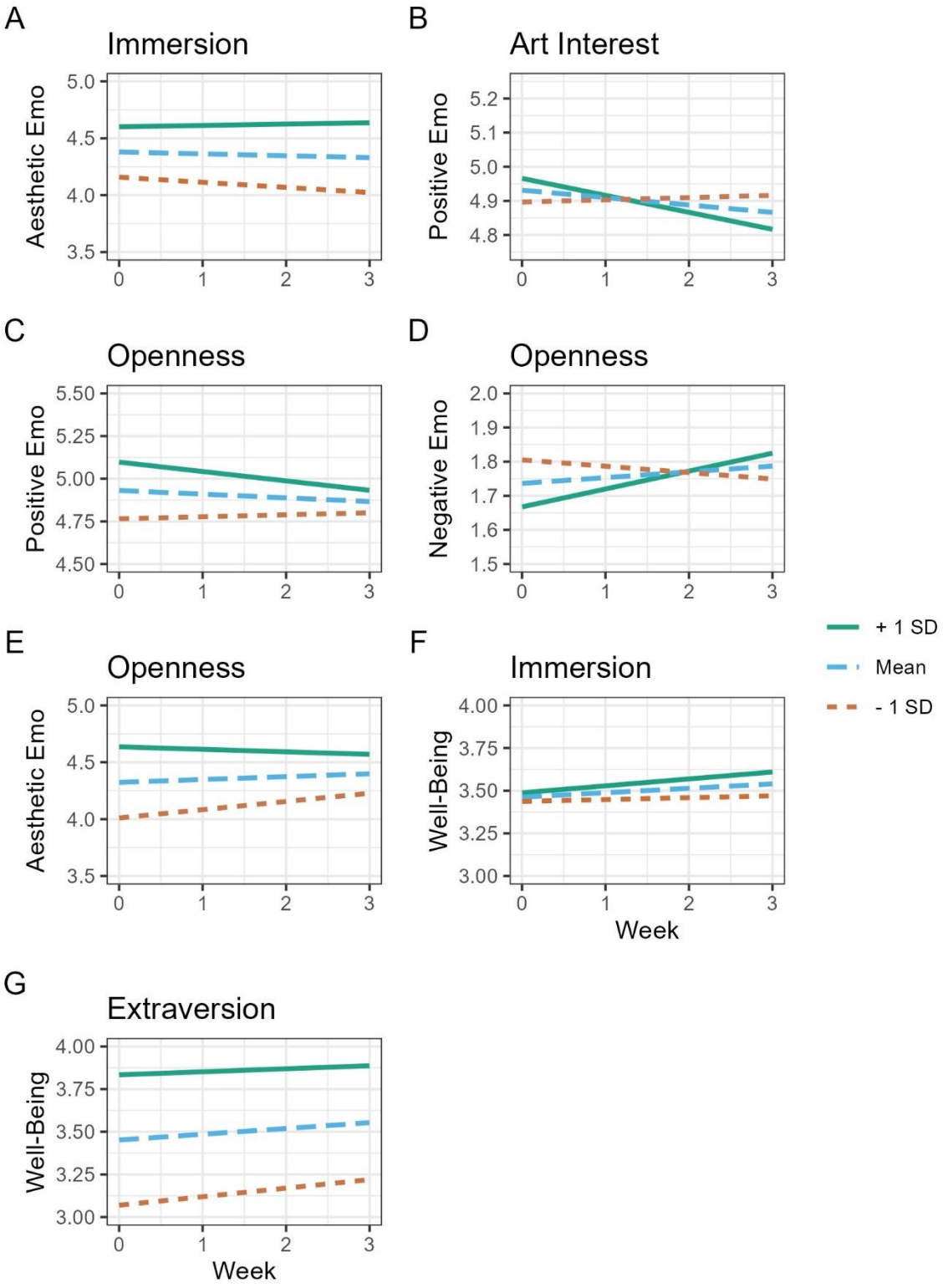
Art interest showed little association with the emotion and immersion factors, though there was a significant interaction between interest and time for positive emotion. There was no significant change in positive emotion across time for people low in art interest, but positive emotion decreased over time for people average or above average in art interest with the sharpest decrease observed for those high in art interest (see Figure 3B, below).

The personality traits showed more widespread associations with emotion and immersion. All personality traits were positively associated with experiences of immersion and aesthetic emotion. Experiences of positive emotion were positively associated with openness, conscientiousness, and extraversion and negatively associated with neuroticism. Experiences of negative emotion were negatively associated with conscientiousness and agreeableness and positively related to neuroticism.

Openness to experience showed a consistent interaction with change across time with the three types of emotional experiences (see Figure 3C-E, below). For positive emotion, people low in openness did not show changes in emotion across time whereas people average or above average in openness showed decreases in positive emotion across time. For negative emotion,

people above average in openness showed increases in negative emotion across time whereas those low or average in openness did not show changes in negative emotion across time. Finally, for aesthetic emotion, people average or below average in openness showed increases in aesthetic emotion across time whereas people high in openness did not show significant change in aesthetic emotion across time.

Figure 3. Interaction effects



3.3 Predicting well-being

In the final set of analyses, we examined how visit qualities—immersion and emotion—and individual differences predicted well-being. In each model, change over time, the visit quality or individual difference, and their interaction with changes over time were included as fixed effects while change over time was included as a random effect (see Table 6).

First, we examined how visit qualities related to well-being. Overall, well-being increased across visits, and greater immersion, positive emotion, and aesthetic emotion were associated with higher levels of well-being. However, the immersion effects were qualified by a significant interaction with time. People experiencing average or above average levels of immersion showed increases in well-being across time whereas people experiencing low levels of immersion did not show changes in well-being across time (see Figure 3F, above).

Next, we examined how personality and art interest related to well-being. Conscientiousness and extraversion were associated with higher levels of well-being, and neuroticism was associated with lower levels of well-being. There was also a significant interaction between extraversion and time—people average or below average in extraversion showed increases in well-being across time whereas people high in extraversion did not show changes in well-being across time (see Figure 3G, above).

Table 6. Predicting well-being

Model	Coefficient	95% CI	SE
Immersion			
Week	**0.03*** **	**0.02, 0.05**	**0.01**
Immersion	**0.05*** **	**0.03, 0.07**	**0.01**
Week x Immersion	**0.02***	**0.00, 0.03**	**0.01**
Emotion			
Week	**0.04*** **	**0.03, 0.06**	**0.01**
Positive Emotion	**0.06*** **	**0.04, 0.08**	**0.01**
Negative Emotion	0.00	-0.02, 0.01	0.01
Aesthetic Emotion	**0.02***	**0.00, 0.03**	**0.01**
Week x Positive Emotion	0.02	0.00, 0.04	0.01
Week x Negative Emotion	0.00	-0.02, 0.02	0.01
Week x Aesthetic Emotion	0.01	-0.01, 0.03	0.01
Individual Differences			
Week	**0.04*** **	**0.03, 0.05**	**0.01**
Openness	-0.02	-0.07, 0.02	0.02
Conscientiousness	**0.14*** **	**0.08, 0.20**	**0.03**
Extraversion	**0.38*** **	**0.32, 0.44**	**0.03**
Agreeableness	0.05	-0.01, 0.10	0.03
Neuroticism	**-0.27*** **	**-0.33, -0.20**	**0.03**
Art Interest	-0.02	-0.07, 0.02	0.02
Week x Openness	0.00	-0.01, 0.02	0.01
Week x Conscientiousness	0.00	-0.01, 0.02	0.01
Week x Extraversion	**-0.02***	**-0.04, 0.00**	**0.01**
Week x Agreeableness	0.00	-0.01, 0.02	0.01
Week x Neuroticism	-0.01	-0.03, 0.02	0.01
Week x Art Interest	0.00	-0.01, 0.02	0.01

4. Discussion

We conducted a 5-week longitudinal study of visual art engagement to examine virtual visual art viewing experiences. First, we examined the differences between people viewing visual art and people reading about art. We found that people viewing art reported higher levels of aesthetic emotion, immersion, and well-being and that, in the reading control condition, positive emotion increased and negative emotion decreased across the sessions. For those in the art viewing condition, we examined how changes in emotion and immersion across viewing sessions predicted changes in well-being and the degree to which two individual differences—personality and art interest—moderated these relationships. Overall, the findings suggest that experiencing immersion, positive emotion, and aesthetic emotion are important for well-being benefits of art viewing and that well-being gains across time may be more pronounced in those with lower levels of extraversion.

The present research makes several contributions. First, this study examined changes in emotional responses, immersion during art viewing, and well-being over time. Few studies have used longitudinal approaches to examine post-visit changes in emotion, immersion, and well-being. Research that has taken longitudinal approaches has tended toward longer time scales and has not captured factors related to the aesthetic experience. Because prior work suggests that repeated and consistent engagement is important for flourishing benefits of arts engagement (e.g., Konlaan et al., 2000), examining a series of repeated arts experiences is necessary to advance our understanding of the links between art engagement and flourishing.

A second contribution of this work is the focus on immersion, a recently proposed mechanism underlying the relationship between arts engagement and flourishing as part of the RAISE mechanism model (Shim et al., 2019; Tay et al., 2018; Thapa et al., 2023). Like prior work (Cotter et al., 2022, in press), participants in this study were able to feel immersed in the virtual gallery environment. Consistent with theory (Tay et al., 2018), people who were more immersed showed greater well-being. Importantly, people who were not immersed did not show week-by-week gains in well-being unlike those who were more immersed. These findings are consistent with other empirical work showing that immersion is important for improvements in well-being (Cotter et al., 2022, in press). Immersion was also connected to greater positive and aesthetic emotions and lower negative emotions, suggesting a better aesthetic experience for those who are immersed in the visit. Further, we found that visually engaging with art was a more immersive experience than learning about visual art via art historical readings, in line with the RAISE model (Tay et al., 2018). Given limitations of prior arts and well-being work not including robust control conditions (Skov & Nadal, 2023), future work should consider relevant reading-based controls as is appropriate.

Finally, this project explored the role of two individual difference factors—art interest and personality. Surprisingly, interest in visual art showed few relationships with the outcomes assessed here. Prior work has shown that expertise in visual art shapes people's aesthetic experiences in a variety of ways; however, much of the prior work has focused on the role of expertise in impacting aesthetic appraisals, such as liking or understanding (e.g., Mullennix & Robinet, 2018; Pietras & Ganczarek, 2022). It should also be noted that prior work has found that experts and novices differ in appraisals, such as beauty and wanting, but not on affective evaluations of art (Pietras & Ganczarek, 2022; van Paasschen et al., 2015), suggesting that emotional responses may be independent from expertise, as was shown in the present findings. This may be partially attributed to differences in knowledge emotion experiences (i.e., interest, confusion) between novices and experts, with experts showing greater interest and less confusion than novices when viewing art (Silvia, 2013).

We also examined how the Big 5 personality traits related to people's experiences with art and well-being. Our findings were largely consistent with prior literature—extraversion and neuroticism were the traits most strongly associated with well-being (Anglim et al., 2020). Interestingly, extraversion and change across time showed a significant interaction, suggesting that those at high levels of extraversion maintained high levels of well-being whereas those with lower levels of extraversion showed increases in well-being across the art sessions. This may have occurred due to those with lower levels of extraversion having greater ability to increase in well-being as compared to those with high extraversion. Alternatively, this may also suggest that art engagement in a virtual environment is particularly beneficial for those with lower extraversion, potentially due to its online nature; however, this is purely speculative and requires additional research. In alignment with prior work showing that openness is a key personality factor in aesthetic contexts (Swami & Furnham, 2020), openness was a consistent predictor for people's emotional reactions and immersion.

These findings are especially important in informing the nature of immersion in art experiences, as understanding who is more or less likely to report being immersed in such experiences. Interestingly, however, some of the associations were counter-intuitive, such as people high in openness showing less positive and more negative emotion across sessions. Typically, people high in openness show higher engagement with art (Clarke et al., 2023), so one potential explanation lies in the virtual nature of art engagement in this study. Specifically, it's possible that people high in openness prefer engaging with art in person rather than in a digital context and so showed lower emotional well-being across sessions—future research should continue to explore this relationship. Alternatively, it is possible that people high in openness became increasingly bored with the virtual gallery engagement and derived less enjoyment from the experiences across time.[8]

4.1 Limitations, implications, and future directions

The present research serves to advance our knowledge of the well-being impacts of repeated art viewing and what visit and personal qualities are important in shaping the benefits of art engagement. Although this work has a number of strengths, including its examination of multiple art engagements, the use of an active control condition, and examination of mechanisms underlying link between art engagement and well-being, no research is without its limitations.

A motivating factor in this work was to examine virtual art engagement given the recent rise in offerings in this medium. For this study, we opted to use OGAR (Rodriguez-Boerwinkle et al., 2023) given its design as a research tool and the additional levels of control afforded in comparison to virtual gallery environments developed for specific institutions as these often allow for less autonomy of the visitor. With the greater autonomy available to viewers in OGAR, there are some limitations on the visual presentation—the images may not appear (depending on participant devices) in as high definition as they may be displayed in a museum online collection. It's possible that some of these visual limitations diminished the quality of visit for some participants, influencing their gallery experiences. Future work should explore different forms of digital presentation to examine the robustness of these findings across other digital platforms.

It is also important to interpret these findings in light of the exploratory and predominantly correlational nature of the study. Although the theoretical underpinnings of the study would suggest a causal pathway between immersive engagement with art and well-being benefits, the

[8] We would like to thank an anonymous reviewer for raising this potential interpretation of these findings.

present research cannot make such causal claims. The present findings do, however, provide encouraging evidence to support future experimental work to examine the potential causal relationship. It is important in future work to consider new ways of manipulating immersion levels effectively—several past studies (e.g., Cotter et al., in press, 2022; Igdalova & Chamberlain, 2023; Ho et al., 2015) have, with mixed success, examined mindfulness-based manipulations to enhance art experiences. Different forms of manipulations (e.g., non-mindfulness based instructions, facilitated vs. non-facilitated experiences) should be examined to provide more robust evidence for the links between immersion and well-being in art engagement.

Finally, it is important to consider the generalizability of the study findings. For this project we drew our participants from a representative sample of United States adults; however, no sample is perfectly representative of the population it is drawn from. Our final sample was predominantly White, partially due to the initial representative sample functioning on Prolific not distinguishing between Hispanic and non-Hispanic White individuals. Given that the nature of arts engagement has unique culturally specific meanings and interpretations, it is important for future research to consider how art engagement experiences may be different within other demographic groups or how arts engagement or interventions can be culturally tailored, in line with recommendations for designing impactful interventions (Calanan et al., 2023).

We view this work as having several implications for our knowledge of cultivation of well-being via virtual art engagement as well as for identifying important avenues for future research in this domain. First, this work builds on the emerging body of research identifying immersion in art viewing as an important factor for increasing well-being through art viewing. With the consistency between the present findings and related projects (e.g., Cotter et al., 2022, in press), continuing to consider the role of immersion in the relationship between art and well-being is important. Although the past work has attempted to manipulate immersion levels, these efforts have not been successful, and future work should explore alternate methods of increasing immersion levels to enhance the benefits of art viewing. Further, the role of immersion should be examined in other arts contexts—the present and past work have focused on digital art engagement, but the relationship between immersion, arts, and well-being should be further explored in other art viewing contexts and within other artistic activities (e.g., art creation, music listening). Although the present research is exploratory, these findings, which align with past work on immersion, suggest that virtual art experiences should be designed with consideration of the ability to become easily immersed in the experience. This appears to be a key factor in promoting both well-being and emotionally resonant experiences in these digital environments and represent an immediate application of this work, especially given the greater accessibility such digital forms of art engagement afford.

In addition to the mechanisms proposed by the RAISE model, another factor that deserves further investigation is self-relevance. Recent research has begun to examine the role of self-relevance in aesthetic appraisals of images (e.g., Vessel et al., 2023) showing that images with greater self-relevance were seen as more beautiful and meaningful. Because several relevant theoretical models suggest that impactful arts experiences necessitate some degree of effortful engagement with the art (e.g., Pelowski et al., 2017; Tay et al., 2018), self-relevance may be a valuable entry point for people—if they see the art as connected to themselves, it may be easier to have a deeper, more meaningful experience with the art, leading to enhanced flourishing. As additional research emerges on such connections, this could provide important direction for arts institutions and educators for framing experiences in ways that maximize opportunities for recognizing self-relevance during the art engagement.

Finally, it is vital to keep in mind who is most likely to benefit from such experiences or interventions. Here we focused on personality and interest in visual art and saw that art interest was not a prominent influence in people's experiences but that a number of personality traits were related to experiential and well-being outcomes. The associations with immersion are particularly important as this and prior work indicates that immersion in experiences is important for enhanced well-being outcomes. Our findings suggest that the Big 5 personality factors are all positively associated with enhanced immersion but that openness is most strongly associated. But we studied only a limited set of individual differences and additional work should explore other relevant factors. For example, one recent study by Trupp and colleagues (2023) examined how individual differences in aesthetic responsiveness influences qualities of art engagement (i.e., liking and meaning) and how these qualities in turn impact flourishing outcomes, such as positive and negative affect and state anxiety. They found that aesthetic responsiveness was important for both liking and meaning judgments but that meaning was the predominant driver of flourishing changes. Further, other work suggests that, in adolescents, personality may be an important factor in shaping which art experiences are appealing and which people are willing to engage in (Kelleher-Clarke et al., 2023)—keeping in mind these influences of personality when designing experiences, so as to offer a variety of experiences, will be important in helping people gain well-being benefits via arts engagement. Approaches such as this should continue to be used in future work to understand the multiple factors that are implicated in influencing well-being through art.

The present research joins a growing body of work examining the flourishing benefits of art engagement. Although prior work has examined this relationship, relatively few studies have focused on potential mechanisms underlying this relationship. Here we provide evidence that the degree of immersion experienced during art viewing in a digital environment is a key factor in promoting flourishing. Future research should continue to examine the role of immersion—and other mechanisms—in providing flourishing benefits through engagement with the arts.

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Competing interests

The authors have no conflicts of interest to declare.

Ethical approval

This research was approved by the University of Pennsylvania Institutional Review Board.

Author contributions statement

Conceptualization: KNC, JOP; Methodology: KNC, JOP, RMRB; Analysis: KNC, AA, JR; Writing – Original Draft: KNC, AA; Writing – Review and Editing: KNC, AA, JR, RMRB, JOP.

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References

Anglim, J., Horwood, S., Smilie, L. D., Marrero, R. J., & Wood, J. K. (2020). Predicting psychological and subjective well-being from personality: A meta-analysis. *Psychological Bulletin, 146*(4), 279–323. http://dx.doi.org/10.1037/bul0000226

Appelqvist-Schmidlechner, K., Heikkinen, R., Vasankari, T., Virtanen, T., Pihlainen, K., Honkanen, T., Kyrolainen, H., & Vaara, J. P. (2023). Relationships between psychosocial well-being and leisure time physical activity among 160.000 young Finnish men: A cross-sectional study during 2015-2021. *Archives of Public Health, 81*, 26. https://doi.org/10.1186/s13690-023-01040-3

Averbach, J. & Monin, J. (2022). The impact of a virtual art tour intervention on the emotional well-being of older adults. *The Gerontologist, 62*(10), 1496–1506. https://doi.org/10.1093/geront/gnac089

Barford, K. A., Fayn, K., Silvia, P. J., & Smilie, L. D. (2018). Individual differences in conflicting stimulus evaluations: Openness/Intellect predicts mixed-valenced appraisals of visual art. *Journal of Research in Personality, 73*, 46–55. https://doi.org/10.1016/j.jrp.2017.11.006

Bates, D., Machler, M., Bolker, B., & Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software, 67*(1), 1–48. https://doi.org/10.18637/jss.v067.i01

Calanan, R.M., Bonds, M.E., Bedrosian, S.R., Laird, S.K., Satter, D., Penman-Aguilar, A., (2023). CDC's Guiding Principles to Promote an Equity-Centered Approach to Public Health Communication. *Preventing Chronic Disease*, 20, 230061. https://doi.org/10.5888/pcd20.230061

Chamorro-Premuzic, T., Burke, C., Hsu, A., & Swami, V. (2010). Personality predictors of artistic preferences as a function of the emotional valence and perceived complexity of paintings. *Psychology of Aesthetics, Creativity, and the Arts, 4*(4), 196–204. https://doi.org/10.1037/a0019211

Chen, C., Wang, K., Chen, S., Zhou, Y., & Zhou, M. (2020). The linear and curvilinear relation between personality and subjective well-being in visual artists: Perceived creation stress as a mediator. *PsyCh Journal, 9*, 533–543. https://doi.org/10.1002/pchj.329

Clarke, A. K., Bartoli, A. J., & Omigie, D. (2023). Exploring barriers to and drivers of participatory arts engagement in early adolescence. *Psychology of Aesthetics, Creativity, and the Arts.* Advance online publication. https://doi.org/10.1037/aca0000576

Clift, S., Phillips, K., & Pritchard, S. (2021). The need for robust critique of research on social and health impacts of the arts. *Cultural Trends, 30*(5), 442–459. https://doi.org/10.1080/09548963.2021.1910492

Clifton, J. D. W. (2020). Happy in a crummy world: Implication of the primal world beliefs for increasing wellbeing through positive psychology interventions. *Journal of Positive Psychology, 15*(5), 691–695. https://doi.org/10.1080/17439760.2020.1789703

Clifton, J. D. W., Baker. J. D., Park, C. L., Yaden, D. B., Clifton, A. B. W., Terni, P., Miller, J. L., Zeng, G., Giorgi, S., Schwartz, H. A., & Seligman, M. E. P. (2019). Primal world beliefs. *Psychological Assessment, 31*(1), 82–99. https://doi.org/10.1037/pas0000639

Clow, A. & Fredhoi, C. (2006). Normalisation of salivary cortisol levels and self-report stress by a brief lunchtime visit to an art gallery by London City Workers. *Journal of Holistic Healthcare, 3*(2), 29–32.

Costa, P. T., and McCrae, R. R. (1992). *Revised NEO Personality Inventory (NEO PI-R) and NEO Five-Factor Inventory (NEO-FFI) Professional Manual*. Lutz, FL: Psychological Assessment Resources, Inc

Cotter, K. N., Crone, D. L., Rodriguez-Boerwinkle, R. M., Boerwinkle, M., Silvia, P. J., & Pawelski, J. O. (2022). Examining the flourishing impacts of repeated visits to a virtual art museum and the role of immersion. *Behavioral Sciences, 12*(12), 500. https://doi.org/10.3390/bs12120500

Cotter, K. N., Harrouche, M., Rodriguez-Boerwinkle, R. M., Boerwinkle, M., Silvia, P. J., & Pawelski, J. O. (in press). Virtual art visits: Examining the effects of slow looking on well-being in an online environment. *Psychology of Aesthetics, Creativity, and the Arts.* https://doi.org/10.1037/aca0000548

Cotter, K. N. & Pawelski, J. O. (2022). Art museums as institutions for human flourishing. *Journal of Positive Psychology, 17*(2), 288–302. https://doi.org/10.1080/17439760.2021.2016911

Csikszentmihalyi, M. (1990). *Flow: the psychology of optimal experience.* New York, Harper & Row.

Csikszentmihalyi, M., & Robinson, R. E. (1990). *The art of seeing: An interpretation of the aesthetic encounter*. J. Paul Getty Museum.

Cuypers, K., Krokstad, S., Holmen, T. L., Knudtsen, M. S., Bygren, L. O., & Holmen, J. (2012). Patterns of receptive and creative cultural activities and their association with perceived health, anxiety, depression and satisfaction with life among adults: The HUNT study, Norway. *Journal of Epidemiological Community Health, 66*, 698–703. https://doi.org/10.1136/jech.2010.113571

Daily, L. Z., DiLima, R., Streett, A., & Healy, K. (2021). The relationship of leisure occupation, personality, and well-being: A comparison of model builders and visual artists. *Journal of Occupational Science, 28*(4), 479–495. https://doi.org/10.1080/14427591.2020.1815074

D'Cunha, N. M., McKune, A. J., Isbel, S., Kellett, J., Georgousopoulou, E. N., & Naumovski, N. (2019). Psychophysiological responses in people living with dementia after an art gallery intervention: An exploratory study. *Journal of Alzheimer's Disease, 72*(2), 549–562. https://doi.org/10.3233/JAD-190784

Dodge, T., Vaylay, S., & Kracke-Bock, J. (2022), Subjective vitality: A benefit of self-directed, leisure time physical activity. *Journal of Happiness Studies, 23*, 2903–2922. https://doi.org/10.1007/s10902-022-00528-z

Ercegovac, I. R., Dobrota, S., & Kuscevic, D. (2015). Relationship between music and visual art preferences and some personality traits. *Empirical Studies of the Arts, 33*(2), 207–227. https://doi.org/10.1177/0276237415597390

Fancourt, D. & Finn, S. (2019). *What is the evidence on the role of the arts in improving health and well-being? A scoping review.* World Health Organization.

Fancourt, D. & Steptoe, A. (2019). Cultural engagement and mental health: Does socio-economic status explain the association? *Social Science & Medicine, 236,* 112425. https://doi.org/10.1016/j.socscimed.2019.112425

Fancourt, D., Steptoe, A., & Cadar, D. (2018). Cultural engagement and cognitive reserve: Museum attendance and dementia incidence over a 10-year period. *British Journal of Psychiatry, 213*, 661–663. https://doi.org/10.1192/bjp.2018.129

Fancourt, D. & Tymoszuk, U. (2018). Cultural engagement and incident depression in older adults: Evidence from the English Longitudinal Study of Ageing. *The British Journal of Psychiatry, 214*, 225–229. https://doi.org/10.1192/bjp.2018.267

Feldman Barrett, L. & Russell, J. A. (1999). The structure of current affect: Controversies and emerging consensus. *Current Directions in Psychological Science, 8*(1), 10–14. https://doi.org/10.1111/1467-8721.00003

Flatt, J. D., Liptak, A., Oakley, M. A., Gogan, J., Varner, T., & Lingler, J. H. (2015). Subjective experiences of an art museum engagement activity for persons with early-stage Alzheimer's Disease and their family caregivers. *American Journal of Alzheimer's Disease & Other Dementias, 30*(4), 380–389. https://doi.org/10.1177/1533317514549953

Herron, A. & Jamieson, A. (2020). Grandfathers at Melbourne Museum: Shining a spotlight on overlooked museum visitors. *Visitor Studies, 23*(2), 101–119. https://doi.org/10.1080/10645578.2020.1772616

Ho, R. T. H., Potash, J. S., Fang, F., & Rollins, J. (2015). Art viewing directives in hospital settings effect on mood. *Health Environments Research & Design Journal*, *8*(3), 30–43. https://doi.org/10.1177/1937586715575903

Hutchinson, S. & Kleiber, D. (2023). On time, leisure, and health in retirement: Implication for public health services. *International Journal of Environmental Research and Public Health, 20*(3), 2490. https://doi.org/10.3390/ijerph20032490

Igdalova, A. & Chamberlain, R. (in press). Slow looking at still art: The effect of manipulating audio context and image category on mood and engagement during an online slow looking exercise. *Psychology of Aesthetics, Creativity, and the Arts.* https://doi.org/10.1037/aca0000546

Kelleher-Clarke, A., Bartoli Jones, A., & Omigie, Diana. (2023). Exploring barriers to and drivers of participatory arts engagement in early adolescence. *Psychology of Aesthetics, Creativity, and the Arts*. Online First. https://doi.org/10.1037/aca0000576

Koide, N., Kubo, T., Nishida, S., Shibata, T., & Ikeda, K. (2015). Art expertise reduces influence of visual salience on fixation in viewing abstract-paintings. *PLOS ONE*, *10*(2). https://doi.org/10.1371/journal.pone.0117696

Konlaan, B. B., Bygren, L. O., & Johansson, S. E. (2000). Visiting the cinema, concerts, museums or art exhibitions as determinant of survival: A Swedish fourteen-year cohort follow-up. *Scandinavian Journal of Public Health, 28*, 174–178.

Kozbelt, A. (2020). The influence of expertise on aesthetics. In M. Nadal and O. Vartanian (Eds.), *The Oxford Handbook of Empirical Aesthetics* (pp. 787–819). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780198824350.013.37

Krajewska, A. & Waligorska, A. (2015). Likeable likeness: Personality, experience and preference for abstract and low complexity art. *Psychologia, 58*, 61–74. https://doi.org/10.2117/psysoc.2015.61

Kuznetsova, A., Brockhoff, P. B., & Christensen, R. H. B. (2017). lmerTest package: Tests in linear mixed effects models. *Journal of Statistical Software, 82*(13), 1–26. https://doi.org/10.18637/jss.v082.i13

Law, M., Karulkar, N., & Broadbent, E. (2021). Evidence for the effects of viewing visual artworks on stress outcomes: A scoping review. *BMJ Open*, *11*(6). https://doi.org/10.1136/bmjopen-2020-043549

Mastandrea, S., Maricchiolo, F., Carrus, G., Giovannelli, I., Giuliani, V., & Berardi, D. (2019). Visits to figurative art museums may lower blood pressure and stress. *Arts & Health, 11*(2), 1–10. https://doi.org/10.1080/17533015.2018.1443953

Mullennix, J. W., & Robinet, J. (2018). Art expertise and the processing of titled abstract art. *Perception, 47*(4), 359–378. https://doi.org/10.1177/0301006617752314

Murphy, K. J., Swaminathan, S., Howard, E., Altschuler, A., Rogan, J., Beauchet, O., Dupuis, K., Galea, L. A. M., Hogan, D., Lingum, N., Rowe, G., Tsotso, L., Szczepura, A., Wittich, W., Xie, F., & Hasher, L. (2021). Accessible virtual arts recreation for wellbeing promotion in long-term care residents. *Journal of Applied Gerontology, 40*(5), 519–528. https://doi.org/10.1177/0733464820967195

Palumbo, L., Harrison, N. R., Trawinski, T., Kass, J., Metelmann, A. C., Bari, R. S. G., & Donnelly, N. (2023). Visual exploration mediates the influence of personal traits on responses to artworks in an art gallery setting. *Psychology of Aesthetics, Creativity, and the Arts*. Advance online publication. https://doi.org/10.1037/aca0000529

Pawelski, J. O. (2016). Defining the 'positive' in positive psychology: Part II. A normative analysis. *Journal of Positive Psychology, 11*(4), 357–365. https://doi.org/10.1080/17439760.2015.1137628

Pawelski, J. O. (2022). The positive humanities: Culture and human flourishing. In L. Tay and J. O. Pawelski (Eds.). *The Oxford Handbook of the Positive Humanities* (pp. 17–42). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780190064570.013.43

Pelowski, M., Markey, P. S., Forster, M., Gerger, G., & Leder, H. (2017). Move me, astonish me…delight my eyes and brain: The Vienna Integrated Model of top-down and bottom-up processes in Art Perception (VIMAP) and corresponding affective, evaluative, and neurophysiological correlates. (2017). *Physics of Life Review, 21*, 80–125. https://doi.org/10.1016/j.plrev.2017.02.003

Pesata, V., Colverson, A., Sonke, J., Morgan-Daniel, J., Schaefer, N., Sams, K., Carrion, F. M. E., & Hanson, S. (2022). Engaging the arts for wellbeing in the United States of America: A scoping review. *Frontiers in Psychology, 12*, 791773. https://doi.org/10.3389/fpsyg.2021.791773

Pietras, K. & Ganczarek, J. (2022). Aesthetic reactions to violations in contemporary art: The role of expertise and individual differences. *Creativity Research Journal, 34*(3), 324–338. https://doi.org/10.1080/10400419.2022.2046909

R Core Team (2023). *R: A Language and Environment for Statistical Computing.* R Foundation for Statistical Computing, Vienna, Austria. https://www.R-project.org/.

Rodriguez, R. M., Fekete, A., Silvia, P. J., & Cotter, K. N. (2021). The art of feeling different: Exploring the diversity of emotions experienced during an art museum visit. *Psychology of Aesthetics, Creativity, and the Arts*. https://doi.org/10.1037/aca0000443

Rodriguez-Boerwinkle, R. M., Boerwinkle, M., & Silvia, P. J. (2023). The Open Gallery for Arts Research: An open-source tool for studying the psychology of virtual art museum visits. *Behavioral Research Methods, 55,* 824–842. https://doi.org/10.3758/s13428-022-01857-w

Schall, A., Tesky, V. A., Adams, A. K., & Pantel, J. (2018). Art museum-based intervention to promote emotional well-being and improve quality of life in people with dementia: The ARTEMIS project. *Dementia, 17*(6), 728–743. https://doi.org/10.1177/1471301217730451

Shim, Y., Tay., L., Ward, M., & Pawelski, J. O. (2019). Arts and humanities engagement: An integrative conceptual framework for psychological research. *Review of General Psychology, 23*, 159–176. https://doi.org/10.1177/1089268019832847

Silvia, P. J. (2013). Interested experts, confused novices: Art expertise and the knowledge emotions. *Empirical Studies of the Arts, 31*(1), 107–115. https://doi.org/10.2190/EM.31.1.f

Silvia, P. J. & Nusbaum, E. C. (2011). On personality and piloerection: Individual differences in aesthetic chills and other unusual aesthetic experiences. *Psychology of Aesthetics, Creativity, and the Arts, 5*(3), 208–214. https://doi.org/10.1037/a0021914

Skov, M., & Nadal, M. (2023). Can arts-based interventions improve health? A conceptual and methodological critique of art therapy. *PsyArXiv* [Preprint]. https://doi.org/10.31234/osf.io/sp9y3

Specker, E., Forster, M., Brinkmann, H., Boddy, J., Pelowski, M., Rosenberg, R., & Leder, H. (2020). The Vienna Art Interest and Art Knowledge Questionnaire (VAIAK): A unified and validated measure of art interest and art knowledge. *Psychology of Aesthetics, Creativity, and the Arts, 14*(2), 172–185. https://doi.org/10.1037/aca0000205

Su, R., Tay, L., & Diener, E. (2014). The development and validation of Comprehensive Inventory of Thriving (CIT) and Brief Inventory of Thriving (BIT). *Applied Psychology: Health and Well-Being*, *6*(3), 254–279. https://doi.org/10.1111/aphw.12027

Swami, V. & Furnham, A. (2020). The influence of personality on aesthetic preferences. In M. Nadal and O. Vartanian (Eds.), *The Oxford Handbook of Empirical Aesthetics* (pp. 820–833). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780198824350.013.36

Tay, L., Pawelski, J. O., & Keith, M. G. (2018). The role of the arts and humanities in human flourishing: A conceptual model. *Journal of Positive Psychology, 13*(3), 215–225. https://doi.org/10.1080/17439760.2017.1279207

Thapa, S., Vaziri, H., Shim, Y., Tay, L., & Pawelski, J. O. (2023). Development and validation of the mechanisms of engagement in the arts and humanities scales. *Psychology of Aesthetics, Creativity, and the Arts.* Advanced online publication. https://doi.org/10.1037/aca0000556

Thomson, L. J., Lockyer, B., Camic, P. M., & Chatterjee, H. J. (2018). Effects of a museum-based social prescription intervention on quantitative measures of psychological wellbeing in older adults. *Perspectives in Public Health, 138*(1), 28–38. https://doi.org/10.1177/1757913917737563

Trupp, M. D., Bignardi, G., Chana, K., Specker, E., & Pelowski, M. (2022). Can a brief interaction with online, digital art improve wellbeing? A comparative study of the impact of online art and culture presentations on mood, state-anxiety, subjective wellbeing, and loneliness. *Frontiers in Psychology, 13*, 782033. https://doi.org/10.3389/fpsyg.2022.782033

Trupp, M. D., Bignardi, G., Specker, E., Vessel, E. A., & Pelowski, M. (2023). Who benefits from online art viewing, and how: The role of pleasure, meaningfulness, and trait aesthetic responsiveness in computer-based art interventions for well-being. *Computers in Human Behavior, 145*, 107764. https://doi.org/10.1016/j.chb.2023.107764

Tyack, C., Camic, P. M., Heron, M. J., & Hulbert, S. (2017). Viewing art on a tablet computer: A well-being intervention for people with dementia and their caregivers. *Journal of Applied Gerontology, 36*(7), 864–894. https://doi.org/10.1177/0733464815617287

Tymoszuk, U., Perkins, R., Fancourt, D., & Williamon, A. (2020). Cross-sectional and longitudinal association between receptive arts engagement and loneliness among older adults. *Social Psychiatry and Psychiatric Epidemiology, 55*, 891–900. https://doi.org/10.1007/s00127-019-01764-0

van Paasschen, J., Bacci, F., & Melcher, D. P. (2015). The influence of art expertise and training on emotion and preference ratings for representational and abstract artworks. *PLoS ONE, 10*(8), e0134241. https://doi.org/10.1371/journal.pone.0134241

VanderWeele, T. J. (2017). On the promotion of human flourishing. *Proceedings of the National Academy of Sciences, 114*(31), 8148–8156. https://doi.org/10.1073/pnas.1702996114

Vessel, E. A., Pasqualette, L., Uran, C., Koldehoff, S., Bignardi, G., & Vinck, M. (2023). Self-relevance predicts the aesthetic appeal of real and synthetic artworks generated via neural style transfer. *Psychological Science, 34*(9), 1007–1023. https://doi.org/10.1177/09567976231188107

Wanzer, D. L., Finley, K. P., Zarian, S., & Cortez, N. (2020). Experiencing flow while viewing art: Development of the aesthetic experience questionnaire. *Psychology of Aesthetics, Creativity, and the Arts*, *14*(1), 113–124. https://doi.org/10.1037/aca0000203

Weziak-Bialowolska, D., Bialowolski, P., & Sacco, P. L. (2019). Involvement with the arts and participation in cultural events—Does personality moderate impact on well-being? Evidence from the U. K. household panel survey. *Psychology of Aesthetics, Creativity, and the Arts, 13*(3), 348–358. https://doi.org/10.1037/aca0000180

Wheatley, D., & Bickerton, C. (2017). Subjective well-being and engagement in arts, culture and sport. *Journal of Cultural Economics*, *41*(1), 23–45. https://doi.org/10.1007/s10824-016-9270-0

Wickham, H. (2016). *ggplot2: Elegant graphics for data analysis.* Springer-Verlag.

Wilkinson, A. V., Waters, A. J., Bygren, L. O., & Tarlov, A. R. (2007). Are variation in rates of attending cultural activities associated with population health in the United States. *BMC Public Health, 7*, 226. https://doi.org/10.1186/1471-2458-7-226