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Examining the Impact of Art Viewing and Appreciation on Well-being

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MacKenzie Dunhill Trupp MSc

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General Introduction

Across multiple settings, the arts have been integrated into small and large-scale programs for the purposes of supporting health and well-being, demonstrating a strong interest from health, cultural, and government institutions in their effectiveness. For example, cities such as Hong Kong and Montreal, among several others, have implemented programs that offer access to art museums as a preventive healthcare strategy (*From Depression to Expression*, 2022). On a smaller scale, NYC Health+Hospitals has extensively utilised visual art in clinical contexts, with over 7,500 artworks placed in hospital spaces to create a more welcoming environment for patients, visitors, and staff (Hu, 2023). With such applications, there seems to be a tacit understanding that the arts can serve society beyond the notion of ‘arts for its own sake’—that is, beyond their historical and cultural value. However, the data supporting such beliefs has not always been present. For instance, in 2003, the UK Minister for Arts, Estell Morris, exemplified this sentiment, saying: *“I know that Arts and Culture make a contribution to health, to education, to strong communities, to well-being, but I don’t know how to evaluate or describe it.”*

In the more than 20 years since Morris' statement, mounting progress has been made in evaluating and describing the impact of the arts. Much of this development is illustrated in a World Health Organization (WHO) scoping review published in 2019 (Fancourt & Finn, 2019) that designated the arts as a social determinant of health—suggesting that access to the arts should be considered when examining disparities between good and poor health in similar ways as exercise and nutrition. This report encompassed over 3000 examples of how various types of arts engagement can support well-being and treat or prevent poor mental and physical health. The arts within these examples included diverse creative activities (also known as active or participatory engagement), including painting, drawing, singing, playing instruments, acting, and dancing, as well as activities in which one interacts with preexisting art primarily through viewing or listening. This latter category is known as receptive art engagement (or passive engagement). It involves activities such as listening to music, reading novels, attending concerts, plays, and dance performances, viewing visual artworks in museums, street art and murals, and art reproductions online or in print.

Alongside the possible impacts that creative acts can provide, this receptive art category holds widespread potential across urban (city art installations), institutional (galleries, museums), clinical (hospital murals), and professional and domestic

spaces (art in offices and homes). The prospective well-being benefits from arts interactions—such as viewing artworks—are supported by the theoretical argument that there are rich cognitive, affective, and neurophysiological mechanisms involved in receptive art experiences (Chatterjee & Vartanian, 2016; Leder et al., 2004; Pelowski et al., 2017), that support mood and arousal regulation (Mastandrea, Fagioli, et al., 2019). Furthermore, the small portion of existing epidemiological and experimental studies that have examined the impact of receptive art engagement show promising indications that visiting arts and cultural institutions or attending performances may indeed be beneficial (Bone et al., 2023; Camic et al., 2014; Clow & Fredhoi, 2006; Cotter et al., 2022; Manolika et al., 2024; Mastandrea et al., 2019; Noguchi & Shang, 2023; Tymoszuik et al., 2020).

However, despite the broad range of receptive art activities available, the theoretical support, and the indications from existing research of positive associations, there was, and still is now in 2025, a disproportionately low presence of research on receptive visual arts. In fact, most of the past research, within and after the 2019 WHO report, has focused on creative art forms. Furthermore, the research available evaluating forms of receptive engagement has methodological issues that limit our understanding of effects on well-being and contributing factors, which I expand on below. Overall, this leaves several open questions about whether and how visiting art museums, viewing art exhibitions, or even stopping to appreciate beauty can make a difference to levels of well-being; what important psychological experiences involved in or activity components of art viewing might be, how interventions or experiences should be designed to support well-being outcomes, and overall if cultural and health policymakers should invest in the arts specifically for their promised mental or physical health benefits.

I explore these aspects in this thesis, focusing on art viewing and appreciation. Below, I provide background and expand on these open questions, ultimately introducing the aims that guide this thesis.

Background and Open Questions

Epidemiological research has revealed positive relationships between the receptive arts and well-being. For example, two independent studies found that while accounting for socioeconomic and demographic factors, the frequency of participating in various receptive arts activities was associated with higher well-being in older

adults from the UK (Tymoszuk et al., 2020) and Japan (Noguchi & Shang, 2023). Similarly, a study of over 3000 young adults indicated that more time spent participating in organised receptive arts activities predicted enhanced flourishing (a composite well-being outcome), finding that engaging daily was better than weekly, which was better than monthly (Bone et al., 2023). Receptive arts attendance has even been called a protective factor. A recent study including over 7000 German and Swiss citizens discovered that regularly attending art events, such as visiting museums, cinemas, and concerts, could lessen the negative impact of the personality trait neuroticism on evaluative well-being (life satisfaction) and, to a lesser degree, emotional well-being (Manolika et al., 2024).

Experimental research, on the other hand, has previously found positive effects. For example, there were larger reductions in cortisol levels after a short museum visit during the lunch break compared to a sham condition (Clow & Fredhoi, 2006) and reductions in blood pressure in the museum (Mastandrea et al., 2019). Further, there were improvements in psychological well-being aspects such as mood (Averbach & Monin, 2022; Ho et al., 2015), meaning in life (Cotter et al., 2022; Totterdell & Poerio, 2021), and overall well-being after participation in multi-session art programs or single art viewing sessions.

However, despite the above suggestions that engaging in receptive art activities may support well-being, the aforementioned research fails to fully clarify the impact of receptive art activities for several reasons, first, by nature of the methods used. Epidemiological studies produce descriptive and associational evidence, making causality difficult to determine even while accounting for factors such as wealth, age, or education. Without randomising one group to an arts activity and the other to a well-matched control condition, there is always room for confounding effects, like similar factors responsible for both measured outcomes. These might include confounds introduced by the research process (i.e., answering survey questions) or latent factors causing both associated outcomes, throwing doubt on observed epidemiological associations.

Second, past large-scale cross-sectional studies have used cumulative measures of receptive arts, asking about how often individuals have participated in any of the following activities: visited museums, attended concerts, visited libraries, attended lectures (Noguchi & Shang, 2023; Tymoszuk et al., 2020). This formulation is almost certainly due to the natural limitations of large-scale data collection, in

which researchers can often only submit a handful of questions to be asked in existing participant pools or in population surveys. However, these composite question-stem formations, while providing a broad understanding of how general engagement in the arts or leisure activities is related to health, do not offer evidence to inform applications or insights into the impacts of specific receptive art activities, such as art museum visits.

Similarly, when considering epidemiological and experimental methodologies, it remains unclear which contextual or psychological aspects of such art experiences might support health or well-being outcomes. Beyond the composite measures mentioned above, even in studies where the effects of museum programmes have been assessed pre- and post-programme and compared to control groups, the additional activity components involved in a museum visit have not been systematically evaluated. These might involve the social elements of the tour, the excitement and reward of breaking from one's routine to visit a museum, or even the extra exercise gained from walking through the gallery—alongside the fundamental act of viewing a painting or experiencing something beautiful. Further along these lines, there has been limited focus on mechanistic factors that could explain the impact of art viewing, which, when both issues are taken together, makes designing interventions and understanding effects difficult.

Overview of Research Aims

Therefore, in response to the open questions above, this thesis has several research aims divided into two sections. The first section, *Establishing an Evidence-Based and Theoretical Background*, focuses on evaluating the existing evidence base for the impact of art viewing on well-being through a systematic review of past studies in Chapter One and a series of experimental studies in Chapter Two (and replicated in Chapter Three and Four) to measure the well-being impact of the most basic unit of receptive art engagement—viewing one painting. At the same time, beyond addressing whether art viewing can support well-being, I outline theoretical mechanisms from past literature and deal with questions of context by providing an overview of what art viewing circumstances have been studied concerning well-being in the past, and consider what kind of art, in what setting and format, viewed with whom, with what schedule, as well as what kinds of subjective cognitive-affective

experiences predict well-being outcomes (i.e. liking or understanding the art, and emotional states).

The second section, *How Art Experiences and Interventions Can be Designed, Implemented and Evaluated*, moves beyond questions of whether, when and how receptive visual art engagement might impact well-being to answer more applied enquiries. Questions such as in Chapter Three, who benefits more from art viewing and why, in Chapter Four, whether well-being effects from art viewing can be enhanced through theory-informed gallery augmentation, and in Chapter Five, whether the art and beauty appreciation can be taught as a preventative strategy buffering ill-being.

Furthermore, throughout the chapters, there is also a consistent theme focusing on methodological rigour and advancement of the field of art viewing, health and well-being. Within the Arts and Health movement, there have been reasonable criticisms regarding the quality of the evidence that many widescale applications are based on (Clift et al., 2021; Skov & Nadal, 2023). This naturally has consequences from both a policy perspective, where funding mandates could support programs that do not have reasonable benefits to users, and a more fundamental issue of understanding the effects of art viewing in general. Without sound research converging across methods, it will remain unclear to what extent the arts should be considered a well-being tool. In light of this background, this thesis not only uses pre-registration (Chapters One, Three, Four) and provides open data and materials (Chapters One, Two, Three) but also produces an open literature database and reporting guidelines for future researchers (Chapter One) to support higher quality science. Finally and most pervasively, I return, again and again, to the experimental golden standard, the previous uses of, need for, and process to design a matched control condition (Chapters One, Two, Four) to be used in randomised experimental designs. This latter goal culminates in Chapter Five, which presents a protocol for a clinical trial evaluating the isolated contribution of beauty appreciation towards well-being and mental health.

Finally, I discuss the results in the context of other research and theory, point out the strengths and pitfalls of my methodology and approach, and outline this research's main conclusions and contributions, suggesting applications and future research directions.

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Establishing an Evidence Base and Theoretical Background

Chapter One

What is the state of the field empirically and theoretically?

Status:

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My Contribution:

Although listed as chapter one, this project has run parallel to my other projects. I led the conceptualisation and project management and designed the scope and methodology alongside CH, AF, and MP. Together with CH, AF, and JK, I conducted the screening process and collaborated with AF and JK on data extraction and quality control. I performed the data analysis and quantitative and qualitative synthesis, drafted and revised the manuscript, and handled data visualisation. Additionally, I secured funding from the University of Vienna to cover Covidence and Nivo licenses as well as supervised an intern who helped with data extraction.

The impact of viewing art on well-being—a systematic review of the evidence base and suggested mechanisms

MacKenzie D. Trupp ^{a,b}, Claire Howlin ^{c,d}, Anna Fekete ^e, Julian Kutsche ^{f,g}, Joerg Fingerhut ^g
and Matthew Pelowski ^{a,h}

^aFaculty of Psychology, Department of Cognition, Emotions and Methods, University of Vienna, Vienna, Austria; ^bDonders Institute for Brain, Cognition, and Behaviour, Radboud University Medical Center, Nijmegen, The Netherlands; ^cSchool of Psychology, Trinity College Dublin, Dublin, Ireland; ^dDepartment of Psychiatry, University of Cambridge, Cambridge, UK; ^eFaculty of Psychology, Department of Clinical and Health Psychology, University of Vienna, Vienna, Austria; ^fDepartment of Neurology with Experimental Neurology, Charité – Universitätsmedizin Berlin, corporate member of Freie Universität Berlin and Humboldt-Universität zu Berlin, Berlin, Germany; ^gBerlin School of Mind and Brain, Department of Philosophy, Humboldt-Universität zu Berlin, Berlin, Germany; ^hCognitive Science Hub, University of Vienna, Vienna, Austria

ABSTRACT

Art viewing is increasingly seen as having benefits for well-being. Despite this, evidence is scattered, and the siloed nature of past research stunts our mechanistic understanding. To address this, we systematically reviewed (CRD42022296890) the evidence of the effects of art viewing on well-being, summarised the characteristics of art viewing experiences, study designs, and results, and thematically analysed suggested mechanisms. CINAHL, EBSCOhost, Scopus, and PubMed were searched, 3893 abstracts were screened, and 38 papers were included ($N = 6805$ participants). Quantitative synthesis revealed a diversity of settings, schedules, activities, and outcomes. Thematic analysis revealed affective, cognitive, social, self-transformative, and resilience-building mechanisms that were often context-dependent. While convergent evidence exists for eudemonic well-being, we found no strong support for other well-being outcomes. More rigorous methodology and a focus on activity components and mechanisms is needed. We make recommendations and introduce the new Receptive Art Activity Research Reporting Guidelines (RAARR, <https://osf.io/qjg72/>) to support future research.

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The last two decades have seen a growing recognition of the potential of the arts to promote well-being and improve health (Fancourt & Finn, 2019). Numerous studies have suggested that engaging in a range of activities, such as attending the theater or cultural events (Fancourt & Steptoe, 2018; Fancourt & Tymoszuk, 2019; Jensen et al., 2023; Tymoszuk et al., 2020), participating in drawing classes (Beauchet et al., 2020), singing, dancing (Estevao et al., 2021; Hillman, 2002; Moss & O'Donoghue, 2020), or incorporating arts activities into one's daily life (Cuypers et al., 2012), may provide numerous benefits to mental and physical health. These findings have been extensively mapped in a World Health Organization (WHO) commissioned scoping review (Fancourt & Finn, 2019), identifying more than 3000 studies evaluating the impact of art and designating the arts as a social determinant of health. However, while there is growing evidence that the arts might

make a difference in the lives of individuals, several research gaps remain. This especially involves whether to-date overlooked art modalities—namely, viewing visual art—can support well-being, as well as when (under what circumstances), where (in what contexts), and through which mechanisms such effects occur.

Visual arts—a compelling, under-examined resource for well-being

The main emphasis on art and well-being research, to date, even regarding visual modalities, has been on engagement as a productive or creative act—in art making, attending classes, or art therapy (Fancourt & Finn, 2019). Far less research has been conducted on engaging with visual art—a visit to a museum, a painting installed in a domestic, clinical, or work setting, or coming across a public artwork in the city—as a receptive

CONTACT MacKenzie D. Trupp  mackenzietrupp@gmail.com  Faculty of Psychology, Department of Cognition, Emotions and Methods, University of Vienna, ARTIS Lab, Wächtergasse 1/306, Vienna 1010, Austria

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activity that can improve well-being. Conversely, other receptive forms, such as music listening for pain management (Howlin & Rooney, 2020; Howlin, Stapleton & Rooney, 2022) or community film and theater for suicide prevention (Sonke et al., 2021), have received considerable review, informing research agendas and applications. This gap exists even though visual arts interactions in our urban, institutional (gallery, museum), domestic, or professional spaces are widely available, often with a low threshold for engagement. In fact, emerging evidence suggests that briefly visiting a museum or engaging with a single painting might be enough to experience positive effects on mood and stress (Clow & Fredhoi, 2006; Mastandrea, Maricchiolo et al., 2018; Trupp et al., 2022, 2023).

As with the ubiquity of digital music listening, which underpins its broad reach, art viewing can be comparatively easy to incorporate into one's life. This accessibility, combined with arts and aesthetic experiences' rich cognitive, affective, perceptual, social, and neurophysiological aspects (Chatterjee & Vartanian, 2016; Leder et al., 2004; Pelowski et al., 2017), suggests that visual art viewing also has the potential to be a well-being resource (Mastandrea et al., 2019). Yet, despite being a community asset of rising societal attention and theoretical prospect, past research on art viewing's well-being implications has not been systematically considered. This leaves unanswered questions about the strength of the evidence base, which represents key issues in arts and health policy discourse (Clift et al., 2021; Grebosz-Haring et al., 2022).

Beyond if—what are the ingredients and mechanisms for well-being effects?

At the same time, beyond addressing whether art viewing can support well-being, a pervasive question regards what features or components might contribute to specific outcomes. In epidemiological work, for example, the frequency of museum attendance is often collected without attention to context. What kind of art, in what setting, with whom, and for how long was the art viewed? In fact, across *all* art-related interventions, this is a topic of interest, as many different 'ingredients'—regarding setting, schedule, artwork, activity, or individuals—may contribute differentially to the overall effects on well-being (Warran et al., 2022). With such diversity across art viewing activities, pinpointing essential components is difficult. For instance, both viewing one painting individually (George et al., 2018; Trupp et al., 2022, 2023) and attending a several-week museum program

that includes educational tours and group discussions (Murphy et al., 2021; Newman et al., 2012) have been concluded to be effective. Yet, little has been attempted to examine the types or importance of such differing contexts or ingredients.

Even more, there is not yet a consensus on or a focused review of the mechanisms for how art-viewing activities may lead to well-being outcomes. Several theories are often cited in past research from the diverse fields of visual empirical aesthetics (Fekete et al., 2022; Mastandrea et al., 2019), positive humanities (Tay et al., 2018), music science (Howlin & Rooney, 2020), leisure activities (Fancourt et al., 2021), and nature exposure (Kaplan, 1995). Typically, these models have been designed for either different engagement modalities or singular outcomes (e.g. pain, see Fekete et al., 2022). For example, from the field of empirical aesthetics, a widely-cited review (Mastandrea et al., 2019) hypothesized a link between well-being and aesthetic experience—a cognitive and affective state founded in the philosophical traditions (Skov & Nadal, 2020), that is evoked by appreciation and results in pleasure (Chatterjee & Vartanian, 2016; Leder et al., 2004; Mastandrea et al., 2019; Pelowski et al., 2017). Primarily, this link to well-being was suggested to be through the ability of art experiences to evoke pleasure and to activate reward networks in the brain (Mastandrea et al., 2019) or emotional processing networks associated with short-term changes in mood (Mitterschiffthaler et al., 2007). However, other mechanisms related to identity affirmation or resilience-building, present in leisure and nature-related fields (Fancourt et al., 2021; Kaplan, 1995), could be equally important to consider. Furthermore, outside of theoretical papers, individual research teams may have suggested pathways underlying the well-being-related effects of art viewing that might be missing without a systematic overview. Considering this, an inclusive overview is needed to support hypothesis generation for researchers and for evidence-based program and policy design.

Study aims

This systematic review summarizes and evaluates the literature on receptive art viewing and well-being. We investigate where, when, and for whom art viewing has been used by summarizing the setting, schedule, and characteristics of art viewing activities. We critically assess the evidence of the well-being effects of art viewing and present a thematic analysis of suggested explanatory mechanisms. Furthermore, our output includes

a database for future researchers to explore trends and research gaps and we developed the Receptive Art Activity Research Reporting Guidelines (RAARR), which provide a guide of what and how to describe art interventions and experiences and related research in an effort to support forthcoming publications and future meta-analyses.

Methods

For more details about the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Tricco et al., 2018), the PROSPERO protocol (CRD42022296890), search, screening, and analysis, see OSF <https://osf.io/kmqds/>.

Search strategy

Four databases were searched for relevant peer-reviewed articles published between 2000 and 2023. These included the Cumulative Index of Nursing and Allied Health Literature (CINAHL), EBSCOhost, Scopus, and PubMed, using main categories of terms related to the categories of Art, Well-being, Mental health, Pain, Stress, and Viewing (see the full syntax in Supplementary Materials). The initial search was conducted in January 2022, with a top-up search conducted in October 2023 based on best practice guidelines for systematic reviews (Kolaski et al., 2023; Shojania et al., 2007).

Study eligibility

Inclusion eligibility was based on three main criteria: types of studies, art viewing activity, and well-being outcome (for further information, see Table 1). Studies had to be empirical, use primary qualitative or quantitative methods, and directly evaluate the effect of art viewing on a well-being-related outcome. Art viewing was defined first by the type of art and second by an active viewing component. The art included was visual

objects or images in any kind of plastic media (e.g. paintings, drawings, sculptures, installations, mixed-media) and did not include films or performances such as performance art, dance, theater, as well as architecture, or nature. We, therefore, included papers if the original authors had labeled the stimuli in their studies as ‘art’ or if a stimulus was typically considered art in public opinion (i.e. a painting) and, importantly, where the participants in a study were expected to assume that they were engaging with art stimuli. Regarding viewing, we excluded studies where it was unclear if the well-being change was due to the art viewing. An example would be if art is hung in a large office space; it might not be noticed or viewed by all employees but could be reported as the cause of measured well-being change from pre- to post-installation. Thus, we included an ‘active viewing’ component, where the researchers had to specify that the art was viewed in the procedure section or report the participant’s opinion or the art or viewing duration (see Protocol for detailed definitions). The primary outcomes of interest were well-being, stress, anxiety, and pain. Well-being: the state of an individual when they have the physiological, social, and physical resources they need to meet psychological, social, or physical challenges (Dodge et al., 2012). Thus, we included evaluative well-being (i.e. life satisfaction), eudemonic well-being (i.e. meaning in life), and short-term transitory emotional well-being (i.e. mood, happiness, emotions) in line with Stone and Mackie (2013). In addition, stress/anxiety included stress, anxiety, arousal, and physiological markers of stress (i.e. blood pressure and heart rate). Pain included any measure of pain. Finally, in rare cases, social well-being (i.e. reduction of isolation) emerged as a relevant aspect during our review process.

Study selection and quality appraisal

Each abstract was screened by two independent reviewers randomly assigned from a group of four (the

Table 1. Study eligibility criteria.

Inclusion Criteria. Studies should:	
(1)	Be empirical studies with primary qualitative or quantitative data collection including randomized, quasi-randomized, cross-sectional, and/or longitudinal evaluation of the effect of art viewing.
(2)	Use receptive art engagement where the person actively views one or more visual artworks (painting, art poster, sculpture, installation, exhibition).
(3)	Evaluate the impact of art viewing on health and wellbeing outcomes e.g. well-being, stress, anxiety, pain, emotional regulation, quality of life, life satisfaction, social connection, loneliness, identity or meaning of life. This list is not exhaustive.
Exclusion Criteria	
(1)	No identification of target objects or images as ‘art’ by either the paper authors, or targets would not be typically considered to be classified/believed as ‘art’ by study participants.
(2)	Sole focus on art-making and/or no independent assessment of art viewing activity and outcomes (i.e. outcomes based on combination of viewing and creating acts).
(3)	No inclusion/identification of any measure of explicit art viewing action (e.g. perception of artwork, duration of viewing, appraisal, etc.).
(4)	No consideration of receptive engagement with visual art (i.e. considers viewing dance, opera, plays, entertainment or documentary films, etc.)

first, second, third, and fourth authors) for relevance against the inclusion and exclusion criteria. The screening was done using online screening tools, first Rayyan (<https://www.rayyan.ai>) and then Covidence (<https://www.covidence.org>), once funding was acquired. For the subsequent full-text review of candidate papers, each manuscript was first reviewed in full by one of the above four reviewers and independently checked by a second reviewer. Any questions regarding suitability for inclusion were discussed for each paper at each stage. Additionally, during full-text review, one reviewer (the first author) conducted a quality control appraisal, focusing on the validity of the study methods, the quality of the methods' application, and the clarity of reported results. The identified at-risk papers were then discussed with a second reviewer (the third author). This step was applied with a low bar for inclusion, as a central aspect of this review sought to consider the robustness of methods among the papers in the analysis.

Quantitative data extraction and analysis

Data were extracted regarding the included papers' aims, study methods (design, methodology, measurement, population and sample size, frequency of testing, subjective art experience), measured outcomes (type of outcome, scales/measurement used, overview of results), and art-viewing activities (duration, number of sessions, setting, art type, social status, number of artworks). In addition to the art viewing activities, we also extracted 'accessory activities', which we defined as any component other than art viewing included as part of the program (i.e. lunch break, educational content in the tour, etc.). This additional information was extracted in a follow-up round by one reviewer (of a group of five possible: the first, second, third, and fourth authors, as well as an intern), and 100% of the data were double-checked by a second reviewer from the group, working independently, using Covidence to compare the extracted data to the original article. The study methods, art-viewing activities, and outcomes, including content analysis and descriptive frequencies, were analyzed using R (R Version 2021.09.1).

Qualitative data extraction and synthesis

To extract and synthesize the suggested mechanisms underlying the impact of art on aspects of well-being, we completed an inductive thematic analysis using a six-step qualitative synthesis strategy (Braun & Clarke, 2006) within NVIVO (<https://lumivero.com/products/nvivo/>), a tool to organizing papers, codes, and themes

(Zamawe, 2015). After familiarization with the data, one reviewer (the first author) went through the introduction and discussion of each printed paper to generate codes that identified descriptions in the text that corresponded with processes or mechanisms of art-viewing experiences linked by the paper authors to psychological benefits. We took an inclusive approach, including when mechanisms and well-being outcomes overlapped. For example, the outcome social well-being is typically measured by asking about social processes such as connection, belonging, or isolation, which represent the means through which social wellbeing is achieved, so we considered these as outcomes. However, these are also implicated as mechanisms in a range of other types of wellbeing, such as anxiety, depression, and stress. Three hundred nineteen codes were extracted and consolidated into 10 descriptive themes based on 29 sub-themes. This thematic framework was discussed and further developed among the full author team for relevance and importance. Finally, one reviewer (first author) re-read all introduction and discussion sections of the papers to review the themes and their significance and prepare descriptions. This was done by extracting all relevant text related to the themes and subthemes. The final mechanism taxonomy included five analytic themes and 18 subthemes.

Results

Search results

The descriptive data on the number of papers considered at each review stage and reasons for exclusion (i.e. wrong outcome, design, intervention, etc., and the definition for exclusions) can be found in the flow chart in Figure 1. After screening, a final set of 38 articles was included for data extraction and synthesis, which included $N = 6805$ participants across all studies. The final selection of papers comprised 22 quantitative papers, six qualitative papers, and 10 mixed methods, which were analyzed and reported together. An overview of included studies can be found in Table 2. Further details can be found in the Supplementary Materials.

Art viewing activity characteristics

Our first aim was to address where, when, and in what contexts art viewing has been evaluated in past research regarding improving well-being. An overview of the characteristics of art experiences, including the setting, accessory engagement, art type, and schedule, is shown in Figure 2, and further details, including percentages

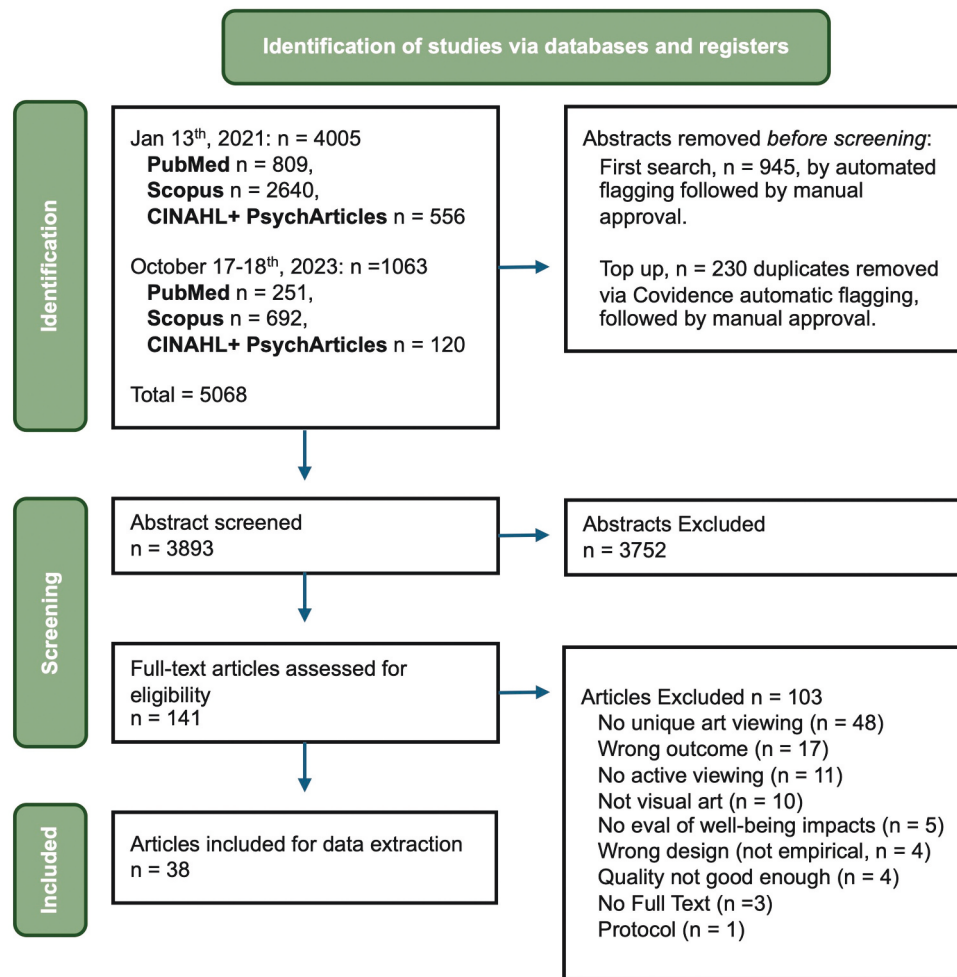


Figure 1. PRISMA flow chart for systematic reviews (Tricco et al., 2018) outlines the search process and exclusions. Reasons for exclusion included: no unique measurement of well-being change related to art viewing; the dependent variable did not meet our inclusion criteria; no indication that the participant actually viewed the artwork; the art included was other than painting, sculpture, installation, mural, and mixed media (for example, performance, music, and dance); no measurement of change in well-being due to art viewing within or between participants; no primary data; insufficient quality (unclear how the study was conducted or analyzed); the full article could not be acquired. Protocol: the article was a protocol for a study but included no data.

and which papers fell in each category, can be found in the Supplementary Materials Tables S2–S7.

Setting

The settings for art experiences included museum contexts, clinical spaces, lab environments, and online and digitally facilitated viewing. The most noted context, 26% of the articles, involved gallery or museum visits most often attended as part of the intervention or research program. These studies again showed a wide range of characteristics within one setting type. For example, for five minutes, Mastandrea et al. (2018) had participants visit a gallery of either figurative or modern paintings. Newman et al. (2014) asked participants to visit a museum thrice, including a group lunch, a tour, and a discussion. 24% of

articles were in online settings, where art viewing typically took place at home with either a tablet sent home with participants (Murphy et al., 2021; Tyack et al., 2017) or using non-immersive virtual reality (Cotter et al., 2023, 2022). In 21% of studies, art was viewed within a clinical (e.g. hospital) setting, with art viewed either as part of one-to-one facilitator-led sessions (Gelo et al., 2015; Thomson et al., 2012) or hung on the wall as part of the décor and evaluated for the impact on staff or patients (Bowen et al., 2015; George et al., 2018). Lastly, 16% of papers were set in the laboratory. In this setting, art viewing was included to directly test aspects of art perception, emotion, or other viewing factors, with participants typically instructed to view many artworks (Laurer & van der Vennet, 2015; Law et al., 2020).

Table 2. Overview of papers included in the review.

Author, Year	Art Viewing n/Total	Population	Art Viewed	Design	Control	Duration	Frequency	Setting	Outcomes
Averbach et al. (2022)	155	older adults	mixed (objects, photographs)	within-subject (repeated measures), between-subject (hybrid vs. virtual vs. in person)	N	31–60 minutes	once	mixed, online, community laboratory	positive, negative emotions (mDES), life satisfaction (SWLS)
Bell and Robbins (2007)	25/50	general population	paintings	RCT, within-subject (repeated measures), between-subject (art production vs. art sorting) after neg. mood induction from 'to-do' list	Y	6–30 minutes	once	laboratory	mood (POMS), state anxiety (STAI), trait anxiety (STAI)
Bowen et al. (2015)	65/90	cardiac surgery patients	paintings, drawings, photography, a collage, and one quilted piece	quasi-experimental controlled within-subject (repeated measures), between-subject (no artwork, regular artwork, staff made artwork)	Y	patient led	unclear	hospital	mood states (POMS-SF)
Camici et al. (2016)	24	dementia patients and caregivers	contemporary art	single group intervention, qualitative research	N	31–60 minutes	5+ times	museum, gallery	positive affect, respite, inspiration, reduced isolation, changed perception (interview)
Cotter et al. (2022)	587/687	general population	paintings	RCT, within-subject (multiple repeated measures) between subject (reading vs. several art viewing conditions)	Y	6–60 minutes	2–4 times	online	depression, stress, anxiety (DASS-21), thriving (CIT), satisfaction with self-determination (BMPN)
Cotter et al. (2023)	155	general population	paintings	randomized experimental, within-subject (repeated measures), between-subject (curious looking, mindful looking, no instruction looking)	N	6–30 minutes	once	online	thriving (BIT), life satisfaction (SWLS), self-acceptance (PWBS), emotional experience (Likert scale)
Drake et al. (2023)	(1) 59, (2) 33/63	students	paintings	(1) counterbalanced experimental within-subject (viewing vs. making + repeated measures) after neg. mood induction; (2) randomized experimental between-subject (making vs. viewing), within-subject (repeated measures)	Y	6–30 minutes	once	laboratory	positive, negative emotions (PANAS)
Gelo et al. (2015)	20	hospital patients	paintings	single-group qualitative research	N	6–30 minutes	once	hospital	spiritual well-being, positive emotions (interview)
George et al. (2018)	131/169	cancer patients	paintings	RCT, within-subject (repeated measures), between-subject (chosen art, non-chosen art, medical whiteboard/no art)	Y	3+ days	once	hospital	anxiety (STAI), mood, depression (ETI), pain, quality of life (medical records)
Goulding (2012)	43	older adults	contemporary art	single-group intervention, qualitative research (repeated measures)	N	unclear	2–4 times	museum, gallery	well-being, reduced isolation (interview)
Grossi (2019)	100	general population	frescos	quasi-experimental within-subject (repeated measures)	N	61+ minutes	once	historic site	well-being (VAS), stress (saliva cortisol)
Hadavi (2022)	60	general population	mixed (paintings, contemporary art)	RCT, within-subject (repeated measures), between-subject (immersive art w. selected background music, and only art)	N	unclear	once	online	positive, negative emotions (PANAS)
Ho et al. (2015)	97	hospital staff, patients, visitors	mixed (drawings, paintings)	randomized experimental within-subject (repeated measures), between-subject (no direction vs. guided relation vs. guided direction)	N	participant determined	once	hospital	mood (BMIS)

(Continued)



Table 2. (Continued).

Author, Year	Art Viewing n/Total n	Population	Art Viewed	Design	Control	Duration	Frequency	Setting	Outcomes
Huet (2016)	20	employees in service jobs	mixed (figurative and abstract paintings, photographs, collages)	exploratory embedded multiple case study (repeated measures)	N	31–60 minutes	2–4 times	workplace	stress (interview), quality of life (ProQOL)
Igdalova and Chamberlain (2023)	144	general population	mixed (photographs, paintings)	RCT, between-subject (2 audio conditions and no audio), within-subject (repeated measures)	N	participant determined	once	online	mood (affect grid)
Jensen (2018)	17	adults with mental health concerns	unclear	single-group intervention, qualitative research	N	unclear	2–4 times	museum, gallery	empowerment, meaning of life (interview)
Johnson et al. (2017)	66	dementia patients and their caregivers	mixed (artifacts, paintings)	quasi-experimental between-subject (order of art viewing vs. object handling), within-subject (repeated measures)	N	unclear	once	museum, gallery	well-being (VAS)
Kamlik et al. (2014)	826/1094	general population	contemporary art	descriptive between-subject (noticed art vs. didn't notice)	N	unclear	unclear	hospital	mood, stress, comfort, pain (scale)
Klingemann et al. (2018)	482/1950	general population	contemporary art	mixed methods quasi-experiment (art type vs. art type x office vs. hospital), interviews, observational study	Y	participant determined	once	hospital	stress, ease (observation and self-report)
Laurer and van der Vennet (2015)	14/28	clinical patients (substance use disorder)	paintings	RCT, within-subject (repeated measures), between-subject (art production vs. art sorting) after neg. mood induction from 'to-do' list	Y	unclear	once	laboratory	negative mood (POMS), state, trait anxiety (STAI)
Law et al. (2020)	15/30	general population	photographs	RCT, within-subject (repeated measures), between-subject (scrambled images vs. art) after stress inducing task	Y	6–30 minutes	once	laboratory	affect (AVI), fatigue (scale), stress (saliva cortisol, α -amylase), arousal (pupil size)
Mastandrea et al. (2018)	46/77	undergraduate students	paintings	RCT, within-subject (repeated measures), between-subject (office visit vs. art museum visit, figurative vs. modern art)	Y	≤ 5 minutes	once	museum, gallery	systolic blood pressure, heart rate
Mastandrea et al. (2019)	126	general population	mixed (art images)	randomized experiment within-subject (repeated measures), between-subject (disturbing vs. neutral vs. serene art content)	N	6–30 minutes	once	online	state anxiety (STAI)
Mitchell et al. (2008)	80	university students, staff and their acquaintances	paintings	RCT, within-subject (conditions: preferred music vs. preferred painting vs. silence control)	Y	participant led	once	laboratory	pain intensity (VAS), state anxiety (SSAQ), pain experience (PMQ)
Murphy et al. (2021)	31	older adults living in long-term care	mixed (photographs, paintings, sculpture, textile)	experimental randomized within-subject (repeated measures), between-subject (partner art app play vs. group art app play)	N	6–30 minutes	5+ times	online	well-being (WEMWBS), quality of life (EQ-5D-5L), global health (VAS)
Newman et al. (2014)	38	older adults	contemporary art	single-group intervention qualitative research (repeated measures)	N	unclear	2–4 times	museum, gallery	identity (focus group, interview)
Nielsen et al. (2017)	30	hospital patients	paintings	mixed methods, natural/quasi-experimental between-subject (no art vs. art)	Y	patient led	once	hospital	stimulating social connection and interaction, emotional and cognitive effects (interview)

(Continued)

Table 2. (Continued).

Author, Year	Art Viewing n/Total	Population	Art Viewed	Design	Control	Duration	Frequency	Setting	Outcomes
Noorily (2023)	40	medical students	paintings	mixed-methods, between-subject, prospective cohort study	N	61+ minutes	5+ times	online, museum	perceived stress (PSC), focus on present moment, emotional awareness (interview) happiness, stress (VAS)
Riches (2022)	111	general population	paintings	quasi-experimental within-subject (repeated measures)	N	unclear	once	museum, gallery	identity, feeling valued, memory triggering (interview), connecting to mind of another, emotional arousal (qualitative)
Roberts et al. (2011)	10	caregivers	mixed (not specified but including paintings)	single-group intervention qualitative research	N	61+ minutes	once	museum, gallery	quality of life (QoL-AD), affective behavior (NPI), emotional well-being (FAHW)
Schall (2018)	44	patients with dementia	paintings	RCT (repeated measures), between-subject (independent museum visits vs. ARTEMIS intervention group)	N	unclear	5+ times	museum, gallery	stress (cortisol), stress, arousal (SACL)
Ter-Kazarian (2019)	31	general population	unclear	quasi-experimental within-subject (repeated measures)	N	31–60 minutes	once	museum, gallery	positive, negative mood (PANAS), wellness, happiness (VAS)
Thomson et al. (2012)	100	hospital patients	mixed (objects, photographs)	quasi-experimental within-subject (repeated measures), between-subject (tactile vs. viewing), (oncology vs. non-oncology)	N	6–30 minutes	once	hospital	emotional well-being (multi-affect indicator), life satisfaction (SWLS), meaning in life (MLQ), mental well-being (WEMWBS), and single items
Totterdell and Poerio (2020)	(1) 544, (2) 50	general population	mixed (drawings, paintings, photographs, video art, sculpture, conceptual art, ceramics)	(1) associational large survey between art types, time engaged the day before, compared to sports, (2) ESM between-subject (sports vs. live art attendance, vs. art production)	Y	participant determined	unclear	mixed	Loneliness (DJGLS), negative, positive mood (scale), life satisfaction (SWLS), state anxiety (STAI), subjective well-being scale (SWBS)
Trupp et al. (2022)	40	general population	paintings	experimental randomized between-subject (art vs. non-art), within-subject (repeated measures)	Y	participant determined	once	online	state anxiety (STAI), positive, negative mood (PANAS) well-being, happiness, wellness, interestedness (VAS), quality of life (QoL-AD), mood improvement, range of feelings, lowered mood (interview)
Trupp et al. (2023)	240	students	paintings	single-group quasi-experimental within-subject (repeated measures)	N	participant determined	once	online	arousal, valence (SAM), implicit emotion regulation (EEG ERP)
Tyack et al. (2017)	24	dementia patients and their caregivers	mixed (sculpture, paintings, photographs)	quasi-experimental mixed methods within-subject (repeated measures)	N	participant determined	unclear	online	
Van Dongen et al. (2016)	24	students	paintings	counter-balanced experimental EEG study within-subject (pleasant vs. non pleasant art pictures), within-subject (art vs. non art context)	Y	≤5 minutes	once	laboratory	

Abbreviations: AVI: Affect Valuation Index, BIT: Brief Inventory of Thriving, BMIS: Brief Mood Introspection Scale, BMPN: Balanced Measure of Psychological Needs, CIT: Comprehensive Inventory of Thriving, DASS-21: Depression, Anxiety and Stress Scale – 21 Items, DJGLS: De Jong Gierveld Loneliness Scale, EEG: Electroencephalogram, EEG ERP: Electroencephalogram Event-Related Potential, ESM: Experience Sampling Method, ETI: Emotional Thermometer Instrument, FAHW: Fragebogen zum allgemeinen habituellen Wohlbefinden, mDES: Modified Differential Emotions Scale, MLQ: Meaning in Life Questionnaire, NPI: Neuropsychiatric Inventory, PANAS: Positive and Negative Affect Schedule, POMS-SF: Profile of Mood States – Short Form, PMQ: McGill Pain Questionnaire, ProQOL: Professional Quality of Life Scale, PSC: Perceived Stress Questionnaire, PWBS: Psychological Wellbeing Scale, QoL-AD: Quality of Life – Alzheimer's Disease scale, RCT: Randomized Controlled Trials, SAM: Self-Assessment Manikin, SACL: Stress Arousal Checklist, STAI: State-Trait-Anxiety Inventory, SWBS: Subjective Well-being Scale, SSAQ: Spielberg State Anxiety Questionnaire, SWLS: Satisfaction With Life Scale, VAS: Visual Analogue Scale, WEMWBS: Warwick-Edinburgh Mental Wellbeing Scale.

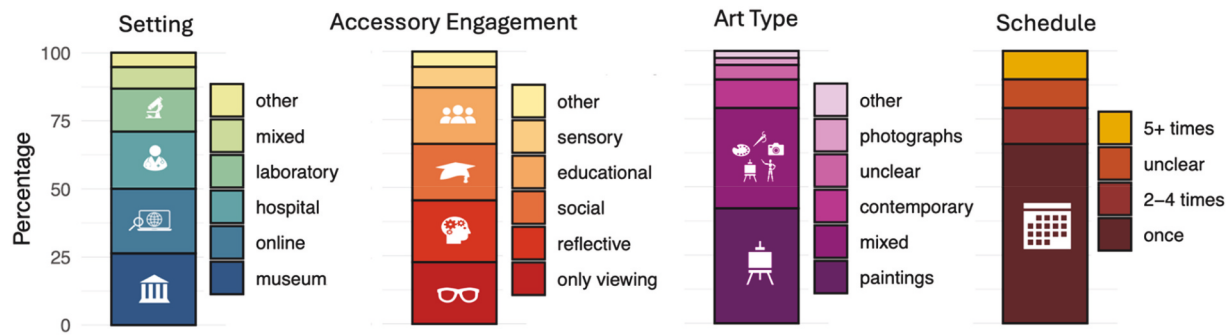


Figure 2. Overview of art viewing activities found in the literature showing the percentage breakdown by included papers ($N = 38$). Art viewing was frequently set in museums, online, hospitals, and laboratories. Accessory engagement activities alongside art viewing were divided into roughly a quarter of included online viewing papers, followed by educational, reflective, and social activities. The art included in interventions or activities was mostly paintings or mixed art types, including mixed media, followed by contemporary artworks. Most articles had only one session of art viewing. Color palette from R package MoMAColors (Mills, 2023).

Interestingly, across settings, the population of participants was also stratified. For example, those in lab settings were always healthy volunteers or students, while those in clinical settings included staff, patients, and visitors. The only population with health concerns that were brought outside of clinical settings was those with dementia who took part in museum programs, usually with their caregiver (Camic et al., 2016).

Accessory engagement

We also extracted 'accessory engagements', defined as tasks accompanying art viewing. As can be seen in Table 2, a large diversity of activities and conditions were employed. Most papers (68%, 26 papers) included some accessory activity in addition to viewing, while 12 papers included only art viewing. The activities broadly fell into reflective, educational, social, and sensory activities. It was common for papers to have several accessory activities across categories; thus, below, we present the occurrences considering the percentages of the total number of activities extracted ($N = 53$ activities across 26 papers).

Reflective activities were the most common, at 23%. These included tasks such as written or creative reflections after art viewing (Camic et al., 2016; Ho et al., 2015), rating or discussing the emotional impact of the artwork while viewing (Gelo et al., 2015; Mastandrea, Maricchiolo, et al., 2019), or following viewing instructions to look mindfully or to think about the meaning of the artwork (Cotter et al., 2022; Ho et al., 2015; Igdalova & Chamberlain, 2023).

Twenty-one percent were social accessories, including discussions in dyads and group social exchanges. This took the form of dialogs about the art, memories, emotional reactions, and thoughts brought up between dementia patients and their caregivers (Tyack et al., 2017) within groups of participants (Camic et al., 2016; Huet & Holttum, 2016;

Newman et al., 2014), and in one-to-one facilitated discussions (Johnson et al., 2017; Thomson et al., 2012). Murphy et al. (2021) added a social element with a social media-like application where participants could post comments and emojis and see others' remarks on the artwork. Otherwise, for example, Newman et al. (2014) included a lunch break.

We were also interested in tracking if the art viewing activity was done in a social setting or alone, independently from the nature of the social activity. We found this mostly unclear, with 37% of included papers not stating whether art viewing occurred in a group. This was followed by 29% of papers employing one-on-one (Johnson et al., 2017; Thomson et al., 2012) or group social activities (Camic et al., 2016; Huet & Holttum, 2016; Newman et al., 2014); 21% of papers had solo sessions, most commonly online (i.e. Igdalova & Chamberlain, 2023; Trupp et al., 2022, 2023) or in the laboratory (Laurer & van der Vennet, 2015; Law et al., 2020).

Educational aspects, 21%, included content given during guided tours (Jensen 2018; Laurer & van der Vennet, 2015; Schall et al., 2018) or via adding written or audio information about the art (Murphy et al., 2021; Trupp et al., 2022, 2023). Sensory activities (8%) included object handling, where a physical object was brought to the bedside for hospital patients (Johnson et al., 2017; Thomson et al., 2012), a physical puzzle was made from the artwork (Murphy et al., 2021), or where background music that matched the artwork was played (Hadavi et al., 2022).

Art type

The most common art type was paintings (42%). These included several styles: figurative (i.e. Gelo et al., 2015; Laurer & van der Vennet, 2015; Nielsen et al., 2017), abstract (i.e. Nielsen et al., 2017), and

modern (i.e. Mastandrea et al., 2018). Using a combination of several art types was also common (37%), with, for example, studies including combinations of photography, painting, drawing, silkscreened prints, sculpture, textiles (i.e. quilts), and collage (i.e. Ho et al., 2015; Huet, Huet & Holttum, 2016; Murphy et al., 2021; Totterdell & Poerio, 2020), or small sculptures and artifacts (Johnson et al., 2017; Thomson et al., 2012). Roughly 11% of papers used contemporary art, including installations (i.e. Karnik et al., 2014; Klingemann et al., 2018).

The number of artworks per session also ranged notably from one to 100. Thirteen percent of studies employed only one artwork, while 16% considered a visit to an entire museum. In 26% of papers, the number of artworks was not reported.

Schedule

Two-thirds (66%) of all articles tested the effects of only one art viewing session, with the remaining one-third split between two to four (13%) and 5+ sessions (11%). These multi-session papers also tended to include repeated measures as part of the intervention design, with several accessory engagements such as tours or discussions, often for special populations such as older adults (i.e. Murphy et al., 2021; Newman et al., 2014). These also had smaller sample sizes (although not always; see Cotter et al., 2022). Notably, the number of sessions was unclear in almost 11% of studies.

We found a large range in viewing duration, from averages of 136 seconds (Mitchell et al., 2008) to continuous viewing while awake for three days (George et al., 2018). To note only the largest categories, 26% of studies had participant-determined durations, while 24% employed short set durations between 6–30 minutes. In 11% of studies, it was unclear (i.e. not reported) how long each session lasted. The duration depended greatly on the field of study. For example, those with healthy adults online or in the laboratory (Cotter et al., 2023, 2022; Mastandrea et al., 2018; Trupp et al., 2022, 2023; Van Dongen et al., 2016) tended to have shorter viewing times than studies with older adults or clinical samples (George et al., 2018; Roberts et al., 2011).

Well-being outcomes

We examined the study designs and reported results to evaluate the evidence supporting the claim that art viewing can improve well-being. The types of well-being outcomes and methods assessed are summarized in Figure 3 and Supplementary Materials tables S8–12. Across the 38 included papers, we found 107 measured well-being outcomes, as many papers had multiple

measurements or outcomes. These were split into categories aligning with current conceptions of well-being (Dodge et al., 2012; Stone & Mackie, 2013), including emotional well-being (40%), stress states, and anxiety, including physiological markers (26%), evaluative (11%), eudemonic (10%), overall well-being (5%), social (4%) and pain (4%) categories. Emotional well-being included, for example, measures of mood and emotions, whereas stress states included state and trait anxiety, self-reported and observed stress, arousal, and physical stress markers such as cortisol, heart rate, blood pressure, pain, or skin conductance. Eudemonic well-being included meaning in life. Evaluative well-being included quality of life and life satisfaction. Pain represented both subjective pain and pain tolerance. Social well-being, which became noteworthy as we extracted the data from the studies, represented reduced social isolation and loneliness. Overall well-being was also added as a distinct category, as several studies used psychometric tools blending items from several well-being categories (Cotter et al., 2023, 2022; Goulding, 2012; Murphy et al., 2021; Totterdell & Poerio, 2020; Trupp et al., 2022).

Methodology

The methods employed to describe and measure the above well-being outcomes are summarized in Figure 3(b) (for exact scales and tools used to assess well-being, see Table 2). A mix of quantitative and qualitative methodologies was employed. At the paper level, 58% of the articles used quantitative methodology, 26% had mixed methods, and 16% were qualitative. We found several measurement types when looking at each measure of well-being (total 107): 69% of measures were self-report surveys, followed in frequency by interviews, 16%, and physiological measures, 7%. In addition, some studies report singular uses of experience sampling (Totterdell & Poerio, 2020), observation of stress/calm behavior (Klingemann et al., 2018), and data extracted from medical records for quality of life and felt pain (George et al., 2018). Encouragingly, most self-report studies used standardized psychometric measures (see Table 2. for scales used to measure well-being).

Use of repeated measures. We then considered the inclusion of pre-/post-designs or repeated measures methods, as well as the inclusion of control conditions. These features are important as they can also help isolate the impact of art viewing from confounding effects (Kolaski et al., 2023; Shojania et al., 2007). $N = 30$ papers included a repeated measures design, with a baseline measurement within subjects. The studies that did not use repeated measures included measurement after or during the art viewing, with quantitative descriptions of

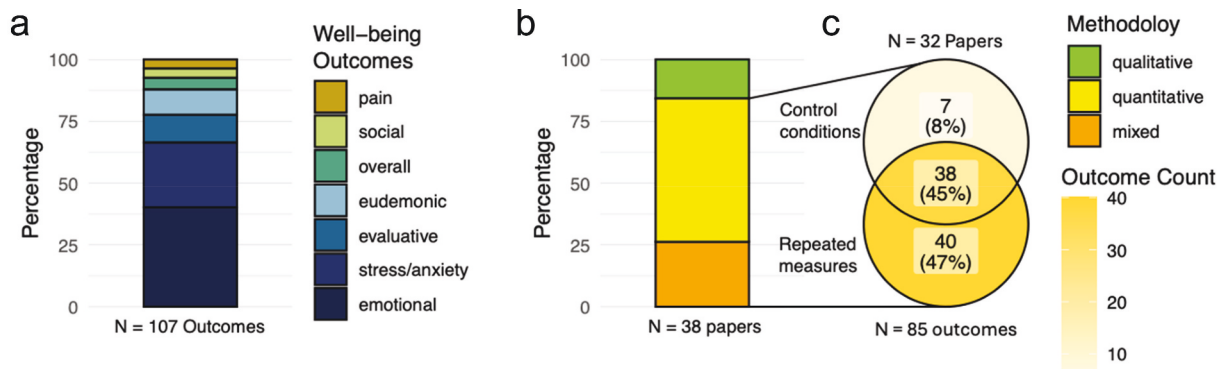


Figure 3. Overview of well-being outcomes, measurement, and methodology. (a) A total of 107 measures of well-being were extracted from the included papers. These included emotional, physical, eudemonic, evaluative, overall, and social well-being. (b) The 38 papers included qualitative, mixed methods, and quantitative study designs. (c) Focusing on the quantitatively measured outcomes (total $N = 88$), $N = 85$ outcomes were compared to either a baseline, a control condition, or both. Note. $N = 3$ quantitative outcomes had neither control nor baseline (Karnik et al., 2014). Color palette from R package MoMColors (Mills, 2023).

self-reported effects of art exposure (Karnik et al., 2014), measures compared between groups (Mitchell et al., 2008) or assessed after the art viewing through qualitative analysis (Camic et al., 2016; Gelo et al., 2015; Jensen 2018; Klingemann et al., 2018; Nielsen et al., 2017; Roberts et al., 2011).

Use of control conditions. On the other hand, only $N = 14$ of the included studies utilized a design with a non-art viewing control condition. Among the control conditions was the absence of artworks or a substitute activity. For example, absent conditions included keeping hospital walls blank (Bowen et al., 2015; Nielsen et al., 2017) or a silent no artwork condition (Mitchell et al., 2008). Other studies included a non-art substitute activity, for example, watching sports (Totterdell & Poerio, 2020), an office visit (Klingemann et al., 2018; Mastandrea et al., 2018), a medical whiteboard in patient rooms (George et al., 2018), a scrambled image of the artwork (Law et al., 2020), or non-art online exhibitions about culture (Trupp et al., 2022). Several other studies compared art viewing to art production (Bell & Robbins, 2007; Laurer & van der Venet, 2015) and reading about art (Cotter et al., 2022). Finally, Van Dongen et al. (2016) manipulated the art context by telling participants that photographs were either art or real depictions of life, testing the cognitive definition of art rather than changing the physical image.

Evidence of well-being effects

We then considered the effects of art-viewing activities on well-being. We briefly provide an overview of the qualitative evidence and then focus on the quantitative results.

Qualitative. Most of the qualitative evidence for outcomes surrounded themes of eudemonic well-being. For example, participants reported greater meaning in their lives (Gelo et al., 2015; Jensen, 2018). Social well-being elements of increased connection, reduced isolation (Gelo et al., 2015; Goulding, 2012), and sense of belonging (Jensen, 2018) were also noted, as well as stress-related outcomes, as referenced as relaxation, calmness, tranquility, and feelings of serenity while viewing art (Jensen, 2018; Nielsen et al., 2017). For emotional well-being, participants reported improved affect and more positive emotions (Camic et al., 2014; Gelo et al., 2015; Huet & Holttum, 2016; Roberts et al., 2011). However, there were limited qualitative references to evaluative well-being, where participants might have reported that they were more satisfied with their lives due to participating in an art-viewing activity.

Quantitative. To address the quantitative data, we coded each quantitatively measured well-being outcome (significant to baseline, to control, to both baseline and control, not significant, or not statistically evaluated) based on whether the authors had reported a significant change in well-being. Of the quantitatively evaluated outcomes ($N = 88$ across 23 papers, as shown in Figure 3), $N = 41$ were reported as having a significant impact on well-being, and $N = 41$ was reported as non-significant (6 outcomes were not evaluated statistically).

As seen in Figure 4, the ratio of significant to non-significant findings was largest for eudemonic well-being at 4:0 (100% significant), followed by emotional well-being (20:15, 57% significant), and then by stress (12:11, 52% significant). All other outcomes had more non-significant than significant results. However,

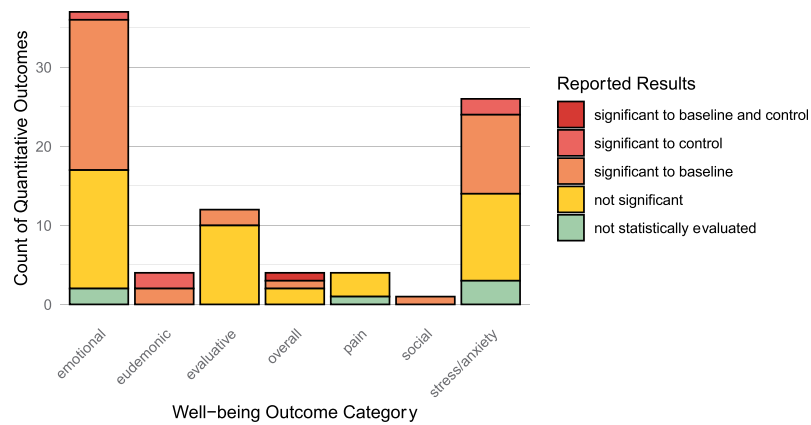


Figure 4. The results of all quantitatively evaluated well-being outcomes ($N = 88$) are split by well-being category. Each bar represents one well-being outcome category, split into codes of not statistically significant results, yes, significant results, or not statistically evaluated, which were based on the reported results extracted from each paper. Convergent evidence emerged supporting the effect of art viewing on eudemonic well-being. Color palette from R package MoMAColors (Mills, 2023).

Table 3. Results of quantitative comparison for papers that include a control condition.

Paper	Outcome Categories(s)	Total # of measured outcomes	N	Control	Sig.	Overview of significant outcome(s) compared to control
Cotter (2022)	Stress/anxiety, Overall, Evaluative	3	$N = 687$	Reading about art	Y	The only factor on which the gallery conditions differed from the non-gallery reading condition was in subfactor meaning. The gallery conditions showed a greater increase in meaning than non-gallery reading control.
Totterdell and Poerio (2020)	Evaluative, Emotional, Eudemonic, Overall	7	Study 1: $N = 544$, Study 2: $N = 50$	Watching sports	Y	Visual arts engagement was a significant predictor of meaning in life whereas sports was not in both a cross-sectional and an experience sample study.
Law (2020)	Emotional, Stress/anxiety	4	$N = 30$	Scrambled images	Y	Significantly larger pupil sizes in art compared to control with scrambled images.
Klingemann et al. (2018)	Stress/anxiety	3	$N = 1950$	No artwork	Y	Significant reduction of observed stress behaviors in art conditions.
Van Dongen et al. (2016)	Stress/anxiety, Emotional	2	$N = 24$	Real life photo context	Y	Significant stronger implicit emotion regulation (via lower LLP amplitude) in the art condition compared to real life photo context.
Mitchell et al. (2008)	Pain, Stress/anxiety	3	$N = 80$	No artwork, silent condition	N	
Mastandrea et al. (2018)	Stress/anxiety	2	$N = 77$	Office visit	N	
Trupp et al. (2022)	Social, Emotional, Evaluative, Stress/anxiety, Overall	6	$N = 84$	Cultural Exhibition about Food, Agriculture	N	
Bowen et al. (2015)	Emotional	1	$N = 90$	No artwork	N	
George et al. (2018)	Stress/anxiety, Emotional, Pain, Evaluative	4	$N = 169$	Medical white board	N	
Drake et al. (2023)	Emotional	4	Study 1: $N = 59$, Study 2: $N = 63$	Art production	N	
Laurer and van der Vennet (2015)	Emotional, Stress/anxiety	3	$N = 28$	Art production	N	

Total outcomes ($N = 42$), Bell and Robbins (2007); $N = 3$ outcomes) was removed from this analysis as it did not report the effects of art viewing condition. Further, although Mastandrea et al. (2018) reported larger effects of the art visit, the authors did not statistically compare the two conditions, and thus, we conclude that there is no significant difference compared to the control. Abbreviations: LLP: Late Positive Potential.

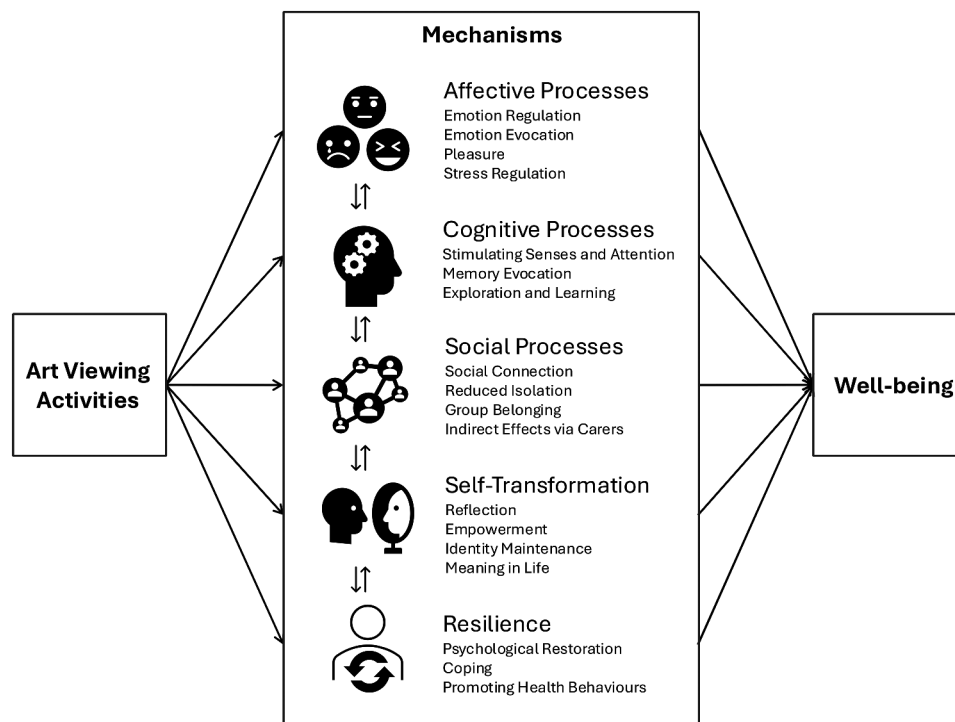


Figure 5. Taxonomy of suggested mechanisms underlying well-being outcomes of art viewing activities. The pathways through which art viewing activities are categorized by theme, with bi-directional arrows showing that mechanisms can also impact each other.

when focusing on papers with a control condition (i.e. those judged to be of the highest standard for empirical study in Figure 3(c)), of $N=45$ outcomes considered, $N=42$ were statistically evaluated considering the art against the control condition (see note in Table 3), but only six outcomes (14.3%) improved significantly more than the included comparison condition (i.e. Cotter et al., 2022; Klingemann et al., 2018; Law et al., 2020; Totterdell & Poerio, 2020; Van Dongen et al., 2016).

A breakdown of these studies, their effect sizes, measured outcomes, and results can be found in Table 3. To briefly summarize these results here, Totterdell and Poerio (2020) found, across two studies, that viewing visual arts significantly predicted meaning in life with a small effect size ($\beta=0.18$), whereas watching sports did not. Similarly, Cotter et al. (2022) found that the meaning of life was significantly higher after the four weeks of virtual art viewing than in a group that read about art, also with a small effect size ($r^2=.01$). The remaining outcomes had less convergence than those for eudemonic well-being. Regarding stress states, Law et al. (2020) reported significantly larger pupil sizes, indicating an excitatory response when looking at art compared to viewing a scrambled image with large effects (Partial $\eta^2=0.33$). Conversely, Klingemann et al. (2018) found that participants waiting

with artworks in the room exhibited less stress behaviors than those in rooms without artworks. Van Dongen et al. (2016) found that the art framing of photographs led to stronger implicit emotion regulation as measured by smaller Lower Late Potential (LLP) amplitude measured with EEG with a large effect size (partial $\eta^2=0.17$).

Taxonomy of mechanisms

Finally, we looked at the suggested mechanisms for how art-viewing activities could impact well-being based on an assessment of the introductions and discussions of the included papers. These are summarized in Figure 5, showing five analytic themes, including affective, cognitive, and social processes, as well as mechanisms relating to self-transformation and resilience, and 18 sub-themes. Table 4 includes an overview of which papers referenced each mechanism and definitions of each sub-theme.

Affective processes

Art viewing was suggested to impact affective processes, including emotion regulation and evocation, pleasure, and stress reduction. Specifically, the adaptive processes of distraction, reappraisal, and acceptance of emotions (Gross, 2015; also see; Fancourt et al., 2020) and the ability of the arts to evoke a range of positive, negative,

Table 4. Taxonomy of mechanisms with descriptions and list of thematic analysis reference papers.

Mechanism Theme	Subtheme	Short Description	Included Papers that Reference Subtheme
Affective Processes	Emotion Regulation	Modulating emotions	Gelo et al. (2015); Grossi (2019); Ho et al. (2015); Igdalova and Chamberlain (2023); Karnik et al. (2014); Noorily (2023); Roberts et al. (2011); Schall (2017); Trupp et al. (2022); Trupp et al. (2023); Van Dongen et al. (2016)
	Emotion Evocation	Eliciting emotions ranging in intensity and valence	Averbach et al. (2022); Bowen et al. (2015); Cotter et al. (2022); Gelo et al. (2015); Ho et al. (2015); Jensen (2018); Karnik et al. (2014); Law et al. (2020); Mastandrea et al. (2018); Mastandrea et al. (2019); Nielsen (2016); Terkazarian (2019); Totterdell and Poerio (2020); Trupp et al. (2022); Totterdell and Poerio (2020); Trupp et al. (2022)
	Pleasure	Feeling enjoyment, liking and felt pleasure or pleasantness of the experience and accompany activation of reward networks in the brain	Averbach et al. (2022); Camic et al. (2016); Drake et al. (2023); Huet (2016); Igdalova and Chamberlain (2023); Johnson et al. (2017); Karnik et al. (2014); Mastandrea et al. (2018); Mastandrea et al. (2019); Riches (2021); Roberts et al. (2011); Schall (2017); Terkazarian (2019); Totterdell and Poerio (2020); Trupp et al. (2022); Trupp et al. (2023); Tyack et al. (2017); Van Dongen et al. (2016)
	Stress Regulation	Regulating stress and psychological arousal including through modulation of endocrine and cardiovascular function	Averbach et al. (2022); Bowen et al. (2015); Camic et al. (2016); Cotter et al. (2022); Cotter et al. (2023); Drake et al. (2023); Gelo et al. (2015); Hadavi et al. (2022); Igdalova and Chamberlain (2023); Jensen (2018); Johnson et al. (2017); Karnik et al. (2014); Laurer and van der Vennet (2015); Law et al. (2020); Mastandrea et al. (2018); Mastandrea et al. (2019); Murphy et al. (2021); Noorily (2023); Riches (2021); Roberts et al. (2011); Schall (2017); Terkazarian (2021); Totterdell and Poerio (2020); Trupp et al. (2022); Trupp et al. (2023); Tyack et al. (2017); Van Dongen et al. (2016)
	Stimulating Senses and Attention	Stimulating attention at flexible intensities	Averbach et al. (2022); Camic et al. (2016); K. N. Cotter et al. (2022); Cotter et al. (2023); Drake et al. (2023); Igdalova and Chamberlain (2023); Jensen (2018); Johnson et al. (2017); Karnik et al. (2014); Klingemann et al. (2018); Law et al. (2020); Mastandrea et al. (2018); Nielsen (2016); Riches (2021); Schall (2017); Totterdell and Poerio (2020); Trupp et al. (2023); Tyack et al. (2017)
Cognitive Processes	Memory Evocation	Eliciting memory recall both short-term and long-term	Averbach et al. (2022); Camic et al. (2016); Johnson et al. (2017); Mastandrea et al. (2019); Murphy et al. (2021); Newman et al. (2014); Schall (2017); Thomson et al. (2012); Totterdell and Poerio (2020); Trupp et al. (2023); Tyack et al. (2017)
	Exploration and Learning	Developing new skills and gaining knowledge	Averbach et al. (2022); Camic et al. (2016); Cotter et al. (2022); Cotter et al. (2023); Ho et al. (2015); Huet (2015); Jensen (2018); Johnson et al. (2017); Karnik et al. (2014); Mastandrea et al. (2019); Murphy et al. (2021); Newman et al. (2014); Roberts et al. (2011); Schall (2017); Thomson et al. (2012); Trupp et al. (2022)
	Social Connection	Developing and strengthening social bonds	Averbach et al. (2022); Bowen et al. (2015); Camic et al. (2016); Cotter et al. (2022); Cotter et al. (2023); Ho et al. (2015); Jensen (2018); Nielsen (2016); Schall (2017); Terkazarian (2021); Totterdell and Poerio (2020); Trupp et al. (2022); Tyack et al. (2017)
	Reduced Isolation	Decreasing self-perceived isolation, and actual lack of social interaction	Gelo et al. (2015); Johnson et al. (2017); Tyack et al. (2017)
	Group Belonging Indirect Effects Via Carers	Developing community and sense of belonging Feedback loops from caregivers and other activity participants	Camic et al. (2016); Cotter et al. (2023); Jensen (2018); Mastandrea et al. (2019); Schall (2017) Bowen et al. (2015); Karnik et al. (2014); Klingemann et al. (2018); Murphy et al. (2021); Schall (2017); Totterdell and Poerio (2020); Tyack et al. (2017)

(Continued)

Table 4. (Continued).

Mechanism Theme	Subtheme	Short Description	Included Papers that Reference Subtheme
Self-Transformation	Reflection	Evaluating new and old beliefs	Bowen et al. (2015); Camic et al. (2016); Cotter et al. (2023); Gelo et al. (2015); Ho et al. (2015); Jensen (2018); Kamik et al. (2014); Mastandrea et al. (2018); Noorily (2021); Riches (2021); Roberts et al. (2011); Totterdell and Poerio (2020); Trupp et al. (2023)
	Empowerment	Increasing feeling of control, ability, self-efficacy, hope, inspiration, and motivation, confidence	Averbach et al. (2022); Bowen et al. (2015); Camic et al. (2016); Cotter et al. (2022); Cotter et al. (2023); Gelo et al. (2015); Hadavi et al. (2022); Jensen (2018); Johnson et al. (2017); Kamik et al. (2014); Laurer and van der Vennet (2015); Mastandrea et al. (2018); Murphy et al. (2021); Schall (2017); Totterdell and Poerio (2020); Tyack et al. (2017)
	Identity Maintenance	Developing and affirming ideas about identity and self-value self-esteem, dignity	Averbach et al. (2022); Bowen et al. (2015); Camic et al. (2016); Cotter et al. (2022); Gelo et al. (2015); George et al. (2018); Hanson et al. (2013); Ho et al. (2015); Jensen (2018); Johnson et al. (2017); Kamik et al. (2014); Klingemann et al. (2018); Newman et al. (2014); Nilsen (2016); Roberts et al. (2011); Schall (2017); Totterdell and Poerio (2020); Trupp et al. (2023); Tyack et al. (2017)
	Meaning in Life	Supporting a sense of purpose or fulfillment in life	Averbach et al. (2022); Camic et al. (2016); Cotter et al. (2022); Gelo et al. (2015); Hadavi et al. (2022); Ho et al. (2015); Jensen (2018); Johnson et al. (2017); Mastandrea et al. (2019); Newman et al. (2014); Roberts et al. (2011); Totterdell and Poerio (2020); Trupp et al. (2022); Trupp et al. (2023); Tyack et al. (2017)
	Psychological Restoration Coping	Building psychological resources Dealing with difficult situations	Hadavi et al. (2022); Ho et al. (2015); Jensen (2018); Law et al. (2020); Mastandrea et al. (2018); Trupp et al. (2022)
Resilience	Promoting Health Behaviours	Reducing pain and increasing ambulation	Gelo et al. (2015); Hadavi et al. (2022); Huet (2016); Laurer and van der Vennet (2015); Law et al. (2020); Mitchell et al. (2008); Nielsen (2016); Roberts et al. (2011); Terkezarian (2021); Totterdell and Poerio (2020)
			Bowen et al. (2015); Gelo et al. (2015); Hadavi et al. (2022); Jensen (2018); Mitchell et al. (2008); Murphy et al. (2021); Totterdell and Poerio (2020)

and mixed emotions at various intensity levels were noted. This could include processing existential and negative feelings in a safe space due to the reduced emotional intensity and disinterest in practical implications that art contexts allow (Van Dongen, 2020; Wagner et al., 2014; Geger et al., 2014; Fingerhut, *Under Review*) as discussed in hospital settings (Bowen et al., 2015; Bower et al., 2019; Hanson et al., 2013). This also includes evoking elevating experiences like awe and wonder (Averbach et al., 2022; Fingerhut & Prinz, 2018; Keltner & Haidt, 2003). Furthermore, pleasure in terms of enjoyment, liking, and pleasantness was linked to increases in positive affect and is considered a fundamental aspect of well-being in general (Berridge & Kringelbach, 2011; Mastandrea et al., 2019). The evocation of pleasure during art viewing is well supported by imaging studies, which find that art viewing and aesthetic experiences generally can lead to activation across reward networks in the brain (Vessel et al., 2022). This is supported by a recent paper that found that those who are more aesthetically responsive have larger improvements in positive mood partially due to their feelings of pleasure while viewing the artwork (Trupp et al., 2023). Finally, relaxation and arousal modulation via endocrine and cardiac pathways was included as a mechanism for stress regulation (Clow & Fredhoi, 2006; Sachs, Damasio & Habibi, 2015; Mastandrea et al., 2019).

Cognitive processes

Cognitive processes included stimulating senses and attention, memory evocation, and exploration and learning. Stimulation of both sense and attention flexibly represented concepts of immersion, being carried away, absorption, flow (Cotter et al., 2023, 2022; Tay et al., 2018; Csikszentmihalyi, 1990), and multi-sensory integration via theories of dual or triple coding, intensifying experiences via the inclusion of multiple sensory channels, such as touch during object handling sessions at hospital bedside (Paivio, 1986; Tyack et al., 2017). Memory evocation was frequently mentioned in art viewing settings for older adults via reminiscing (Averbach & Monin, 2022; Camic et al., 2016; Eekelaar et al., 2012; Hathorn, 2012), stimulating memory recall for those with dementia (see Johnson et al., 2017), and allowing for self-referential processing (Trupp et al., 2023; Vessel et al., 2023), and possible increased verbal fluency (Young et al. 2015). This aligns with general models of art viewing or aesthetic experiences, including recall and memory evocation as key components along the perceptual process (Chatterjee & Vartanian, 2016; Leder et al., 2004, Leder & Nadal, 2014; Pelowski et al., 2017). Reminiscing about

positive memories was linked especially to eudemonic well-being and is connected to other important pathways like identity maintenance and connection with caregivers for those with dementia (Schall et al., 2018). The sub-theme, exploration and learning, is known to be one of the key motivations for visiting art museums (Falk, 2008), and includes acquiring knowledge, skills, and critical thinking development, including exercising curiosity and explorative play (Fingerhut, *Under Review*). Often a central outcome of the usage of Visual Thinking Strategies (Housen, 2007), such a learning process was suggested to be linked to well-being mainly through self-efficacy but also through reductions in boredom and was found to have a small but significant effect on well-being (Thomson et al., 2012).

Social processes

Social processes include both interpersonal and group processes that contribute to overall well-being. The social connection subtheme, which is considered a determinant of mental well-being (Wickramaratne et al., 2022), represented the developing feelings of connection and bonding between individuals who attended the art viewing sessions together. Typically, this was noted between dyads that attended sessions together and between session facilitators and participants, allowing for deeper conversations (Gelo et al., 2015) or more social connection when chatting about the art seen (Tay et al., 2018; Igdalova et al., 2024), especially facilitated by joint attention. Reduced isolation is the feeling of being less alone, less isolated, and feeling that one has a larger and stronger social network to rely on, which is fundamental to reducing loneliness and eudemonic and evaluative well-being (Hawkey & Cacioppo, 2010). Group belonging is a social process focused on developing feelings of community, belonging, and integration within a group. This process appears to be mainly relevant in group activities, where participating can help develop community (Howells & Zelnik, 2009) and provide a means for clinical patients to stay connected with the outside world (Nielsen, 2014). Lastly, indirect effects include feedback loops via caregivers. This pathway is only relevant when the intervention targets an individual who needs care, like hospital patients or those with dementia who have a caregiver. In these cases, the art viewing session could lead to positive effects on the caregiver via all of the above and below mechanisms, and thus lead to better care and inter-dyad relationships, which in turn support the patient's well-being (Bowen et al., 2015; Klingemann et al., 2018; Murphy et al., 2021).

Self-transformation

Processes related to the theme of self-transformation included reflection, empowerment, identity maintenance, and building meaning in life. Reflection refers to re-evaluating personal thoughts, perspectives, attitudes, and beliefs about the self, others, and the world (Tay et al., 2018). Stigmas, worldviews, and habits can be reappraised, disregarded, or updated as part of this process (Johnson et al., 2017; Roberts et al., 2011). This sub-theme was particularly relevant for seeing new or other perspectives in group sessions (Camic et al., 2014; Gelo et al., 2015; Jensen, 2018), and art viewing has previously been shown to increase self-reflection (Cotter et al., 2024; Morris, 2018). Empowerment describes increasing personal feelings of control over one's life, having more positive ideas about one's abilities and overall self-efficacy, and building hope, inspiration, and motivation to achieve one's goals. Generally, empowerment allows for action through the belief that one has power over one's life and outcomes Jensen 2018. This sub-theme was particularly present for older adults and those with dementia, where arts viewing activities were designed to draw on their lived experiences and abilities (Johnson et al., 2017). Identity maintenance, on the other hand, is the belief in the value that one has rather than the abilities that one has, as is the case with empowerment (Daykin et al., 2010). This subtheme includes developing and affirming self-value, esteem, thoughts, and core beliefs about oneself. This is especially the case for those who see themselves as defined by their illness; art viewing was noted as helping to redefine one's identity beyond illness and to regain dignity (Jensen, 2018; Secker et al., 2007). For example, Liebenberg (2009) argued that co-constructing the meaning of art as a group is a process of hierarchy flattening and contributes to feeling valued. It has also been found that the idea of getting more engaged with the (visual) arts or beauty is considered to change one's identity (Fingerhut et al., 2021). Finally, to support meaning in life, art viewing was suggested to allow for developing a sense of purpose and fulfillment in life through providing meaningful daily activities (Miranda-Castillo et al., 2013) and through creating general meaning in life. Also closely related to self-referential memory recall, in group discussions about the meaning of art, participants without art history training used links to their families, past events, and personal histories to interpret the art, resulting in the art viewing being a way to understand themselves and society (Newman et al., 2014).

Resilience

The last pathway identified from the literature was resilience building through art-viewing activities,

including the mechanisms of psychological restoration, coping, and promoting health behaviors. Psychological restoration primarily came from nature exposure and Attention Restoration Theory (Kaplan, 1995), suggesting that soft fascination can protect against mental fatigue and overstimulation and increase one's resources to deal with life events (Korpela & Hartig, 1996). Conversely, coping was a general adaptive process of thoughts and behaviors to deal with difficult situations in life and was mainly cited in clinical settings or for those with illnesses (Gelo et al., 2015; Laurer & van der Venet, 2015). Promoting health behaviors, on the other hand, refers to the uptake of positive behaviors that support healing and health, including reducing pain medication through dulling felt pain (Lane, 2006; Malenbaum et al., 2008; Tse et al., 2002) and increasing ambulation in clinical settings (Bowen et al., 2015; Karnik et al., 2014). As one of the important predicting factors for recovery is walking after surgery or during hospital stays, putting artworks or small galleries where patients can enjoy walking more was found to increase ambulation, leading to higher positive mood levels (Bowen et al., 2015; Karnik et al., 2014).

Discussion

This systematic review provides a first summary of the literature on how art viewing can impact well-being, focusing on characteristics of art viewing, the evidence of well-being effects, and the proposed mechanisms that might play a role in effects. Overall, we identified four main settings where art viewing was used to impact well-being: museums, hospitals, online, and laboratories. Among the art viewing activities, we discovered that accessory engagements, in addition to the act of viewing, were common and likely important to overall outcomes, yet often poorly explained. Further, the diversity of art, schedules, settings, and the missing descriptions of such necessitate reporting guidelines to aid future studies.

When evaluating the well-being, stress, and pain outcomes and methodology, outcomes were measured across five domains: emotional well-being, stress/anxiety, evaluative well-being, eudemonic well-being, social well-being, and overall well-being. When evaluating reported results, eudemonic well-being emerged as an under-researched outcome with convergent evidence of positive effects. In contrast, other domains of well-being did not have sufficient

evidence of improvement compared to baseline or control conditions. Overall, well-being was measured most often by self-report, and we concluded that there is a need for well-designed studies using control conditions and larger, well-powered sample sizes.

Finally, through a thematic analysis synthesizing the suggested mechanisms of how art viewing could lead to well-being effects, we identified five mechanism categories, including affective, cognitive, social, self-transformation, and resilience. This taxonomy of mechanisms moves beyond past work, especially by including social and self-transformational processes, and can guide future research in making predictions and designing interventions. Below, we discuss these findings, make recommendations, and introduce a toolkit to support future research and application.

Art viewing characteristics

The art-viewing activities encompassed various settings, accessory activities, materials, and schedules. We found that art viewing as an activity is being put to use in hospitals for both patients and staff, via online and digital modalities for the use of seniors and the general population at home, in museums via organized groups and self-directed exploration, and also in laboratories where researchers aimed to isolate art viewing and evaluate its effectiveness at impacting pain (Mitchell et al., 2008), affect and arousal (Bell & Robbins, 2007; Drake et al., 2023; Laurer & van der Vennet, 2015; Law et al., 2020), and emotion regulation (Van Dongen et al., 2016).

Several trends across the types of art activities implemented in studies deserve mention. Notably, a large proportion of online art viewing was found after the top-up search conducted in October 2023 and compared to the initial assessment, which was likely propelled by the COVID-19 pandemic. At the same time, more immersive digital (VR) experiences were absent. As immersive technology becomes more accessible, this could be a potential avenue for future research, especially in clinical contexts where accessibility is key.

Similarly, regarding the type of art used, we found a departure from the traditional preferences (Ulrich, 2001; Ulrich & Gilpin, 2003) of representational or nature paintings. Several studies opted for contemporary art to stimulate cognitive engagement (Goulding, 2012; Karnik et al., 2014; Klingemann et al., 2018; Newman et al., 2014). However, the efficacy of different art types remains an area warranting further exploration. This especially refers to the absence of studies on how negatively-valenced or

somewhat disturbing artwork might affect levels of well-being or health. Lastly, the large and diverse number of accessories to the art-viewing experience, categorized as reflective, educational, social, or sensory engagements, underscores the importance of considering the holistic context of art viewing. These are particularly important to note, as understanding what an 'active ingredient' might be, borrowing from pharmacology (Warran et al., 2022), can support our understanding of how to design interventions and how they work.

The broad uses of art viewing as a well-being-supporting activity are encouraging for the field, yet this breadth, taken together with commonly missing descriptions of activity characteristics, poses limitations. The mere diversity of activities means our understanding of how these various ingredients impact well-being is limited. Likely, the complexity (variety and number of engagement activities, arts, setting, etc.) and intensity of activities (duration and frequency) play a significant role in well-being outcomes. Similarly, distinct characteristics may influence outcomes through unique pathways. Choosing accessory engagements with care is likely as important as the artwork viewed. For example, some points for future research are the contrast between facilitated social interactions during art viewing and solo reflective viewing, looking at differences across duration and schedule in the context of population and outcome, and how additional activities can enhance the well-being impact over just viewing.

Evaluation of the evidence that art viewing can impact well-being

We evaluated the well-being outcomes and methods and found a large diversity of the types of outcomes and employed methods. We found consistent pre-to-post-effects across different types of well-being; however, when we filtered studies by gold-standard experimental methods (Hariton & Locascio, 2018), namely the use of control conditions, we found that only six of 42 outcomes showed significant effects of art viewing above the impact of a control condition. The absence of comparisons, even with the inclusion of a baseline, creates several threats to internal validity. Among these, issues can be caused by history (factors external to the intervention), maturation (the passage of time), selection bias (selecting people who would be susceptible to improvement regardless of the intervention), testing (effects caused by being part of the study or interaction with the researcher), and regression to the mean (tendency to improve) (Bell & Robbins, 2007; Cook & Campbell, 1979).

To control for such effects, randomized control trials (RCTs) can create similar groups at baseline that have equal opportunity to experience treatment-related effects and effects due to maturation, bias, testing, or regression to the mean. Yet, a consistent issue for researchers revolves around choosing a quality control condition matched on intensity (effort, attention), duration (frequency and length), and plausibility (the reasonableness of the control activity to the participant). The studies in this review included a variety of tasks summarised in the results, but few offered matched active comparisons, except reading about art (Cotter et al., 2022) and watching sports (Totterdell & Poerio, 2020), which were more closely matched as comparison conditions. These two high-quality studies also reported evidence for eudemonic well-being, as referenced above. Further studies should consider carefully how they will control such bias and spend adequate time developing their control procedure in addition to an intervention.

Overall, the evidence base for the effect of art viewing is currently in development. Our analysis suggests that the evidence is particularly weak for evaluative well-being and pain outcomes, whereas most studies report null results. Whereas, for emotional, overall, and stress/anxiety outcomes, the reported effects were more mixed, calling for further study. This could be due to consistently low sample sizes across studies, with trends emerging for null results, possibly due to inadequate power to detect interaction effects between baseline and condition effects. The weak evidence aligns with recent critiques of the field of arts and health (Clift et al., 2021). Yet, we are encouraged that eudemonic well-being seemed to emerge as a well-supported outcome, with small effect sizes (Cotter et al., 2023, 2022; Totterdell & Poerio, 2020) compared to watching sports (Totterdell & Poerio, 2020) and reading about art (Cotter et al., 2022). The inclusion of eudemonic well-being measures is recommended for future research as it was included at a much lower frequency (11%) compared to emotional well-being (40%) or stress and anxiety outcomes (26%). Finally, meta-analysis is needed as follow-up research to further examine effects.

Taxonomy of mechanisms

The last aim of the review was to extract and synthesize the suggested mechanisms of action that link art viewing characteristics to outcomes. Here, we synthesized our findings into five main categories containing 18 sub-theme mechanisms. We identified mechanisms across affective, cognitive, and social processes and those relating to self-transformation and resilience.

One of the novel contributions of this review, which only became apparent due to our broad scope, is that the setting of art viewing might interact with how art viewing can impact well-being. This was previously unknown due to the siloed nature of mechanistic theories. For example, empowerment mechanisms are relevant for older populations, typically those suffering from dementia-related diseases, where art-viewing activities allow them to feel a sense of competence and autonomy in front of their caregivers (Camic et al., 2016; Jensen 2018; Tyack et al., 2017) and may also be particularly relevant for children and adolescents. However, these processes might not play a role for healthy adult individuals visiting a digital museum. Similarly, identity maintenance was mentioned heavily in clinical settings, where the disease and clinical treatment can leave limited room to feel oneself beyond being ill or a patient. It was reported that by viewing artworks in the hospital room or as part of groups, individuals felt a softening of the clinical space, allowing them to feel more than their diagnosis (Identity Maintenance; Bowen et al., 2015; George et al., 2018; Ho et al., 2015; Karnik et al., 2014). Similar arguments can be made for social processes that may be triggered by quality social interaction in museum-based groups but are not relevant for digital viewing or can be detrimental to provoking reflective processes. Importantly, the mechanisms seem contextually based and are highly dependent on the ingredients of the intervention or activity.

Reflecting on the other previous theories, we turn back to the models of mechanisms cited in the introduction to explain the benefits of art viewing. These included theories from empirical aesthetics (Fekete et al., 2022; Mastandrea et al., 2019), positive humanities (Tay et al., 2018), music science (Howlin & Rooney, 2020), leisure (Fancourt et al., 2021), and nature exposure (Kaplan, 1995), and general creative arts engagement (Fancourt et al., 2020). First, all the mechanisms included in our taxonomy seem to be general processes, rather than art-viewing specific, that can be activated in non-art activities, as seen by their various inclusions in the above-cited models. However, although outside of the scope of this paper, an interesting avenue of study would be to investigate if the arts are particularly beneficial because they can trigger diverse processes, whereas other activities may have more limited or specific mechanisms (i.e. a running club may not regularly lead to reflection through challenging world beliefs, but can regulate emotions through distraction, and facilitate social connection and bonding, among other possibilities).

Second, comparatively, we found a stronger emphasis on social and self-transformational processes in the

introductions and discussions of our included papers than we expected based on prior models, including those related to the arts (Fancourt et al., 2020; Fekete et al., 2022; Mastandrea et al., 2019). At the same time, compared to the all-encompassing Multi-Level Model of Leisure with over 600 mechanisms (Fancourt et al., 2021), only a few biological pathways emerged from our review. For example, several mentions of modulating hormone levels (i.e. cortisol), the modulation of cardiovascular function (heart rate, blood pressure) supporting stress regulation, or the activation of reward networks, commonly cited as an underlying process of felt pleasure. If relevant, much more research is needed to establish these biological processes.

Overall, most importantly, this paper provides an overview specific to art viewing rather than pointing future researchers to five or more models. With this overview, we hope future research will have a more holistic picture when considering which processes might be relevant in their interventions.

Nevertheless, there is a need for more research designed to test these mechanisms. To evaluate where and when they are relevant and how the setting, art activity ingredient, or characteristics can trigger them. The evaluation of mechanisms can prove challenging. Several methods can be used to evaluate our taxonomy of mechanisms or relevant additions. Mechanisms can be evaluated by mediation analysis, experimental design, and realist methodology (Schmitt, 2018). Several studies have already used mediation analysis and experimental manipulation of candidate mechanisms (e.g. Cotter et al., 2022; Ho et al., 2015). Further, as a means of isolating mechanisms through mediation, one study examined how the pleasure and meaningfulness of the art-viewing experience explain outcomes (Trupp et al., 2022). However, one avenue that has great potential but is yet to be applied to art viewing is realist methodology. Realist approaches focus on ‘what works, how, in which conditions, and for whom’, using mixed methods approaches and acknowledging that interventions work differently in different contexts (Dalkin et al., 2015; Lacouture et al., 2015). This methodology has already been used in the study of creative and performance activities, health, and well-being to great success (Karkou et al., 2024; Scott et al., 2023). Yet, to our knowledge, it has not yet been applied to art-viewing interventions. We call for future research to consider this when designing studies.

Limitations and next steps

Despite the importance of systematic reviews, we urge readers to contemplate our results while considering the

methodology’s strengths and pitfalls. First, the included papers were limited to those in our four databases, which we know excludes a small portion of relevant papers. However, we believe that a good picture of the field has been presented up to October 2023. Further, when evaluating the evidence base, we highlight that we did not assess aspects such as blinding, validity of randomization, or attrition in our critical appraisal of included articles. In the future, as more RCTs come out, these can be addressed to build an adequate evidence base to support the integration of art viewing as an intervention in cultural and health policy. Theoretically, this could have led to overestimating the support that art viewing can impact well-being. It is, however, worth noting that, due to the nescience of this field of study, many of the included papers were pilot studies or proof of concepts having small sample sizes. This review is, thus, potentially more likely to underestimate the true effect of art viewing, as our focus on statistical significance is constrained by statistical power. We eagerly await more studies in this area and look forward to further meta-analysis follow-up to determine relevant effect sizes. Similarly, our thematic analysis did not include reliability coding by a second independent reviewer. Instead, we included a second round of coding by the same author who conducted the initial thematic analysis, as well as discussed, the process among the team at several stages.

Finally, what constitute art is widely recognized to differ from subject to subject. We acknowledge that our category, which focused on traditional examples like paintings, sculptures, and installations, may have imposed limitations by adhering too closely to a classical understanding of what art is. However, our primary aim was to inform practitioners and researchers who are interested in creating museum programs or installing art in hospitals for well-being benefits. As such, we did not want to include categories of architecture or performances or capture general aesthetic experiences. Despite this, we were open to including craft objects, such as quilts, that were displayed in exhibits. Ultimately, we recommend that future definitions of art be left up to the viewer, as highlighted in two of the papers we included in the review, where the subjectivity of art was marked (Trupp et al., 2022; Van Dongen et al., 2016).

Tool kit — database and guidelines

As an output, we offer two tools for future researchers and practitioners (Available on OSF, <https://osf.io/qjg72/>). First, we have made an extensive database containing details of each paper beyond what we have summarized. This can allow filtering through past literature by art characteristics,

specific methods, or well-being outcomes, allowing researchers a streamlined way to identify literature on art-viewing activities. For example, if interested in art viewing activities, including guided tours for seniors, one must only filter by accessory engagement and population.

Second, we have prepared a reporting checklist for researchers modeled after the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines (PRISMA; Tricco et al., 2018). The Receptive Art Activity Research Reporting guidelines (RAARR) include items to consider and report in detail (i.e. schedule, setting, the flexibility of activity, art, people included, methods, measurement, effect sizes, descriptives, etc.). These are meant to be published alongside papers so that the location of each key piece of information is listed. One of the main outcomes of this study is that key characteristics are not commonly reported. Thus, this tool will support describing art activity characteristics and study methods well and enrich our ability as a field to conduct future reviews and meta-analyses in which the impact of certain activity characteristics can be estimated.

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ORCID

MacKenzie D. Trupp  <http://orcid.org/0000-0003-3542-7787>
 Claire Howlin  <http://orcid.org/0000-0001-8173-2972>

Anna Fekete  <http://orcid.org/0000-0002-7858-9826>
 Julian Kutsche  <http://orcid.org/0000-0002-2206-4924>
 Joerg Fingerhut  <http://orcid.org/0000-0002-9021-9617>
 Matthew Pelowski  <http://orcid.org/0000-0001-5563-3727>

Author contributions

Conceptualization: MT, CH, AF, MP, Screening: MT, CH, AF, JK, Data extraction: MT, AF, JK, Data analysis: MT, Manuscript drafting and Data Visualization: MT, Feedback and revision: MT, CH, AF, JK, JF, MP, Funding acquisition: MT, MP, JF. All Authors approved the final version of the manuscript.

Data availability statement

The Supplementary Materials are available on OSF <https://osf.io/kmqds/>.

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Chapter Two

Can online art viewing impact well-being compared to a control condition?

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My Contribution:

As this was the first project I undertook in my PhD, I conducted the project in a collaborative style. I worked with GB and MP on the study design and collaborated with KC on the literature review. I prepared the materials, collected the data, and cleaned and processed it. Along with GB, ES, and MP, I planned the analysis that GB and MP conducted. ES and I validated the analytical work. I drafted the manuscript with assistance from GB and KC, and revised it with MP.



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United Kingdom

Reviewed by:

Daniela Villani,
Catholic University of the Sacred
Heart, Italy
Dorina Cadar,
Brighton and Sussex Medical School,
United Kingdom

*Correspondence:

MacKenzie D. Trupp
mackenzie.trupp@gmail.com

†ORCID:

MacKenzie D. Trupp
orcid.org/0000-0003-3542-7787
Giacomo Bignardi
orcid.org/0000-0002-7439-0684
Eva Specker
orcid.org/0000-0003-0836-045X

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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

MacKenzie D. Trupp^{1*†}, Giacomo Bignardi^{2,3†}, Kirren Chana¹, Eva Specker^{1†} and Matthew Pelowski^{1,4}

¹ Department of Cognition, Emotion, and Methods in Psychology, Faculty of Psychology, University of Vienna, Vienna, Austria, ² Max Planck School of Cognition, Leipzig, Germany, ³ Department of Language and Genetics, Max Planck Institute for Psycholinguistics, Nijmegen, Netherlands, ⁴ Vienna Cognitive Science Hub, University of Vienna, Vienna, Austria

When experienced in-person, engagement with art has been associated—in a growing body of evidence—with positive outcomes in wellbeing and mental health. This represents an exciting new field for psychology, curation, and health interventions, suggesting a widely-accessible, cost-effective, and non-pharmaceutical means of regulating factors such as mood or anxiety. However, can similar impacts be found with online presentations? If so, this would open up positive outcomes to an even-wider population—a trend accelerating due to the current COVID-19 pandemic. Despite its promise, this question, and the underlying mechanisms of art interventions and impacts, has largely not been explored. Participants ($N = 84$) were asked to engage with one of two online exhibitions from Google Arts and Culture (a Monet painting or a similarly-formatted display of Japanese culinary traditions). With just 1–2 min exposure, both improved negative mood, state-anxiety, loneliness, and wellbeing. Stepdown analysis suggested the changes can be explained primarily via negative mood, while improvements in mood correlated with aesthetic appraisals and cognitive-emotional experience of the exhibition. However, no difference was found between exhibitions. We discuss the findings in terms of applications and targets for future research.

Keywords: cultural engagement, receptive art engagement, wellbeing, mental health, digital art, art viewing

INTRODUCTION

With the spread of the novel Coronavirus around early 2020, governments asked their citizens to stay at home to slow the rate of infection and protect the most vulnerable, forcing large parts of society to close their doors and everyday activities to move online. This included engagement with art and cultural institutions, which greatly increased online access to collections to connect with people now stuck at home (Radermecker, 2020; Samaroudi et al., 2020). Virtual tours emerged,

encouraging people to “visit the museum from their couches” (Romano, 2020) and, for the first time, engaging with art and culture online was on the minds of a broad audience (Unitt, 2020).

At the same time, many online formats of art and culture signaled their potential application for a pragmatic purpose—ameliorating the negative pandemic-related effects on wellbeing and mental health. A number of projects and discussion in the press were built around suggestions that a brief engagement with a few works of art, or a trip to a virtual museum, might help soothe anxiety, boost one’s mood (Barbican Center, 2020), provide better wellbeing (International Arts and Mind Lab, 2020), or even help those isolated and lonely (Belvedere Museum, 2020). These aims seem to have been well received by the public, especially by those with low wellbeing and mental health issues, with evidence suggesting that a notable portion of individuals were, for the first time, seeking out online art encounters (Bu et al., 2021).

These developments are not unique. Rather, the present world-wide pandemic accelerated two trends that have come to define the arts’ pragmatic application for wellbeing and health: (1) Researchers and practitioners have considered art as a powerful tool to positively modulate wellbeing, which is widely-accessible, cost-effective, and non-pharmaceutical. In a growing body of evidence, when experienced in-person, engagements with art have been associated with positive outcomes (Fancourt and Finn, 2019 for review). (2) With the ubiquity of the internet, it is being increasingly recognized that digital, online formats might reach an even wider audience and present new possibilities for health-related use. If online engagement could provide a systematic impact, this would represent an even more cost-effective means of reaching large numbers in society (Clayton and Potter, 2017; Thomson et al., 2018), especially individuals who cannot visit museums, bringing doses of art into homes, hospital beds, or places of work without installation of a costly artwork. As put by one museum director (Gilman, in Rice, 2020), summarizing these dual trends changing the role of the arts, “right now, art... [is] more important than ever. It is one of the key things sustaining us while we are cocooning at home,” especially in its new online presence, “...it is what will nourish us as we adjust to the new normal of a post-COVID-19 world.”

However, despite this promise, this also raises several questions that have not seen much empirical research: *Can art or cultural engagements actually impact mental states such as wellbeing, state-anxiety, mood, satisfaction with life, or loneliness? If so, in which ways and by how much?* An answer to these questions has immediate pragmatic importance and raises important issues about the role and nature of typical art interventions, the potential importance of “real” artworks, and which factors might be key when considering impacts on wellbeing. Similarly, especially considering the wealth of other interventions that might be found online—*how does online art stack up against similar, non-art cultural engagements, such as other materials that might typically be found in museums and are similarly moving to the digital realm?* Is there anything particularly different about engaging with visual art? Further, this topic raises several tangential questions of

interest, regarding how the nature of the art experience, and appraisal of an online exhibition might maximize or unlock specific wellbeing outcomes.

This is the aim of the present paper. Employing a quasi-randomized design in which individuals, via the internet, engaged briefly with art content (impressionist painting), we explore the potential impact on a number of factors—wellbeing (mood, life satisfaction, and subjective wellbeing), state anxiety, and loneliness—measured before and after viewing. We compare this intervention to another type of online cultural content (a display of Japanese culinary traditions), which employed a similar presentation format, but was generally expected to be seen as “not art” by participants and aligning more with receptive engagement such as visiting a history or science museum. We also consider secondary topics in an exploratory analysis, such as the nature of the experience at the appraisal and cognitive-emotional level, individuals’ label of the stimuli as “art,” and the interrelation of dependent wellbeing variables.

BACKGROUND—(ONLINE) ART AS A WELLBEING INTERVENTION

The argument that art, in an online format, *could be* a tool for addressing wellbeing and mental health can be traced through past research; as can many outstanding questions.

Engagement with a variety of forms of arts and culture—in *person*—is now well-documented to support wellbeing and mental health. A 2019 World Health Organization review, included, for example, results from more than 900 publications (Fancourt and Finn, 2019) suggesting that engaging with various artistic or cultural activities can lead to meaningful impacts both in regards to preventative capacities (maintaining physical and mental wellbeing) and in support of a wide range of psychological issues. Among the many possible receptive or creative interventions (attending performances, making or viewing visual art or music, etc.), visually engaging artwork or visiting museums and galleries have increasingly been employed in partnership with public health initiatives, and healthcare providers in several countries have started to prescribe such activities as psychological health interventions (Packer and Bond, 2010; Camic and Chatterjee, 2013; Chatterjee and Noble, 2017; Todd et al., 2017; Thomson et al., 2018).

Among the various effects, empirical evidence has shown that on-site art interactions have been particularly associated with decreased loneliness by providing museums as spaces to learn and socially engage. This type of sustained engagement with institutions like art museums over the life span is associated with feeling less lonely and having greater levels of eudaimonic wellbeing (Todd et al., 2017; Tymosuk et al., 2019, 2020). Further, participation in arts and cultural leisure activities was associated in cross-sectional studies with greater life-satisfaction, and mental health in a cohort of 8200 Norwegian adolescents (symptoms of anxiety and depression; Roberts et al., 2011; Hansen et al., 2015; Clayton and Potter, 2017). In many studies, the impact on mood and subjective wellbeing has also been illustrated. For example, in paradigms eliminating the activity

of visiting a museum, Nanda et al. (2011) showed that simply hanging paintings of restorative nature scenes in common rooms led psychiatric patients to have reduced agitation (as reported by nurses) and need for anxiety medication compared to days without the paintings. Similar studies of art in patient or common rooms have been found to improve the anxiety, stress levels, depression, mood, and general wellbeing of both patients and staff. Further, the addition of a contemporary art gallery or bringing art to the patient's bedside in a hospital, allows staff, patients and family members the ability to access art in difficult times and can lead to better mood and subjective wellbeing (Binnie, 2010; Roberts et al., 2011; Karnik et al., 2014; Hansen et al., 2015; Ho et al., 2015; Bennington et al., 2016; Davies et al., 2016; Wang et al., 2020). In regard to stress and anxiety, similar to the interventions that will be explored in this paper, Clow and Fredhoi (2006) asked individuals to take a 35-min visit to an art gallery on their lunch break and found that even short exposures lead to significantly lower self-reported stress (~ 2.4 points on a pre-/post-visit 10-point scale) and cortisol concentrations. Impacts have also been found, see also Kweon et al. (2008), for similar paradigms showing lower reported stress following art installations in an office. Overall, there is a wealth of evidence that in-person art engagement can impact aspects of wellbeing including, subjective wellbeing, mood, anxiety, loneliness, and satisfaction with life.

The explanations of such impacts are themselves under debate (Mastandrea et al., 2019). However, they have been suggested to involve enjoyable or pleasurable experiences (Sachs et al., 2015; Chatterjee and Noble, 2017; Fancourt et al., 2020), which might improve aspects of subjective wellbeing by regulating mood. If this were the case, one might expect that the more enjoyable the experience with art is, the better improvement to aspects of wellbeing. They may be tied to shared social, communal factors (Roberts et al., 2011; Cuyper et al., 2012), escapism or removal from daily routine (see Kaplan, 1995), or even experiences of beauty as part of an aesthetic experience (Fancourt and Finn, 2019; Mastandrea et al., 2019). However, such aspects have received little attention systematically and need further research to examine which parts of art experiences are particularly important to impact wellbeing.

Digital, Online Art—Would This Translate to Similar Wellbeing Impacts?

Online and digital technology *might* offer a natural ability to further empower the use of the arts in health and wellbeing formats. Today, art viewing, cultural engagements, and trips to art or other types of museums can take place via computers, tablets, smartphones and even virtual reality. This would certainly make it possible for many more individuals to engage art (Leng et al., 2014; Bu et al., 2021). Personal media, bringing artworks directly to a viewer could perhaps duplicate many of the same results, especially if beneficial effects are tied to the visual or cognitive-emotional aspects of experience. The potential for targeted, bite-size interactions with augmented information, seen in the comfort of one's personal space without need for extra effort or distractions, perhaps could overcome some of the issues

often given for why individuals may not enjoy art (Pelowski et al., 2014), allowing art to be more accessible, understandable, personal, even increasing impact beyond traditional installations or museum visits (Alelis et al., 2015).

At the same time, a long-running argument in especially art-critical, and more recently, psychological discussions suggests that art, for its full effect, might require to be seen in person, and that digital formats or other reproductions lose necessary aspects—immediacy, ambiance, level of engagement or importance, even artwork size—of the experience (Benjamin, 1968; Berger, 2008; Pelowski et al., 2017a; Specker et al., 2021). A handful of studies have suggested that art especially in digital formats, when compared to in-person gallery viewing, may lead to lower ratings of pleasantness (Locher et al., 1999, 2001; Locher and Dolese, 2004), interest (Locher et al., 2001; Locher and Dolese, 2004), liking, time spent viewing (Brieber et al., 2014) or even positive emotion or arousal (Brieber et al., 2015), all of which might be important for wellbeing benefits. Beyond this, if art impacts are driven more by the tangential aspects of an in-person visit—making a special trip, being with other people; even taking a break from everyday life activity or physical exertion itself (McLean, 2011)—these might be lost or diminished in online formats, or may connect to different results, for example, with factors such as life satisfaction or loneliness.¹

The ability for online engagements to lead to wellbeing-related impacts especially requires further research. To our knowledge, only two studies have begun to provide tentative evidence. Leng et al. (2014) compared cultural activities (cooking and craft exercises) via tablets to traditional in-person activities, finding that participants displayed similar or better levels of wellbeing in the tablet group. Tyack et al. (2017) actually examined if art interventions could be delivered through touchscreen tablets. Assessing dementia patients in their homes; wellbeing (happiness, wellness and interestedness, 1–100 scale) was measured before and after freely viewing a set of artworks (with the ability to select and move between styles) via a specialized app designed for the study. The results showed that after each session of around 20 min, wellbeing increased, although not significantly. These papers conducted their studies with specialized samples of dementia patients, and as part of therapy programs (see also Zubala et al., 2021 for research on digital creative art therapy). Even in-person interventions have, somewhat surprisingly, not typically considered art brought into individuals' homes. However, an ongoing mental health survey, conducted by University College London in the United Kingdom (Covid-19 Social Study, 2020), found a fifth of 70,000 respondents engaged more with the arts during lockdown than before. Those individuals who identified as having a mental illness or disability were likely to engage more in the first 22 weeks, which was speculated to be due to the move of cultural institutions online (Bu et al., 2021),

¹Interestingly, although one might surmise that a solution to loneliness requires being with other people or engaging at least in communal activity, one of the topics specifically addressed in Covid-19 times-related online art was loneliness, with several exhibitions featuring works on this theme (Jones, 2020; Knott, 2020).

however, this study did not quantify whether such use translated to actual effects.

“Art” Versus “Non-art” Cultural Engagements?

The above issues touch another aspect that we explore in this paper, regarding how engagements with art might impact individuals via online formats in comparison to other varieties of cultural engagements. On one hand, engaging with “art” might be an ideal means to induce pleasurable and enjoyable experiences (Pelowski et al., 2017b). Previous research has found that viewing objects that one believes to be “art” (either via external cues or labels or derived from personal opinion) can lead to higher liking, beauty, pleasure (Locher et al., 2001; Leder et al., 2004; Pelowski et al., 2017b), positive affective experiences (Cupchik et al., 2009; Kirk et al., 2020), and even elicit greater activation of reward-related brain areas (Kirk et al., 2009; Lacey et al., 2011), all of which may lead to greater wellbeing or mood benefits (Berridge and Kringelbach, 2011; Becker et al., 2019). Having stronger aesthetic experiences, which is noted as a possible wellbeing mechanism (Fancourt and Finn, 2019), are likely to be particularly pronounced with art. This may be due to the perspective that one takes when engaging with something that they believe to be art. It is well known that such aesthetic perspectives are more evaluative, appreciative and contemplative of an object (Cupchik et al., 2009), which may specifically be the state that can enhance wellbeing. If the act of stopping to admire is important in wellbeing interventions, as supported by a study by Martínez-Martí et al. (2018) that found that learning to stop and admire beauty was effective in improving wellbeing, art could be much better than another type of engagement as it is, philosophy aside, there to be looked at, contemplated and admired.

On the other hand, wellbeing impacts can be tied to many other types of cultural engagement. For example, the in-person research referenced above is inclusive of a broad range of, often overlapping, cultural activities (see Davies et al., 2016). In just museum visits, one can find, among others, history, or science museums, which have been linked to wellbeing (Wheatley and Bickerton, 2017, 2019). Research has found positive impacts from the simple presence of other visual materials such as photos of nature (White et al., 2010). However, most research to date has not considered the impact of art in direct comparison to other types of cultural engagement in terms of health and wellbeing, and such distinction and comparison is argued to be a target for research (Ander et al., 2013). This is especially true with the internet, where there is a wealth of activities that offer potential wellbeing benefits (e.g., Son and Lee, 2021 for a recent study on stress and online shopping).

Summary of Research Questions

To summarize, our main research questions include: How does art and cultural engagements impact mental states such as wellbeing, state-anxiety, mood, satisfaction with life, and loneliness? Second, how does online art compare to a similar, non-art online cultural engagement?

In addition, we examine the importance of several other dependent and independent factors in assessing the impact of online art, each of which, we address in our results section as *post hoc* and exploratory analysis.

First, we address if there are specific relationships between the different aspects of wellbeing outcomes (i.e., mood, anxiety, loneliness), which can also help to define the mechanisms underlying interventions. For example, past research has suggested that some aspects such as mood or state-anxiety may be particularly variable to immediate fluctuations in the environment, like an art intervention (e.g., Fredrickson and Branigan, 2005). These factors may then subsequently contribute to changes in more complex cognitive states such as loneliness and evaluative aspects of subjective wellbeing or life satisfaction and call for consideration.

Further, we explore how outcomes can depend on differing aspects of the individual's experience. Research suggests that individuals' reactions to art, and likely all forms of culture, are quite subjective (Pelowski et al., 2017b). Most basically, regardless of what kind of cultural engagement, this involves appraisal aspects such as whether one would like to visit again, finds beautiful or meaningful what they are engaging with.

Similarly, research has shown that—at the emotional and cognitive level—individuals respond differently to the same artwork. For example, the extent to which an engagement with art is more or less intellectually stimulating, educational, novel, harmonious, or boring, among other felt emotions (Pelowski et al., 2017c for review). Here we examine how these factors also differentiate impacts to wellbeing.

MATERIALS AND METHODS

Participants

To test the above questions, the study included a final sample of 84 participants (65 women, 17 men, 1 other, 1 unknown; $M_{age} = 34.89$, $SD = 14.47$, range = 21–74). Participants were further divided between two conditions of cultural engagement, with 40 individuals (31 women, $M_{age} = 35.40$, $SD = 14.44$, range = 22–74) exposed to an “art” condition (see below) and 44 (34 women, $M_{age} = 34.43$, $SD = 14.64$, range = 21–72) exposed to a “non-art” condition. Participants were recruited as a convenience sample through advertisements on social media and consisted of nationals from Europe (43%), the Americas (48%), Asia (8%), and Africa (1%). They received no compensation for participation. They engaged in the study between April 17 to June 6, 2020 during the first wave of the COVID-19 pandemic when most nations had instituted various degrees of lockdown.

The final sample was derived from an initial sample of 143, with participants removed due to exclusion criteria (see section “Results”). The study followed the ethical standards of the Declaration of Helsinki and the University of Vienna ethics board.

Stimuli

The online cultural engagement conditions consisted of two interactive exhibitions, broadly argued to be generally thought

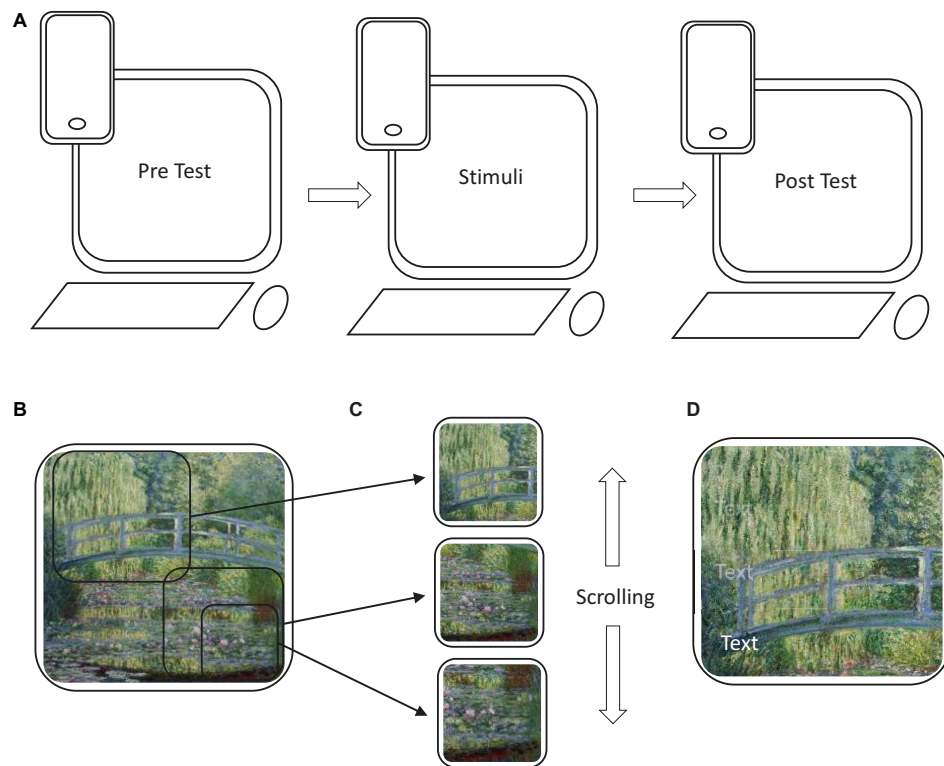


FIGURE 1 | Study design, stimuli composition. **(A)** The procedure was a pre-post design which could be taken on both personal computers and smartphones. **(B)** Demonstration of stimuli showing “Waterlilies condition” as an example depicting Claude Monet, *The Water-Lily Pond*, 1899. (Oil on canvas, 88.3 × 93.1 cm. public domain image, Wikimedia commons). Stimuli from Google Arts and Culture were interactive, where smaller compositions of one main image **(B)** could be scrolled through **(C)** with accompanying text that faded away when scrolling down **(D)**. Available from: [https://commons.wikimedia.org/wiki/File:Water-Lilies-and-Japanese-Bridge-\(1897-1899\)-Monet.jpg](https://commons.wikimedia.org/wiki/File:Water-Lilies-and-Japanese-Bridge-(1897-1899)-Monet.jpg).

of as “art” and “non-art,” counterbalanced between subjects.² See **Figure 1** for stimuli examples and **Supplementary Materials** for an access link and all accompanying texts. Both sets of stimuli were selected from Google Arts and Culture, a free online repository of virtual art galleries, interactive experiences, and educational materials on a range of topics covering culture, history, and art (About Google Cultural Institute, 2020), and consisted of a single visual image which could be appreciated by itself, as well as zooming in on various details accessed by scrolling with the mouse. Though the order of details was predetermined, the participants had the autonomy to scroll up and down as they liked. Each detail was accompanied by related text (e.g., “. . . This is one of 18 canvases of this view in differing light conditions. . .”). Thus, in both cases they were aimed at duplicating what might be an engagement with a single painting or exhibit, where one might move forward or backwards and read accompanying labels or materials.

For the “art” condition (hereafter, “Water-lilies condition”), we used an exhibition of Monet’s *The Water-Lily Pond; An*

in-painting tour from the National Gallery, London (Google Cultural Institute, 2020). This displays the single painting (*The Water Lily Pond*, 1899) of a bridge over a water-lily-festooned pond in Giverny, and was chosen because landscape and waterscape artworks have been suggested to be especially useful to reduce stress and anxiety among both patient and non-patient populations (Ulrich and Gilpin, 2003). The accompanying text in each frame focused on painting features (color, brushstrokes) or contextual information about the artist and painting.

The “non-art” stimulus (hereafter, “Bento condition”) was *A Bitesize History of Japanese Food; Explore a mouthwatering box of Japan’s iconic cuisine* (Google Cultural Institute, 2020). This explored a diagram in the shape of a bento box, containing photos and facts introducing the viewer to the history and traditions of Japanese food, and included images of food and food-related activities, such as harvesting or drinking. The text covered aspects of Japanese culture, including origins of specific dishes, agricultural traditions, and food preparation.

Procedure

The study employed a mixed Two (Time: pre vs. post, within-participant) × Two (Online Cultural Engagement: art vs. non-art, between-participant) design. Participants were supplied with a survey link via Qualtrics, which led them to a short description

²Note, we are not making any ontological claim regarding the definition of art, however, we selected our stimuli so the painting was an example of objects highly popular and well-known to the general public as fine art, whereas the non-art condition had no clear connection to art and was focused on a different aspect of culture, namely the cultural/history of food.

of the study. The description noted that the study was designed to test participants before and after they freely explored an online exhibit, and the types of experiences that could be engendered. After agreeing to participate, participants were first asked to provide demographic information, and then completed a pre-viewing baseline measure of our dependent variables. The order of the scales for both the pre-viewing baseline and the post test was randomized for each participant to avoid any sequence bias. Upon beginning this, participants were also already assigned, unbeknownst to them, to one of the two types of online engagements, with the general description being the same for both the Water-lilies and Bento conditions. In both cases, we refrained from using the term “art” but rather referred to an “online experience” or “exhibit” in all instructions. Participants were explicitly instructed not to enter any other parts of the website or other webpages and to return to the post survey once finished. They were then presented with a hyperlink button which, upon clicking, would open either the art or non-art Google Arts and Culture exhibition in a new window, where they were able to spend as much time as they liked viewing and interacting with the stimuli.

Pre-viewing Survey – Demographics and Personality, and COVID Related Conditions

In the pre-study survey, participants provided demographic descriptions (age, gender, nationality, location of current residence) as well as the status of their lives during the present lockdown, including lockdown severity (ranging from “I am staying only in my personal residence” to “I am not in lockdown at all,” see **Supplementary Table 1**), duration, and number of other people living in the participant’s residence. The Ten Item Personality Inventory (TIPI) was used to assess personality traits (Gosling et al., 2003). Art expertise was assessed through four items derived from the Vienna Art Interest and Art Knowledge Questions (Specker et al., 2020) on art education or training, art interest, and art related behavior. We also asked if participants had ever visited any online art presentation previously in their lives.

Pre-/Post-viewing Survey—Wellbeing, Anxiety, Mood, Loneliness

To measure the impact of visiting the online material, we assessed six dependent variables (hereafter “Wellbeing DVs”). These were presented in random order in both the pre- and post-viewing survey to assess change after the brief online engagement; (1) The De Jong Gierveld 6-Item Loneliness Scale (De Jong Gierveld and Van Tilburg, 2010); (2) State-Trait Anxiety Inventory (Martean and Bekker, 1992); (3) The Satisfaction with Life scale (Diener et al., 1985); (4) The Subjective Wellbeing scale (Tinkler and Hicks, 2011); (5–6) Mood was assessed by two questions asking participants to rate their overall positive and negative mood. Note, all Likert-type scale-based questions here and in the post-study were adapted to seven points to aid consistency of answering.

Online Experience Evaluations

In the post-viewing questionnaire, participants also appraised the stimuli via four questions on a 7-point scale (1 = ‘not at all,’ 7 = ‘very much’), indicating how beautiful, meaningful, and good the stimuli were, and how much they would like to visit the website again. Participants were also asked if they felt they had seen ‘art’ during the experience or not (binary forced-choice: “I saw art”/“I saw something else”).

As an exploratory means of collecting more information on the nature of the experience, participants were presented with a list of 55 cognitive-emotional terms (e.g., “serenity,” “bored,” “angry,” and “harmonious,” etc.), and asked to express how much they felt each of them while they were viewing the stimulus (1 = ‘not at all,’ 7 = ‘very much’). See **Supplementary Table 2** for full list. Previously, variations of this list have been used to further examine types of art experiences (Pelowski, 2015; Pelowski et al., 2018, 2019).

RESULTS

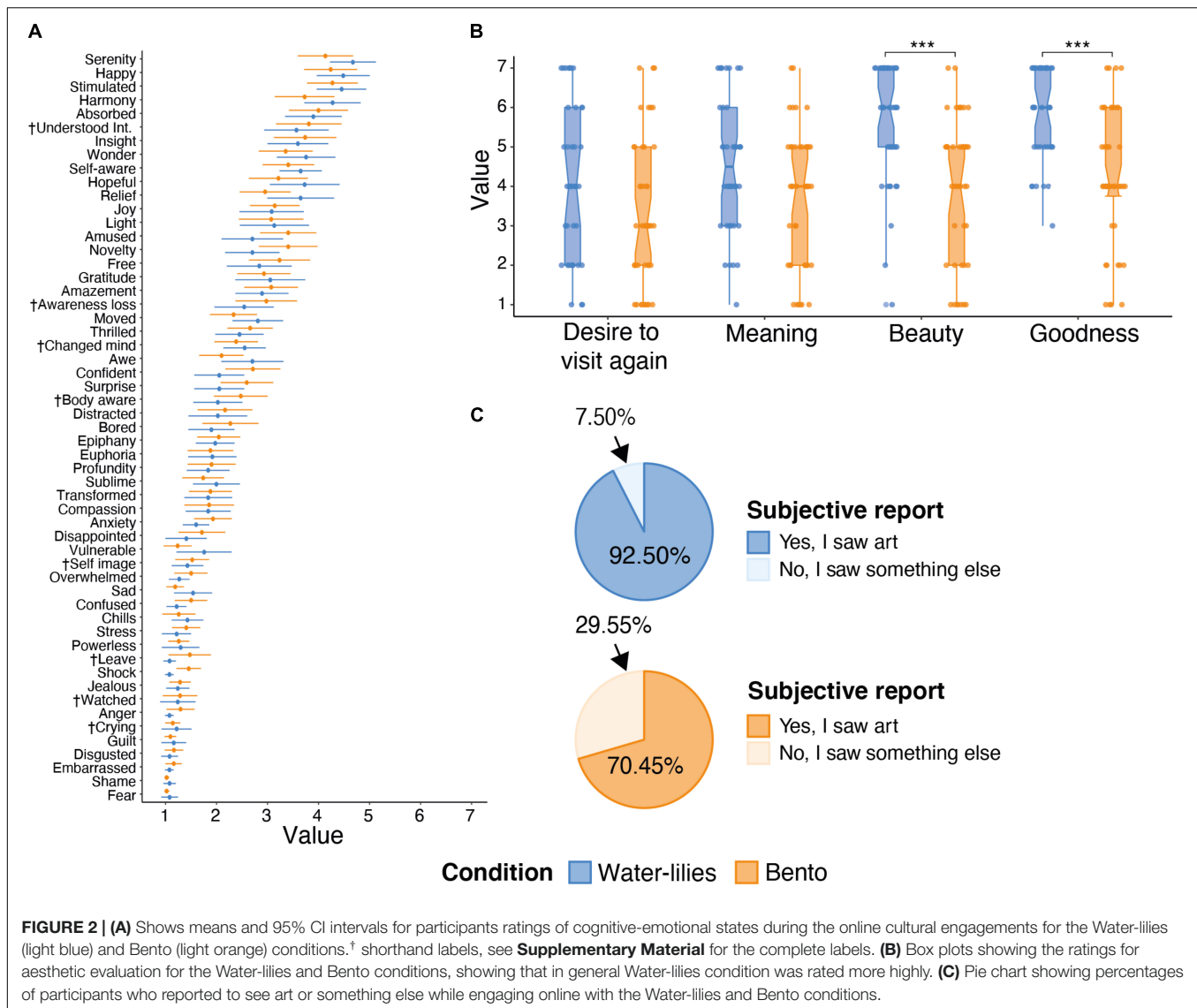
Participants were included in the final sample if they had completed more than 65% of the total survey, allowing at least one pairwise comparison, and if they had spent at least 10 s viewing the online materials. This cut off was selected based on the mode viewing time reported in a classic study of art viewing by Smith et al. (2016) which was 10 s, also consistent with other studies (see for review Smith and Smith, 2001; Pelowski et al., 2017c; Verhaverdt et al., 2018). Forty participants were excluded due to insufficient survey completion; 19 were excluded due to overly short viewing times. A histogram of the time spent viewing can be found in the **Supplementary Figure 1**.

Supplementary Table 1 provides the demographic and art interest descriptive statistics across the final sample of participants divided between conditions, as well as between-conditions statistical comparisons. A comparison of individual’s average art interest, typical art engagement, and art training found no significant differences between groups (**Supplementary Table 1**). In addition, there were no significant differences in days spent in lockdown ($M = 50.6$), age, or personality.

Here, and throughout the results section, we employed a mix of parametric and equivalent non-parametric analyses on a case-by-case basis, depending on violation of assumptions. These are indicated where applicable.

Descriptive Results of Viewing Time, Appraisal and Experience of Online Engagements

Mean results of reported appraisal and cognitive-emotional terms are shown in **Figure 2** (see also **Supplementary Table 2** for descriptive statistics). Comparison between conditions for whether individuals believed they had seen a work of “art” versus “something else” revealed, as expected, a significant difference [$\chi^2(1,84) = 5.25$,



$p = 0.02$], with 92% of individuals in the Water-lilies condition agreeing they saw art, compared to 70% in the Bento condition (this, a still rather high result, is also considered further below).

Participants in both conditions, on average, evaluated their online engagements positively, with Wilcoxon rank-sum tests conducted for each variable independently revealing comparatively higher beautifulness and goodness appraisals in the Water-lilies condition ($Z = -4.18$, $p < 0.001$, and $Z = -4.56$, $p < 0.001$), whereas meaningful and desire to visit again did not show differences ($Z = -1.81$, $p = 0.279$ and $Z = -2.06$, $p = 0.157$, respectively; p -values adjusted with a Bonferroni correction for multiple comparisons; Non-parametric tests employed due to violation of normality of appraisals' distributions, see **Supplementary Figure 4**). The four appraisals themselves also showed positive intercorrelation ($r_s = 0.55$ – 0.71) across conditions.

On average, participants engaged with the online content for around one-and-a-half to two minutes (Water-lilies: $M = 107$ s, $SD = 69$ s, range = 11–274 s; Bento: $M = 209$ s, $SD = 249$ s, range = 10–1401 s). A Wilcoxon rank-sum test comparing conditions was not significant ($Z = -1.76$, $p = 0.08$). Across conditions, viewing time was also not correlated with the four appraisals of the material themselves (all $r_s = 0.04$ – 0.1 , scatterplots of relationship between time spend and each DV per condition can be found in **Supplementary Figure 3**).

When asked how they felt while engaging the online content, participants indicated quite similar positive-valence emotions and cognitive states (e.g., serenity, happy, stimulated, insight), with low levels of negative emotions (fear, embarrassed, anger, etc.), in both conditions (see **Figure 2** for comparisons at the individual item level).

TABLE 1 | Average participant self-report ratings for each time condition per group (means and standard deviations).

Variable		Water-lilies ^a				Bento ^b			
		Pre		Post		Pre		Post	
Negative mood	<i>M (SD)</i>	3.08	(1.32)	2.75	(1.36)	2.95	(1.53)	2.64	(1.60)
Positive mood	<i>M (SD)</i>	4.31	(1.39)	4.75	(1.18)	4.69	(1.24)	4.86	(1.34)
Anxiety	<i>M (SD)</i>	3.60	(1.18)	3.19	(1.16)	3.31	(1.32)	3.09	(1.24)
Loneliness	<i>M (SD)</i>	3.49	(1.10)	3.32	(0.93)	3.50	(0.93)	3.34	(0.97)
Life satisfaction	<i>M (SD)</i>	4.54	(1.28)	4.95	(1.30)	4.52	(1.21)	4.41	(1.40)
Wellbeing	<i>M (SD)</i>	4.26	(1.12)	4.49	(1.11)	4.41	(1.14)	4.66	(1.14)

N^a = 36, *N^b* = 42, (see exclusion criteria). For a positive impact to occur, negative mood, anxiety, and loneliness should decrease whereas positive mood, satisfaction with life and wellbeing should increase.

What Is the Impact of Art and Non-art Online Engagements on Wellbeing and How Do They Compare?

Descriptive statistics for the Wellbeing DVs, pre- and post-viewing, are provided in **Table 1** and visualized as violin plots with individual slopes for each participant, in **Figure 3**. Effect sizes for each condition and the total sample are shown in **Figure 3**. Correlations between Wellbeing DVs (pre-, post-, and post-pre changes) are shown in **Supplementary Figure 2**.

As can be seen, in general, participants showed mean baseline scores (before viewing) at just below the midpoints for most DV scales, albeit with a rather large spread across participants. We also found a general moderate correlation between most baseline Wellbeing DVs (**Supplementary Figure 2**). No differences in baseline scores were found, for all Wellbeing DVs, when comparing between condition groups (**Supplementary Table 1**).

In general (**Figure 3**) the Wellbeing DVs, when considered after the online engagements, tended to show mean changes in the expected directions (i.e., decreased state-anxiety, loneliness, negative mood; increased positive mood and wellbeing), with the Water-lilies conditions tending to have generally larger effect sizes.

To statistically test the results, we first conducted a two-way mixed repeated measures multivariate analysis of variance (MANOVA) on the six Wellbeing DVs, with *Time* (pre, post; within-subjects) and engagement *Condition* (Water-lilies, Bento; between-subjects) as independent variables (conducted in Rstudio, R version 3.6.2; RStudio Team, 2019). In MANOVA, group differences are tested by creating a linear combination of the Wellbeing DVs that maximize group differences, and is considered to be optimal when Wellbeing DVs show correlation (Tabachnick and Fidell, 2013). This was conducted on a reduced sample of 78 participants (36 Water-lilies, 42 Bento) due to three participants having missing data and the detection of three multivariate outliers (2 Bento, 1 Water-lilies) with Mahalanobis distance exceeding the critical value (22.46; *df* = 6, MD1 = 23.35, MD2 = 24.52, MD3 = 24.81). Analyses including the outliers did not substantially differ, however, it impacted the marginal significance of a covariate in one of the *post hoc* analysis (see **Table 2**). The Wellbeing DVs were not multivariate normally distributed, however, MANOVA has been shown

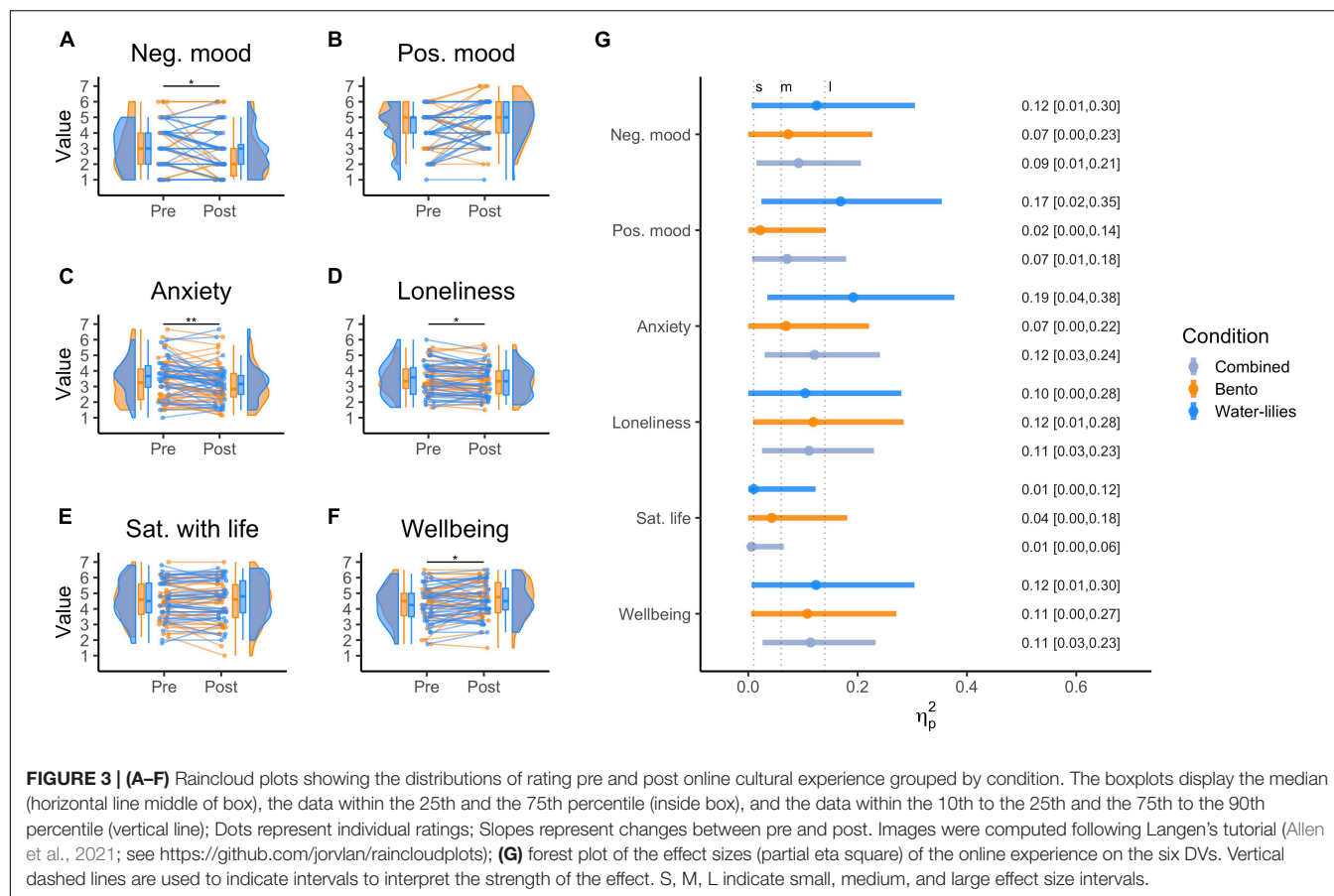
to be robust to violations of the assumption of multivariate normality when the sample is, as in our case, > 30 per condition (Tabachnick and Fidell, 2013). The data met assumptions for homogeneity of variance (all Levene's tests $p > 0.05$) and multicollinearity for Wellbeing DVs (correlations between Wellbeing DVs were < 0.8).

The analysis showed a main effect of *Time* [$F(6,71) = 3.65$, $p = 0.003$; $\eta_p^2 = 0.24$, 90% CI = [0.05; 0.31]] across both conditions. However, neither the main effect of *Condition* [$F(6,71) = 0.56$, $p = 0.763$] nor the *Condition* $\times$ *Time* interaction [$F(6,71) = 0.64$, $p = 0.700$] significantly affected the linear combination of Wellbeing DVs. These results suggested that both types of online cultural engagement significantly impacted the combined Wellbeing DVs; however, there was not a significant difference between the impact of the Water-lilies and Bento conditions ($\eta_p^2 = 0.05$, 90% CI = [0; 0.07]). An additional series of repeated measures ANOVAs, run independently for each of the Wellbeing DVs and looking at potential differences between conditions, showed all interactions with *Time* not to be significant, with *p*-values ranging from $p = 0.171$ to $p = 0.971$ (all *p*-values uncorrected, see **Supplementary Table 3**).

What Is the Impact of Online Engagement on Individual Wellbeing DVs?

To further consider the impact of the online interventions on the specific Wellbeing DVs which were assessed above, as well as their potential interrelation, we carried out a Roy-Bargman stepdown analysis. This approach is suggested as a best-practice follow up for MANOVA (Tabachnick and Fidell, 2013), especially in cases of correlation between Wellbeing DVs as noted above. This procedure consisted of, first, univariate post-hoc ANOVAs on each individual DV, in order to examine main effects of time at the individual DV level.

This was followed by a set of ANCOVAs, which tested for the effects of *Time* on each of the Wellbeing DVs, taking into account other Wellbeing DVs as covariates in a prioritized, step-down order. This second step allowed us to control for effects that are shared between the Wellbeing DVs, a phenomenon found in past studies looking at factors of wellbeing (i.e., Dua, 1993; Cohen et al., 2017). As a consequence of the above findings of a significant impact of the online



engagements across both conditions with a non-significant difference between them, the samples were combined for these two subsequent analyses. All independent p -values for each of the main effects in the following tests were corrected for the number of comparisons ($N = 6$, p -values for covariates were not corrected).

At the univariate level, the results, reported in **Table 2** (see also **Figure 3** for effect sizes), indicated that the online cultural engagements had a significant impact on four of the Wellbeing DVs—negative mood, state-anxiety, subjective wellbeing, and loneliness—but not on positive mood or satisfaction with life.

For the stepdown analysis, the effects of the online engagement on the Wellbeing DVs were prioritized as follows: (1) effect on mood (negative and positive); (2) effect on negative variables (state-anxiety and loneliness), after having controlled for the effect of mood; and (3) the effect on positive wellbeing variables (satisfaction with life and subjective wellbeing) after accounting for changes in mood and negative variables. This order was selected because, as noted in the introduction, changes in mood and state-anxiety are argued to be potentially more variable as a result of changes in one's immediate environment, which can possibly contribute to changes in more complex cognitive states (Fredrickson and Branigan, 2005). Homogeneities of the regression slopes were obtained for all of the subsequent univariate analyses.

The results suggested that changes observed in state-anxiety and wellbeing were not uniquely impacted by the online cultural engagements beyond the shared effect on mood. For loneliness, although significantly impacted by the online engagements, the effect was accounted for by changes in state-anxiety, after controlling for the effect of changes in mood.

Exploratory Analyses

We then turned to a *post hoc* exploratory analysis, considering some of the other research questions noted in this study, as well as some of the above-reported findings.

Do Appraisals of the Experience Relate to Impacts on Wellbeing?

First, as a general consideration of the relation between the nature of experience and its impact, we considered the correlation between appraisals of the online material (meaning, beauty, goodness, desire to visit again) and the change scores (post-pre) for the individual Wellbeing DVs. We similarly considered viewing time. Due to the violations of normality, we used Spearman's Rank correlations. Results for combined online conditions are shown in **Figure 4**. Results split between conditions can be found in **Supplementary Table 4**.

Decreases especially in negative mood, as well as state-anxiety and positive mood, were significantly related to relatively higher appraisals. Changes in negative mood were

TABLE 2 | Stepdown analysis statistics.

Variable	Analysis	Covariate	Pre	Post	df	F	p(adj)	η_p^2	90% CI	
			M (SD)	M (SD)					LL	UL
Negative mood	Univariate	–	3.01 (1.43)	2.69 (1.49)	1, 77	7.81	0.039	0.09	0.15	0.21
Positive mood	Univariate	–	4.51 (1.32)	4.81 (1.26)	1, 77	5.92	0.104	0.07	0.00	0.18
	Step-down	Negative mood			1, 76	49.72	<0.001	0.40	0.25	0.51
Anxiety	Step-down				1, 76	0.83	0.353	0.01	0.00	0.08
	Univariate	–	3.44 (1.26)	3.14 (1.20)	1, 77	5.92	0.001	0.12	0.03	0.24
	Step-down	Negative mood			1, 75	29.71	<0.001	0.28	0.15	0.41
	Step-down	Positive mood			1, 75	13.72	<0.001	0.15	0.05	0.28
Loneliness	Step-down				1, 75	3.68	0.406	0.05	0.00	0.15
	Univariate	–	3.50 (1.00)	3.33 (0.95)	1, 77	9.64	0.016	0.11	0.03	0.23
	Step-down	Negative mood ^a			1, 74	3.47	0.067	0.06	0.00	0.16
	Step-down	Positive mood			1, 74	1.26	0.265	0.02	0.00	0.09
	Step-down	Anxiety			1, 74	6.14	0.016	0.08	0.00	0.18
Life satisfaction	Step-down				1, 74	4.54	0.219	0.05	0.00	0.14
	Univariate	–	4.53 (1.24)	4.50 (1.35)	1, 77	0.00	>0.999	0.01	0.00	0.01
	Step-down	Negative mood			1, 73	0.01	0.932	0.01	0.00	0.07
	Step-down	Positive mood			1, 73	0.18	0.281	0.01	0.00	0.09
	Step-down	Anxiety			1, 73	0.14	0.705	0.00	0.00	0.01
	Step-down	Loneliness			1, 73	0.13	0.721	0.00	0.00	0.05
Well-being	Step-down				1, 73	0.53	0.353	0.00	0.00	0.05
	Univariate	–	4.34 (1.12)	4.58 (1.12)	1, 77	9.90	0.014	0.11	0.03	0.23
	Step-down	Negative mood			1, 72	6.19	0.015	0.08	0.01	0.19
	Step-down	Positive mood			1, 72	4.57	0.036	0.06	0.00	0.16
	Step-down	Anxiety			1, 72	1.31	0.256	0.00	0.00	0.06
	Step-down	Loneliness			1, 72	3.26	0.075	0.04	0.00	0.15
	Step-down	Life satisfaction			1, 72	0.30	0.588	0.02	0.00	0.10
	Step-down				1, 72	3.44	0.353	0.04	0.00	0.14

CI, confidence interval; LL, lower limit; UL, upper limit. The bolded values indicate statistically significant values.

^aBefore exclusion of three multivariate outliers, negative mood explained a significant proportion of the change in loneliness, $p = 0.032$.

related to reported desire to visit the experience again, meaningfulness, beauty, and marginally related to goodness. Similarly, changes in state-anxiety and positive mood were significantly related to desire to visit again, goodness, with state-anxiety also marginally related to beauty. Goodness alone also was correlated with lower loneliness. Note, however, that, only the relationships between meaningfulness and changes in negative mood and goodness and changes in loneliness remained significant or marginally significant (after multiple comparisons testing) (adjusted $p_s = 0.049$ and 0.067 , respectively; Bonferroni correction for 24 tests). Amount of time spent by individuals was not significantly related with any DV change ($r_s = -0.21$ – 0.19).

Does Seeing “Art” Influence Impact on Wellbeing?

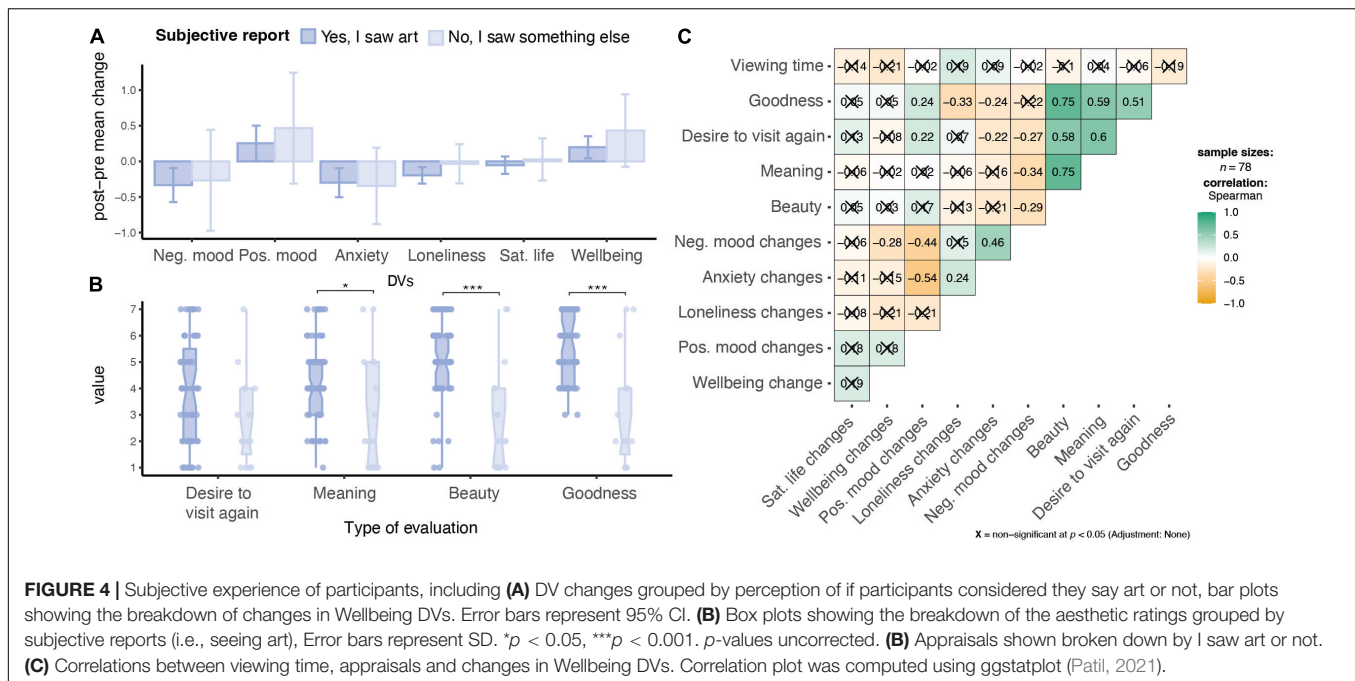
We then followed up on participants’ classification of the stimuli as “art,” considering the large number of individuals that considered even the Bento condition to be an artwork. A breakdown between participants who said they saw either “art” or “something else,” regardless of their actual Waterlilies/Bento assignment, comparing appraisals of beauty, goodness, meaningfulness, and desire to visit again are shown in **Supplementary Table 5**. A breakdown of DV change scores

for “I saw art” and “something else” is shown in **Supplementary Table 6**. Difference in appraisals and Wellbeing DVs are shown in **Figure 4**. To consider these distinctions, we used multivariate analysis with groups, “I saw art” group ($N = 63$) or “I did not see art” ($N = 15$). Wilcoxon rank sum test suggested that participants who indicated that they saw “art,” regardless of assigned condition, reported significantly higher meaningfulness ($Z = -2.29$, $p = 0.022$), beauty ($Z = -3.72$, $p < 0.001$), and goodness ($Z = -3.99$, $p < 0.001$), and marginally significant higher desire to visit again ($Z = -1.91$, $p = 0.055$).

However, a series of two-sample nonparametric Welch’s t -tests, comparing change scores between conditions, did not reveal significant differences between those who reported seeing “art” or “something else” for any DV (all p -values > 0.26).

Do Cognitive-Emotional Experience Factors Predict Impact on Wellbeing?

Finally, we returned to the list of the cognitive-emotional items that participants reported feeling during their experiences. To reduce the data and to identify potential patterns, we conducted a Principal Component Analysis (PCA) on all 55 items. A parallel analysis using Monte Carlo simulation with permutations (5000) of the raw data set, conducted in SPSS with the rawpar.sps script



(O'Connor, 2000), suggested four significant components. These were then assessed using a Direct Oblimin rotation, which allows for an orthogonal or oblique solution, expected to provide a more natural fit for the data. The Kaiser–Meyer–Olkin measure verified sampling adequacy ($KMO = 0.65$; Field, 2009). Bartlett's test of sphericity $X^2 = 3359.9$, $p < 0.001$, also indicated sufficient correlations between items to support the PCA analysis.

The resulting rotated components solution (**Supplementary Table 7**) accounted for 48.48% of the variance, with a breakdown of items more or less in line with past findings (Pelowski, 2015; Pelowski et al., 2019). The first component (26.20% of variance) largely consisting of items related to positive or socially focused terms (highest loadings: confident, changed self-image, compassion, gratitude, free, sublime, etc.). The second component (11.11%) described largely negative and again socially focused terms (fear, like crying, sad, powerless, stress, shame, guilt, vulnerable). The third component (5.91%) included items previously suggested to indicate largely “facile” (Pelowski, 2015) or unrewarding experience (disappointed, bored, need to leave, embarrassed, and confused). The fourth component (5.30%) described more insightful or transformative aspects (absorbed, thrilled, insight, change mind, epiphany, etc.).

Component scores were then calculated per component for each participant (*via* regression method). These scores were then used in a series of multiple regressions to predict change in the Wellbeing DVs. See **Supplementary Tables 8–10** for all results both considering combined or split between conditions. Once again, changes in especially negative mood emerged as being significantly predicted by the combined model [$F(4,69) = 6.29$, $p < 0.001$, $R^2 = 0.27$]. Further analysis revealed that such changes were significantly driven by Component 1 (“positive/social affect”; $t = -2.15$, $p = 0.035$), with higher scores relating to a decrease

in negative mood, and to lower scores of Component 3 (“facile”; $t = 3.75$, $p > 0.001$).

Decreasing state-anxiety was also significantly predicted, again, by component one [$t = -2.39$, $p = 0.020$; main model ($F(4,69) = 2.285$, $p = 0.069$, $R^2 = 0.12$]. No other Wellbeing DVs were significantly predicted by any of the components (p -values are uncorrected). Interestingly, as with the appraisals above, the relationships between the cognitive-emotional components and Wellbeing DVs also tended to emerge more saliently in the Water-lilies condition, whereas with the Bento condition no significant state-anxiety or mood-related effects were found.

DISCUSSION

We found a significant impact on several wellbeing variables in a pre-/post-paradigm in which individuals were asked to briefly visit an online art exhibition (one Monet painting) or another similarly-formatted, “non-art” cultural engagement (a display of Japanese culinary tradition, aligning more to what might be encountered in a history museum offline). This included lowered state-anxiety, negative mood, loneliness, and increased subjective wellbeing. This occurred, in the art condition, with an interactive display of one painting, and in the other display of cultural material, and in both cases, over durations averaging one-and-a-half to two minutes, notably with no significant relationship between positive impact and actual time spent engaging.

A stepdown analysis found that the changes in Wellbeing dependent variables (Wellbeing DVs) tended to be explained by changes in negative mood (in the case of positive mood, state-anxiety and wellbeing), while improved loneliness was explained by improvements in state-anxiety. Finally, the “art” condition had generally larger effect sizes, but was not significantly “better” than

“non-art” at improving any Wellbeing DV. When considering the nature and appraisals of the experience, a significant relationship was found between decreases in negative mood, and to a lesser extent state-anxiety and positive mood, and positive appraisals of the experience (desire to visit again, beauty, and, most pronounced, meaningfulness). Similarly, changes in negative mood and state-anxiety related to higher reported positive or socially focused cognitive-emotional states (Component 1).

General Efficacy for Online Art and Cultural Interventions

These results raise several implications for both pragmatic and theoretical application of the arts for wellbeing. First, this provides initial evidence that such wellbeing effects can be found via brief interactions with art and similar cultural materials online, impacting many of the same variables as considered in in-person studies. This finding, detected with an adult sample of convenience, during a unique COVID-19-induced lockdown period, might be viewed as proof of concept that technology, via the internet, can deliver targeted doses of art and culture into the everyday lives of individuals. The findings also contribute evidence to the potential of digital reproductions to produce similar effects to those found with real artworks installed in common spaces or seen in-museum visits.

The reduction of reported loneliness also merits specific mention. While probably only tangentially connected to the art experience—via the changes in anxiety—a claim could be made that the loneliness-reducing aspects of cultural engagements, routinely found in-person (Todd et al., 2017; Tymoszuk et al., 2019), might come about from the social connection or collaborative nature of visiting a museum or sharing art experiences. Here, however, we found that even visiting an exhibit, likely by oneself via the internet, led to significant effects. This is possibly due to the communal nature of visiting a public website and seeing another person’s art or design. In support of such a communal claim, loneliness was one of the only variables that showed slightly larger effects in the Bento condition, which focused on human activities in a more explicit way. This adds credence to recent initiatives, especially arising during COVID-19, for online arts and culture exhibitions to target loneliness during isolation from others—another compelling target for future research.

In both conditions we found lack of significant effects on positive mood and satisfaction with life. When considering satisfaction with life, this is likely due to the more global wellbeing nature of the construct, in that the questions are asking about a more overall assessment of one’s satisfaction, which is possibly not likely to change on short timescales. It would be interesting, however, to include more testing timepoints to address this in future study as satisfaction with life has been noted to be related to cultural engagement like visiting art museums (Lee et al., 2020). In regard to positive mood, it was slightly surprising to find a non-significant effect but at the same time to find a significant effect in the reduction of negative mood. It seems that both art and cultural engagement may be specifically better targeted at decreasing negative feelings while not as effective at increasing

positive ones. Here it could be seen that visiting an online art and cultural website, like Google Arts and Culture, may help decrease feelings like sadness, anxiety or agitation but may not increase feelings of happiness, warmth, satisfaction. It would be especially valuable for future research to include a measurement of mood that has a variety of feeling items that can help to disentangle this further.

When comparing the effect of online art interventions to past literature, our findings are similar. Looking to the two most salient effects found in this paper—improvement in mood and state-anxiety—we found moderate to large effects in the art condition (negative mood $\eta_p^2 = 0.12$, positive mood $\eta_p^2 = 0.17$, and state-anxiety $\eta_p^2 = 0.19$). These are in line, for example with Ho et al. (2015) who reported a pre/post change (assessed via Brief Mood Introspection Scale) following an art exhibition visit in a hospital. As well as Paddon et al. (2014), who reported medium effect sizes in negative mood (Cohen’s $d = 0.38$) and positive mood ($d = 0.69$), assessed via Positive and Negative Affect Schedule (PANAS), following a cultural museum object-handling session in a hospital [also see Clow and Fredhoi’s (2006) report of reduction in self-reported stress after individuals spent a lunch break in-person in a museum of art].

Even comparing to other domains, our results remain roughly equivalent. For example, Cracknell et al. (2016) reported a change in affective valence (assessed via 11-point bipolar Feeling Scale), following a roughly 5-min intervention in which participants observed an aquarium fish tank, $\eta_p^2 = 0.47$ (negative-to-positive). Comparing across interactions with nature, which have been routinely shown to provide impacts on mood, a meta-analysis (McMahan and Estes, 2015) of both lab or in-person interventions reported a standardized reduction in negative affect across studies of $r = 0.12$ (increase in positive affect $r = 0.31$). In emerging results of other online interventions, Howells et al. (2015) report a smartphone-based mindfulness intervention impact on affect (measured via PANAS after 10 days of use) of medium size effect ($\eta^2 = 0.071$) for positive affect and small effect ($\eta^2 = 0.010$) for negative mood. Keeping in mind the self-report method of the present study, differences in assessment scales, and leaving open the question of the duration of impact or whether self-report might relate to physical or behavioral differences, our results provide compelling evidence for art and culture in online spaces.

Is There Anything Different About Engaging Art Versus Other Cultural Content?

In regards to our second research question, we found mixed, albeit still compelling, suggestions about the potential role that “art” might play in improving wellbeing. We did not find a significant difference between conditions. One probable explanation for the lack of difference is that both conditions, which were selected to be formally similar, evoked similar responses—for example, a generally positive interaction with visually pleasing material. Note, while the artwork was rated as more beautiful and good, both conditions were equally meaningful and evoked a desire to experience them again.

One telling result in line with the above argument was that, despite explicitly not labeling it as such on our part, we found almost 70% of those in the Bento condition actually believed that they had engaged with “art.” This finding that individuals would label something—even if not intended to be seen as art in a classic sense—as an “art” example, is in line with past research. For example, Pelowski et al. (2017b) reported this with photographs of a number of random every-day objects, suggesting that individuals may use “art” as a general label of particularly appreciated visual stimuli. Thus, it is reasonable to assume that we were not in fact comparing apples to oranges as we had designed, but more likely that we were comparing apples to a different variety of apples. Indeed, it is also worth noting that culinary traditions are also seen as a form of art, possibly also contributing to these results.

The fact that participants reported higher appraisals in the case of the artworks suggests that this design indeed did elicit slightly more positive responses. On the one hand, it is important to note that, the *subjective* “art”/“not-art” label provided by the participants for their interventions (regardless of the actual assigned condition), did not result in significant differences between the impact of the cultural engagement at the level of our Wellbeing DVs, regardless of the higher appraisals. Thus, our conclusion and overall interpretation is that the label of art alone does not appear to be a necessarily important factor of cultural interventions but rather the subjective experience that the individual has with the content is much more important. This being said, these interpretation rest upon the design of the study with the inclusion of stimuli that were chosen to be similar. It would be important to further any claim based on the label of art or non-art with stimuli that are more distinct, or possibly to use a top-down manipulation of art context (see Kirk et al., 2009). We encourage further research to address participants’ subjective experience in both arts and cultural interventions rather than assuming that art by way of ‘aura’ is necessarily better.

Potential Mechanisms for the Modulation of Mood, Anxiety, and Wellbeing

Our study also sheds light on possible potential underlying mechanisms for how art and culture can lead to wellbeing impacts. Our stepdown analysis highlighted that online cultural engagement might especially be an avenue to regulating mood, which possibly drives other positive impacts (state-anxiety, subjective wellbeing). This highlight of mood regulation is supported by past research, which has found emotion and mood regulation as a common beneficial outcome of a variety of types of arts and cultural engagement (Ivcevic and Brackett, 2015; Fancourt et al., 2019, 2021).

The significant relationships between the impacts on mood and individuals’ appraisals and cognitive-emotional experience adds new data to our understanding of how art interventions might work. The finding that higher positive cognitive-emotional states (e.g., joy, and social terms such as confident, compassion, gratitude) and more profound states such as free, moved, awe, sublime, raise interesting implications for past arguments that contributors to wellbeing impacts beyond mere pleasure. For

example, many of these terms could be argued to overlap with Kaplan’s (1995) discussion of “fascination” as a pillar of restorative effects from viewing nature. Empirical evidence for such nuanced aspects in art engagement is only recently emerging (Pelowski et al., 2017c). However, it seems plausible that encouraging specific types of cognitive-emotional states, perhaps through choice of content, is an important consideration when designing interventions and is another target for further research.

Several of these states (awe, moved) are also suggested to be prototypical emotions in aesthetic experience (Fingerhut and Prinz, 2020). Along with our findings of the relationship of beauty, meaningfulness, and other positive appraisals to individual’s change in mood, one could make a claim that the present results support arguments highlighting aesthetic experiences as an important factor in art interventions (Sachs et al., 2015; Fancourt and Finn, 2019; Mastandrea et al., 2019). Fancourt and Finn (2019), include aesthetic experience in their summary of the mechanisms underlying the impact of art engagement on health and wellbeing while Mastandrea et al. (2019) further note that aesthetic experiences from visual art can induce highly pleasurable states and these states can impact affect and aid mood regulation. In future research, these features of art and cultural interventions need to be further teased apart so that we may understand what types of experiences, and which aspects of those experiences can impact which types of individuals.

Duration and Dosage

Another interesting finding of the study involves the required time and amount of art. Unlike previous studies that have typically either installed some works of art or asked individuals to have a complete museum experience, in the present study we found improvement in wellbeing variables even with an interactive exhibition of one painting in under 5 min. This viewing duration aligns with typical ranges of individual artwork engagement in museums (Pelowski et al., 2017a). The results are also in line with other wellbeing findings. For example, the Cracknell et al. (2016) study of aquarium-viewing found that peak impacts on mood tended to be delivered within the first 5 min. Our results provide a suggestion for the possibility of “micro-dosing” art and culture that might fit into everyday routines, delivered online.

Caveats and Targets for Future Research

This study is, of course, not without its limitations. It should, we would argue, be treated as a first exploratory step, with its findings viewed primarily as calls for future research. Readers should also take our results and interpretations with our sample size in mind. Although we found that, indeed, there is a measurable, systematic effect on a variety of variables related to wellbeing as they are self-reported by participants, it is important to consider several factors that could be raised about this result. First, in regard to the intervention itself, we had little control over what type of device was used (computer or phone), in which setting (home, office, while commuting, in hospital), and how intently participants engaged with the chosen stimuli. Similarly, in line with the nature of this type of ecological online experiment we were unable to

supervise participants to see if they viewed the stimuli with a desirable amount of concentration.

We recommend that future study should therefore not only test for replication, but also include more rigorous and more controlled paradigm (e.g., using a webcam to monitor engagement, recording screen and mouse movement, etc.). That said, it could also be argued that the experience of viewing the online exhibitions, where participants could freely engage with the stimuli in their home environments, represents a strength of this study, as it reflects findings that can be generalized to more ecologically valid scenarios. Indeed, regardless of the confounding behavior that participants might have engaged in, we still found a systematic improvement in their wellbeing, suggesting that such online engagement, not in a lab where researchers ensure no distractions, but rather in the real world, is viable and deserves further study.

It is also possible due to the pre-post nature of our design that participants' answers may have been impacted by, for example, a placebo effect or more social-driven factors such as the Hawthorne effect (Adair, 1984) in which participants might guess the study goals and respond how they feel they should (desirability effect or command bias). Although this is possible, as is the case for many psychological studies, we do not believe this precludes our results from a meaningful interpretation. Indeed, the supposed Hawthorne effect was neither consistent across all wellbeing variables (e.g., we did not find significant overall changes in positive mood or satisfaction with life) nor across all individuals (for each variable, some participants indicated that their positive mood, for example, decreased, see **Figure 4**). Further, due to the randomization of the six batteries of DV questions, it would be difficult for individuals to remember so many questions to then seek based on their figuring out the hypothesis to fake their answers. Thus, despite these noteworthy limitations, our results still suggest that online cultural intervention on specific facets of wellbeing is a viable area for more research. As a next step, we strongly encourage the addition of a control condition to strengthen the interpretability of the effect possibly through larger sample sizes based on these reported effect sizes, and the inclusion of a post only comparison group or other control groups.

Additionally, we are unable to determine the causality of the relationship between appraisals, cognitive-emotional experience, and impacts on mood and anxiety. Participants first viewed the cultural content, then indicated which cognitive-emotional states they experienced while viewing, and subsequently provided their appraisals of the exhibition, followed by their actual mental wellbeing state. We would encourage further research to examine if subjective experiences, such as beauty and meaningfulness, mediate the impact of said intervention on mood and anxiety. Or, alternately, if an improved cognitive, emotional, or physiological state influence reported appraisals. It would be interesting to compare these effects to other—perhaps less visually appealing or more information-focused—conditions, or stimuli that might not be spontaneously labeled as art but rather lacking any trace of intentionality of human connection.

CONCLUSION

In conclusion, the results of this paper suggest that online cultural engagement, including but not limited to fine art, does seem to be a viable tool to support individuals' mood, anxiety, loneliness and wellbeing especially when such content is beautiful, meaningful, and inspires positive cognitive-emotional states in the viewer.

DATA AVAILABILITY STATEMENT

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found below: <https://github.com/giacomobignardi/Trupp-online-art-wellbeing>.

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

MT, KC, and MP contributed to the design of the study. MT and KC conducted the literature review. MT prepared the materials and collected and processed the data. MT, GB, ES, and MP contributed to the planning of the analysis. GB and MP conducted the analysis. MT and ES validated the analytical work. MT, GB, and KC drafted the manuscript. MP supervised the study. MT and MP revised the manuscript. All authors contributed to the article and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpsyg.2022.782033/full#supplementary-material>

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How Art Experiences and Interventions Can Be Designed, Implemented and Evaluated

Chapter Three

Who benefits from art viewing and how?

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I conceived the core idea for this work and collaborated with GB, ES, EV, and MP on the study's design and methodology. I prepared the materials and led the investigation, as well as data collection, cleaning, and curation, while overseeing project administration and management. I worked with GB and EV to plan the formal analysis, which was conducted by GB and myself. I drafted the manuscript and revised it based on feedback from all authors.



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

MacKenzie D. Trupp^{a,*}, Giacomo Bignardi^{b,c}, Eva Specker^a, Edward A. Vessel^d, Matthew Pelowski^{a,e}

^a Department of Cognition, Emotion, and Methods in Psychology, Faculty of Psychology, University of Vienna, Vienna, Austria

^b Department of Language & Genetics, Max Planck Institute for Psycholinguistics, Nijmegen, the Netherlands

^c Max Planck School of Cognition, Leipzig, Germany

^d Max Planck Institute for Empirical Aesthetics, Frankfurt Am Main, Germany

^e Vienna Cognitive Science Hub, University of Vienna, Vienna, Austria

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ABSTRACT

When experienced in-person, engagement with art has been associated with positive outcomes in well-being and mental health. However, especially in the last decade, art viewing, cultural engagement, and even ‘trips’ to museums have begun to take place online, via computers, smartphones, tablets, or in virtual reality. Similarly, to what has been reported for in-person visits, online art engagements—easily accessible from personal devices—have also been associated to well-being impacts. However, a broader understanding of for whom and how online-delivered art might have well-being impacts is still lacking. In the present study, we used a Monet interactive art exhibition from Google Arts and Culture to deepen our understanding of the role of pleasure, meaning, and individual differences in the responsiveness to art. Beyond replicating the previous group-level effects, we confirmed our pre-registered hypothesis that trait-level inter-individual differences in aesthetic responsiveness predict some of the benefits that online art viewing has on well-being and further that such inter-individual differences at the trait level were mediated by subjective experiences of pleasure and especially meaningfulness felt during the online-art intervention. The role that participants’ experiences play as a possible mechanism during art interventions is discussed in light of recent theoretical models.

The arts are increasingly becoming an important partner for well-being and health promotion (Fancourt & Finn, 2019). Emerging evidence has indicated that art viewing can be an effective intervention in various settings. For example, a short visit to an art museum over a lunch break can offer respite from a stressful day, improving self-reported stress and mood, lowering cortisol levels (Clow & Fredhoi, 2006) and blood pressure (Mastandrea, Maricchiolo, et al., 2019). Hospital rooms with artwork result in happier, less stressed, and less medicated patients than those in rooms without art (Froggett & Little, 2012; Ho, Potash, Fang, & Rollins, 2015; Karnik, Printz, & Finkel, 2014).

Beyond in-person, art viewing can now take place in a range of contexts through the rise of the internet and digital technology. Today, computers, smartphones, and even virtual reality headsets provide new means of delivering art into homes, hospital rooms, or places of work.

Art institutions have also embraced these trends by moving en masse online, providing new access to their collections, and expanding their reach to new visitors (e.g., Bu, Mak, Bone, & Fancourt, 2021; Rice, 2020; Trupp, Bignardi, Chana, Specker, & Pelowski, 2022). This is matched by social media and several new digital channels (streaming, digitizing, non-fungible tokens (NFTs; see e.g., Paul, 2021)), allowing individuals to create and share their art online. In combination, digital art viewing is occurring to such an extent that it has been called the most common means of ‘real life’ art engagement (Leder, Hakala, Peltoketo, Valuch, & Pelowski, 2022).

This rise in digital art engagement could also provide innovative avenues for designing and implementing well-being interventions. Outside the arts, various well-being interventions have been successfully translated into the digital realm (Fleming et al., 2018). For example,

* Corresponding author. Faculty of Psychology, University of Vienna, Wächtergasse 1/306, 1010, Vienna, Austria.

E-mail address: mackenzietrupp@gmail.com (M.D. Trupp).

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smartphone-based game interventions have been shown to assist with lowering anxiety (Cumino et al., 2017) and web-based training programs for beauty appreciation (Martínez-Martí et al., 2018) and tablet-enabled cooking or craft exercises (Leng, Yeo, George, & Barr, 2014) have shown positive well-being impacts. Recently, a new study reported the first evidence of similar effects from viewing online art. Trupp et al. (2022) asked individuals to visit a Google Arts and Culture exhibition of one Water lily painting by Monet on their personal computers or smart devices. Using a pre-/post-intervention survey design, the authors reported significant reductions in reported negative mood, anxiety, and loneliness and an increase in subjective well-being, with the latter two effects primarily driven by the former. These effects occurred with only brief visits—within an average viewing time of less than 2 m (range 11–274 s)—providing an exciting glimpse into the potential for embedding art engagement in everyday lives.

However, although there is evidence that online art viewing may be an effective well-being intervention (Trupp et al., 2022; see also Cotter et al., 2022), replication is needed to ascertain whether we might find consistent and actionable patterns of evidence. Even more, in all art-viewing modalities on- and offline, very little work has focused on the circumstances—for whom and how—successful well-being impacts might occur. It is becoming increasingly clear that art engagements and well-being effects are not one-size-fits-all, with interventions working better for specific individuals and/or with certain types of art experiences. For example, in Trupp et al. (2022), despite a sample-wide general effect, there were inter-individual differences related to the type of subjective experiences participants had while viewing the online art. However, without controlled evidence exploring these aspects, this limits the ability to design effective interventions and has led to calls for a better understanding of the necessary ingredients of the experience and explanations of mechanisms through which impacts could emerge (Warran, Burton, & Fancourt, 2022).

1. The present study

The aim of this study is to address whether, for whom, and how online-delivered art might have well-being impacts in a pre-registered, hypothesis-driven fashion replicating the design of Trupp et al. (2022) with improved methodology (larger sample, more controlled assessment of viewing behaviour, better measurements). First, we replicated the reported effects, further solidifying the potential of online art experiences to be delivered via personal computers, tablets, and smartphones as an effective intervention and provide more robust evidence regarding the specific well-being outcomes impacted. Second, moving beyond simple replication, we examined whether and how art viewing is especially beneficial. We considered a theoretical framework including two contextual factors at the state and trait level, involving the subjective art experience (state) and “aesthetic responsiveness” (trait), a new measure of individual differences in the way that people typically seek out and respond to aesthetic stimuli (Schlotz et al., 2020). As we present below, both of these have been previously suggested to influence art viewing intervention efficacy and are related to well-being. However, why these factors are related to well-being has not been investigated, leaving a gap in our understanding of how art viewing leads to improved well-being. As presented in our model below, we investigated the possibility that aesthetic responsiveness (trait) influences well-being outcomes *because* it influences subjective art experience (state).

2. Theoretical framework

2.1. State factors: pleasure, meaningfulness, and well-being outcomes

First, we present theoretical literature and empirical evidence relating to the specific state factors of subjectively felt pleasure and meaningfulness. These aspects represent often-noted features of aesthetic and art engagements, pertaining to the reward individuals

receive from or the depth of processing of art or aesthetic stimuli. They are connected to the outcomes of an art experience (appraisals, sense of importance, desire to revisit; Pelowski, Markey, Forster, Gerger, & Leder, 2017), and several theoretical papers have proposed meaning and pleasure as mediators of art's impact on well-being (Eekelaar, Camic, & Springham, 2012; Fancourt & Finn, 2019; Mastandrea, Fagioli, & Biasi, 2019; Silverman, 2002). Throughout the literature, viewing art is most frequently suggested to have beneficial effects through feelings of pleasure. This is supported by literature on general affect, where felt pleasure is considered to be a fundamental contributor and component to overall well-being (Berridge & Kringelbach, 2011; Mastandrea, Fagioli, & Biasi, 2019) and in art contexts is associated with regulation of negative emotions and stress through activation of the reward network (Sachs, Damasio, & Habibi, 2015).

Similarly, the cognitive process of meaning-making has been theorized to underlie how art viewing can impact well-being (Eekelaar et al., 2012; Silverman, 2002) through processes of reminiscing, self-referential memory evocation, and cognitive re-framing (Chiang et al., 2010; Eekelaar et al., 2012; O'Rourke et al., 2011). In general, having a sense of meaning in life (goals, rewarding commitments, positive beliefs about life and self) is associated with health and well-being (Koenig, 2012), and the active process of meaning-making, in particular, is known to be a health and well-being resource (Alea & Bluck, 2012; Knizek et al., 2021). Meaning-making is the reflective process through which individuals balance situational meaning, such as interpreting events, objects, and discourses in their lives within the context of their past experiences, knowledge, and their global meaning in life (Park, 2010). The arts, especially, have been heralded for their ability to be a catalyst for such processes by presenting opportunities for self-exploration, renewal of self-esteem, and re-framing of attitudes and beliefs (Knizek et al., 2021).

Corresponding empirical evidence supports these theoretical claims, with associations between well-being outcomes and subjective states experienced while art viewing. The previous Trupp et al. (2022) study noted individuals who reported the online art as more meaningful and beautiful and who wished to visit again had larger improvements in negative mood, while improvements in anxiety were associated with the desire to visit again and with the subjectively rated goodness of the art. Similarly, an online training program by Martínez-Martí et al. (2018) reported a connection between experiences of beauty and greater well-being effects, and Fekete et al. (Under Review), found that enjoyment and being moved during an in-person (museum) art intervention predicted well-being outcomes (see also Fancourt, Garnett, and Müllensiefen (2020) for similar findings for the enjoyment of creative activities and mood regulation). Lastly, Fróis & Silvia (2014) found that the individuals (artists, in this case) who mentioned feelings of well-being while viewing art also referred more often to experiencing processes of meaning-making while viewing art.

These findings are consistent with work in the fields of empirical aesthetics and neuroaesthetics, which have consistently found that experiences with art frequently evoke meaningful and pleasurable states (Belfi et al., 2019; Vessel, Gabrielle Starr, & Rubin, 2012), possibly explaining the success that art experiences have in positively impacting well-being. However, there is little empirical evidence addressing the mediating role of pleasure and meaning-making in art interventions. Furthermore, correlations between subjective experiences and affective outcomes can also be mixed. For example, Mastandrea, Fagioli, and Biasi (2019) reported that systolic blood pressure reductions after an art gallery visit were not associated with liking the artwork. Therefore, taking into consideration the mixed results, in addition to the small number of studies, the variety of types of subjective experiences assessed (i.e., enjoyment, desire to visit again, meaningfulness, or liking), and the correlational nature of the analyses, it is challenging to draw conclusions about possible mediators without experimental examination, making this paper a significant step forward by considering these aspects.

2.2. Trait features: aesthetic responsiveness predicting the impact of art interventions

The expectations and personality traits that one brings to art, or any intervention, also represent a crucial target for research. Although there is little understanding of how individuals' characteristics might specifically influence the efficacy of art-viewing interventions, there is ample cross-sectional evidence indicating that well-being is related to an individual's relationships with and expectations of art, and aesthetic stimuli more generally. Such evidence suggests that an appreciative attitude towards what individuals deem to be aesthetic stimuli—*noticing more, having intense physiological reactions, liking, finding it meaningful and important*—may contribute to overall well-being. For example, as summarized in Table 1., those higher in trait *appreciation of beauty, aesthetic sensitivity, or savouring of art* have higher subjective well-being (i.e., Martínez-Martí et al., 2016), life satisfaction (i.e., Littman-Ovadia & Lavy, 2012), lower depression (i.e., Diessner, Solom, Frost, Parsons, & Davidson, 2008), and better health (i.e., Lee, Lee, & Choi, 2021). Additionally, in the case of Lee et al. (2021), results remained significant after inclusion of openness to experience as a covariate, placing stronger weight on the specifics of these traits (see Table 1 Outlining associations between each trait, their definitions, and specific well-being outcomes).

Recently, a study explicitly tested if similar trait aspects could predict the outcome of an art intervention on well-being (Fekete et al., Under Review). This employed a new battery, the Aesthetic Responsiveness Assessment (AReA), a measure of a trait characteristic that captures many of the above features in a domain-specific context regarding an individual's likelihood to respond strongly to aesthetic stimuli such as art (Schlotz et al., 2020). The AReA provides a general measure composed of three sub-aspects: intense aesthetic experiences (i.e., heart beating faster, feeling awe, or overwhelmed by art and nature), aesthetic appreciation (i.e., visiting museums, noticing beauty, being moved by art), and creative behaviour (i.e., drawing or writing poetry). In the above study, those with higher aesthetic responsiveness showed greater benefits to their well-being after a 10–15-min art intervention that combined music and visual art in a museum setting.

Moreover, higher scores on the AReA have also been related to more pleasurable or intense responses to music, visual art, and poetry (Schlotz et al., 2020), suggesting that this trait could predict important states during art engagement that are associated with, and could lead to well-being impacts, explaining its effect. Thus, these findings and the literature on related traits (appreciation of beauty, aesthetic sensitivity, savouring) provide support for the hypothesis that aesthetic responsiveness would predict the impact of art interventions. However, it is not known if the better art experience had while viewing, predicted by

Table 1
Overview of literature on trait aesthetic responsiveness constructs in relation to well-being.

Construct	Construct Measurement	Paper	Well-being Measure	N	r/R ²
Appreciation of Beauty and Excellence	Engagement with Beauty scale (EBS; Diessner et al., 2008) "I notice beauty in one or more aspects of nature", "When perceiving beauty in a work of art, I feel changes in my body, such as a lump in my throat, an expansion in my chest, faster heartbeat, or other bodily response", "When perceiving an act of moral beauty, I feel emotional, it "moves me," such as feeling a sense of awe, or wonder or excitement or admiration or upliftment."	Diessner et al. (2008)	Life satisfaction (SWLS) Depression (BDI)	206	$r = .20^*$ $r = -.12^*$
	Values in Action Inventory of Strengths (VIA-IS; Peterson & Seligman, 2004) Appreciation of Beauty subscale e.g., "I am often been left speechless by the beauty depicted in a movie" "I often fail to notice beauty until others comment on it (reversed)".	Littman-Ovadia and Lavy (2012)	PANAS PA PANAS NA Life satisfaction (SWLS) Subjective well-being (SWB)	184	$r = .31^*$ $r = -.02$ $r = .18^*$ $r = .26^*$
	Appreciation of Beauty and Excellence Scale (Martínez-Martí et al., 2016) <i>Appreciation of beauty:</i> e.g., "I am a person who is very sensitive to beauty". <i>Appreciation of moral excellence:</i> e.g., "When I witness somebody doing something good for others without reciprocation, I feel a lot of appreciation." <i>Appreciation of non-moral excellence:</i> e.g., "I like very much to surround myself with people who have outstanding talents or skills"	Martínez-Martí et al. (2016)	PANAS PA Life satisfaction (SWLS) Vitality	329	$r = .18^*$ $r = .18^*$ $r = .24^*$
Aesthetic Sensitivity	Aesthetic Sensitivity (AES) Subscale of Highly Sensitive Person Scale (Aron & Aron, 1997; Smolewska, McCabe, & Woody, 2006) e.g., "Do you seem to be aware of subtleties in your environment?", "are you deeply moved by the arts or music", "Do you notice and enjoy delicate of fine scents, tastes, sounds, works of art".	Sobocko and Zelenski (2015)	PANAS PA PANAS NA Life Satisfaction (SWLS) Subjective Happiness Scale (SHS)	154	$r = .25^*$ $r = -.10$ $r = .09$ $r = .07$
			PANAS PA PANAS NA	118	$r = .01$ $r = .08$
Savoring Art	Savoring Art (Lee et al., 2021) e.g., "I enjoy the beauty of art", "I believe in the importance of art", "I get deeply immersed in music" and "I need a creative outlet".	Lee et al. (2021)	Psychological well-being (PWB) Subjective well-being (SWLS + PANAS)	501	$r = .21^*$ $r = .21^*$
Aesthetic Responsiveness	Aesthetic Responsiveness Assessment (AReA Schlotz et al., 2020) <i>Aesthetic appreciation:</i> e.g., "I notice beauty when I look at art" I am emotionally moved by music", "I experience joy, serenity, or other positive emotions when looking at art". <i>Intense Aesthetic Experience:</i> e.g., "When I look at art, my heart beats faster, I perspire, get dizzy, or have other physical effects", "I experience awe, fear, or a feeling of being overwhelmed when look at art". <i>Creative Behaviour:</i> e.g., "I sculpt, paint, draw, direct films or do design work", "I write poetry or fiction", "Presently (or in the past) I take (or have taken) classes in art, creative writing, or aesthetics".	(Under Review)	PANAS PA change pre/post art intervention PANAS NA change pre/post art intervention	204	$R^2 = .01$, $\beta = 0.138^*$ $R^2 = .02$, $\beta = -.0158^*$

aesthetic responsiveness could explain the impact of this trait on well-being outcomes. Similarly, questions arise about whether such effects might be domain-specific and particularly related to an individual's trait responsiveness to art and aesthetics (as in the AREA) or more domain-general sensitivity to reward in an individual's environment, which we tease apart.

2.3. Hypotheses

In sum, we test the following hypotheses: (1) the replicability of well-being improvement on mood and state anxiety, which were the two most salient results in the Trupp et al. (2022), (2) if trait aesthetic responsiveness (AREA) predicts the well-being impact of art viewing, and if this is mediated by the states of pleasure and meaning felt during the art experience.

To achieve this, we use an experimental design similar to Trupp et al. (2022) in which observers engage with a Google Arts and Culture online art exhibition of a Monet Water Lily painting and measure the effectiveness of online art viewing on aspects of experienced well-being (Fig. 1a). We evaluate the contributions of aesthetic responsiveness and two mediating variables (liking as a proxy of felt pleasure, and meaning) to individual differences in well-being change from pre-to post-measurement (Fig. 1b) by means of structural equation modelling (SEM). As seen in our hypothesized model in Fig. 1c–d, AREA scores are the exogenous variable, and the subjective experience variables are mediating factors, all acting upon changes caused by the online art exhibition in positive mood, negative mood, and anxiety (referred to as well-being outcomes).

We also test whether the contributions from AREA and mediators act distinctly on individual well-being variables or similarly through a common well-being factor. Lastly, we examined the importance of domain-specificity in trait assessments by including domain-general reward sensitivity as a possible confounder to assess the importance of responsiveness to aesthetic stimuli as a predictor of the specific art-media response and well-being impacts.

3. Methods

As noted above, this study design, hypotheses, and analysis plan were pre-registered with the Open Science Framework (OSF). For pre-registration see <https://doi.org/10.17605/OSF.IO/TWNDM>.

3.1. Participants

The study involved 240 participants collected from the University of Vienna (Age $M = 23.35$ y, $SD = 4.46$ y, 150 identified as female, 82 as male, and eight as other). Participants were recruited using a university system that allows students to sign up for research studies as part of a requirement for undergraduate students to participate in and learn about research. For participation, students received course credit towards meeting this requirement. The final sample of students was derived from an initial total of 283 completed surveys (see results section for details of participant exclusion). The study was approved by the University of Vienna ethics board.

4. Materials

4.1. Stimuli—Online art viewing intervention

The art stimulus (used by Trupp et al., 2022) consisted of an interactive online art exhibition entitled *Monet's The Water-Lily Pond; An in-painting tour from the National Gallery, London*, selected from Google Arts and Culture, an online repository of museum and art collections (About Google Cultural Institute, 2020). This exhibition allowed participants to view a single visual image (*The Water-Lily Pond*, 1899, displaying a pond covered in water-lilies under a bridge in Giverny) that

could be appreciated by itself, as well as by zooming in to enlarge various details that were accompanied by written descriptions (see [Supplementary Materials](#) for all texts). The details were accessed by scrolling with a mouse causing text and smaller sections of the main image to be shown on the screen. As noted in Trupp et al. (2022), the impressionist artwork was itself selected because such landscape/waterscape artworks have been identified as particularly good candidates for stress and anxiety-reducing or restorative experiences among both patient and non-patient populations (Ulrich & Gilpin, 2003).

4.2. Well-being measures

As our main well-being outcomes, we assessed self-reported state anxiety and mood, which are key assessments of experiential well-being. As outlined by Stone and Mackie (2013), distinct from evaluative (life satisfaction) or eudemonic well-being (meaning in life), experiential well-being is the moment-to-moment positive and negative emotions and sensations, such as stress, mood, and anxiety, that individuals experience. These aspects of well-being are especially susceptible to changes in the environment, making them an ideal target for interventions. Additionally, the specific scales we used were selected for their length, as the task of answering 20 mood and six anxiety-related questions about particular states was expected to decrease the likelihood that participants would remember pre-test answers and intentionally or subconsciously change them on the post-test (e.g., Chen & Risen, 2010; Warren, McGraw, & Van Boven, 2011). The range of items also provided detailed information on what kinds of specific affective states might be impacted for future exploratory analysis. Both scales were assessed pre-and post-intervention.

State anxiety was assessed with the state subscale of the State-Trait Anxiety Inventory (STAI; Marteau & Bekker, 1992), following Trupp et al. (2022). The STAI-S includes six items, for which individuals indicate to what extent they feel each state (i.e., calm, tense) at the moment (1 = Not at all, 4 = Very much). The STAI-S is noted to be valid compared to longer and other versions of state anxiety measures (Marteau & Bekker, 1992) and is widely used (Emons, Habibović, & Pedersen, 2019).

Mood was assessed with the Positive Affect Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988). This battery was included as an improvement to the design of Trupp et al. (2022), which employed only two questions asking participants to rate their overall positive and negative mood. The PANAS instead is comprised of 20 mood adjectives, half of which were positive (i.e., determined, enthusiastic) and half negative (i.e., afraid, distressed), and which can be summed into positive and negative mood scores. Individuals were asked to indicate the extent to which they felt each adjective at the moment (1 = Very slightly or not at all, 5 = Extremely). This scale was also selected due to its wide use in both assessments of clinical interventions (i.e., Molinari et al., 2020) as well as in cultural interventions such as art museum visits (i.e., Thomson, Ander, Menon, Lanceley, & Chatterjee, 2011), and its reliability and validity, especially in non-clinical samples (Crawford & Henry, 2004). The present study also used the original English versions, as validated in the previously cited studies.

4.3. Measures of subjective art experience, subjective pleasure and meaningfulness

As our two target mediating factors regarding subjective experience, we focused on pleasure and meaningfulness. *Subjective felt pleasure* was quantified by asking participants to indicate to what extent they agreed with the statement, "I liked my experience." This phrasing marked a modification of the previous Trupp et al. (2022) paper, which had included several questions regarding stimulus beauty, goodness, and desire to revisit (showing moderate-to-high correlation, $r = 0.55$ – 0.71). Liking was selected following past literature (Berridge & Kringelbach,

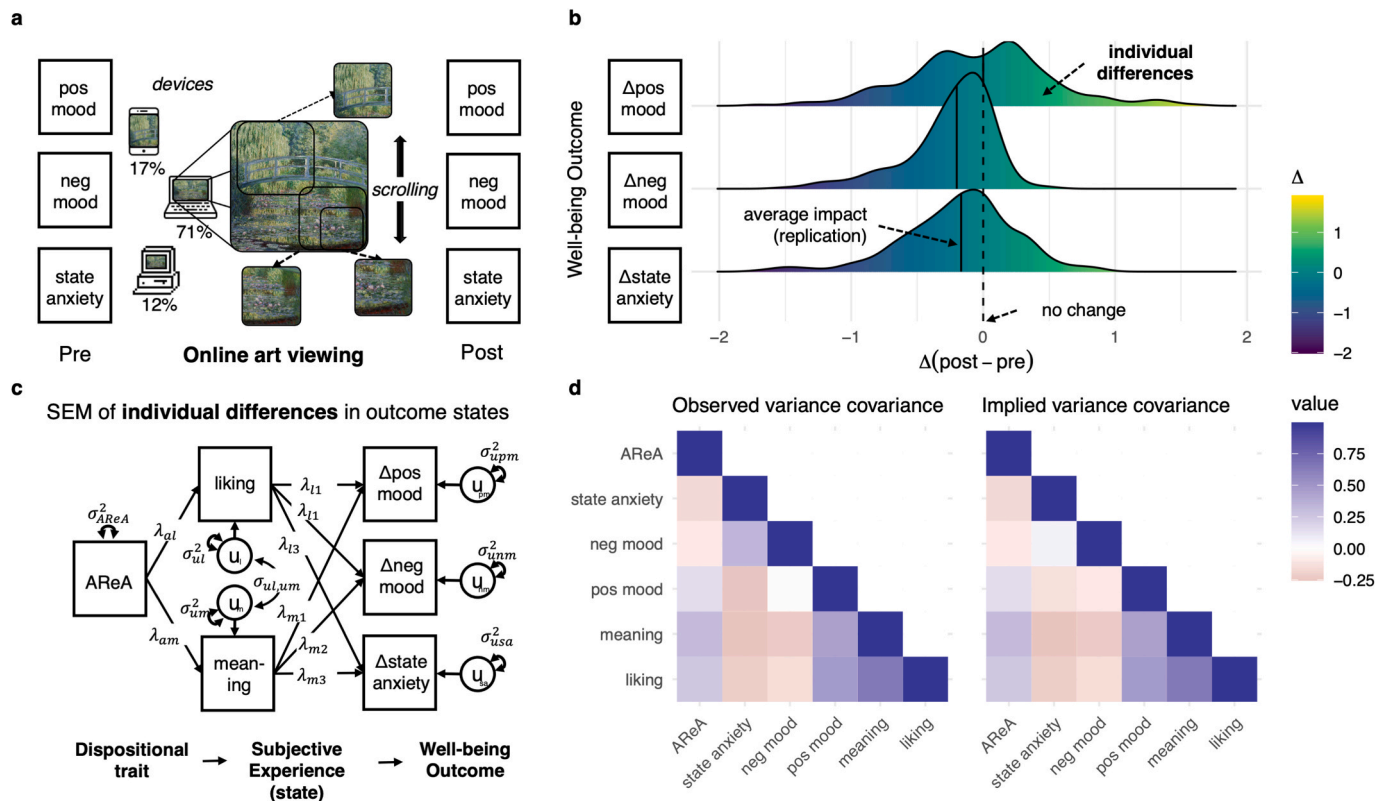


Fig. 1. Graphic Abstract of Design and Methods. **A)**, well-being outcomes were measured before and after interacting with a Google Arts and Culture exhibition of Claude Monet's *The Water-Lily Pond* (1899, The National Gallery, London). Most users opted to complete the survey and view the art with a laptop computer over smartphones or desktop computers. **B)**, the pre-and post-measures of each well-being outcome were converted into a change score, which is plotted in a frequency distribution to show the individual differences in the impact of art viewing. The dotted line represents the no-change line at zero, and the dark solid line indicates the mean for each outcome distribution. The portion of the distribution on the right for positive mood (left for neg. mood and anxiety) indicates improvements in these psychological states. **C)**, this Structural Equation Model was pre-registered to test the impact of trait AReA on well-being outcomes mediated by subjective experience states. **D)**, the observed and implied variance-covariance matrix, which visualize the comparison of the predicted model with the data collected.

2008) as a proxy for felt pleasure. *Meaningfulness* was assessed by asking participants to indicate to what extent they agreed with the statement "The experience was meaningful to me" (following Trupp et al., 2022). This questioning style is in keeping with the field of empirical art and aesthetic perception, whereas dimensions of aesthetic experience are assessed with single items and map onto physiological and neurological correlates (see Pelowski et al., 2017 for review). In addition to these two questions selected for their targeted ability to measure our theoretically informed subjective states, beyond the pre-registered plan and target questions, for separate additional exploratory studies, we also included questions regarding how much participants felt that their experience was enjoyable, self-relevant, and beautiful, and which types of emotions they experienced.

All ratings above were quantified by using a continuous sliding scale, allowing participants to register precise increments (using two decimal places) from 0 = 'Not at all' to 7 = 'Extremely'. This method was selected again as a modification of the Trupp et al. (2022) method, which used a standard 7-point Likert-type approach, to provide more continuous data.

4.4. Individual differences, aesthetic responsiveness

Aesthetic responsiveness, our target interpersonal trait factor, was measured with the Aesthetic Responsiveness Assessment (AReA Schlotz et al., 2020), with 14 items assessing individual differences in responsiveness to the arts, nature, and beauty, and containing three subfactors, Aesthetic Appreciation (AA; i.e., visiting museums, noticing beauty, being moved by art), Intense Aesthetic Experience (IAE; i.e., heart beating faster, feeling awe, or overwhelmed by art and nature), and Creative Behaviour (CB; i.e., drawing or writing poetry). Items could be

scores between 0 = never, 1 = rarely, 2 = sometimes, 3 = often, 4 = very often.

For the purpose of comparison, we also included an assessment of *Reward Sensitivity* using the Temporal Experience of Pleasure Scale (TEPS; Gard et al., 2006). The TEPS was designed to measure, with 18 items, two aspects of experiences of pleasure; *anticipatory pleasure* (TEPS-A), the pleasure that is experienced in anticipation of an event, and *consummatory pleasure* (TEPS-C), the pleasure experienced at the moment (combined as TEPS). This is a domain-general trait that captures individual differences in the experience of pleasure in the sensory environment. This trait has also been associated with well-being, with low levels of reward sensitivity indicating anhedonia, an aspect of depression (Rømer Thomsen et al., 2015). Higher levels, conversely, have also been associated with having more pleasurable and beautiful experiences with art and music (Belfi & Loui, 2020; Briellmann & Pelli, 2019), making it a good comparison point to the AReA's focus on arts and aesthetic specific contexts. Items are scored between 1 = very false for me and 6 = very true for me.

Finally, general relation to the arts was assessed by asking participants whether they had studied fine art or art history (ranging from "no" to "I am a professional", see descriptive results for each item) and how interested they were in art (1 = not at all, 7 = very much).¹

¹ As above, for exploratory purposes (i.e., not included in the preregistered SEM plan), we also included an assessment of Openness to experience, measured with the Openness facet of the Big Five Inventory (BFI; John, Donahue, & Kentle, 1991). This trait was included for an unrelated study and will not be further discussed in the paper.

4.5. Quality control measures—attention and actual visit with the art

Finally, to ensure the acquisition of high-quality data, we included several measures in the survey. First, three questions asked participants to move the slider to the position of ‘extremely’ on the scale. These were embedded in the pre-and post-PANAS and in the subjective experience evaluation and were included as a measure of attention to the survey items.

Second, to check that individuals had visited the online art website and spent at least some time with the art, after returning to the survey, participants were asked if they had visited and viewed the online exhibition if they had any problems doing so, and to specify what happened. This was also matched to the page submission metadata provided by Qualtrics. Lastly, to check for confounds, we asked if participants had ever visited virtual or online galleries, if they had seen this exact exhibition, or if they had visited similar experiences in the past.

4.6. Design and procedure

The procedure largely followed Trupp et al. (2022). This used a matched pre-/post-design. Participants, using their own computers or other devices (see also Results for breakdown), joined the study from a provided link, taking them to an online survey platform (Qualtrics). They were first told that they would be participating in a study about online engagement. After obtaining informed consent, a pre-viewing survey was conducted. Participants reported their demographic data, their level of art interest, education, and whether they had previously visited online art presentations. This was followed by the target well-being outcome measures, mood and anxiety scales. These were presented in randomized order to avoid any systematic effect of one scale preceding the other. Then participants were presented with a hyperlink window that opened the Google Arts and Culture exhibition in a new tab. They were asked to click on the link and to “spend a few minutes viewing” the stimulus. After they had looked for as long as they desired, they were asked to navigate back to the survey tab. Participants were then asked quality control questions (attention, issues with visiting) about their subjective art experience states, followed by, once again, the mood and anxiety scales (order randomized). Last, participants completed individual difference scales.

5. Results

5.1. Descriptive statistics

Participants were excluded for one or more of the following reasons: duplicates ($N = 8$),² failing the attention check ($N = 11$), viewing times under a 10 s cut off (following Trupp et al., 2022; $N = 4$), or being part of previous pilot testing ($N = 8$). The final ($N = 240$ participants) sample had a wide range of interest in art (range 1–7, $M = 4.34$, or just above the midpoint on the ‘not at all to ‘very much’ 7-point scale; $SD = 1.45$); 80% of participants were taking or had taken at least one fine art or art history classes in school or university. However, only 18% were pursuing or had completed a minor in fine art or art history, and only 1% ($N = 2$) were working or had worked towards an art degree.

The sample had an average aesthetic responsiveness score of $M = 1.50$, ($SD = 0.73$), representing average responses between ‘rarely’ and ‘sometimes’ and an average reward sensitivity of $M = 4.41$ ($SD = 0.69$, out of possible range of 1–6). Twenty percent of participants reported that they had previously visited an online art gallery. However, only 2% reported having visited an online presentation similar to the

intervention; less than 1% ($N = 2$) reported visiting the specific Monet Water-Lily exhibition before. About 71% of participants completed the experiment on a laptop, 17% used a smartphone, and 12% used a computer with a desktop monitor. (We note that liking and changes in positive mood were lower when participants viewed the art on their phones compared to laptops and desktop computers [liking: $F(2, 237) = 5.24, p = .036$, change in positive mood: $F(2, 237) = 5.17, p = .038$], see supplement for detailed results split by device type).

5.2. Online art-viewing experience—viewing time and liking/meaning ratings

The average viewing time was $M = 2$ min and 7 s (127 s; $SD = 75$ s), ranging from 10 to 529 s (8 min 49 s). This compared similarly to the average viewing time of $M = 107$ s ($SD = 69$ s; range = 11–274 s) reported in Trupp et al. (2022), and is even at the long end of viewing time ranges typically reported for museum or lab-based engagements with one work of art (e.g., median/mean results often suggest 10–40s; see Smith, Smith, & Tinio, 2016 for review).

The ratings of the art experience suggested that, on average, participants tended to report moderately high liking when viewing the art ($M = 5.16, SD = 1.52$), while average meaningfulness was more mid-range ($M = 3.52, SD = 1.71$). As in the earlier paper, we also found that, when considered across the participants, there was quite a high variance in the ratings, showing a range across the full scale.

6. Confirmatory analyses

6.1. Online art viewing impacts well-being outcomes

Turning to the well-being outcomes, as can be seen in Fig. 2, both negative mood and anxiety showed a general decrease, across all participants, from pre-to post-assessment. Negative mood changed from $M_{pre} = 1.55$ ($SD = 0.62$) to $M_{post} = 1.30$ ($SD = 0.47$). Anxiety changed from $M_{pre} = 3.46$ ($SD = 0.63$) to $M_{post} = 3.28$ ($SD = 0.54$). Positive mood, however, remained stable with a slight decrease, with $M_{pre} = 2.42$ ($SD = 0.61$) and $M_{post} = 2.39$ ($SD = 0.71$).

To test whether the differences in pre-to post-assessment were statistically significant, we aimed to first replicate the analysis carried out by Trupp et al. (2022). This involved a one-way repeated measure multivariate analysis of variance (MANOVA) with time (pre/post) as the independent variable (IV) and individuals’ positive mood, negative mood and anxiety as DVs. The pre/post variable distributions, however, did not meet MANOVA assumptions of multivariate normality (Shapiro-Wilk $W = 0.99, p = .011$) and homogeneity of variance (all Levene’s tests $p < .05$). Thus, as opposed to the original paper and our pre-registered plan, we used a non-parametric alternative to MANOVA as implemented in the R statistical package MANOVA.RM (Friedrich, Konietzschke, & Pauly, 2018). We calculated the multivariate Wald statistic, $F(3,237) = 24.04, p = <.001$, which indicated that the combination of effects was significant from pre-to post-assessment, suggesting that the online art exhibition significantly impacted the psychological states of individuals (the interpretation of the result was unchanged following the pre-registered MANOVA, $F(3,237) = 49.29, p = <.001$). A post hoc Wilcoxon signed-rank test (Bonferroni corrected for multiple comparisons) indicated that while negative mood and anxiety significantly changed ($Z = -10.38, p < .001$ and $Z = -6.05, p < .001$, respectively), positive mood did not ($Z = -0.98, p = .981$).

6.2. Aesthetic Responsiveness explains the impact of online art on mood and anxiety via liking and meaning

We then moved to the second aspect of our analysis. The relationship between changes in the well-being measures and reported art experience (pleasure, meaning) are plotted as the distribution of the pre-and post-scores for each variable in Fig. 2d–f, where the size and colour of the dot

² Due to a technical error in the participant recruitment platform credit granting system, some participants completed the survey twice. These individuals were identifiable by their unique participant code and their second set of data was removed.

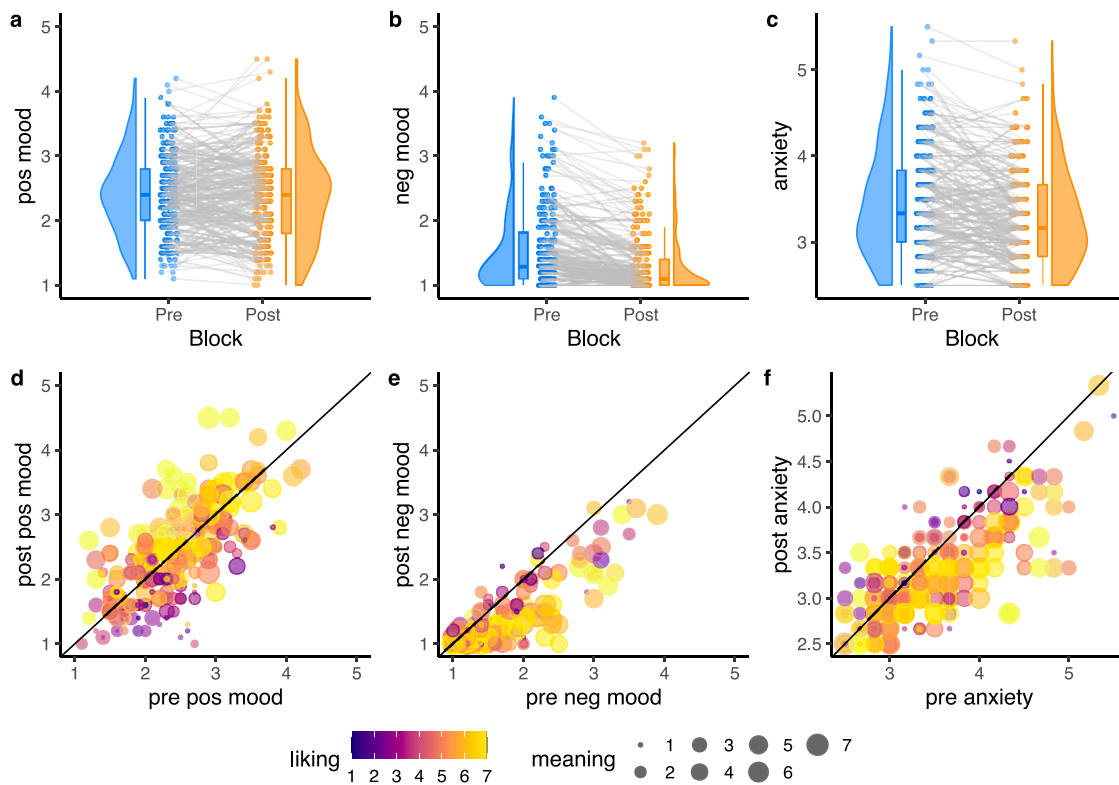


Fig. 2. Pre- and post-changes in PANAS and STAI after online viewing of the Monet Water Lily Google Art and Culture exhibition. **A), B)** and **C)**, show the group distributions and individual slopes from pre-to post-assessment (Allen et al., 2021). Negative mood and anxiety significantly changed, while positive mood did not. **D), E),** and **F)** show the relationship between the changes in the well-being outcomes and subjective experience variables liking and meaningfulness. On the x-axis are pre-distributions, and on the y-axis are post-distributions. The solid black line indicates the position of no change from pre to post. The colour of the dots indicates the strength of liking, while the size of the dot indicates meaningfulness. For positive mood, larger, brighter dots are found above the black line, indicating that those participants who experienced an increase in positive mood were also those who reported liking the art more and found it more meaningful. For negative mood and anxiety, the larger, brighter dots are under the black line, similarly indicating that those who experienced decreases in these variables were also those who liked the art experience more and found it more meaningful.

indicate the intensity of liking and meaning. From these plots, it appears that individuals' subjective experiences appeared related to changes in mood and anxiety. This was particularly the case for positive mood (Fig. 2d), where the larger brighter dots are distinctly clustered above the black line, and smaller darker dots below, indicating that those participants who experienced a positive change in positive mood (dots above the black line) liked the art experience more and found it more meaningful. A similar pattern was observed for negative mood and anxiety, with decreases in both (dots below diagonal) associated with greater liking and meaning.

6.2.1. SEM

To then statistically assess these relationships, we applied structural equation modelling (SEM). In the following sections, we first report (6.2.2) the fitting of the SEM, including first fitting our theoretical model (Fig. 1, panel c, above) to test if aesthetic responsiveness predicts changes in the well-being outcomes and if this is mediated by liking and meaning. (6.2.3) Second, we fit a common factor model, testing if aesthetic responsiveness and mediators act differently on each well-being outcome. Further, we (6.2.4) conduct path suppression to test for full or partial mediation and report the path coefficients and summarize the main mediation results. All SEM analyses were conducted with the R package Lavaan (Rosseel, 2012).

6.2.2. Model fitting

To increase the interpretability of the model coefficients, all variables were z-scored prior to model fitting. Absolute Model fit was assessed by CFI (Comparative Fit Index), TLI (Tucker-Lewis Index), SRMR (Standardized Root Mean Square Residual), and RMSEA (Root Mean Square Error of Approximation), while the relative model fit by the AIC (Akaike Information Criteria). Following standard recommendations (Brown, 2015), the threshold indicating a good fit for CFI and TLI are values $>.90$ (1 represents perfect fit), and for the RMSEA and SRMR, 0 indicates a perfect fit, with values below <0.08 considered a satisfactory fit.

Prior to model fitting, we validated the measurement model of the AReA. Confirmatory Factor Analysis (CFA) indicated that a model composed of the AA, IAE, and CB facets, as specified by Schlotz et al. (2020), was a good fit to the data, CFI = 0.97, TLI = 0.97, SRMR = 0.04, and RMSEA = 0.05.

We then fit our proposed model (Fig. 1c). Fit indices were only poor to satisfactory, $\chi^2(3) = 33.33, p < .001$, CFI = 0.89, TLI = 0.47, SRMR = 0.07. Based on current best practices in SEM, we deviated from our pre-registered analysis by directly estimating the AReA factor-scores by including the three facets of the instrument. This allowed us to estimate more precisely the weighted contribution of each facet to the total AReA score and to disregard unique variance related to each of the individual facets. By refitting the data to the updated model, we observed an improved model fit, $\chi^2(28) = 643.42, p < .001$, CFI = 0.92, TLI = 0.83,

RMSEA = 0.12, SRMR = 0.07. However, model fit was still below an acceptable threshold. As such, we investigated the residual matrix, which captures the differences between the implied and the observed variance-covariance matrix, to examine if the model could be further improved.

The residual matrix indicated a likely correlation between changes in anxiety and positive mood residuals. Further deviating from our initial model, we allowed for the residual variance of the change in anxiety to covary with the residual variance of the changes in both positive and negative mood. Fit indices for this third model were good, $\chi^2(11) = 643.42$, $p < .001$, CFI = 0.97, TLI = 0.92, RMSEA = 0.09, SRMR = 0.05 (Restricting the residual covariance resulted in worsened model fit, $F(2,13) = 29.96$, $p < .001$). This deviation implied that, at least in this sample, covarying changes in anxiety and mood following the online intervention were also affected by other trait or state variables not considered in the model.

6.2.3. Aesthetic responsiveness and mediators act differently on well-being outcomes

To investigate whether individual differences in AReA, liking, and meaning acted independently on well-being outcome changes or if they exerted their effect in a specific fashion, we compared SEM fit indices for the independent and common pathway models. The independent

pathway estimates the direct and mediated effects of the AReA on each DV independently, while in contrast, the common pathway estimates such effects on an additional hypothetical latent factor capturing similarity across DV changes. Fit indices for the common structural factor model were poor, $\chi^2(28) = 643.42$, $p < .001$, CFI = 0.76, TLI = 0.60, RMSEA = 0.19, SRMR = 0.12. This indicated that the AReA and mediators acted heterogeneously on the well-being outcomes, and that the changes in well-being were not captured by a common factor.

6.2.4. Sequential path suppression indicating full mediation

We then examined if liking or meaning were full mediators of the effect of the AReA on well-being outcome changes. We sequentially constrained the indirect paths, from meaning and liking to the outcome changes, and the direct paths, from the AReA to outcome changes. We also compared it to the unconstrained model. Excluding liking resulted in a significant worsening of the fit, $F(3,14) = 17.90$, $p < .001$ (AIC = 4890.35). Similarly, excluding meaning significantly worsened the fit, $F(3,14) = 15.77$, $p = .001$ (AIC = 4888.22). In contrast, when suppressing all direct paths from the AReA to the changes in the DVs, the constrained model did not significantly differ, $F(3,14) = 1.55$, $p = .670$ (AIC = 4874.00), indicating that the effects of AReA on changes in well-being outcomes were fully mediated by liking and meaning. This resulted in a final model shown in Fig. 3.

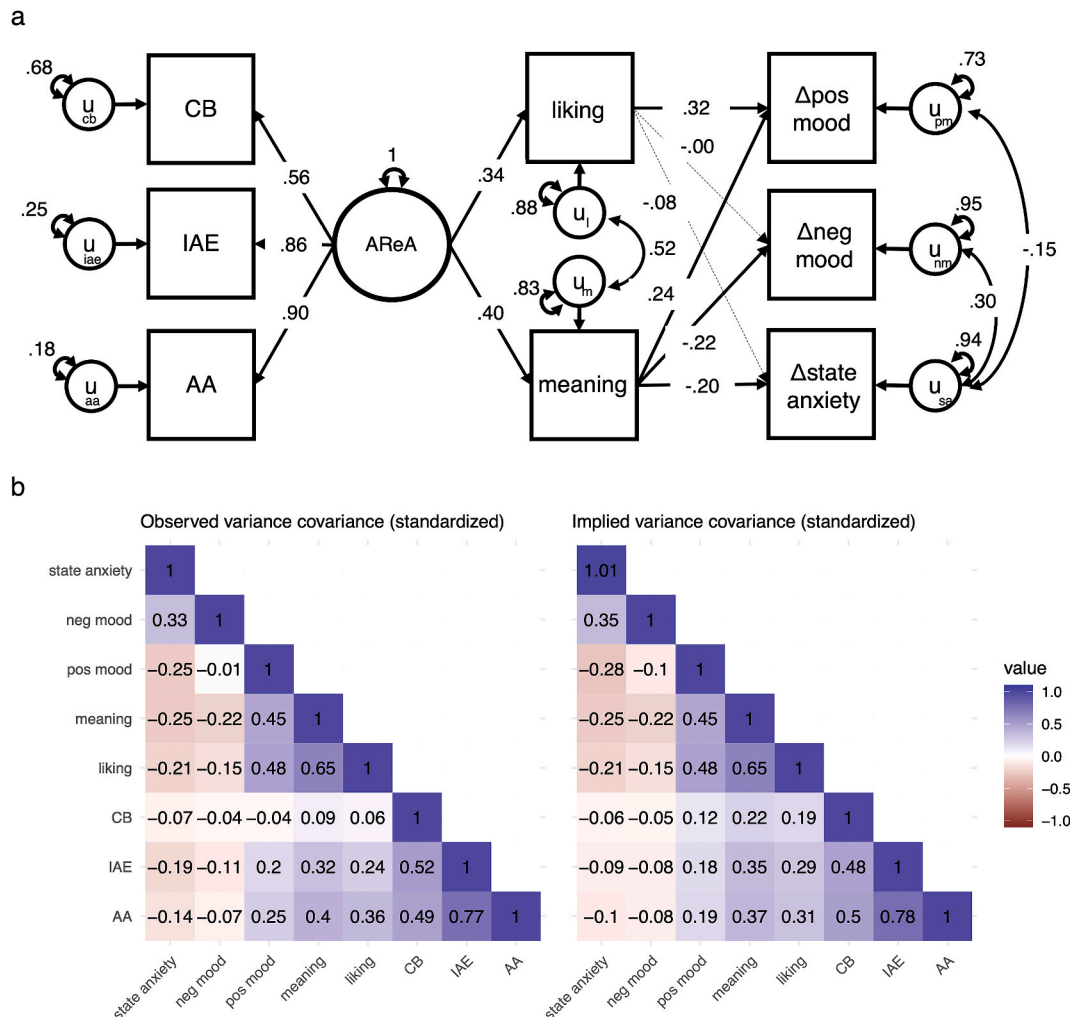


Fig. 3. Final SEM Model with Observed and Implied Variance Covariance matrices. **A)** the final model is depicted with significant paths in bold and path estimates. The final model depicts the predictive influence of AReA on well-being outcome variables as mediated through subjective experiences states. In the case of liking, only changes in positive mood were significantly predicted by liking, while meaning predicted all outcome changes. All Paths are Standardized. **B)** the observed variance covariance matrix is shown next to the implied variance covariance matrix demonstrating the expected relationships as predicted by our pre-registered model and the actual relationships observed from the data.

6.3. Summary of mediation results

As hypothesized and shown in Fig. 3 and Table 2, the paths between the AReA and both liking ($\beta = 0.34, p = <.001$) and meaning ($\beta = 0.40, p = <.001$) were significant. The AReA accounted for 12% and 16% of the variance in liking and meaning, respectively. To our surprise, however, liking was only associated with changes in positive mood ($\beta = 0.32, p = <.001$), indicating that as participants liked their experience more (experiencing more pleasure), they also experienced larger benefits, with 10% of the variance in changes in positive mood accounted for by liking. Meaning, on the other hand, was associated with *all* well-being outcome changes (pos. mood, $\beta = 0.24, p = .001$; neg. mood, $\beta = -0.22, p = .008$; anxiety $\beta = -0.20, p = .017$). Thus, if the experience was more meaningful, the improvements in well-being were larger. Meaning accounted for 6% of the variance in positive affect and 5% and 4% of the variance in negative mood and anxiety, respectively. Furthermore, the overall results indicate that the effect of the AReA on the changes in DVs is partially explained by experiencing stronger states of pleasure (liking) and meaningfulness while viewing the art, partially confirming our prediction.

6.4. Sensitivity analysis—Comparison of AReA with reward sensitivity

Lastly, to further compare the specific role of aesthetic responsiveness, we conducted a follow-up SEM, adding reward sensitivity as a possible confounder to the final model. Looking at changes in path coefficients, this allowed us to test whether general reward sensitivity acted as a common confounder for our results, biasing the estimates between aesthetic responsiveness and both liking and meaning. To do so, we simultaneously regressed the TEPS from the AReA, liking and meaning. The model including the latent TEPS as confounder fit the data well, $\chi^2(26) = 44.32, p = .014$, CFI = .97, TLI = 0.96, RMSEA = 0.05, SRMR = 0.05 (See Supplementary Fig. 2 For indexes and estimates). The TEPS was a strong predictor for the AReA ($\beta = 0.67, p < .001$), but not for liking ($\beta = 0.17, p = .087$) or meaning ($\beta = 0.05, p = .621$). This indicated that reward sensitivity was *not* a common cause for how much individuals liked the online art exhibition or found it meaningful, as predicted by AReA. The observed drop in the path coefficients from the AReA to both liking and meaning indicated that some of the effects we estimated from the AReA to the state variables were partially accounted for by the TEPS differences. However, the drop was only partial, indicating that aesthetic responsiveness predicted liking and meaning of the online art experience above and beyond general reward sensitivity to the sensory environment, highlighting the importance of a specific predisposition to respond strongly to art and aesthetic stimuli.

Table 2
Model estimates for final SEM model.

From	To	Final Model A			
Regression Parameters		λ	95% CI	SE	p
AA	AReA	.90	[.79, 1.02]	.06	<.001
IAE	AReA	.86	[.75, .97]	.06	<.001
CB	AReA	.56	[.43, .68]	.06	<.001
AReA	Liking	.34	[.21, .47]	.07	<.001
AReA	Meaning	.40	[.28, .53]	.07	<.001
Liking	PM Δ	.32	[.18, .47]	.07	<.001
Liking	NM Δ	-.003	[-.17, .16]	0.08	.968
Liking	STAI Δ	-0.08	[-.25, .08]	0.08	.308
Meaning	PM Δ	0.24	[.10, .39]	0.07	<.001
Meaning	NM Δ	-0.22	[-.38, -.06]	0.08	.008
Meaning	STAI Δ	-0.20	[-.36, -.04]	0.08	.017

Note: Path diagram is shown in Fig. 3. PM Δ = Positive Mood Change, NM Δ = Negative Mood Change, STAI Δ = STAI change. λ = standardized parameters, 95% CI = 95% confidence interval, SE = standard error, p = p-value. Note model is shown with the covariance between the residuals of change in anxiety and change in positive and negative mood.

7. Discussion

This paper provides evidence for the potential of online art interventions—viewing one artwork for a short (1–2 min) period on one's personal internet-enabled device—to have a detectable positive effect on well-being (negative mood, anxiety). The results replicate a recent publication (Trupp et al., 2022) employing one water-lily painting by Claude Monet, curated by Google Arts and Culture, which suggested first evidence of such effects but, more than anything, called for more research and replication. In the present study, we found that the same online art exhibition could once again reduce negative mood and state anxiety and was consistent with Trupp et al. (2022), yielding no group-level effect on positive mood. The current evidence provided in this study is more robust, building on previous work by including a larger, more controlled data set and improved measurement of dependent variables. Overall, the results contribute to the growing body of evidence highlighting the potential of online art to be used as a well-being intervention (Cotter et al., 2022; Trupp et al., 2022) and, importantly, open up further avenues for direct real-life application for digital technology in arts and well-being spaces.

Beyond the fundamental question of whether improvements in well-being aspects at the group level were detectable, this study investigated state and trait factors impacting individual differences in the effectiveness of art viewing on improving well-being. Based on past literature, we hypothesized that those who do show traits suggesting that they are more prone to strong reactions in response to aesthetic and art stimuli, such as experiencing states of pleasure and meaning, would be more susceptible to art viewing intervention benefits. We expected that the predictive power of trait aesthetic responsiveness on well-being outcomes caused by the art intervention would be mediated by the measured states of pleasure and meaning experienced by participants while viewing the online art. The results were consistent with our hypotheses as we were able to fit our predicted structural equation model with minor adjustments. We found that the effect of aesthetic responsiveness on art intervention outcomes was fully mediated by the states that individuals experienced. These findings indicate that there is a type of person who can benefit more from art viewing due to their tendency to have more impactful experiences while engaging with art online. Further, with the comparison of domain-general reward sensitivity as a confounder, we found that this trait proneness seems to be a specific predisposition that is art and aesthetic-related, above and beyond general sensitivity to rewards from the sensory environment (i.e., enjoying a deep breath of fresh air or a good yawn). This approach and the results provide an assessment of the role of individual differences in art interventions at the trait and state level, which was previously unexamined.

These findings offer new insights. In light of past research, these results lead to a more nuanced understanding of the literature referenced in the introduction. Summarized above, both aesthetic responsiveness and related traits (*savouring, aesthetic sensitivity, and appreciation of beauty*) were noted to predict art interventions' impact or cross-sectional overall well-being (Diessner et al., 2008; Lee et al., 2021; Littman-Ovadia & Lavy, 2012; Martínez-Martí et al., 2016 also see Table 1). We showed that this predictive ability of aesthetic responsiveness in acute settings, such as individual art interventions or singular visits to museums, may be due to an individual's proneness to have more pleasurable and meaningful experiences. On a more long-term basis, one could speculate, and future research should examine, if the cross-sectional associations between the above traits and overall well-being can be explained by those individuals consistently experiencing strong states of pleasure and meaning in their general lives in response to aesthetic and artistic stimuli on digital platforms or otherwise through design, architecture, nature, etc. From a practice perspective, the findings emphasize the importance of designing digital art interventions to enhance individuals' viewing experiences, regardless of their trait aesthetic responsiveness. Perhaps, this is doubly crucial

due to the possibility of digital art interventions' embeddedness in users' lives, allowing for bite-size art experiences on demand, ready to shift them from the everyday into therapeutic states of pleasure and meaning-making.

Interestingly, as reported at the beginning of the descriptive results of our sample, we discovered that the device type that participants used to visit the online Monet art exhibition had an impact on their changes in positive mood. We found that there was a possible detrimental effect of viewing art on a smartphone compared to a laptop or desktop computer and that this impact was predicted by lower levels of liking (with potential moderation of the relationship between liking and changes in positive mood by device type). Although this did not change the main finding of the present study, and is beyond the scope of our aim, we do delve further into this, for the interested reader, in the Supplementary Material. Further study should address not only why individuals can benefit from art but what factors may inhibit the efficacy of art interventions. Research should examine the best design choices (presentation size and style, intractability, accessory text) and how to implement them (digital optimization across devices) to bring viewers into beneficial states of pleasure and meaning, with a special focus on those low in aesthetic responsiveness to increase access to the benefits of the arts. The use of qualitative interviews could provide an enriched data set targeting individuals who did not experience benefits from online art viewing or who in some cases reported worse psychological states after the art experience.

7.1. Summary of results in connection to avenues for future research and practical applications

This study calls for future application and study. First, the results of this paper offer recommendations for how to design art-viewing interventions. When considering the experiences of pleasure and meaning, it was clear that those who had better experiences had greater impacts on their well-being after viewing the artwork. Interestingly, we found that the state and trait predictors differed in their ability to explain the variability in changes in well-being outcomes caused by art viewing. Our model was more effective at explaining variance in changes in positive mood compared to either negative mood or anxiety changes, with roughly a quarter of the variance explained in positive mood and less than 10% in changes in negative mood and anxiety, as seen in the residual variances. This could offer some insight into the reoccurring finding that art viewing does not lead to group-level effects on positive mood but rather has large individual differences, as found in Trupp et al. (2022) and again here. Our results indicate that changes in positive mood are more susceptible to impacts from states that individuals experience while viewing and to their trait likelihood to have these types of responses in general. Further research could confirm whether changes in positive mood have a special susceptibility to mediations or design choices before or during art viewing implemented to increase the pleasure and meaning that viewers experience.

Further, our findings reveal that pleasure and meaning acted distinctly on aspects of well-being. Whereas pleasure was a mediator of only changes in positive mood, meaning mediated changes in all well-being outcomes. From an application standpoint, this could help to inform intervention design. Suppose well-being benefits are sought across both positive and negative outcomes, it could be more strategic to design an intervention that prompts meaning-making, memory evocation, and cognitive reframing instead of something the viewer prefers or finds pleasant. However, more research is required to solidify this finding.

Pragmatically, the enhancement of experiences in art interventions could be accomplished in several ways, including through artwork choice and priming viewing behaviour. For example, the enhancement could be achieved by having self-selected artwork instead of artworks pre-selected by academics, curatorial staff, or intervention practitioners. Self-selection is a paradigm commonly utilized in music interventions

(Howlin & Rooney, 2020), and is recently starting to be implemented in empirical laboratory research on the impact of art interventions (Cotter et al., 2022). Supporting these advancements, a recent study on the effect of self-relevance of artwork found that self-relevant paintings led to better ratings of aesthetic appeal (Vessel, Pasqualetto, Uran, Koldehoff, & Vinck, Under Review), which are related to well-being outcomes through past literature and confirmed by these findings. Self-selection is especially relevant for digital art interventions. One of the central powers of computer-based art viewing is the accessibility that the internet can provide as, for the first time in history, many individuals can access unlimited free visual artworks on demand. Although in this study we did not allow participants to choose an artwork, as we were specifically seeking a range of subjective experience states, we recommend this be employed in the future. We especially suggest exploring multiple artworks or artwork types, considered in within-participant designs if possible, which would allow for both the expression of individual differences to a greater extent and for the consideration of consistent or artwork-specific well-being effects. Future studies could also include full gallery spaces both in-person settings and in virtual reality.

Future studies could also explore the use of priming as a strategy to enhance states of pleasure and meaning. Several papers have shown that art perception and the experiences and appraisals that follow are susceptible to priming (Brieber, Nadal, Leder, & Rosenberg, 2014; Cupchik, Vartanian, Crawley, & Mikulis, 2009). Intervention design could capitalize on this research, using a pragmatic versus aesthetic viewing condition as aesthetic viewing was found to lead to stronger feelings of pleasure (Cupchik et al., 2009). Similarly, a recent pre-print has also attempted to increase immersion through viewing behaviour instructions (Cotter et al., 2022), finding potential impacts and offering exciting new design applications.

7.2. Contribution of results to understanding of art viewing mechanisms

These results make a significant contribution to the field of arts and health beyond the utilization of digital technologies. Previous studies have posited mediators or mechanisms for the beneficial effects of art encounters (Eekelaar et al., 2012; Fancourt & Finn, 2019; Mastandrea, Fagioli, & Biasi, 2019; Silverman, 2002); however, they have suffered from a lack of experimental support. From an 'arts in health' standpoint, pleasure and meaningfulness can be considered *active ingredients* of effective art interventions and *mechanisms of action* impacting well-being. Using the framework of Warran et al. (2022), when taking a broader perspective of how the arts can impact higher levels of well-being and health, reducing negative states is considered the mechanism of action. At the same time, the aspects of the actual art viewing experiences, such as experiencing pleasure, meaning, or aesthetic experience, are considered active ingredients. In our case, where negative states of mood and anxiety reduction is the outcome, we suggest that subjective experiences are better thought of as mechanisms of action as they enable and include processes of reward activation, dopamine release, memory evocation, cognitive reframing, and insight (Pelowski et al., 2017), leading to reductions in negative outcomes. Our results support these explanations but still call for further evidence. One avenue to provide further data to tease out the role of such mechanisms would be to experimentally manipulate the subjective experience states and directly compare the proportional rise or fall of well-being outcomes.

7.3. Caveats and limitations

No paper is without limitations. Even though this paper is an improvement on Trupp et al. as we pre-registered the design and analysis, and increased the level of control through the introduction of quality control measures and the exclusion of participants who failed them, the design of this study, as for many other psychological studies,

including Trupp et al., 2022, is at risk of methodological artifact (e.g., Hawthorne effect; Adair, 1984). For example, it is possible that participants in this study anticipated the study's goal and answered the post-survey accordingly. Although this is possible, here we suggest that this study was less at risk of such artifacts due to the high number of states participants had to respond to (i.e., 26). Further, we note that the directionality of the changes from pre-to-post were far from being homogeneous, (e.g., no average changes in positive mood) and that these changes were systematically related to trait variables, making effects, such as the Hawthorne effect, a less likely explanation to the data. Nonetheless, we recommend future work include an agreeability trait questionnaire that could be used to estimate how much of the impact was due to participants' Hawthorne bias. Furthermore, the single painting that participants could interact with limited our results and, thus, conclusions. The painting we selected was liked by many participants, reducing the variability in subjective states that our sample experienced, which limits our model's descriptive ability. Future work should include several examples of art, allowing for greater variability in experiences.

8. Conclusion

To conclude, this paper offers evidence that those who experience art viewing as more pleasurable and meaningful can benefit more from an online art intervention. The impact of these results is a step forward in the empirical investigation of possible mechanisms, as well as a replication of the potential of computer-based online art viewing for well-being benefits.

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MT- Conceptualization, Methodology, Investigation, Data Curation, Formal Analysis, Writing-Original Draft, Writing- Review & Editing, Project Administration. GB- Methodology, Formal Analysis, Visualization, Writing-Original Draft, Writing- Review & Editing, ES- Methodology, Formal Analysis, Validation, Writing- Review & Editing, EV- Methodology, Writing- Review & Editing, MP- Methodology, Writing- Review & Editing, Supervision, Funding Acquisition.

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.chb.2023.107764>.

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Chapter Four

Can the well-being benefits of art viewing be enhanced?

Status:

Trupp, M. D., Yin, S., Landau, R., Templar Lewis, K., Igdalova, A., Kühnappel, C., Bignardi, G., Chiles, L., Fingerhut, F., Chamberlain, R., Pelowski, M. (Submission prepared and planned for May/June 2025). Enjoyable but not effective: Evaluating gallery augmentation strategies to enhance the well-being effects of art viewing.

My Contribution:

I conceptualised the core idea for this work and collaborated with MP, RC, JF, and SY on the study design and methodology. To conduct this study, I undertook a research stay at Goldsmiths, University of London, and Kinda Studios to develop the stimuli with RL and RTL, prepare the investigation materials, and collect data at the National Gallery, London. This involved leading a team of research assistants from Goldsmiths and co-supervising the Master's thesis of SY, who conducted study two. I cleaned, processed, and performed the formal analysis and data visualisation in collaboration with GB. CK and I focused on analysing the qualitative data. AI and I conducted a literature review, and I drafted and revised the manuscript. In addition to general project management, I secured funding for the research stay, material costs, and participant payments from Division 10 of the American Psychological Association and the University of Vienna.

Enjoyable but not Effective: Evaluating Gallery Augmentation Strategies to Enhance the Well-being Effects of Art Viewing

MacKenzie D. Trupp^{1,2*}, Shiqi Yin³, Robyn Landau⁴, Katherine Templar Lewis⁴, Aleksandra Igdalova³, Corina Kühnappel^{1,5}, Giacomo Bignardi⁶, Lawrence Chiles⁷, Joerg Fingerhut⁵, Rebecca Chamberlain³⁺, Matthew Pelowski^{1,8+}

¹ University of Vienna, Faculty of Psychology, Department of Cognition, Emotion and Methods in Psychology, Vienna, Austria

² Radboud University Medical Center, Donders Institute for Brain, Cognition and Behaviour, Department of Cognitive Neuroscience, Nijmegen, the Netherlands

³ Goldsmiths, University of London, Department of Psychology, London, UK

⁴ Kinda Studios, London, UK

⁵ Humboldt-Universität zu Berlin, Berlin School of Mind and Brain, Department of Philosophy, Berlin, Germany

⁶ Max Planck for Psycholinguistics, Nijmegen, the Netherlands

⁷ The National Gallery, London, Department of Digital Services, London, UK

⁸ CogSci-hub, University of Vienna, Vienna, Austria

**Corresponding Author at mackenzietrupp@gmail.com, +Shared Senior Authorship*

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Acquisition. MP: Conceptualization, Methodology, Writing-Review & Editing, Supervision, Funding Acquisition.

Declarations: Authors RL and KTL are directors of Kinda Studios, which created one of the video products evaluated in this study. They could benefit from its commercial success, even though this particular study found null results. LC is employed at the National Gallery, London, which may benefit financially or otherwise from the results of this study. The author team has no other conflicts of interest.

AI Statement: ChatGPT improved some sections of the text, especially when shortening it. The authors critically evaluated all AI suggestions.

Abstract

Art viewing, as a leisure activity, has been associated with well-being and positive mental health, though its benefits are not universal across contexts or viewers. A fundamental question is, how can art viewing experiences be designed or augmented to enhance well-being effects? To answer this question, this study evaluates two theory-informed gallery augmentation videos—one providing guided viewing instructions focused on style and slow detail recognition and the other offering a pre-viewing mindful breathing session. In the first large (N = 281) pre-registered study, we compared augmentation videos to a standard gallery visit at the National Gallery, London. Further, in a laboratory-based follow-up (N = 33), we contrasted one pre-viewing intervention with a filler task to further isolate the potential effects of augmentation strategy. Both studies used mixed-methods randomised controlled trial designs. Across conditions and studies, despite finding significant well-being improvements from pre- to post-viewing, we found no evidence that either intervention enhanced the art viewing experience nor led to larger well-being changes. We interpret these null findings in the context of prior mixed results and conclude that future research should move beyond pre-viewing interventions to consider the art-viewing experience more holistically, incorporating aspects that trigger candidate mechanisms.

Keywords:

Museum, Art-viewing, Receptive arts, well-being, intervention design, slow-looking, mindfulness, empirical aesthetics

Supplementary Materials: can be found on Open Science Framework at <https://osf.io/nc2dt/>.

Introduction

Receptive art engagement, including leisure activities such as attending performances, visiting cultural institutions, or viewing art, has been linked to higher well-being and positive mental health outcomes in population-based epidemiological studies^{1–3} and, increasingly, in experimental research evaluating the impact of the arts across various settings such as art galleries^{4–6}, urban spaces^{7,8}, clinical contexts^{9,10}, and online^{11–13}. These studies suggest that art engagements, and even encounters with individual artworks, might provide an accessible, adaptable, and often community-based set of activities to support a range of well-being outcomes ^{for review see 14}. However, with these results, there are several outstanding questions. Most prominently, recent reviews have emphasised that arts encounters do not always result in positive effects for all viewers^{14,15}, underscoring the need to better understand the factors shaping art experiences and to develop strategies for optimising their well-being impact.

Understanding and enhancing well-being outcomes through art viewing is a growing area of research, yet existing interventions face key challenges in both effectiveness and feasibility. While studies have explored various strategies—such as comparing specific media content, concurrent music listening, or mindfulness-centered gallery spaces—findings remain inconsistent. For instance, some evidence suggests that representational art reduces physiological stress biomarkers more effectively than abstract art¹⁶. Yet, other interventions, such as music accompaniment⁴ or mindfulness-focused gallery designs¹⁷, have produced largely null results. Beyond these mixed findings, many of these interventions require high logistical investments, such as modifying gallery layouts or changing artworks, making them impractical for widespread implementation.

A potentially more accessible and scalable approach may be to focus on the transitional space between the entrance to an art setting—such as the foyer of a museum—and the first engagement with art. Such spaces and moments of transition may provide a strategic time and location for brief but impactful priming interventions before visitors engage with artworks. Prior research suggests that structured viewing instructions—such

as telling viewers to pay attention to details, to focus on style, or to slow down—can shape the art experience ^{18–20} as one aspect of the general role of context ²¹. However, research using such strategies also has mixed results ^{11,22,23}, likely due to past implementations having relied on short, text-based prompts, which may lack the depth and engagement necessary for meaningful impact.

Alternatively, the present study introduces professionally produced, theory-informed gallery augmentation videos as novel pre-viewing interventions designed to enhance art engagement and well-being. Specifically, we consider two strategies: *guided aesthetic viewing* instructions and a pre-viewing *mindfulness exercise*, both of which are supported by theoretical and empirical research, but which have to date not been explored in a systematic, comparative assessment.

Guided Viewing: The Case for Slow and Aesthetic Looking

Offering instructions to slow down and to pay attention to style can be connected to prior theory and evidence, suggesting that this may be a means of supporting art experiences. First, regarding guided viewing, ‘slow looking’ instructions ²⁴ encourage deliberate and detailed observation of artworks over extended periods. ‘Aesthetic looking’, on the other hand, is a type of looking that emphasises that every picture perception is a twofold experience of the medium and what is depicted in artworks—stemming from the philosophical concept of “Seeing-in” (Wollheim, 1980). This simultaneous engagement with an artwork's stylistic features and its content is a necessary condition of experiencing representational artworks, however it has been argued that art appreciation might be higher when attention is directed towards the style and details of configuration and the surface rather than the content of a painting ^{25,26}. Empirical evidence also supports this. For example, one study showed that when participants focused on the stylistic features of representational paintings rather than their content, they reported higher beauty ratings ²⁶. Similarly, another study requiring participants to focus on either the style or the content of artwork while undergoing a functional magnetic resonance imaging (fMRI) brain scan indicated that prioritising aesthetic aspects (style) over pragmatic ones (content) led to enhanced art evaluations and activation in brain areas associated with heightened emotional processing ¹⁸, which

is a potential mechanism by which art viewing can support well-being ^{14,27}. Furthermore, providing such instructions to slow down and notice artistic elements has been associated with improved well-being effects from art viewing ¹⁹, thus strongly supporting aesthetic looking as an effective strategy for pre-viewing.

Pre-Viewing Mindfulness: Enhancing Art Engagement Through Awareness

Alternatively, pre-viewing mindfulness exercises also have a theoretical foundation for enhancing art experiences and could support a gallery visit. Mindfulness is the practice of being fully present in the moment without judgment ²⁸ and can be cultivated through breathing exercises. Several studies point to a positive connection between mindfulness and enhanced art experiences. For instance, individuals with higher mindfulness traits report more frequent aesthetic experiences ²⁹. Further, a stronger mind-body connection, closely linked to mindfulness and reflected in heightened interoceptive body awareness, has been associated with greater emotional responses to representational paintings ³⁰. Beyond associations, a large study found that mindful breathing significantly increased the pleasantness of art-viewing experiences compared to an information-based condition at the Manchester Art Gallery ¹⁷, although the breathing was not more effective than as-usual visit, possibly due to the concurrent viewing being distracting from the art. However, mindfulness inductions, such as body scans, have been shown to enhance aesthetic responses in music listening ³¹ and improve observational skills ³², suggesting that a pre-viewing mindfulness session may offer more positive results.

Study One

Thus, in study one, we conducted a three-arm, mixed-methods, randomised control trial (RCT) to evaluate the effectiveness of the two intervention strategies (Aesthetic Looking and Mindful Breathing) introduced above, which were created with a multidisciplinary team in collaboration with or by, respectively, our industry partner Kinda Studios—a company designing evidence-based experiences with science. These conditions were further compared to a typical gallery visit control condition, all at the National Gallery, London. The first condition, shown in Figure 1, was a four-minute Aesthetic Looking video, designed and produced based on the past literature for this

study, which animated a painting from the National Gallery, London's collection to demonstrate how to slow down and pay attention to an artwork's style, colours, and details, exemplifying slow aesthetic-looking techniques. The second condition, also shown in Figure 1, was a five-and-a-half-minute Mindful Breathing video that used abstract art images and music to guide viewers through an intentional breathing activity. Finally, the as-usual group had no video and allowed participants to enter the museum directly, representing a more typical gallery experience.

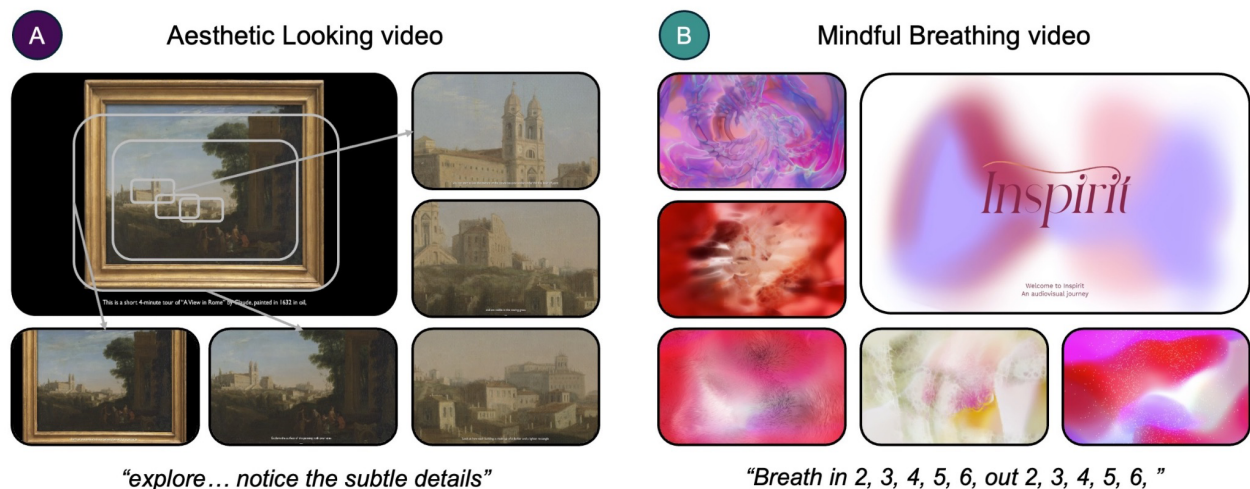


Figure 1. Depiction of videos shown before art viewing. *Aesthetic Looking video* animation demonstrates how to slow down and pay attention to the details and style of an artwork. Each image is a video frame, showing different focal points, panning and zooming into the painting (Claude, 1604/5?–1682, *A View in Rome*, 1632 © The National Gallery, London). The *Mindful Breathing video*, “*Inspirit*”, guides viewers with music and visuals to breathe to the beat on 6-6 blocks, each image is a video frame. For more details, see the *Methods* section. Images reproduced with permission from the National Gallery, London (panel A) and Kinda Studios (panel B).

As depicted in Figure 2 and discussed further in Methods below, $N = 281$ participants were included in the analysis, drawn from an overall sample of $N = 337$ (see Methods for exclusions, demographics, and art background and interest). Participants were recruited and given a pre-survey assessing demographics and baseline well-being.

They were then randomised blindly to either one of the two video conditions or to go directly to the gallery without a video. Once in the gallery, all groups were asked to choose an artwork to view before returning to complete a post-survey that included secondary evaluations of mood and state anxiety and appraisals and evaluations of the art viewing experience and artwork (for details, see the Methods section).

We predicted that the Aesthetic Looking video, which explicitly taught viewing techniques shown to trigger candidate mechanisms, followed by the Mindful Breathing video, would result in more positive art-viewing experiences (as measured via liking, beauty, meaning, understanding, self-relevance, goodness) and larger improvements in well-being outcomes compared to the standard gallery visit. Well-being outcomes encompass momentary positive and negative mood (also referred to as experienced or hedonic well-being) and state anxiety. Furthermore, we assessed art viewing behaviour to see if the videos impacted attention towards the art or one's body, as well as evaluated the video and art viewing experiences via qualitative open text boxes. Specifically, we evaluated whether the Aesthetic Looking video led to larger self-reported shifts in attention towards the style of the artwork and a feeling of looking more slowly. For the Mindful Breathing video, we assessed if participants had greater increases in awareness of their heartbeat and reported being more aware of their bodies in the gallery, in line with past literature suggesting a stronger connection to one's body after mindfulness activities

33,34

Results

Following our pre-registration, as the assumptions were not met for parametric testing for Study One or Two, we used a non-parametric alternative from the MANOVA.RM R package. This method relies on bootstrapping permutation approaches that do not assume homogeneity of covariances or multivariate normality using a Wald-type statistic (WTS) ³⁵.

Priming Video Experience and Effects

First, participants generally enjoyed both priming videos but had higher ratings for the Aesthetic Looking video (Aesthetic Looking, enjoyment min = 1, max = 7, M = 6.07,

SD = 1.12) as compared to Breathing (M = 4.60, SD = 1.33). We then evaluated whether the videos impacted aspects of art viewing behaviour and participants' perception of the gallery or their awareness of their own bodies in the gallery. The descriptive statistics found in Table 1 (at the end of this manuscript) indicated that all conditions reported paying more attention to the style than the content and that the Aesthetic Looking Video participants reported paying the most attention to style, as expected. Similarly, all participants felt they looked slowly at the artwork, and the Aesthetic Looking condition reported the slowest subjectively felt-looking. The overall sample tended to be aware of the location of their body in the gallery, with the Aesthetic Looking condition having the highest levels of awareness, however counter to our expectation, each group decreased in their awareness of their heartbeat, with the largest decrease in heartbeat awareness in the Mindful Breathing condition.



Figure 2. The design of Study One shows the random blinded allocation between conditions and the timeline of participation (pre-survey, allocation, art viewing in the gallery, post-survey). The floor plan shows where participants entered: the research room on the left of the stairs, mid-way up, and Gallery Room Nine, where the art viewing occurred. Four paintings given as options to participants are shown in situ; see the Materials section for artwork details. Images of the video screening room are depicted for both videos. Images of the Gallery taken by authors, published with permission for the National Gallery, London. Image of Aesthetic Looking video: Claude, 1604/5? – 1682, A

View in Rome, 1632 © The National Gallery, London. Paintings included in gallery from left to right: Paolo Veronese, 1528-1588, The Consecration of Saint Nicholas, 1562 © The National Gallery, London; Paolo Veronese, 1528-1588, The Family of Darius before Alexander, 1565-1567 © The National Gallery, London; Paolo Veronese, 1528-1588, The Dream of Saint Helena, 1570 © The National Gallery, London; Titian, c. 1488/90–1576, Diana and Actaeon, 1556-1559 © The National Gallery, London.

To statistically evaluate these differences, we conducted two MANOVAs, with condition as IV and the video-specific outcomes as DVs (respectively). The first MANOVA predicted the looking speed and attention to style while viewing the artwork. The second MANOVA examined a change in awareness of one's heartbeat and the location of one's body in the gallery, for which one participant was removed due to missing data (A: 94, B: 92, C: 94). We found no differences between conditions on the linear combination of DVs for either test. First MANOVA (looking speed, style/content): $WTS = 5.15$, $df = 4$, $p = .272$. Second MANOVA (heart and body awareness): $WTS = 5.09$, $df = 4$, $p = .278$.

Finally, participants' written reports about their experience watching the videos via an open text box were assessed using qualitative inductive content analysis, with responses coded and grouped into categories. For detailed descriptions of each category and quotations, see the Supplementary Section. We included only the top three themes for each video. Participant's reactions to the Aesthetic Looking video were Inspiring Art Appreciation (40% of $N = 22$ total codes), Educational and Insightful (32%), and Relaxing (9%). The Mindful Breathing video responses were grouped into themes of Relaxing (18% of $N = 39$ codes), Confusing or Difficult (18%) and Having Criticisms or Suggestions (15%), suggesting different subjective experiences of the videos.

Art Viewing Experience

Descriptive statistics for the evaluations of the artworks (including liking, meaning, pleasure, self-relevance, understanding and art goodness) across all three groups are shown in Table 1. All conditions tended to report high levels on all appraisals max). Liking, beauty and art goodness were especially high, with average scores above 5 (1-7. max =

7). Liking, meaning, and beauty were highest in the aesthetic-looking condition, which aligned with our prediction. A multivariate analysis of variance (MANOVA) using condition as IV and the six art appraisals as DVs was used to test potential condition differences. Two multivariate outliers were removed based on Mahalanobis distance scores (analysis sample size $N = 275$, A: 94, B:90, C:91). Results revealed no significant differences between conditions on the linear combination of DVs ($WTS = 12.55$, $df = 12$, $p = .403$).

Finally, to further compare participants' art-viewing experiences inside the gallery, we offered another open text box asking participants for keywords that described their experience. For detailed descriptions of each theme, quotations, and a breakdown across conditions, see the Supplementary Section. We again used inductive content analysis and found the same top five themes between conditions however at different frequencies. These included: Positive Emotional Experience, Interesting and Curious, Calming, Engaging, and Insightful and Inspirational. We found one notable difference between conditions, that the control condition included only 5% of responses associated with the theme of Calming compared to 16% for Aesthetic-looking and Breathing conditions, indicating less responses related to calming art viewing experiences in the control group.

Well-being outcomes

Descriptive statistics in Table 1 and depicted in Figure 3 indicated that all conditions experienced improvements in all well-being variables. We used repeated measures MANOVA (RM.MANOVA) to test potential condition differences between the condition and time (pre/post), which were IVs, and the three well-being variables, which were DVs. $N = 8$ multivariate outliers were detected and filtered out, reducing the sample to $N = 91$ in each condition (total $N = 273$).

The main effect of Time was significant ($WTS = 24.04$, $df = 3$, $p < .001$), indicating significant changes from pre- to post-assessment on the linear combination of DVs. A post-hoc Wilcoxon signed-rank test with Bonferroni correction revealed that positive mood increased significantly ($Z = 5.19$, $p < .001$) and that negative mood ($Z = -5.19$, $p < .001$) and state anxiety decreased significantly at the group level ($Z = -6.99$, $p < .001$). Effect sizes were all moderate (Pos. mood = .32, Neg. mood = .44, anxiety = .33). The Time*Condition

interaction, however, was not significant (WTS 9.71, $df = 6$, $p = .137$) because the groups did not differ in subjective experiences or well-being changes, we did not evaluate the hypothesised mediating effect of liking and meaningfulness of the experience explaining the effect of condition on changes in well-being outcomes as pre-registered.

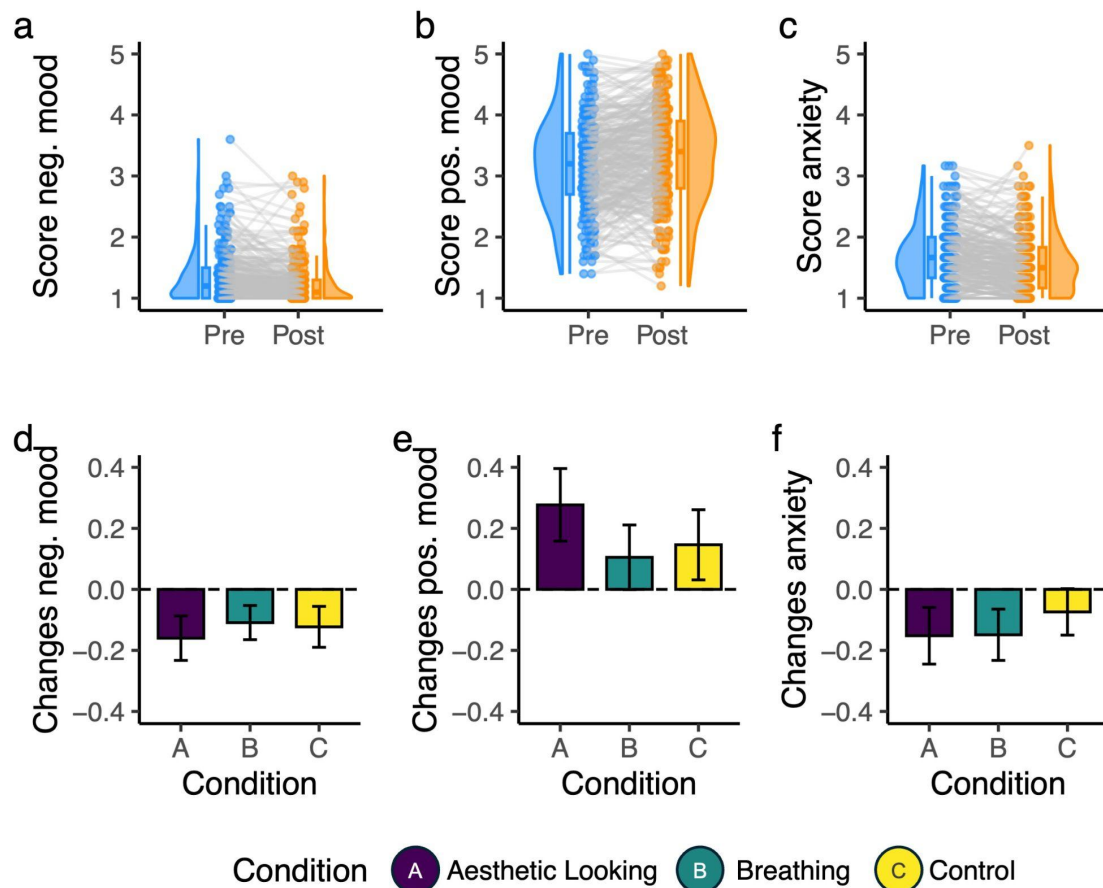


Figure 3. Overall well-being variables change from pre- to post and breakdown by condition, showing a significant group change in each variable but no significant differences between conditions. Figure created based on R Raincloud plots package ³⁶.

Study One Discussion

We found no significant differences between the conditions (two priming videos and as usual visit control condition) into which participants were randomised, regarding their art experience as measured by how much they liked, found meaningful or relevant,

or understood and deemed the art to be 'good'. Similarly, despite a significant improvement in well-being variables across the group level, we observed no differences between conditions in how well-being increased after briefly viewing a single artwork in the gallery. Reflecting on the group-level effect, this study detected a significant improvement in positive mood after interacting with just one artwork, contrary to previous studies employing this one-artwork design that have consistently failed to report effects on this aspect of well-being^{8,12,13,37}.

Nevertheless, we did find qualitative differences in how participants reported their video and art experiences. Those who viewed the aesthetic-looking video reported more positive experiences associated with art appreciation, inspiration, and calm, and the control group had lower reports thematically related to a calming art viewing experience. Yet, we did not observe significant differences between the variables we anticipated would be higher in each video condition, such as looking more slowly at the style despite the direction of the effect being consistent with our predictions.

Overall, this study indicated that, despite the results being in the direction of our predictions, the effect sizes were smaller than expected and not significantly different compared to the as-usual gallery visit control condition. One interpretation of this might be that the gallery setting alone has the effect of inducing more deliberate and aesthetic looking and allow for more awareness of one's body and feeling, because one is removed from the social demands of everyday life.

Study Two

Study Two was intended to validate and extend the findings of Study One by using a more rigorous control condition in a laboratory environment. Specifically, as shown in Figure 4, we replaced the as-usual gallery visit with an active control condition—a free-writing filler task—designed to match the Aesthetic Looking video in duration but was not expected, based on theory or prior research, to influence art viewing. This approach allowed us to better isolate the effects of the Aesthetic Looking video on art appraisal and

well-being changes, beyond the extra time elapsed and additional focused attention that video participants had between the pre and post test, compared to the as-usual viewing group that proceeded directly to the art viewing.

We conducted a two-arm mixed-methods RCT, opting for a two-condition design to maximise statistical power, omitting the Mindful Breathing video. High-quality replica images of the same artworks from Study One were displayed on an iPad in a pseudo-gallery room, maintaining consistency in materials and procedures across studies (see Methods section). Although this study had a smaller sample size due to recruitment challenges at the university laboratory compared to the National Gallery, London, our primary interest was in comparing effect sizes to see if they were consistent with those from Study One. Of the initial sample ($N = 41$), $n = 33$ were included in the analysis (see Methods section for exclusions, demographic, and past art education and interest).



Figure 4. Design of Study Two, showing randomisation of blinded participants to either the Aesthetic Looking condition or the Free-Writing Filler tasks active control condition followed by an art viewing period, where participants can choose one of four artworks from Study One on an iPad, followed by a post-test. A = Aesthetic Looking video, F = Free-Writing task. Image of Aesthetic Looking video: Claude, 1604/5? – 1682, *A View in Rome*, 1632 © The National Gallery, London. Paintings included from left to right: Paolo Veronese, 1528-1588, *The Consecration of Saint Nicholas*, 1562 © The National Gallery, London; Paolo Veronese, 1528-1588, *The Family of Darius before Alexander*, 1565-1567 © The National Gallery, London; Paolo Veronese, 1528-1588, *The Dream of Saint Helena*, 1570 © The National Gallery, London; Titian, c. 1488/90–1576, *Diana and*

Actaeon, 1556-1559 © The National Gallery, London. Reproduction of paintings with permission for the National Gallery, London.

Results

Video Effects

First, we addressed the effects of the video on viewing behaviour. The descriptive statistics for art-viewing behaviour, also shown in Table 2, including the extent to which individuals reported focusing on style over content and how slowly they felt they were looking, suggested that the Aesthetic Looking group reported paying more attention to the style and reported slightly slower subjective-looking. To compare these, a MANOVA with the condition as IV and speed of looking and attention to style as DVs, was conducted. The results indicate a non-significant effect of the condition ($WTS = .324$, $df = 2$, $p = .850$). Effect size differences between conditions were negligible.

Art Viewing Experience

Descriptive statistics, shown in Table 2, indicated, consistent with our hypothesis, that the Aesthetic Looking video group had higher scores on almost all art appraisals except for liking. To compare the art-viewing experiences of the two groups, we followed the protocol for Study One. We ran a MANOVA with the condition as IV and variables liking, meaning, beauty, goodness, understanding and relevance as DVs. The results indicate a non-significant effect of condition on the linear combination of DVs ($WTS = 2.43$, $df = 6$, $p = .877$). Effect size differences between conditions were negligible, except for a small effect size for meaning, where the aesthetic-looking group had higher scores.

Finally, a comparison of the qualitative descriptions of the art-viewing experiences, following the same procedure as Study One, suggested that the three highest codes for the Aesthetic Looking group were Curiosity and Interest (18%), Peaceful (15%), and Positive Feelings (15%). For the free-writing group, the top themes were related to Curiosity and Interest (23% of codes), Focused (14%), Peaceful (14%), and Calming (14%), indicating slight qualitative differences surrounding more positive feelings in the video group and more calming feelings in the free-writing group during their art viewing sessions (see supplement for details).

Differences in Well-being Changes

Finally, we compared the changes in well-being variables between conditions. We similarly did this with a repeated measures MANOVA with condition and time (pre/post) as IVs, and positive mood, negative mood, and anxiety as DVs. $N = 1$ multivariate outlier was removed. The main effect time was significant ($WTS = 19.27$, $df = 3$, $p < .001$), however, the interaction Time*Condition was not significant ($WTS = 1.84$, $df = 3$, $p = .606$). A post-hoc Wilcoxon signed-rank test with Bonferroni correction revealed that positive mood did not increase significantly ($Z = 2.19$, $p = .089$) however that negative mood ($Z = -3.01$, $p = .008$) and state anxiety did decrease significantly at the group level ($Z = -2.89$, $p = .011$). Effect sizes were moderate to large (Pos. mood = .37, Neg. mood = .54, anxiety = .56).

Study Two Discussion

Study 2 reported similar effect sizes when comparing the Aesthetic Looking and Free Writing conditions to Study One. Furthermore, considering the overall qualitative similarities between art-viewing experiences, we conclude that there is no evidence that the Aesthetic Viewing video causes meaningful differences in art-viewing experiences or well-being effects, despite how enjoyable it was.

Overall Discussion

Pre-viewing gallery augmentation has been suggested to impact art experiences, thus contributing to the effects of art on well-being. Building on professionally produced, theory-informed gallery augmentation videos designed to enhance art engagement and well-being across two studies, we show no consistent nor significant enhancement of art experiences. In particular, by focusing on guiding viewing and mindfulness, two previously suggested pre-viewing strategies, we were not able to find evidence for a significant impact on positive changes in well-being outcomes from pre- to post-viewing compared to either an as-usual gallery visit or a free-writing filler exercise. Rather, across both studies, regardless of the pre-viewing augmentation, we found significant increases in

well-being outcomes from pre- to post and high levels of positive art appraisals in all conditions.

That the pre-viewing strategies did not have stronger effects than art engagement alone, aligns with findings from some recent studies, while is inconsistent with others. For instance, several studies have reported positive effects from pre-viewing instructions on art appraisal ^{18–20}, which are known to predict well-being changes from art viewing ^{4,7,12,13}. However, other studies reported that providing instructions—such as to reflect on the meaningfulness of the artwork, or to look mindfully or curiously—did not significantly enhance mood-related outcomes ²²³⁸. In contrast to the former, and in line with the latter, our study, which included a large sample and a well-designed professionally produced and experiential-based didactic approach to teaching aesthetic-looking techniques, suggests that gallery augmentation instructions given before viewing are likely not effective for supporting well-being outcomes. We note, however, that while we find an absence of evidence for effects of augmentation strategies on either well-being outcomes and art experiences, it is still an open question whether pre-viewing interventions may facilitate other outcomes, such as learning. Learning outcomes may be particularly relevant for future research, especially in light of our qualitative findings, where participants described the aesthetic-looking video as educational and insightful.

Another possible future direction for developing interventions would be to holistically address candidate mechanisms proposed to explain the impact of art viewing on well-being outcomes. As mentioned in the introduction, a recent review ¹⁴ summarised a number of pathways that may contribute to well-being outcomes, including social aspects such as viewing art in a pair or a group, which can facilitate social bonding, isolation reduction and feelings of belonging, contributing to overall well-being. An alternative approach to designing art viewing specifically for well-being outcomes, might involve modifying the art viewing experience through ‘online’ or concurrent modifications, such as audio guides or tours, rather than through pre-viewing activities, despite the logistic burden. For example, Igdalova et al. ⁵ successfully modified an art experience during viewing by providing audio instructions and further enhanced the well-being effects

of art viewing by modifying social interactions during a gallery visit, finding support that social processes during art-viewing experiences supported well-being.

Beyond the primary research question, we observed notable effects across groups. Both studies showed consistent reductions in negative mood and anxiety, aligning with past research^{12,13,37}, while study one—uncharacteristically for single artwork research—revealed a significant increase in positive mood as well, possibly due to the setting—a world-class museum featuring master artworks. However, it is important that readers consider that the measured changes in well-being from pre to post viewing, do not only represent the well-being improvement caused by art viewing. Rather, confounding factors may also explain why mood improved. For example, aspects of the study itself, like interacting with a researcher or simply the time that passed between pre and post-time points (e.g., regression to the mean), may explain some of the observed changes. Thus, we urge readers to contextualise our findings within our research question, focusing on the contrast between conditions, which offers a controlled comparison due to the inclusion of an as-usual gallery visit and a free-writing filler task—both strengths of the current study. To address the possible multiple causes of well-being changes associated with art viewing, future studies should incorporate control conditions that are better suited to isolate art-related effects.

Conclusion

This study evaluated the impact of theoretically informed gallery augmentation strategies installed pre-viewing compared to an as-usual gallery visit and a free writing filler task. Despite their favourability with participants, we found no evidence that these video strategies enhanced art viewing experiences or, in turn, well-being which instead significantly increased in all conditions.

Methods

Study One Methods

This study fell under the blanket ethics approval for the EU Horizon 2020 consortium program ARTIS (Art and Research of Transformations of Individuals and

Society), as submitted and positively reviewed by the University of Vienna Ethics Review Board. We pre-registered our hypothesis and the quantitative analysis for study one (<https://osf.io/2enkd>). The analysis was done in R (R Studio, 2021.9.1).

Participants

A total of $N = 281$ participants were included in the analysis, drawn from an overall sample of $N = 337$. To be eligible for participation, individuals had to have normal or corrected to normal vision, be over 18 years of age, and feel confident in their English ability to complete the survey and follow instructions. We excluded participants based on several pre-registered criteria, such as having incomplete data ($N = 12$) or failing to pass the attention check questions concealed in the surveys ($N = 44$). Participants' ages ranged from 18 to 96 ($M = 37.46$ years, $Mdn = 31$ years), and most participants were female ($N = 167$; 60%) or male ($N = 104$, 37%; $N = 6$ preferred not to say, $N = 3$ non-binary). Participants represented a diverse array of nationalities, including being from countries in the UK ($N = 116$, ~42%), Europe ($N = 77$), North America ($N = 34$), Asia ($N = 29$), Australasia ($N = 12$), South/Central America ($N = 6$), and Africa ($N = 3$); one participant reported being a dual national (UK/Asia). Of the participants, 164 had no formal past art education, 79 had taken an art class in school, 14 were either pursuing or had pursued a minor or special focus on art in college or university, 19 individuals were seeking or had completed an art degree, and five were professionals in art or art history. Most of the sample ($N = 121$) visited the National Gallery, London for the first time on the day of testing, while 71 individuals had been there more than three years ago, 24 within the last year, 34 within the previous six months, and 31 within the previous month. Overall, the sample generally reported above midpoint interest in the arts ($M = 5.62$, $SD = 1.30$, rated from 1-not at all interested to 7-very interested).

Power Analysis

A power analysis was conducted to determine the needed sample size to detect differences in changes in well-being outcomes between conditions. Using G*Power and based on an RM-MANOVA with small to moderate effect sizes, a within*between participant interaction (F effect size = 0.15-0.25, 3 groups, two measurements, and three DVs) at 80% power indicated a total sample size of $N = 158$ -432. Given this information

and considering the study's budget to compensate participants, we set an a priori stopping rule at $N = 350$ participants, which we were slightly short of during our 10-day data collection window ($N = 337$).

Randomisation and Blinding

To reduce the risk of bias, we randomised participants into conditions and blinded them to the condition they were assigned to. Initially, the study was designed to double-blind the researchers who were recruiting participants from the gallery stairs and the researchers who gave the viewing instructions in the gallery to prevent any researcher effects. However, after two days (of ten), we discovered that this was not possible, as we often had to switch roles of the research team (recruiter, gallery instructor, or research room manager) to maintain smooth management. Thus, this study is only single-blind. Randomisation was done by time block using a random number generator to select the order of conditions, meaning that different periods (day 1 morning, day 1 afternoon, day 2 morning, etc.) were randomised rather than the actual participants. This was implemented to prevent participants from realising they were not offered the chance to watch a video (i.e. contamination).

Procedure

Participants for this study were recruited through pre-booking an appointment on Eventbrite (<https://www.eventbrite.com>) and on-the-day recruitment. The Eventbrite invitation was sent to several London universities, including Goldsmiths, University of London, University College London, Royal Holloway, University of London, The London College of Fashion, the University of Cambridge, Queen Mary, University of London, and the National Gallery's members list, and our team's networks. Potential participants were informed that the study aimed to explore how art makes people feel and that the results would help museums and policymakers better understand the impact of art on well-being. Moreover, participants were told that they would receive a free exhibition ticket to the Winslow Homer: Force of Nature exhibition.

To recruit participants on the data collection days (10 days in December 2022 between 10 am and 4:30 pm), researchers were positioned on Level 2 of the National Gallery Sainsbury Wing, midway up the stairs between the entrance and the gallery rooms. A sign was placed to draw attention, and researchers approached visitors in groups of 1-3 people to ask if they would be interested in a free exhibition ticket. After gaining interest, the researchers explained the study duration and aims and answered any questions the visitors may have had. Participants were unaware of the video aspect of the study until after they had completed the entire procedure. All participants were equally told they would participate in a study testing a "special viewing experience."

After being recruited either after entering the museum or after arriving for their pre-booked appointment, participants were informed about the study and gave their informed consent. The study management then gave participants a participant number on a small piece of paper that they carried with them throughout the study, and a letter that was written on the pre-study table and communicated verbally as the "letter of the day" which allowed for a record of their condition. Participants were asked to complete a pre-survey on Qualtrics (<https://www.qualtrics.com/>) before continuing to their viewing experience which they accessed via a QR code on their personal smartphones or paper and pen.

The pre-survey included questions regarding demographics, the participant's last visit to the National Gallery, their perception of the National Gallery, baseline assessments of well-being and how much they felt their heart rate at that moment. If the participants were allocated to a video condition, they were taken from the survey section of the room to a separate area divided by screens to watch the condition-specific video. When allocated to the as-usual gallery visit control participants, they were directly led to gallery room 9. The video viewing area consisted of five chairs arranged in front of a large screen (see Figure 1), with individual headphones and volume settings that were sterilised between participants to maintain hygiene. After being comfortably seated, participants were instructed to view the video until the end, and if they were in a group, they were asked not to talk to each other during the viewing. Once the video ended, the researcher returned and took them to the gallery room 9. Participants were told to call out

in case of technical difficulties, and the researcher would come to assist them (although this only happened once). Although the participants were left alone to view the video, they were still under the supervision of the researchers, who were able to observe them from a distance.

Once in gallery room 9, a 30-second walk from the research room, the researcher verbally instructed the participants to spend as long as they wanted, such as a few minutes, viewing one painting of their choice from a particular wall. Participants were instructed not to leave the room or view any other paintings. After viewing the painting, they were instructed to return to complete a post-survey. At all times, the participants were supervised by a research team member.

The post-survey, also accessed either via QR code on a personal smartphone or via paper and pen, included questions regarding which painting they chose, their experience while viewing the artwork in the gallery, a second assessment of their momentary well-being as well as open text boxes about the video (if they saw one) and the gallery viewing experience. Additional piloting, exploratory and museum-requested questions were also asked. Once finished, participants were debriefed and given their compensation.

Materials

Aesthetic Looking Video. To design and produce a gallery augmentation to enhance the viewing experience, we reviewed established theories and research to pinpoint engagement styles that significantly increase aesthetic experiences such as pleasure and meaningfulness. Past literature (reviewed in the intro) revealed that spending more time observing the same painting ¹⁹ and focusing on the style rather than the content ¹⁸ are effective methods to enrich the art viewing experience, potentially improving mood and reducing anxiety more than a typical viewing experience.

We developed a 4-minute introductory video in an interdisciplinary team to implement these two engagement styles (see Figure 1). The video animated the painting

"A View of Rome" (Claude, 1604/5? – 1682, A View in Rome, 1632 © The National Gallery, London); professional animation on commission by Jack Field Worldwide) from the gallery's collection, portraying a cityscape of Rome on the left and an imaginary ruin in the right foreground, featuring five figures, including a man giving change to women. By animating the image, the video demonstrated how one might view it through zooming in and changing perspective, showcasing methods of observation that encouraged viewers to slow down and focus on the style and details of the artwork while connecting with their own experiences. The narrator guides viewers in examining the painting, highlighting the colours, brushstrokes, and textures. The video starts with a free exploration and then points out the many layers of the painting. As it zooms in and out, the brushstrokes and use of paint become the focus, demonstrating how standing closer to or further from a painting can drastically alter one's perception and experience. For instance, as the video zooms in on a section of the painting depicting buildings, the narrator urges visitors to observe how each building comprises lighter and darker, nearly abstract rectangles, forming a recognisable city street from a distance. The video concludes by asking the viewer to think about what the artist is trying to express through the colours, brushstrokes, and textures, ending with the message, "Next time you are in front of a painting, stop for a moment, slow down, and explore for yourself," encouraging visitors to apply these techniques during their visit.

Breathing Video. The six-minute mindful breathing video was included to provide an embodied condition that did not focus on teaching viewing techniques, instead offering a space for breathing before entering the gallery room. The video, "Inspirit," produced by Kinda Studios (a preview can be viewed at <https://www.kindastudios.com/inspirit>), uses art and sound to guide viewers in 6-6 resonance breathing (in for six beats, out for six). This video was designed to reduce stress and support the interoceptive connection between the mind and the body. The video begins by welcoming viewers, inviting them to get comfortable, guiding them into body sensations, followed by controlled breathwork, in rhythm with the beat of the music composed by Nailah Hunter, as the narrator counts, "in, 2, 3, 4, 5, 6, out, 2, 3, 4, 5, 6." The visuals by artist Lucy Hardcastle consisted of

vibrant abstract images that shift with the music (see figure 1). A comparison of the two videos can be found in Table 5.

Table 5. Comparison between video conditions

Intervention Mapping		
Distinct to Aesthetic Looking	Similar in Both	Distinct to Mindful Breathing
1. Contain instructions on where and how to look slowly and deeply at the surface and style of painting	1. Contain instructions to follow during the video (look here, notice this, or breathe in, breathe out).	1. Deep Breathing interoception intervention
2. Representational painting (from National Gallery, London's Collection).	2. Contain animated artwork	2. Contain bi-neural music and beat to breathe in time to.
	3. Contain calming narrator	3. Abstract non-representational digital artwork.
	4. Moment to sit and connect to themselves before entering the gallery (4-6m).	4. Improves interoceptive awareness (heartbeat awareness).
	5. Contain aspects of mindfulness (focus on breathing or focus on details in painting).	
	6. Both will likely evoke aesthetic experiences, and initial impacts on mood/anxiety.	

Art Viewing Setting and Paintings. Participants had the chance to choose from four paintings located beside one another on one corner walls of room 9 at the National Gallery, London. The choice of painting was offered to increase the participant's sense of autonomy in the gallery, which was more ecologically valid. Furthermore, we chose this group of artworks due to their location close to the research room and their relatively lesser-known profiles than other more famous pieces in the Gallery (i.e. paintings by J. M. W. Turner or C. Monet, among many others). The first painting was "The Consecration of Saint Nicholas" by Paolo Veronese (1562, 286.5 x 175.3 cm). The painting depicts Saint Nicholas being consecrated as bishop in front of spectators. The second painting is also by Paolo Veronese, titled "The Family of Darius before Alexander" (1565-1567, 236.2 x 474.9 cm). It portrays Alexander the Great meeting the family of King Darius III of Persia after his defeat in battle, with Alexander showing mercy and insisting the family continue

to be treated as royalty. The third painting was "The Dream of Saint Helena" by Paolo Veronese (1570, 197.5 x 115.6 cm). It depicts Saint Helena, the mother of Emperor Constantine, having a dream in which she is told to go to the location of the True Cross, as revealed by the angle. Finally, the fourth painting was "Diana and Actaeon" by Titian (1556-1559, 184.5 x 202.2 cm). The painting depicts the moment when the goddess Diana discovers the hunter Actaeon spying on her while bathing and punishes him by transforming him into a stag. See Figure 1 for a photo showing the hanging of the paintings in situ. Most of the participants choose to view "The Dream of Saint Helena" (N = 101), followed by "The Family of Darius before Alexander" (N = 84), then "Diana and Actaeon" (N = 67), and "The Consecration of Saint Nicholas" (N = 29).

Measures

Demographic information about the participants and their previous experiences with art and the National Gallery were collected, including the year of birth, gender (male, female, non-binary, prefer not to say), nationality, and level of interest in art on a 7-point scale (1 = not at all, 7 = very much). Participants were also asked about their formal education in fine art or art history, with options ranging from none to being a professional. To assess their previous experience with the National Gallery, the participants were asked when they last visited, with options ranging from within the last month to within the last six months, one year, more than three years ago, or it was their first time. They were also asked to describe their perception of the National Gallery on a 5-point Likert scale, with options ranging from very negative to very positive.

Subjective Art Experience Appraisals and States. The study included questions about the participants' art experience and appraisal. The questions were designed to gather information about the participants' art experience and perception. The post-survey began with a question asking participants to select the painting they viewed in the gallery (by choosing the photo of the painting out of the four options). Then, the participants were asked to rate their emotional response to the painting on a scale of 1 to 7 (1 = not at all, 7 = very much) using keywords such as confident, absorbed, and grateful (not included in our pre-registered analysis). The next set of questions asked participants to rate their

experience while viewing the artwork in the gallery on a scale of 1 to 7. They were asked to rate their liking, meaning, beauty, and whether the artwork related to their identity, their experiences or the events that they felt defined them as a person (self-relevance). Additionally, participants were asked to rate whether the artwork was good and whether they understood it on a scale of 1 to 7 (1 = not at all, 7 = very much). Finally, at the end of the survey, we asked them if they saw a video as part of the study (as a last question, do not confound the other scales) and if they selected yes, we asked how much they enjoyed the video (1-7, 1 = not at all, 7 = very much).

Well-being Measures. Additionally, two standardised measures of well-being were included: the State-Trait Anxiety Inventory ^{STAI; 39} and the Positive and Negative Affect Schedule ^{PANAS; 40}. The STAI assessed participants' current and general anxiety levels on a 4-point scale, while the PANAS assessed their positive and negative affect on a 5-point scale. Research has shown that the PANAS and STAI can detect changes in effect following interventions and exposure to art ¹⁴ with high reliability and validity ^{39,40}.

Qualitative Data and Analysis. Three open text boxes were included to collect qualitative data to enrich the study. To evaluate the gallery experience, participants were asked “to add a few keywords (or more) that describe your experience in the gallery space while looking at the artwork (adjectives/descriptive words)” and about the video, if they viewed one. In addition, for other purposes, we asked participants to add keywords about how their entrance experience made them feel before the pre-survey.

We used an inductive content analysis method known as bottom-up analysis to analyse the qualitative data. This method involves examining response data by developing categories during the coding process, grounded in the actual content of the data set to describe and understand the phenomenon under investigation. Unlike deductive theory-driven approaches, such as framework synthesis, this approach does not aim to generate theory. Instead, it focuses on identifying themes a priori to specify coding categories. The study adopted an emergent coding approach consisting of three steps: 1) familiarisation with the responses; 2) coding by assigning at least one code to

all statements, often resulting in multiple codes per statement; and 3) synthesis, where related codes were identified and merged into broader semantic themes. A flat framework was used, meaning all codes maintained the same specificity and significance level. This iterative process allowed for new aspects to be discerned from the data as more responses were analysed, with answers being recoded as necessary. These steps were completed by an independent coder (author C.K.) who was unaware of the condition in which the participants were involved. Once each response was coded, a second reviewer (author M.T.), aware of the conditions, checked and synthesised the codes per condition, counted them, and selected example quotes. The results section presents categories as percentages, indicating the number of mentions (codes) divided by the total codes found across all categories. This does not represent the percentage of people who reported the category, as many responses were double-coded.

Study Two Methods

This study was approved by the Ethics Review Board at Goldsmiths, University of London.

Participants

Of the initial sample ($N = 41$), $n = 33$ were included in the analysis with eight individuals excluded for failing the attention checks. Participants' ages ranged from 19-47 years ($M = 25.91$, $mdn = 24$, $SD = 5.04$), where 75% women ($N_{\text{women}} = 25$, $N_{\text{male}} = 4$, $N_{\text{non-binary}} = 4$). Most participants were from countries in Asia ($N = 24$), followed by Europe ($N = 3$), North America ($N = 4$) and the UK ($N = 1$), South America ($N = 1$). $N = 14$ had no formal past art education, 10 had taken an art class in school, five were either pursuing or had pursued a minor or special focus on art in college or university, two individuals were seeking or had completed an art degree, and 2 were professionals in art or art history. Overall, the sample again generally exhibited interest in the arts ($M = 5.91$, $SD = 0.95$, 1-not at all interested to 7-very interested). The sample size was based on logistic and resource evaluations rather than power.

Randomisation and Blinding

Participants were randomly assigned to conditions after giving their informed consent and blinded to the conditions they were allocated to.

Procedure

The study was conducted in person at the standard testing cubicles at Goldsmiths, University of London. Upon arrival, participants were randomly assigned to one of two groups (control/video viewing) that was unbeknownst to them. After reviewing the participant information sheet, understanding data protection regulations, and signing a consent form, participants scanned a QR code on their personal smart phones linking to the pre-survey on Qualtrics. Initially, they provided demographic information such as nationality, age, gender, and level of art education. Next, they completed a pre-viewing assessment of well-being variables. To mitigate potential bias from the order effect, the pre- and post-survey question items were randomised.

Participants then engaged in either a four-minute free-writing session or watched the Aesthetic Looking video, both lasting the same duration to ensure a comparable baseline. They were then instructed to choose one of four paintings displayed on an iPad and not view any of the other artworks. They used their fingers to zoom in and out to simulate moving closer to or further away from the painting in a gallery setting. When they felt satisfied with their viewing experience, they exited the exhibition room, returned to the testing room, and scanned the QR code for the post-survey.

The post-survey asked participants to identify the painting they had selected earlier, questions about their art experience, and the same questions about their well-being for a second time. They also indicated their willingness to visit the original paintings and described their art-viewing experience using one or two words. Participants in the intervention group were additionally asked to rate the video they had watched. To conclude, the survey included a question about their interest in participating in a raffle for Amazon shopping vouchers as a thank you.

Materials

The paintings were high-resolution digital reproductions of those in Study One, but they were displayed on a smart tablet. Similarly, the Aesthetic Looking video was also utilised; see Study One for a detailed description. This study introduced a novel writing prompt for the free-writing condition: Participants were asked to “Please write freely for four minutes about how you feel at this moment. This written content will not be used for data collection in the experiment, and you can keep it to yourself after writing.” Most of the participants choose to view “Diana and Actaeon” (N = 11) or “The Dream of Saint Helena” (N = 10), followed by “The Family of Darius before Alexander” (N = 8) and “The Consecration of Saint Nicholas” (N = 4).

Measures

The same measures from Study One were used to assess changes in well-being variables (PANAS, STAI). The art-viewing experience was also evaluated similarly, with questions regarding liking, meaning, beauty, understanding, relevance, and goodness. Furthermore, the same questions were employed to evaluate the impact of the video on the art viewing session, inquiring about the speed of looking and how much participants focused on the style of the artwork over the content. Additional questions were posed for the purpose of conducting the second author’s master’s Thesis project.

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Annex 1. Tables

Table 1. Descriptive Statistics for Art Viewing Experience

Liking				
	Condition	N	M	SD
	Aesthetic Looking	94	5.511	1.233
	Breathing	90	5.089	1.379
	Control	93	5.290	1.273
Meaningful				
	Condition	N	M	SD
	Aesthetic Looking	94	4.979	1.633
	Breathing	90	4.667	1.492
	Control	93	5.000	1.511
Beautiful				
	Condition	N	M	SD
	Aesthetic Looking	94	5.606	1.401
	Breathing	90	5.267	1.627
	Control	93	5.538	1.536
Self-Relevant				
	Condition	N	M	SD
	Aesthetic Looking	94	4.021	1.697
	Breathing	90	3.989	1.917
	Control	93	4.108	1.953
Understanding				
	Condition	N	M	SD
	Aesthetic Looking	94	4.457	1.577
	Breathing	90	4.500	1.644
	Control	93	4.753	1.579
Art Goodness				
	Condition	N	M	SD
	Aesthetic Looking	94	5.894	1.168
	Breathing	90	5.722	1.316
	Control	93	5.925	1.191
Twofoldness Check				
	Condition	N	M	SD
	Aesthetic Looking	94	4.787	1.585
	Breathing	93	4.882	1.793
	Control	94	5.170	1.663
Slowness Check				
	Condition	N	M	SD
	Aesthetic Looking	94	3.298	1.225
	Breathing	93	3.441	1.410
	Control	94	3.660	1.456
Heartbeat Awareness Change				
	Condition	N	M	SD
	Aesthetic Looking	94	-0.191	1.693
	Breathing	92	-0.457	1.253
	Control	94	-0.234	1.688
Body Location Awareness				

Condition	N	M	SD
Aesthetic Looking	94	4.468	1.739
Breathing	92	4.054	1.800
Control	94	4.074	1.969

Table 2. Descriptive Statistics for Well-being Variables

Positive Mood					
Condition	N	Pre M	Pre SD	Post M	Post SD
Aesthetic Looking	91	3.197	0.650	3.466	0.766
Breathing	91	3.092	0.702	3.192	0.743
Control	91	3.231	0.780	3.386	0.824
Negative Mood					
Condition	N	Pre M	Pre SD	Post M	Post SD
Aesthetic Looking	91	1.332	0.386	1.187	0.363
Breathing	91	1.300	0.309	1.202	0.267
Control	91	1.337	0.355	1.203	0.265
Anxiety					
Condition	N	Pre M	Pre SD	Post M	Post SD
Aesthetic Looking	91	1.641	0.480	1.471	0.462
Breathing	91	1.645	0.417	1.498	0.391
Control	91	1.670	0.473	1.601	0.426

Table 3. Descriptive Statistics for Art Experience Variables

Liking			
Condition	N	M	SD
Aesthetic Looking	18	4.5	1.200
Free Writing	15	4.6	1.404
Meaningful			
Condition	N	M	SD
Aesthetic Looking	18	4.444	1.464
Free Writing	15	4.067	1.534
Beautiful			
Condition	N	M	SD
Aesthetic Looking	18	4.889	1.779
Free Writing	15	5.067	0.884
Self-Relevance			
Condition	N	M	SD
Aesthetic Looking	18	3.111	1.530
Free Writing	15	3.067	1.668
Understanding			
Condition	N	M	SD
Aesthetic Looking	18	3.667	1.029
Free Writing	15	3.533	1.552
Art Goodness			

	Condition	N	M	SD
	Aesthetic Looking	18	5.167	1.249
	Free Writing	15	5.133	0.834
Twofoldness Check				
	Condition	N	M	SD
	Aesthetic Looking	18	4.722	1.406
	Free Writing	15	4.933	1.387
Slowness Check				
	Condition	N	M	SD
	Aesthetic Looking	18	3.278	1.320
	Free Writing	15	3.200	1.082

Table 4. Descriptive Statistics for Well-being Variables

Positive Mood					
Condition	N	Pre M	Pre SD	Post M	Post SD
Aesthetic Looking	17	4.078	1.311	4.324	1.175
Free Writing	15	4.044	1.356	4.478	1.556
Negative Mood					
Condition	N	Pre M	Pre SD	Post M	Post SD
Aesthetic Looking	17	2.353	0.62	2.078	0.457
Free Writing	15	2.833	0.85	2.422	0.610
Anxiety					
Condition	N	Pre M	Pre SD	Post M	Post SD
Aesthetic Looking	17	1.951	0.592	1.647	0.338
Free Writing	15	2.267	0.559	1.978	0.499

Chapter Five

Can everyday art viewing and beauty appreciation support well-being and mental health?

Status:

Trupp, M.D., Igdalova, A., Wijnands, M., Spee, B., Stamkou, E., Pelowski, M., Greven, C. (Submitted). Art-based beauty appreciation intervention in young adults: Protocol for a two-arm active control mixed-methods randomised controlled trial (ABBA-Vention).

My Contribution:

I conceptualised the initial idea for this project as part of a Marietta Blau Mobility Fellowship grant application and then further developed it during my 1.5-year research stay with CG at Radboud UMC, Donders Institute for Brain, Cognition and Behaviour, considering feedback from the team. I conducted a literature review that informed the intervention design, created the initial intervention, and revised and improved it with input from CG and AI. I prepared the project materials, collected and processed the data, redesigned the intervention and control programs, and prepared the materials and manuscript for the protocol. In addition to funding myself throughout this project, I secured funding from the University of Vienna to compensate participants and cover material costs. Finally, I co-supervised MW's master's thesis during a nine-month internship on the project.

Art-based beauty appreciation intervention in young adults: Protocol for a two-arm active control mixed-method randomised controlled trial (ABBA-Vention)

Names protocol contributors

#MacKenzie D. Trupp, Radboudumc, Donders Institute for Brain, Cognition and Behavior, and University of Vienna, Faculty of Psychology

Aleksandra Igdalova, Goldsmiths, University of London, Department of Psychology

Maartje Wijnands, Radboudumc, Donders Institute for Brain, Cognition and Behavior

Blanca T.M. Spee, Radboudumc, Donders Institute for Brain, Cognition and Behavior, Department of Neurology; University of Vienna, Vienna Cognitive Science Hub.

*Eftychia Stamkou, University of Amsterdam, Department of Psychology

*Matthew Pelowski, University of Vienna, Faculty of Psychology

Corina U. Greven, Radboudumc, Donders Institute for Brain, Cognition and Behavior; and Karakter Child and Adolescence Psychiatry

*Contributed Equally

#Corresponding Author at mackenzie.trupp@gmail.com

Abstract (350 words max)

Background: Young adults are experiencing rising levels of mental health concerns and low well-being, which is exacerbated for around 20% of the population who are high in sensory processing sensitivity (SPS), a distinguishable, partly heritable trait associated with poorer mental health. However, despite this worrying increase in mental health issues among young adults, individuals who score highly on beauty appreciation tend to enjoy better well-being and improved mental and physical health. Several studies have shown that beauty appreciation can be taught and may serve as a cost-effective and enjoyable intervention strategy that can be easily implemented.

Methods: This study has two main aims: 1) to evaluate the effectiveness of an art-based beauty appreciation intervention on enhancing beauty appreciation (primary outcome), and 2) to determine whether increasing beauty appreciation has a causal effect on reducing psychological distress and increasing mental well-being (secondary outcomes) when compared to an active matched control condition designed to isolate beauty appreciation skill development. To assess this, we will conduct a mixed-method randomised controlled trial (RCT) across three measurement points: enrollment, post-intervention, and a 4-week follow-up. N = 114 young adults, including those high in SPS, will be blinded and randomly allocated to the intervention or control group (~N = 57/group). Our primary hypothesis is that the intervention condition will exhibit higher levels of beauty appreciation compared to the control group at the post-test while accounting for baseline differences. Our secondary hypotheses evaluate mental well-being and psychological distress. A follow-up analysis will assess if individuals with high SPS can especially benefit and qualitative analysis will address mechanisms, barriers and facilitators between intervention and control, as well as in a high SPS subgroup.

Discussion: The study aims to provide evidence that beauty appreciation skills specifically can lead to increased well-being and decreased psychological distress by including an active matched control condition that isolates this skill development. Based on positive results, the evidence will support the implementation of such interventions for young adults and highly sensitive individuals, which would be widely accessible and easy to incorporate into day-to-day life. **Trial registration:** ClinicalTrials.gov Registry Number: [NCT06788496](https://clinicaltrials.gov/ct2/show/study/NCT06788496)

Keywords

Arts-based Interventions, Beauty Appreciation, Well-being, Burnout, Mental health, Young Adults, Sensory Processing Sensitivity

Administrative information

Note: the numbers in curly brackets in this protocol refer to SPIRIT checklist item numbers. The order of the items has been modified to group similar items (see <http://www.equator-network.org/reporting-guidelines/spirit-2013-statement-defining-standard-protocol-items-for-clinical-trials/>).

Title {1}	Art-based beauty appreciation intervention in young adults: Protocol for a two-arm active control mixed-method randomised controlled trial (ABBA-Vention)
Trial registration {2a and 2b}.	ClinicalTrials.gov Registry Number: <u>NCT06788496</u>
Protocol version {3}	Version 1
Funding {4}	Trupp is supported by a Marietta Blau Mobility Fellowship funded by the Austrian Federal Ministry Republic of Education, Science and Research (BMBWF) and University of Vienna Seed Grants from the Student Office and the Vienna Doctoral School for Cognition, Behavior and Neuroscience (VDS CoBeNe). C. U. Greven is supported by an Aspasia grant from the Netherlands Organization for Scientific Research (NWO, grant number 015.015.070).
Author details {5a}	#MacKenzie D. Trupp, Radboudumc, Donders Institute for Brain, Cognition and Behavior, and University of Vienna, Faculty of Psychology Aleksandra Igdalova, Goldsmiths, University of London, Department of Psychology Maartje Wijnands, Radboudumc, Donders Institute for Brain, Cognition and Behavior Blanca T.M. Spee, Radboudumc, Donders Institute for Brain, Cognition and Behavior, Department of Neurology; University of Vienna, Vienna Cognitive Science Hub

	*Eftychia Stamkou, University of Amsterdam, Department of Psychology *Matthew Pelowski, University of Vienna, Faculty of Psychology Corina U. Greven, Radboudumc, Donders Institute for Brain, Cognition and Behavior; and Karakter Child and Adolescence Psychiatry #Corresponding Author *Contributed Equally
Name and contact information for the trial sponsor {5b}	Radboud University Medical Center, +31 (0) 24 361 42 44, Secretariaat.cns@radboudumc.nl
Role of sponsor {5c}	The sponsor has no say in the design or interpretation of the study.

Background and rationale {6a}

The industrialised world is increasingly stimulating for young adults. Bright 24-hour lights, constant traffic noise, strong influences from social media, and an inundation of conflict in the news are now the norm rather than the exception. Although humans have adapted to this increasingly overstimulating world, individuals also vary. Young people, and especially university-age students, are at the brunt of the ever-overstimulating world, with higher levels of mental health issues than ever seen before. A recent study of more than 70,000 Dutch people found that more than half of those aged 16 to 25 have mental health concerns (1).

These effects are further increased for approximately 20% of young adults due to naturally amplified sensitivity to sensory input. This group of “highly sensitive people” is described in the scientific literature as being high on the trait Sensory Processing Sensitivity (SPS). This trait is characterised by increased depth of processing, emotional reactivity and empathy, awareness of the environment's subtleties, and ease of overstimulation (2). SPS is considered partially distinct from other personality traits (3), is moderately heritable (4), and correlates with broad functional and structural brain networks supporting sensory, cognitive, and emotional processes (5). Young adults with high scores on SPS appear to be even more at risk for psychological issues (6) with small to medium effect sizes (7,8). For example, in a recent Dutch survey, people with high SPS had a three times higher burnout rate than the general population (9). Furthermore, young adults with heightened sensitivity face an elevated vulnerability to developing mental health concerns (10–12) and report more physical health complaints (13,14), likely due to overstimulation and lack of emotional regulation skills (11) (2) (14).

One potential avenue that could support young adults' well-being, including highly sensitive young adults, is the practice of beauty appreciation. Large-scale cross-sectional studies suggest that trait appreciation of beauty may be a protective factor associated with well-being (15–19). As reviewed by Trupp et al. (20), individuals with a higher appreciation of beauty, aesthetic sensitivity, or art-savouring exhibit elevated subjective well-being (17), greater life satisfaction (16), reduced depression (21), and improved physical health (15). Lee et al. (15) also demonstrated predictive validity after accounting for other personality traits, like openness to experience. Notably, aesthetic sensitivity, representing an awareness and appreciation of the environment, is a fundamental part of SPS and many

studies suggest that of the facets of the Highly Sensitive Person Scale used to measure SPS (18), aesthetic sensitivity tends to be associated with positive health and well-being outcomes much more than other facets (22). The past evidence indicates that cultivating an appreciation for beauty could be beneficial for young adults generally, and possibly especially so for young adults with heightened sensitivity.

In addition to studying beauty appreciation as a trait, it can also be studied as a skill. Beyond the above associational data, several experimental studies indicate that one's tendency to appreciate one's environment can also be increased (23–28). These studies use multi-week paradigms that involve increasing exposure to beauty, teaching awareness of beauty, and reflecting on the worth of beauty. Across these interventions, evaluations of the programs suggest positive effects. First, compared to baseline or control conditions, significant increases were found in engagement with beauty with large effects (23,25), and appreciation of beauty (26,27) and noticing beauty with medium effects (24). For well-being outcomes, Martinez-Marti et al. (26) found that 97% of the sample qualitatively reported a well-being increase, while Martinez-Marti et al. (27) found significant increases in well-being compared to the control groups with moderate to large effects in a randomised control trial (RCT). However, another study (24) did not see improvements in depression or anxiety between a beauty walk group and a control walk group, possibly due to the small sample size, or more likely due to the single activity used to practice beauty repeatedly.

The link between appreciation of beauty and higher well-being in both the general population of young adults and those high in SPS, as well as previous studies showing the possibility of teaching this skill, raises the question of whether enhancing the propensity to perceive the environment as beautiful could improve well-being and mental health in—and if those high in SPS might particularly benefit from such an intervention.

Study Objectives {7}

This study has two main aims: 1) to evaluate the effectiveness of a novel art-based beauty appreciation intervention (ABBA) on increasing beauty appreciation and 2) to determine if increasing beauty appreciation has a causal effect on decreasing psychological distress and increasing mental well-being by comparing these outcomes against a matched control condition which is designed to isolate beauty appreciation skill improvement to only the intervention.

Our intervention goes beyond previous studies by aggregating diverse elements from successful interventions and presenting them in an art-based learning paradigm. Utilising the arts as a tool in education has been widely successful in teaching observation skills and awareness of subtleties in medical education (29). This study builds upon previous research through a new delivery method, aiming to create an intervention that not only fosters beauty appreciation, but also utilises cultural assets such as artworks and museums as venues to practise beauty appreciation—an activity recognised for its contributions to overall health and well-being (30).

Design {8}

To evaluate this, we will conduct a mixed-method randomised controlled trial (RCT) with an active control condition assessing the impact of the ABBA intervention on trait appreciation of beauty as a primary outcome and well-being and psychological distress as a secondary outcome. There are three measurement points for the primary and secondary outcomes, including 1) enrollment, 2) a post-test after the intervention/control program, and 3) a 4-week follow-up measure. N = 114 participants will be randomised into either the intervention or control group (~N = 57/group). In addition, to investigate perceived mechanisms, barriers, and facilitators, participants will be selected using purposive sampling and invited to a semi-structured interview until data saturation is reached in both the intervention and control groups, with an additional subgroup analysis on those high in SPS from the intervention group. This qualitative subgroup analysis, combined with a quantitative moderation analysis, will determine whether the intervention is especially effective for those high in SPS.

Main Hypothesis

H1: The intervention condition will report larger increases in the primary outcome, appreciation of beauty, compared to the control group at the post-test.

H2: The intervention condition will report a larger decrease in the secondary outcome, psychological distress and a larger increase in mental well-being, compared to the control group at the post-test.

H3: The intervention condition will report higher levels of the primary outcome, appreciation of beauty, secondary outcomes: mental well-being, alongside lower levels of psychological distress compared to the control group at follow-up.

Exploratory H4: Sensory processing sensitivity will moderate improvements in both the primary and secondary outcomes.

Methods

Study setting {9}

The study is conducted via correspondence (communication through email, Microsoft Teams, online surveys and postal mail, and online-based intervention program) in the Netherlands.

Participants

Eligibility criteria {10}

1) Participants must be between 18-28 years of age, 2) indicate that they have a smartphone to support data collection and program components, 3) have the ability and interest to make a trip to a museum or new location (i.e., new part of the city), 4) be willing to complete short activities every day for two weeks, 5) be fluent in English, and 6) be based in Amsterdam. Participants must not currently be 7) in clinical treatment for a mental health disorder, assessed via self-report, or 8) indicate that they are currently experiencing severe psychological symptoms (i.e., depression, suicidal ideation, severe anxiety) via self-report.

Sample size {14}

The power analysis is based on the primary hypothesis that appreciation of beauty will be higher post-test in the intervention group than in the control group. Effect sizes for appreciation of beauty range from $d = .27$ to $d = .58$ in previous RCTs (25,27). Due to our active control group, we based our power calculation on a small to moderate effect size of $d = .35$ effect size for an ANCOVA where the baseline is the covariate. Power analyses were run using the software G*power and based on the procedure by (31). This method obtains the N per group from a t-test multiplied by a design factor (D). The design factor is $D = 1-r^2$.

where r is the pre-and post-test correlation. We base r on the four-week test-retest reliability of the Experience of Beauty Scale of .72 (32); thus, $D = 1 - .72^2 = .48$. Based on the power of 80% for a two-tailed test with an alpha of .05 and an estimated effect size of .35, $102 * .48 = 49$ /group are needed. ~15% are added for the estimated dropout rate, bringing the total sample size to $N = 114$.

Procedure

Recruitment and Screening {15}

Participants will be recruited through the participant platform at the University of Amsterdam and via social media. The participant platform advertises studies to students and provides them with research credits they must complete as part of their undergraduate curriculum. An advertisement will be placed on the participant platform that includes necessary study information with a link for interested participants to click to fill out a screening survey (via online survey platform Qualtrics, <https://www.qualtrics.com>) and provide their contact email. This survey starts with the information letter and a screening informed consent. The intervention and control programs will be advertised as targeting observation skills while being a tourist in your city. There is no mention of arts or beauty appreciation in the advert. In addition, advertisements will be placed on social media with links to the study information and the same screening survey.

Consent {26}

Participants meeting the inclusion criteria will be invited to participate via email. With this invitation email, they will receive the detailed study information letter and the informed consent sheet and will be invited to schedule an online enrollment meeting via Microsoft Teams. At the enrollment meeting, the researcher will verbally explain the study. This will include the schedule and activities as well as the timeline for online surveys and the optional interview. The researcher will give the participants a chance to ask questions, and then, if the participants are ready, they will digitally sign the informed consent sheet. A follow-up meeting will be scheduled if the participant needs more time to consider joining the study. The informed consent and info sheet provide information about the storage and protection of the data and the right to leave the study at any time. The time-stamped digital informed consent will be kept according to the GDPR art.6.1.a.

Randomisation {16}

Participants will be randomised in blocks of 2 and 4 via the electronic data capture system Castor (<https://www.castoredc.com>) after giving consent.

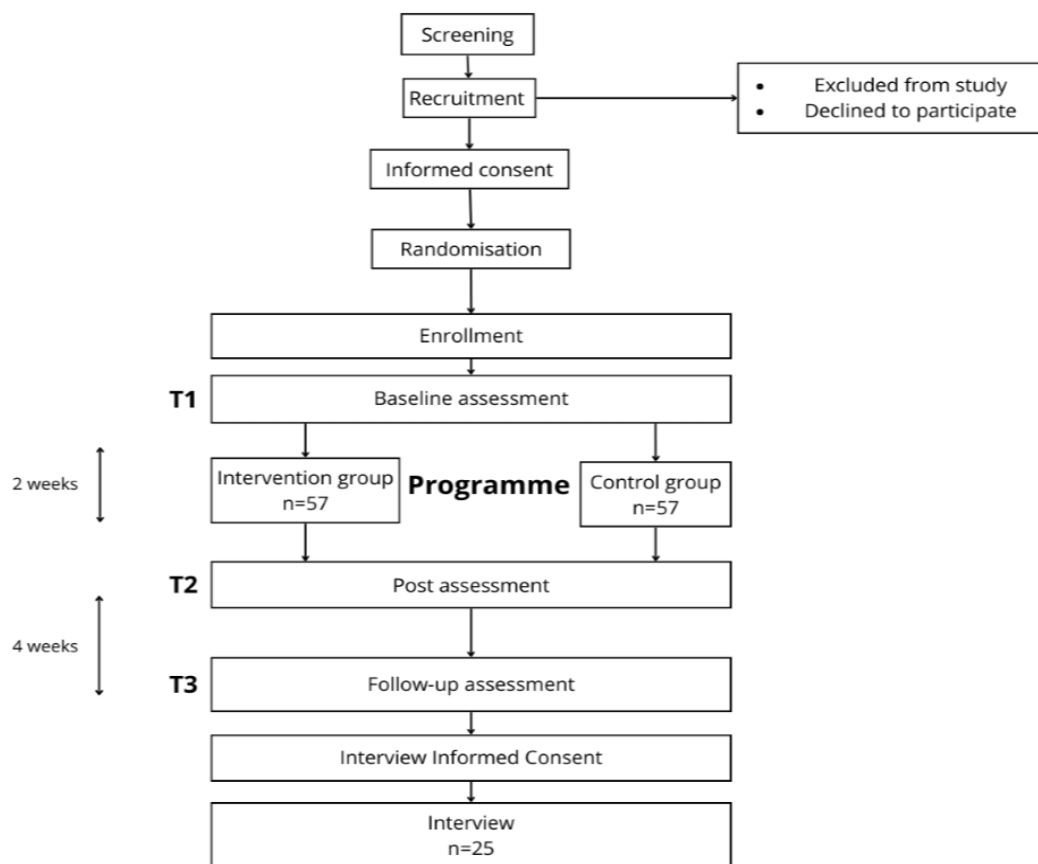


Figure 1. Participant timeline {13}

Blinding {17}

Participants are blinded to the allocated condition. Although the information sheet specifies that there are two conditions, it is unclear to participants which is the control and which is the intervention due to the high-quality, credible active control condition. It is not possible in this study to keep the researchers blind, as they are responsible for explaining the programs during the enrollment meeting.

Enrollment and Baseline

In an enrollment meeting hosted on Microsoft Teams, the researcher will walk the participant through the selected program components and instructions with a PowerPoint presentation and provide time for questions. As listed in the information sheet,

advertisement, and screening survey, the participants will be asked for their postal address so that the log-in details for the respective program and the free museum tickets (intervention only) can be sent via post. Participants will set up an account on the Samplify Research Application (33) to receive reminders about the study. At the end of the meeting, the researcher will explain that the surveys will be sent to them via email (via Castor). Once the participant has no further questions, the enrollment meeting will finish. The participants will then be sent the baseline survey. The list of baseline questions is provided in the overview in Table 3.

Intervention and Control Programs

After finishing the baseline survey and the research materials arrive by post, the participant can access the online program platform (hosted on Thinkific, an online course-sharing platform) to start the program. The program is followed daily for 14 days by logging into Thinkific on their personal phones or computers (see Intervention section for intervention procedure description).

Post-Survey, Follow-up Survey and Compensation

The post-survey will be sent once participants have completed the 14-day program. The list of surveys is in Table 3. At this time, participants are reminded that in 4 weeks, they will be sent the final survey and, following its completion, their compensation. Once the participant has completed it, as confirmed by checking the ID codes of the completed surveys, they will be awarded their Dutch online shopping voucher (Bol.com) and research credits.

Semi-structured Qualitative Interviews

After follow-up (4 weeks post-intervention), participants selected through purposive sampling (selecting to maximise diversity by varying levels of program completion, gender, age, and level of SPS) will be sent an invitation to participate in a qualitative interview with the information sheet and the interview specific informed consent sheet. As is common in qualitative research, it is not yet possible to determine how many participants will participate in the interviews. Participants will continue to be approached and interviewed until the interviews no longer generate new information (i.e., data saturation is reached). The point at which saturation occurs depends, among other factors, on the heterogeneity of the sample. Given that our sample is relatively homogeneous (mostly university students and

young adults in Amsterdam), we anticipate that a sample of approximately $N = 20$ participants will ultimately be included, $N = 10$ per group. An additional $N = 5$ high SPS individuals from the intervention group will be selected for a sub-group analysis. If participants do not accept the invitation, we will contact replacements from the remaining pool of intervention condition participants. The interviews will be conducted one-on-one by one of the study's researchers on Microsoft Teams, which allows recording and automatic transcription. Transcripts will be sent to interviewees to check all is correct. Participants will be compensated with an online shopping voucher. The interview description can be found in the Outcomes Section.

Debrief

After the study, participants will be unblinded as to which condition they were allocated and offered a full explanation of the study design, aims, and a description of both conditions. This will be done in writing, with the additional offer to discuss the study at the participant's request. At this time, participants will also be provided information about existing mental health services and support.

Intervention

Explanation for the choice of comparators {6b}

The intervention and control conditions are described in detail in Table 2, including the intervention goals, activity descriptions, and duration. Both programs are designed to be progressive curriculums that build upon each day. All intervention program components were selected based on previous research and have been pilot-tested. The objectives of the intervention program (see also Table 2) are to help individuals develop an aesthetic mindset, practice observation and appreciation skills, apply these skills to their day-to-day lives, practice emotion regulation with beauty, and incorporate more beauty into their lives. The program aims to facilitate a gradual transfer of skill from appreciation in art contexts to natural beauty and everyday life. On the other hand, the control program is designed to match the intervention program in all aspects except for teaching beauty appreciation and increasing exposure to art and beauty. Past studies (15,16,18) have not included control over increased observation skills as a possible confounding factor; instead, other studies have used active control conditions but not matched conditions that truly isolate beauty appreciation as a learned skill or behaviour.

Development of the intervention and control programs

To prepare for this study, we designed, produced, and validated the intervention procedure. First, we conducted a literature review on past arts and beauty appreciation interventions to glean activity components and learning goals that should be incorporated into our new arts-based beauty appreciation program. Six studies were identified, finding evidence that appreciation of beauty can be enhanced, that informed our intervention design (23–28). These studies use multi-week programs that involve activities aligning with four learning outcomes, including increasing exposure to beauty, learning to notice beauty, cultivating an aesthetic mindset, and reflecting on the worth or utility of beauty. In addressing these aspects, past programs increased exposure to beauty through, for example, nature walks (23,24) or adding plants to the house (26,27). To increase awareness of beauty—that is, noticing the beauty that is already part of one’s environment—directed attention tasks were used like keeping beauty journals or shooting photos of beauty to increase the habit of being aware of the beauty around them (28). Past studies included didactic components to cultivate an aesthetic mindset, which focuses on noticing the beauty in objects in addition to their pragmatic purpose (34). This included learning about how to appreciate mundane objects as beautiful through practice in the classroom-based sessions, for example (25). Lastly, understanding the worth of beauty was encouraged through reflection exercises about the emotions felt during beautiful experiences (26,27). This latter learning goal is linked to how beauty can regulate emotions. However, the authors did not label it as such. Emotion regulation through beauty is a likely mechanism of how beauty appreciation as a skill or trait can impact well-being and mental health outcomes—known as sensory emotion regulation (35). Having an aesthetic mindset and engaging with beauty have been shown to reduce the impact of distressing images (36,37), induce positive emotions (38), activate reward networks in the brain (For review see 39), and is theorised to support distancing and emotional reappraisal (40)—key aspects of emotion regulation (41). Thus, we developed our intervention program activities to target these learning goals, as seen in column two of Table 2. The control program, on the other hand, was designed to mirror the activity components but not activate these learning goals.

After designing the initial intervention and matched control programs, we conducted a small-scale qualitative study to establish the credibility, feasibility, and comparability of the intervention and control programs (N = 6, 3/condition). Participants completed a condensed version of one of the programs, which included only one repetition of each activity (see Intervention Description Section). They were asked about feasibility issues, that is,

facilitators and barriers to participation, and the effects of the intervention or skills learned in an in-depth semi-structured interview. After informed consent, online interviews were recorded on Microsoft Teams and automatically transcribed and manually checked. Feasibility issues mentioned by participants were addressed in a revision of the programs, which included adding daily reminders, more explanatory text, and reducing the duration to two weeks instead of the planned three weeks.

The transcripts were coded based on the Braun and Clark six-step method (42) to assess learning outcomes and effects and grouped into themes. Table 1 illustrates the key themes of the intervention and control programs' effects or skills developed, notably revealing that feedback regarding the beauty awareness program centred on appreciating beauty in everyday life, which was previously unnoticed. In contrast, the control program focused on observation skills and recognising beauty in only picturesque locations. From this pilot study, we concluded that the programs were comparable in intensity, credibility, and enjoyment and that the control condition did not enhance the appreciation of beauty in mundane spaces and objects.

Table 1. Comparison of the intervention and control program effects and learning outcomes

Program	Theme	Description
Intervention	Art Seeking and Appreciation	Having a desire to seek out art experiences and appreciate art more deeply and slowly.
	Mood Boost	Improved mood, motivated and inspired positive behaviour and thoughts.
	Noticing Mundane Beauty	Increased awareness and appreciation of everyday objects and locations and looking beyond obvious sources of beauty.
Control	Observation Skills/Mindfulness	Increased attention towards the environment.
	Noticing Beauty only in Beautiful Places	When in a beautiful location, noticing more details in the environment and appreciating them but not noticing more beauty in mundane objects/locations.

Intervention description {11a}

Participants will first visit an art museum (with a free entrance ticket) that they can choose from a pre-selected list of five art museums, with an accompanying audio guide developed as part of the project and instructional video. This guide and video instruct

participants to view artworks slowly and to practice their observation and appreciation skills (often called “slow-looking” in museum studies, (43). From there, participants will journal three beautiful things they have encountered that day. Next, participants will be shown video art demonstrating how to observe beauty in small details (such as lentils boiling in water or waving grass), which they will be instructed to practice on a beauty walk. Following this, participants will be encouraged to take photos or videos of beautiful things they see around them in the photographer's style (zoomed in to almost abstraction). Finally, information about regulating emotions through sensory experiences will be provided with the instruction to practice seeking beauty when stressed or having negative emotions. The information will be a short text about how our sensory experiences, such as appreciating beauty, can help to regulate emotions, summarising the latest research findings on sensory emotion regulation (35). Finally, participants will be instructed to plan to incorporate more beauty into their lives in a self-made list (i.e., museum trips, taking a more beautiful way home, adding plants to a workspace, choosing seats with lovely views, or going for nature walks).

Active control description

The active, matched control group will focus on developing pragmatic observation skills that do not focus on cultivating beauty appreciation. Instead, participants will be instructed to pay attention to and identify objects and elements in their surroundings without emphasizing their aesthetic value. For example, they will be asked to pay attention and count objects of the same colour they encounter, notice social behaviour and the people they pass on the street, or the types of buildings and elements in the city. The program starts with a two-hour tourist trip to their own or a new city. They will receive a video and an audio guide that will guide them in closely observing their environment. Following this, participants will be asked to write a journal about three things they observed that day. Next, they will be shown a video demonstrating how to notice tiny details and improve observation skills, take a wider perspective, and keep track of patterns, following which they can practice on an observation walk.

Table 2. Intervention and control condition program descriptions

Intervention		Control	Time (mins/day)
Goal	Activity Description	Equivalent Activities	
Day 1	Develop Aesthetic Mindset	4-minute priming video showing a landscape painting that focuses on the brushstrokes, composition, and color.	120
	Practice Aes. Mindset and observation skills	Museum visit with audio guide and reflection about visit. Audio guide asking participants to slow-look at 1-3 artworks and reflect on the meaning and beauty.	
Day 2,3,4	Beauty journal about artistic beauty	Written reflection on 3 experiences of beauty that they have encountered that day that is man-made.	5-10
Day 5	Learning to transfer Aes. Mindset to everyday	Art photography videos focusing on slow and aesthetic looking.	20-30
		Beauty Walk	
Day 6,7,8	Beauty journal	Taking photos or videos of natural beauty they passed during the day.	5-10
Day 9	Learning about emotion regulation with beauty	Reading a short text about how beauty can induce positive emotions and with the challenge of reflecting on how beauty has impacted emotions.	5-10
Day 10,11,12,13	Practicing emotion regulation with beauty	Daily reflection on how beauty impacted emotions/stress that day. Challenge to stop, find and appreciate beauty when stressed or upset.	5-10
Last day	Develop beauty seeking behavior	Making a written plan to add beauty to life. Like taking a trip to encounter beauty or adding beauty to the home.	15

Participants will practice documenting observations with their cameras. They will then be given a text about how important being observant is, especially being aware of emotions and be asked to report on their daily experiences and emotions. Here, participants will journal about their day and how daily events impact their feelings. This aims to match the intervention aspect of learning to be more aware of emotions. Finally, participants will be asked to make a written list of things they want to add to their lives to continue to practice their observation skills, like visiting a new city, or changing their routine.

Criteria for discontinuing or modifying allocated interventions {11b}

Allocation groups will not be modified after randomisation.

Strategies to improve adherence to interventions {11c}

Reminders are sent to participants' mobile phones before and during the two-week program. Frequent monitoring of participant progress and adherence will be conducted, and participants not completing the program will be contacted personally by the researcher over email to determine the reason for non-adherence and offer technical support and encouragement if needed.

Relevant concomitant care permitted or prohibited during the trial {11d}

There are no restrictions to either group, except that the control group is asked not to visit museums or shopping malls (as a cover) during the tourist trip.

Provisions for post-trial care {30}

There is no provision for post-trial care.

Outcomes {12}

Primary Outcome

The primary outcome is beauty appreciation, measured with the Engagement with Beauty Scale Revised (EBS-R) (44,45), containing 18-item self-report items designed to assess cognitive and emotional engagement with natural beauty, artistic beauty, moral beauty, and beautiful ideas. Participants respond on a 7-point Likert scale, ranging from 1 (very unlike me) to 7 (very much like me). Example items include reflections on physiological responses to natural beauty, the spiritual experience elicited by art, and the desire for

personal growth through moral beauty appreciation. Subscales measure engagement with moral beauty (scores 6-42) and the other three domains (scores 4-28), contributing to a total score ranging from 18 to 126. The EBS-R has demonstrated strong internal consistency and test-retest reliability (.72 after 4 weeks), while its main strength lies in assessing trait appreciation of beauty without including other aesthetic traits, states, or emotions (32).

Secondary Outcomes

Secondary outcomes include mental well-being and psychological distress. Mental well-being will be measured using the Mental Health Continuum Short Form (MHC-SF) (46). This has 14 items over three subscales: Emotional Well-being, Social Well-being (eudemonic well-being), and Psychological Well-being. The items are scored on a 6-point Likert scale (0-5), then sum-scored.

The Depression, Anxiety, and Stress Scale (DASS-21) (47) will be used to measure psychological distress. The DASS-21 has 21 items divided over three subscales including Depression, Anxiety, and Stress. The items are assessed using a 4-point Likert scale (0-3), summed together, and then multiplied by two. This results in 3 subscales as well as a total score.

Tertiary Outcomes

Furthermore, we included tertiary outcomes, including emotion regulation, beauty awareness, attention regulation, mindfulness skills, and burnout. The Emotion Regulation Strategies for Artistic Creative Activities Scale (ERS-ACA; (48)) will be used with slight modification to the question stem. The 18-item scale was designed to measure what type of emotion regulation strategies creative activities can facilitate by responding to each item in the context of “when I am engaging in [name creative activity] ... I can/feel, it gives/helps/makes me, it boosts/redirects/reaffirms ...” on a 5-point Likert scale from strongly disagree to strongly agree. Items can be summed into avoidance strategies (i.e., I can block out unwanted thoughts or feelings), approach strategies (i.e., it makes me reflect on my emotions), and self-development strategies (i.e., it reaffirms my identity). The stem “When I am appreciating beauty...” is used.

Table 3. Outcomes and Timepoints of Assessment

Assessment tools	Baseline T1	Post T2	Follow-up T3
Demographics and covariates			
Demographics (6 items)	x		
SPSQ-SF (26 items)	x		
Experience with Arts (bespoke; 2 items)	x		
BFI-O (10 items)	x		
Primary outcome			
EBS-R (18 items)	x	x	x
Secondary outcomes			
MHC-SF (14 items)	x	x	x
DASS-21 (21 items)	x	x	x
Tertiary outcomes			
ERS-ACA (18 items)	x	x	x
Beauty Awareness Question (1 item)	x	x	x
FFMQ-15 (15 items)	x	x	x
ACS-12 (12 items)	x	x	x
BAT-12 (12 items)	x	x	x
Interview*			x
Additional questions			
CEQ (6 items)	x		
Adherence and Enjoyment (2 items)		x	
Additional background questions (2 items)			x

Note. SPSQ-26 Sensory Processing Sensitivity, BFI-O Big Five Inventory-Openness, EBS-R Engagement with Beauty Revised, MHC-SF Mental Health Continuum Short Form, DASS-21 Depression, Anxiety, and Stress Scale-21 item, ERS-ACA Emotion Regulation Strategies for Artistic Creative Activities Scale, FFMQ-15 Five Facets Mindfulness Questionnaire Short Form, ACS-12 Attention Control Scale-12 item, BAT-12 Burnout Assessment Tool-12 item, CEQ Credibility and Expectancy Questionnaire. * Interviews will only be conducted in a subsample (n=25) until data saturation.

In addition, based on Diessner et al. (24), beauty awareness is measured by the question, “Compared to two weeks ago, I notice beauty... 1) much less than before, 2) less than before, 3) the same, 4) more than before, 5) a lot more than before”. Attention regulation will be assessed using the 20-item Attention Control Scale (ACS) (49). The questionnaire consists of 2 subscales: 1) Attention Focusing and 2) Attention Shifting. The items are assessed on a four-point Likert scale (1-4), and items will be sum-scored. Mindfulness will be assessed using the Five Facet Mindfulness Questionnaire Short Form (FFMQ-15), with 15 items (50), with five facets: 1) Observing, 2) Describing, 3) Acting with awareness, 4) Non-judging, and 5) Non-reactivity (51). The items are assessed on a five-point Likert scale (1-5) from rarely to always. Scores will be summed for each facet and the total score. Burnout will be measured using the Burnout Assessment Tool–12 (BAT-12), consisting of 12 items (52) (53). This questionnaire measures burnout with four subscales: 1) Exhaustion, 2) Mental Distance, 3) Emotional Impairment, and 4) Cognitive Impairment (53). The items are assessed on a five-point Likert scale (1-5), summed to a total score.

Demographics and Individual Difference

Information about demographics and individual differences will also be collected. This includes age, biological sex (man, female, inter-sex, prefer not to say), gender (man, woman, non-binary/non-conforming, trans-gender, prefer not to say), nationality, and education. High sensitivity will be measured using the English translation of the validated Dutch short version of the newly developed Sensory Processing Sensitivity Questionnaire – Short Form (SPSQ-SF), consisting of 26 items (SPSQ-SF) (13). A total score can be formed in addition to six subscales: 1) Sensory Sensitivity to Subtle Internal and External Stimuli, 2) Sensory Comfort, 3) Social-Affective Sensitivity, 4) Aesthetic Sensitivity, 5) Emotional and Physiological Reactivity, and 6) Sensory Discomfort. The first four subscales load onto a positive SPS dimension, whereas the last two load onto a negative SPS dimension (54). The items are assessed on a seven-point Likert scale (1-7), sum scored together.

Furthermore, two bespoke questions will be asked to evaluate participants’ past experience with arts, including interest and engagement. Including, “How interested are you in art, music, or visiting art/cultural spaces? (1 not at all, 7, very much)”. Second, “In the past year, how often have you engaged with/attended/visited arts venues (including music events, the theatre/dance, concerts, art museums, art festivals, exhibitions, either in-person or online, etc.)? 1) More than once a month, 2) once a month, 3) once every two or three months, 4) three times per year, 5) twice per year, 6) once a year, 7) not in the past year.”

These two questions will then be summed together and treated as a continuous variable. These questions are based on the art interest construct from the widely used Vienna Art Interest and Knowledge scale (55). Finally, openness to experience will be measured with the openness facet of the Big Five Inventory (BFI; 56), which has ten questions. These questions are measured on a 1 to 5 Likert scale (strongly agree to strongly disagree) and will be summed together.

Expectation, Credibility, Adherence, and Enjoyment

To understand how participants' expectations and adherence might impact the results of the trial, several aspects will be assessed. Expectation and credibility will be measured through the Credibility and Expectancy Questionnaire (CEQ), which has six questions about how much participants expect the program to benefit their well-being (57). We have slightly modified this questionnaire from its intended use as a clinical instrument for therapies asking about improvement to functioning by replacing the term "functioning" with "well-being" in the questions.

To measure adherence, as part of the program, each day, participants will also be asked to indicate whether they fully, partially or did not complete the program elements for that day. These questions were introduced in the enrollment meeting with emphasis on the need for honesty that would not impact any compensation. Adherence will also be monitored via the number of sign-ins and their progress in the online programs. Finally, enjoyment of the programs will be asked on a 1-7 Likert scale.

Qualitative Interview

A semi-structured qualitative interview will be conducted with a subset of participants focusing on the effects and learning outcomes of the intervention and control programs, mechanisms, barriers and facilitators. We will follow the Consolidated Criteria for Reporting Qualitative Research (COREQ; (58)).

Analysis

Statistical methods for primary and secondary outcomes {20a}

The main analysis will be conducted in two stages. The first is according to the intention-to-treat (ITT) analysis principle (59), with all participants included where possible. This includes dropouts and non-completers of the programs. Second, we will repeat the

analysis Per-Protocol (PP) (59) to gain a clearer picture of the intervention-related effects, excluding non-completers or poor-quality data (see exclusions below). To evaluate whether there are differences between the conditions at the post-test, considering baseline differences, a series of ANCOVAs with the condition as the IV and the post-test as the DV, with baseline scores, sex, and age as covariates will be run on primary and secondary outcomes. To evaluate the long-term effects of the intervention and the control condition, linear mixed models (LMM) will be fitted to predict each outcome variable. The same approach will be applied to evaluate the tertiary outcomes.

For more details see our pre-registration:

https://osf.io/upx46/?view_only=05578a4028594d15946a5f6d57c4b73e.

Methods for additional analyses (e.g. subgroup analyses) {20b}

To understand the pattern of an individual response, we will calculate the Reliable Change Index (RCI) for pre-post change scores, expecting more individuals in the intervention condition to reliably improve on primary, secondary, and tertiary outcomes than in the control condition (60). Furthermore, factors including adherence, expectancy and credibility, past art experience and personality will be compared between groups. If the groups differ significantly on any scale, we will include that scale as an exploratory covariate.

Finally, we will assess any differential effect of the intervention on highly sensitive individuals in three ways. First, we expect SPS to predict a greater likelihood of improvement in the RCI analyses. Second, moderation analysis will be used to assess whether individuals with higher scores on SPS experience larger increases in primary and secondary outcomes from the intervention. Third, qualitative sub-group analysis will be used to investigate mechanisms, barriers and facilitators for a high SPS subgroup, by comparing their responses to a group of low and moderate SPS individuals.

Methods in analysis to handle protocol non-adherence and any statistical methods to handle missing data {20c}

In ITT analysis, we will only exclude participants who do not have pre- and post-data for the DV in question. We will record reasons for dropout and look at baseline measures between groups to assess the randomness of missing data. If data are found to be random, missing outcome data will be used as the last observation carried forward approach (61). In PP analysis, participants will be excluded if they a) fail two out of three of the attention of the checks (1 per survey), b) signed into the program less than seven times or c) self-

reported not completing more than seven activities, indicating they have done less than half of the program (for more details see the pre-registration).

Thematic Analysis

The qualitative data will be analysed using thematic analysis within the qualitative software package Atlas.ti (version 24.1.1), employing a constant comparison method and adhering to the framework of Braun and Clarke (42), utilising open coding (62). Two researchers will code the transcripts (a PhD candidate and an MSc level researcher). The first five transcripts will be independently coded by both coders and subsequently compared, while the remaining transcripts will be coded by one researcher and checked by the other. Mapping the codes involves examining the transcript, coding, grouping codes into themes and subthemes, and identifying the core concept through axial and selective coding (62) (63), moving back and forth between the codes and the original data (63). The coders will meet regularly to discuss the codes and emerging patterns, as well as to assess when data saturation has been achieved.

Interim analyses {21b}

No Interim analyses will be done.

Plans to give access to the full protocol, participant level-data and statistical code {31c}

Pre-registration: https://osf.io/upx46/?view_only=05578a4028594d15946a5f6d57c4b73e.

Data Management and Monitoring

Plans for assessment and collection of outcomes {18a}

Data will be collected using an electronic data capture system called Castor. Surveys are sent by email to participants within the Castor platform.

Plans to promote participant retention and complete follow-up {18b}

Participants are informed of their right to leave the study at any time without consequences to themselves. Reasons for withdrawals and timing will be documented. To promote participant retention, we will send reminders to those who stop having poor adherence and ask all withdrawn participants to complete the post and follow-up tests where possible. Participants who withdraw are not replaced if they have completed the pre-survey.

Data management {19}

The research team will frequently monitor the completion of survey data for completeness and send reminders to participants to amend incomplete data. The interview will be audio recorded, automatically transcribed using Microsoft Teams, and manually edited to remove identifying information. Transcripts will be sent to participants for approval (member checks). The audio file will be destroyed after the transcription has been approved.

Confidentiality {27}

This study will be conducted according to the Declaration of Helsinki version 2013 principles and following the Good Clinical Practice (GCP) guidelines promulgated by the International Conference on Harmonization (ICH). The handling of personal data will comply with the General Data Protection Regulation 2018 (GDPR), in Dutch, the 'Algemene verordening gegevensbescherming' (AVG).

The researcher will give each participant a unique identification code. Participant contact details and linking identification codes will be saved in a password-protected file and stored separately from the data. The data will be stored following RadboudUMC protocols. The analysis, when necessary for data protection, will be conducted in a secure Digital Research Environment (DRE). Data will not be published; however, further researchers can request access after signing a data-access agreement. The principal investigator will destroy documents containing personal information, such as consent forms or non-anonymized data, after 15 years.

Composition of the coordinating centre and trial steering committee {5d}

The coordinating centre comprises the principal investigator, the lead researcher, and other personnel. The principal investigator oversees the scope of the experiment, while the lead researcher manages the daily operations and research team, including recruitment, enrollment, data collection, monitoring, analysis and reporting. Weekly meetings occur between the lead researcher and the research personnel and bi-weekly meetings are held between the entire team to track progress. Emergency meetings are convened as necessary. There is no involvement from a steering committee or stakeholders.

Composition of the data monitoring committee, its role and reporting structure {21a}

There is no monitoring committee; the research team conducts the monitoring.

Adverse event reporting and harms {22}

No adverse events or harms are expected from this study.

Frequency and plans for auditing trial conduct {23}

There are no plans for conducting an audit. However, an audit can be conducted randomly as part of RadboudUMC protocols.

Plans for communicating important protocol amendments to relevant parties (e.g. trial participants, ethical committees) {25}

Major amendments will be submitted to the ethical committee.

Dissemination plans {31a}

The study results will be published in academic journals, at scientific conferences, and in reports and social media posts for lay audiences and stakeholders.

Discussion

In order to reduce the high levels of poor mental health among young adults generally, and especially those who are highly sensitive who are at increased risk, this study aims to determine whether an art-based intervention can enhance beauty appreciation and, consequently, improve mental well-being while alleviating psychological distress. This addresses the need for enjoyable, non-pharmacological interventions that leverage leisure to support health and well-being (64).

Previous research has predominantly examined the relationship between beauty appreciation—also known as aesthetic sensitivity—and mental and physical health outcomes through cross-sectional studies (15–19), often implying causality without experimental validation. Several studies have evaluated interventions aimed at increasing beauty appreciation skills; however, earlier intervention studies have lacked active control conditions that isolate the specific effects of enhancing beauty appreciation from other aspects, such as heightened general observation skills or attention regulation skills. Therefore, despite the considerable potential, it remains unclear whether increasing beauty appreciation in young adults is a suitable candidate for developing a large-scale intervention that could be implemented in universities or schools. This is also particularly relevant for highly sensitive young adults, for whom interventions are limited, and there have been calls to gain a deeper understanding of methods that can support those with high Sensory

Processing Sensitivity (SPS).

Overall, this study possesses several strengths. First, we developed the intervention alongside a rigorously designed active control condition, validated through a qualitative pilot study. This enabled us to address feasibility issues and confirm that the control condition primarily enhances observation skills rather than beauty appreciation. Methodologically, this high-quality control condition supports blinding measures and minimises expectancy effects by ensuring a credible and engaging condition. This also supported reducing participant self-selection effects and minimising expectancy or placebo effects, as we were able to promote the study as a general observation intervention, where neither beauty appreciation, the arts, nor museums were mentioned.

Beyond these aspects, the mixed-method design facilitates a more comprehensive assessment of outcomes and underlying mechanisms, providing deeper insights into the intervention's effectiveness and mechanisms and allowing for a more nuanced understanding of how highly sensitive individuals might experience the intervention program and its effects. Finally, by implementing the study in a real-world setting, we enhance the ecological validity of the findings, offering a clearer understanding of how the intervention may function outside a controlled trial environment. This approach strengthens the study's potential for practical application and broader impact, aligning with the lifestyle or community-based intervention strategy that seeks to utilise behaviours and leisure activities to support health and well-being in addition to, or at times in place of, more clinical interventions.

Trial status

Recruitment started in November 2024 and will continue until June 2025.

Abbreviations

SPS	Sensory processing sensitivity
RCT	Randomised controlled trial
ABBA	Arts-based beauty appreciation
D	Design factor
EBS-R	Engagement with Beauty Scale Revised
MHC-SF	Mental Health Continuum Short Form
DASS-21	Depression, Anxiety, and Stress Scale- 21 item

ERS-ACA	Emotion Regulation Strategies for Artistic Creative Activities Scale
ACS	Attention Control Scale
FFMQ-15	Five Facets Mindfulness Questionnaire Short Form
BAT-12	Burnout Assessment Tool-12 item
SPSQ-SF	Sensory Processing Sensitivity Questionnaire - Short Form
BFI-O	Big Five Inventory-Openness
CEQ	Credibility and Expectancy Questionnaire
ITT	Intention-to-treat
PP	Per-Protocol
LMM	Linear mixed models
COREQ	Consolidated Criteria for Reporting Qualitative Research
RCI	Reliable Change Index
GCP	Good Clinical Practice
ICH	International Conference on Harmonization
GDPR	General Data Protection Regulation
AVG	Algemene verordening gegevensbescherming
DRE	Digital Research Environment

Declarations

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Authors' contributions {31b}

MT and CG conceived the study, and MT led the proposal and protocol development. MT

and AI prepared the intervention materials. MT, BS, ES, MW, and AI contributed to the study design, and all authors approved the final manuscript.

Funding {4}

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Availability of data and materials {29}

Data will be available upon request and data agreement with the RadboudUMC from the corresponding author.

Ethics approval and consent to participate {24}

This study was approved by the Ethics Review Board (FMG-UvA), University of Amsterdam, the Netherlands (FMG-9934) and considered non-WMO by the CCMO at RadboudUMC, meaning it is regarded as non-medical research and approved to proceed. Informed consent will be acquired from all participants at screening, enrollment and before the optional interview.

Consent for publication {32}

A model consent sheet will be available upon request from the corresponding author.

Competing interests {28}

None.

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Additional Research Contributions

Over the past years, several projects have run parallel to those I have spearheaded. These projects have often supported my main research direction and, at times, have provided interesting counterpoints or extensions. Despite my diverse contributions—most often to conceptualisation, design/methodology, literature search/screening, data extraction/synthesis, or writing—I have chosen not to include these published or pre-printed papers in full, as doing so would result in a document too broad in scope and length. However, in addition to my first-author chapters, I summarise and provide each abstract and full-text link below. In the discussion that follows, I highlight and integrate them when appropriate. By doing this, my thesis is enriched, showcasing the breadth of work that occupied my thoughts and hours and illustrating my contributions to the field.

I collaborated to explore further how engagement with art can enhance well-being or be used for societal good. This collection of work showed that viewing a public, pedestrian-level art exhibition increased visitors' sense of neighbourhood connectedness and well-being, especially when participants resonated with the emotions intended by the artist (Kühnapfel et al., in press). We also demonstrated that experiencing visual art alongside music can amplify aesthetic enjoyment and improve mood, particularly when the music is perceived as congruent with the artwork (Fekete et al., 2023). However, in another study, we tracked participants for two weeks around a museum visit using daily diary methods. We found that an art exhibition about refugees and bodily harm can elicit short-term increases in empathy and prosocial thoughts, along with decreases in well-being. However, most effects faded quickly, highlighting the need for more nuanced methods to measure art's lasting impact (Pelowski et al., 2024).

In two scoping reviews, I collaborated to extend my research topic into medical education and urban environments. First, we investigated how the arts are integrated into health and medical education, identifying their role in promoting empathy, communication, and self-awareness while calling for stronger connections between arts education and evidence-based health outcomes (Howlin et al., submitted). Additionally, in a review of urban aesthetics, we examined how the design of built environments contributes to well-being, revealing a need for clearer concepts and measures in environmental psychology (Chana et al., under review) and concluding that aesthetics can offer a fruitful area of

study and application for addressing the well-being of city dwellers. Overall, these two areas hold potential for further development for the Arts and Health field.

Furthermore, across three papers, we addressed what contextual (genuineness), interpersonal (genetics), and stimulus factors (painting content) contribute to aesthetic experience. As one of my first experiences in research, I worked with a team to conduct a meta-analysis on whether genuine artworks provide stronger experiences than reproductions, finding that the so-called “genuineness effect” is more complex and context-dependent than previously assumed (Specker et al., 2023), as overall there were no differences. Using twin data, we explored genetic and environmental contributions to aesthetic preferences, demonstrating that individual differences in aesthetic evaluations are partly heritable (Bignardi et al., 2024). Lastly, by examining how the content of paintings matters to preference, we investigated how social elements in artwork—such as people, touch, and setting—affect viewers’ preferences, revealing that viewers prefer scenes without people, especially in outdoor settings. However, individual traits modulate these effects (Hur et al., 2025). Together, these studies contribute to a richer understanding of how art affects us and where and when it might matter for our well-being.

Finally, I shifted towards sensitivity, driven by my interest in why aesthetic sensitivity relates to well-being. In a review and theoretical paper, we summarised the last five years of research on the personality trait of sensory processing sensitivity, providing mechanistic explanations, an update of the latest evidence, and a critical commentary on past and future studies (Greven et al., in revision) finding that the individuals who are highly sensitivity, but also highly aesthetically sensitivity, seem to be better off in well-being and mental health than those with lower levels of aesthetic sensitivity. This particularly offered a solid foundation for Chapter Five and for the work of future research.

Below, I have included the reference, abstract, and a link to the full text for interested readers listed in order of mention.

Additional Research

Kühnapfel, C., **Trupp, M. D.**, Pelowski, M. & Fingerhut, J. (In Press). On the Impact of Public Art: Engaging a Pedestrian-level Exhibition Improves Neighbourhood Connectedness and Well-being. *Wellbeing, Space and Society*. Pre-print: <https://doi.org/10.31234/osf.io/h6m4a>

Abstract: Interest is emerging in how art can enhance well-being and positively impact mental health. One aspect concerning a more wide-ranging view of the potential well-being impacts of art is the idea that engaging art can make us feel more connected to our neighborhood or surroundings and give us a sense of community. Although this has long been a goal for artists and cultural activities, especially in urban areas, it has not been studied experimentally. To fill this gap, we assessed whether a free sidewalk-level exhibition on neighborhood appreciation altered visitors' connection to and satisfaction with their neighborhood, as well as their overall well-being. Using a pre-registered pre-post design, we asked passers-by to engage with the exhibition and assessed their attitudes and well-being before and after the experience. We also considered participants' cognitive-affective experiences and their agreement with the intended emotions of the artist and curator as factors predicting changes. Results showed that after engaging the exhibition, participants (N = 64) felt significantly more connected to the neighborhood and had improved well-being. These changes were higher when participants felt the emotions intended by the artist. Additionally, feeling expansive emotional states and reporting higher cognitive appraisal in terms of meaningfulness and understanding of the art related to improved neighborhood connectedness. Our findings provide the first empirical evidence that art can serve as a community-connecting node and highlight the role of the artist's intention, felt emotions, and cognitive appraisals in the impact of neighborhood galleries. This research could inform future exhibitions and interventions.

Fekete, A., Specker, E., Mikuni, J., **Trupp, M. D.**, Leder, H. (2023). When the Painting Meets its Musical Inspiration: The Impact of Multimodal Art Experience on Aesthetic Enjoyment and Subjective Wellbeing in the Museum. *Psychology of Aesthetics, Creativity, and the Arts*. <https://psycnet.apa.org/doi/10.1037/aca0000641>

Abstract: It is assumed that multimodal experiences of art (e.g., listening to music while viewing a painting) can improve aesthetic experience as the two modalities can complement each other. In the current museum study, we tested whether the multimodal experience of works of art—where the artwork is inspired by the musical piece—can enhance aesthetic experience, leading to better well-being benefits. For this, we used a mixed design to compare people who viewed Klimt’s *Beethoven Frieze* painting in the Secession Museum (Vienna, Austria) either on its own ($n = 111$) or while listening to its musical inspiration ($n = 129$), excerpts of Beethoven’s *Ninth Symphony*. For all visitors, a short museum visit ($M = 14.3$, $SD = 6.6$ min) reduced anxiety, stress, and negative mood, as well as improved positive mood. Furthermore, this effect was larger for those who also heard the music and perceived it as pleasant and congruent with the artwork. Additionally, these two factors slightly enhanced aesthetic experience and made people less distracted by the other things, and resulted in longer viewing times. Finally, those who knew more about art, who were more interested in art, or more aesthetically responsive enjoyed the art more, understood it better, and their mood improved more in the museum. Overall, our results highlight the role of subjective experience and indicate that qualitatively better art experiences lead to higher well-being gains.

Pelowski, M., Cotter, K. N., Specker, E., Fingerhut, J., **Trupp, M. D.**, & Speidel, K. (2024). How lasting is the impact of art?: An exploratory study of the incidence and duration of art exhibition-induced prosocial attitude change using a two-week daily diary method. *Psychology of Aesthetics, Creativity, and the Arts*. Online first. <https://doi.org/10.1037/aca0000670>

Abstract: The use of art exhibitions to mediate people’s attitudes toward societal challenges—climate change, refugees; general prosocialness—is an emerging

interest for institutions, artists, policy, and, recently, for empirical study. However, there is still much need for data regarding whether, and in which ways, we might detect attitude change. Even more, important questions concern whether typical designs—pre–post or even post-only assessments of attitude batteries—can reliably detect subtle impacts on thoughts or behaviors. Further, how long might effects last—a question almost completely unconsidered in empirical research. In this exploratory article, we assess an exhibition focused on empathy and acceptance for refugees, employing both a pre–post design (Study 1) and a daily diary/ecological momentary assessment approach (Study 2), which tracked participants' reports over 2 weeks regarding how they felt or acted each day, using multilevel modeling to assess changes from a weeklong baseline. The pre–post paradigm detected some reduction in self-assessed xenophobia and increased negative mood. However—matching past findings—effects were small and inconsistent, but also with intriguing suggestions that participants tended to reduce their estimations of their own hypothetical empathic and prosocial abilities, post-visit. The daily diary detected—inversely—increased empathic concern and prosocial thoughts following the visit but which mostly returned to baseline by the next day. “Trying to consider others' feelings” and “reflecting about oneself” did show increases into the following week, providing some basis for a more extended impact. Although exploratory, by presenting a review of the field and new method, this article aims to provide an intriguing basis for future, hypothesis-driven research.

Howlin, C., **Trupp, M.D.**, Sin, J., Chatterjee, H., Dhital, R. (Submitted). Creative health in medical education: A scoping review and evidence map. Pre-print: https://doi.org/10.31234/osf.io/ac97t_v1

Abstract: Introduction: Creative Health can be described as creative approaches and community-based activities which have benefits for health and wellbeing. Health professionals are seeking specific evidence-based education to equip them with the knowledge needed to advise, and recommend community-based programmes and creative arts therapies. The current review seeks to understand ‘What is known about how visual arts, performing arts, and creative writing are embedded in health and medical

education?'. Given that Creative Health is a general term that can be applied to a vast array of activities the current scoping review focuses on visual and performing arts, to facilitate more specific discussions.

Methods: A systematic search across six different databases [CINAHL, ERIC, Medline, AMED, Proquest Dissertations, and Web of Science] identified 6090 papers. The core search terms were 1. Visual arts; performance arts and creative writing 2. Tertiary education and 3. Descriptive statistics were used to quantify the characteristics learning activities. Thematic analysis was used to identify the intended learning outcomes from visual arts, performing arts, and creative writing in health professional education.

Results: Of the 6417 articles originally identified, 284 studies were included in the analysis from 34 different countries. Nursing was the most represented profession, followed closely by medicine. An extremely wide range of art practices were identified including graffiti, sculpture, clowning, cinematic arts, music, creative writing, poetry, dance, photo, and art viewing. The review characterises how visual arts, performing arts, and creative writing are currently being used, including the group size, setting, engagement style, and collaboration with creative practitioners. Surprisingly, only 10% of studies identified educated professionals on the evidence base underpinning creative interventions and therapies, and no mention of social prescribing was identified. Finally this review highlights that professional development (promoting empathy, communication, preparedness for practice, negative attitudes), clinical practice (critical thinking, specialist knowledge, clinical skills), and personal development (self-awareness, wellbeing) are the intended learning outcomes from visual arts, performing arts, and creative writing in health professional education.

Discussion: This review highlights the need for more educational provision in relation to patient-focused outcomes, in community arts, creative arts therapies, and social prescribing. Future curricula could engage arts practitioners and cultural spaces more directly to support experiential learning approaches and evaluate creative techniques to identify if they can enhance student learning. Together these findings will equip medical educators and creative practitioners to join forces to develop engaging opportunities for authentic creativity, that are matched to specific learning outcomes mandated by professional registration bodies.

Chana, K., Dehove, M., Mikuni, J., Specker, E., Knoll, A. L., Barrière, T., **Trupp, M.D.**, Pelowski, M., Leder, H. (Under Review). Aesthetics elements of urban environments and impacts on wellbeing: A scoping review. Pre-print: <https://doi.org/10.31219/osf.io/nxvtq>

Abstract: Urban human-made environments present a range of potential benefits for wellbeing through their design. However, there is a lack of comprehensive organization on this topic. To this end, we performed a scoping review to provide an overview of how the urban environment, particularly its designed components, has been previously studied in relation to aesthetics and wellbeing. A total of 255 articles related to urban aesthetics were identified, of which 122 were also related to wellbeing. The results showed the frequency (most and least studied) and the diversity in the man-made components, aesthetic and wellbeing dimensions studied in relation to the urban environment within two decades. Our review highlights the need for consensus in terminology regarding the distinction between aesthetics and wellbeing concepts, and which terms/measures ought to be implemented more in environmental psychology research. All in all, we provide the basis for (1) researchers from various fields, who can use our findings to plan future studies, and (2) urban planners and designers alike, who can use our review to assess the aesthetic and wellbeing potential of urban elements for their designs; so that they can make our cities more aesthetically pleasing, better for wellbeing, and, fundamentally, better places to live.

Specker, E., Fekete, A., **Trupp, M. D.**, & Leder, H. (2023). Is a “real” artwork better than a reproduction? A meta-analysis of the genuineness effect. *Psychology of Aesthetics, Creativity, and the Arts*. Advanced online publication. <https://doi.org/10.1037/aca0000399>

Abstract: In general, people assume that looking at a real artwork—versus a reproduction—provides an experience that is qualitatively heightened, also called the *genuineness effect*. In this study, we used meta-analysis to assess the current evidence for the genuineness effect. We found a meta-analytic effect of Hedges’s $g = .32$

(N = 11). However, only three studies did not include a context confound (i.e., real artworks in a museum vs. reproductions in the lab), and when this moderator was considered, the effect seemed to disappear. Furthermore, we found a lot of heterogeneity between studies. Thus, we looked at additional moderators: type of genuine artwork, type (and quality) of reproductions, aesthetic experience measure, and number of artworks included. We found that only the type of reproduction and the number of artworks were significant moderators of the effect. In addition, we found the best model fit for a random-effects model including confound, reproduction type, and number of artworks as moderators (Akaike information criterion [AIC] = 36.96, Bayesian information criterion [BIC] = 48.93, $R^2 = 61.91$). Nonetheless, even this model had significant residual heterogeneity. The findings suggest that it is too early to conclude that there is no genuineness effect, and we provide one theoretical explanation (the facsimile accommodation hypothesis) and two methodological explanations (a potential anchoring effect and using the wrong experience measures) that could explain why our meta-analysis (after considering the context confound) found no effect. Additionally, based on the included moderators, we discuss methodological concerns for future studies on the genuineness effect and for empirical research on art in general.

Bignardi, G., Smit, D., Vessel, A., **Trupp, M. D.**, Ticini, L. F., Fisher, S. E., Polderman, T.J.C. (2024). Shared and distinct genetic sources of variability in visual aesthetic value. *Communications Biology*, 7(55). <https://doi.org/10.1038/s42003-023-05710-4>

Abstract: The aesthetic values that individuals place on visual images are formed and shaped over a lifetime. However, whether the formation of visual aesthetic value is solely influenced by environmental exposure is still a matter of debate. Here, we considered differences in aesthetic value emerging across three visual domains: abstract images, scenes, and faces. We examined variability in two major dimensions of ordinary aesthetic experiences: taste-typicality and evaluation-bias. We build on two samples from the Australian Twin Registry where 1547 and 1231 monozygotic and dizygotic twins originally rated visual images belonging to the three domains. Genetic influences explained 26% to

41% of the variance in taste-typicality and evaluation-bias. Multivariate analyses showed that genetic effects were partially shared across visual domains. Results indicate that the heritability of major dimensions of aesthetic evaluations is comparable to that of other complex social traits, albeit lower than for other complex cognitive traits. The exception was taste-typicality for abstract images, for which we found only shared and unique environmental influences. Our study reveals that diverse sources of genetic and environmental variation influence the formation of aesthetic value across distinct visual domains and provides improved metrics to assess inter-individual differences in aesthetic value.

Hur, Y., Abad-Hernando, S., Joly-Mascheroni, R., **Trupp, M.D.**, Calvo-Merino, B. (2025). The preference for social content in painting: The roles of people, interpersonal touch, and indoor/outdoor setting. <https://doi.org/10.1177/02762374251320823>

Abstract: While art, nature, and social interactions are key elements of a healthy culture and lifestyle, how nature and social factors in paintings impact the viewer experience still remains unclear. This study aimed to explore how the number of depicted people, the presence of interpersonal touch, and the setting (indoor vs. outdoor) affect art preference. A total of 420 paintings were rated (online survey) on their liking across 300 participants. Across participants, paintings without people were significantly liked over paintings with people, which was especially prominent in depictions of outdoor settings. Furthermore, while people liked paintings without touch, this was only the case for paintings of outdoor depictions. The study also explored how these preferences were modulated by individual differences. The findings underscore the relevance and importance of social aspects in art and how this interacts with the viewer's individuality.

Greven, C., **Trupp, M.D.**, Homberg, J., Slagter, H. (In Revision, Invited at *Trends in Cognitive Sciences*). Sensory processing sensitivity; Theory, evidence, and challenges. Pre-print: <https://doi.org/10.31234/osf.io/wkdhg>

Abstract: In recent years, scientific interest in sensory processing sensitivity (SPS), a personality trait that captures inter-individual differences in the processing, perception and response to both negative and positive stimuli, has grown exponentially. This review summarises the recent literature on SPS to discuss a number of central themes, including its assessment, relation to other personality traits, effects on cognition and mental health, and its (neuro)biological basis. We also identify existing knowledge gaps and capitalise on a general theory of brain function, predictive processing, to provide a novel mechanistic account of SPS. This account offers a unified explanation for the phenotypic consequences of enhanced sensory sensitivity and can serve as a guide for future research.

Chapter Summaries

Across Five first author chapters, this thesis investigated the impact of viewing and appreciating art and beauty on well-being outcomes while exploring the underlying mechanisms and circumstances surrounding such effects. To do so, in **Chapter One**, I first evaluated the current evidence base throughout the literature, finding that diverse art-viewing activities have been assessed for having well-being impacts across many museums, hospitals, online, and laboratory settings, with varying methodological rigour and mixed results. Furthermore, I collated previously identified mechanisms and produced a taxonomy to support hypothesis generation and intervention design, finding that mechanisms may be context-dependent and are not specific to art viewing but are general processes that are involved in many types of activities.

In parallel, across several empirical studies, I considered the impact of the smallest unit of engagement—viewing a single artwork—while also identifying factors that may contribute to well-being improvements. In **Chapter Two**, I investigated how brief online art viewing might support well-being. I found acute improvements in hedonic well-being, stress states (negative mood and state anxiety), overall subjective well-being, and loneliness. However, the changes were not greater in an art condition compared to a ‘non-art’ control. I also found that individuals who reported ‘better’ art experiences—seeing more beauty, finding more meaning, wishing to visit again, finding the art good, or having higher levels of positive emotions—had more extensive improvements in mood and anxiety. Digger deeper, in addition to replicating the effects of online art viewing, **Chapter Three** explored who benefits more from art viewing by testing a pre-registered theory that trait aesthetic responsiveness would cause more intensely meaningful and pleasurable art experiences, which lead to larger well-being effects. I found that beyond general reward sensitivity, the predisposition of being aesthetically responsive predicted changes in well-being from art viewing and that states of pleasure and meaningfulness during the art viewing session did mediate this relationship.

In **Chapter Four**, I shifted towards applied science, informed by the prior chapters. I attempted to moderate the art-viewing experience and, thus, the resulting well-being outcomes. This included examining whether gallery-based augmentation strategies, such as teaching slow-aesthetic looking—a theory-backed viewing strategy that promotes detailed attention to stylistic features—or providing a mindful breathing exercise before

viewing might amplify well-being outcomes by improving states such as pleasure or meaningfulness and generally the art session. These two augmented conditions were compared to a regular gallery visit or a pre-viewing filler task condition. This chapter revealed that although all groups in the museum and the laboratory follow-up experienced pre- to post-well-being improvements, neither pre-viewing video intervention had an effect. In line with the broader research landscape, these null results and the participants' qualitative descriptions of the didactic aesthetic-looking video led to the conclusion that pre-viewing instructions may not be a fruitful line of inquiry for well-being outcomes but perhaps could be suitable for other outcomes, such as learning.

Finally, I turned away from the sole impact of one artwork and towards the possibility of well-being effects from more embedded everyday art and beauty appreciation. In **Chapter Five**, I developed a novel 14-day intervention to teach beauty appreciation through art viewing as a skill to support emotion regulation. I conducted a small validation/feasibility study on the initial intervention and control condition programs to be used in a clinical trial, which is ongoing at the time of thesis submission. This last chapter integrated insights across the preceding studies theoretically and methodologically, culminating in a protocol for a randomised controlled trial that isolates beauty appreciation skill development from basic observation skills while also controlling for confounding effects. Furthermore, I outlined a plan to evaluate highly sensitive individuals who are theoretically more likely to benefit from beauty appreciation due to their increased aesthetic sensitivity (similar to aesthetic responsiveness) and plan to assess possible mechanisms of the intervention, control, and any moderating effects of sensitivity through mixed methods.

General Discussion

As an impetus for this thesis, I presented several outstanding questions in the introduction that addressed the theoretical and empirical evidence base, as well as applied topics such as intervention or art experience design. These included mainly (1) whether art viewing, as one type of receptive art engagement, can impact well-being, (2) under what circumstances or through which types of intervention designs, and (3) via what mechanisms such effects can occur. Below, I contextualise my results from the preceding chapters and additional co-authored research that provide answers to such questions. I conclude by discussing limitations and offering suggestions for future research. Ultimately, I close with an overview of the strengths and significance of the work.

Does art viewing impact well-being? — Consistent but not conclusive evidence

In response to the primary question of whether art viewing affects well-being, overall, there is growing data that art viewing activities can improve well-being outcomes. However, not all evidence is conclusive or free of confounding effects, casting reasonable doubt on what the actual well-being impacts of looking at a painting during a short break or visiting a museum might be.

Via primary empirical research, I found consistently, across five independent studies, that one artwork or exhibition across online, museum, or community settings revealed consistent pre- to post-effects on well-being (Chapter Two and Four; Fekete et al., 2023; Kühnapfel et al., 2025). Results showed that brief art viewing reduces negative mood and anxiety (Chapter Two and Three; Fekete et al., 2023; Kühnapfel et al., 2025), with some effects on overall well-being, loneliness (Chapter Two), community connectedness (Kühnapfel et al., 2025), and positive mood (Chapter Four), although at similar levels to a culturally focused control (Chapter Two). In most cases, we found that short-duration visits, lasting 15 minutes or less, positively impacted well-being. At the same time, in another study that explored the lasting effects of art viewing (Pelowski et al., 2023), we documented that art exposure can also temporarily lower mood and life satisfaction while boosting self-awareness and empathy, especially in exhibitions addressing challenging social issues like migration or bodily harm. This adverse effect

critically indicates that not all art equally benefits well-being and that differential impacts of the art experience need more research.

Reflecting on the motivations for this thesis—to further elucidate the associations found in epidemiological literature—this body of work corroborates the relationships between receptive art engagement and well-being outcomes observed in large-scale cross-sectional studies (Bone et al., 2023; Manolika et al., 2024; Noguchi & Shang, 2023; Tymoszuk et al., 2020). This particularly relates to the dosage effects presented in Bone et al. (2023), where daily receptive engagement was preferable to weekly, which was better than monthly, as seen in adolescents and concerning flourishing levels (Bone et al., 2023). My research supports these findings in several ways. First, we show that even short bouts of receptive art engagement have been documented to impact well-being outcomes positively (Chapter Two to Four; Fekete et al., 2023; Kühnapfel et al., 2025; Trupp et al., 2023), suggesting that each experience does not need to be extended or burdensome. Second, we also found that the effects of engagement with art are also fleeting. For example, Pelowski et al. (2024) found that adverse effects on mood and life satisfaction returned to baseline after 24 hours. In an unpublished ongoing study (not included), I found similar returns to baseline of positive changes in mood and anxiety levels after initial museum visit-related improvements (Trupp et al., In Prep). Finally, the most convincing evidence from Chapter One, effects above and beyond control conditions, was from repeated art viewing (Cotter et al., 2022; Totterdell & Poerio, 2021). Taken together, these results strengthen the idea that this research area may still hold promise and that receptive art engagement might be effective when practised briefly, frequently, and repeatedly, be it as part of one's hobbies or as a community-based behavioural intervention.

Alongside this positive outlook, I also developed a sceptical view of the quality of the evidence base. First, in Chapter One, when looking at the evidence across well-being outcomes, it became clear that there is minimal positive evidence for outcomes such as pain management or life satisfaction. In contrast, for stress, anxiety and hedonic mood-related outcomes, the evidence was mixed. Second, I presented specific insight into the art-viewing-related methods and data that had not previously been systematically assessed. In doing so, the need for rigorously considering art-viewing activities became

apparent, as it turned out that many of the previously published studies were underpowered proof-of-concept or pilot studies. This implies that the methods employed to establish an evidence base still require development—a conclusion that aligns with other criticisms of the Arts and Health sector (Clift et al., 2021; Skov & Nadal, 2025).

The most prominent need I identified throughout the systematic review was increased use of randomised controlled trials. For instance, while examining control conditions as a quality marker in Chapter One, I found that less than half of past research included a control condition and even less a well-designed control. An example of a suboptimal comparison condition is the “non-art” cultural comparison, included in one of my own chapters (Chapter Two). Notwithstanding having selected a non-art condition as a control, three-quarters of the participants believed what they were observing was art. Without such considerations and inclusions of good control conditions, the risk of confounding effects from non-intervention-related causes such as maturation (time passing), testing effects (effects of survey questions), or regression to the mean (improvement regardless of intervention) is not controlled for. Learning from this, the final chapter of this thesis propels the field forward thanks to the design of an active control condition for a clinical trial, which I have developed during my mobility fellowship at Radboud University Medical Centre. This active control condition focuses on mirroring the intervention condition in intensity, schedule, and plausibility while isolating the key factor of interest. I believe the outcome will yield a highly effective design to tackle the question of whether embedding beauty appreciation in everyday life improves well-being or supports mental health.

In conclusion, while increasing evidence collated in Chapter One and presented across Chapters Two through Four suggests that repeated art viewing activities and one painting engagement may enhance well-being, especially eudemonic well-being, the presence of inconclusive data, missing control conditions, and uncontrolled confounding factors does not allow for firm conclusions as of yet. However, due to the work I have presented here, we, as a field, are closer to understanding what such effects may be, what research has been done, and can ultimately continue solidifying the evidence base.

Under what circumstances? — Diverse activities, but unknown contributions of context and accessory engagements

Before this thesis, little was known about what types of art experiences could enhance a visitor's or viewer's well-being. Here, I have revealed that the activities are much more diverse than previously considered and that there is a need for systematic contemplation of the holistic experience beyond the art-person interaction.

Aside from being one of the first research teams to explore the well-being outcomes of the novel setting of online art viewing, as spurred on by the COVID-19 pandemic, Chapter One showed that very diverse art-viewing activities are being researched concerning well-being and health. For instance, art viewing has been studied across diverse settings—hospitals (for patients and staff), homes (via digital platforms for seniors and the general public), museums (through group or individual visits), and research labs. In terms of what type of art has been utilised, while earlier work emphasised more classic nature or representational art (Ulrich, 2001), more recent studies have embraced contemporary art to promote cognitive engagement (Goulding, 2012; Karnik et al., 2014; Klingemann et al., 2018; Newman et al., 2014), to target specific outcomes such as community connectedness (Kühnapfel et al., 2025) or to promote reflection and empathy (Pelowski et al., 2023). Furthermore, a wide range of supplementary elements or activities can run alongside the act of viewing—reflective, educational, social, and sensory activities, and can be the impetus for a range of mechanistic pathways.

Overall, this highlights the importance of considering context more inclusively. For instance, within the framework of Empirical Aesthetics, past theoretical ideas, including my own at the beginning of this PhD, primarily focused on the 'aesthetic experience' or the art-person interaction, examining what type of artwork is viewed (Hur et al., 2024), under what cognitive constraints (Cupchik et al., 2009; Gartus et al., 2015), and how the museum context or authenticity might lead to more or less intense or pleasant experiences (Specker et al., 2023). These concepts, and the models of art perception (Chatterjee & Vartanian, 2016; Leder et al., 2004; Pelowski et al., 2017), understandably influenced how we, as a field, began to address the question of how art viewing or other diverse aesthetic experiences affect viewers' well-being or health. However, although

necessary, this line of thought has not yet addressed the added benefits of more everyday-like aspects of art viewing sessions, such as the exercise older adults may gain from wandering a gallery or the social bonding that friends might experience when visiting a museum together. Even as examples, these two ignored effects could help explain the impact of the arts on well-being and should be considered valued components rather than confounders.

In contrast, other fields of study have taken a different approach that falls within epidemiology, complexity science, or the health sciences, for example, by considering exercise or social interaction during the exploration of a museum as potential "active ingredients" (Warran et al., 2022) and how they can inform intervention design. The term "active ingredients" comes from pharmaceutical science and denotes the component of a drug or activity that initiates these processes behind the mechanism of action, which instead refers to the process that affects change. For example, ibuprofen is a widely used active ingredient in over-the-counter pain relievers. Upon ingestion, it stimulates a reduction in the hormones responsible for inflammation and pain perception (Vane & Botting, 1997). In behavioural activities, the complexity, components, and intensity of the activity, such as its structure, setting, and frequency, play a role in what mechanisms are triggered, and ultimately in how long-lasting or what type of well-being or health changes one might experience.

Along these lines, a growing subfield in the literature examines various aspects of intervention design. These have often contrasted different components or styles of art viewing sessions to determine what components contribute to well-being, at times informed by theoretical understandings or empirical research of what makes art experiences more pleasant. For instance, in Chapter Four, I evaluated how two pre-viewing videos would support well-being benefits compared to a standard gallery visit or filler task. Specifically, I concentrated on providing guided viewing instructions and a mindfulness breathing video, two previously proposed pre-viewing strategies. However, there was no notable impact on well-being outcomes from pre- to post-viewing compared to a typical gallery visit or a free-writing filler exercise. Instead, in both studies, we observed significant increases in well-being outcomes from pre- to post-viewing, regardless of the pre-viewing enhancement, along with high levels of positive art

evaluations. Despite the null results, this type of study helps to test how museum or intervention programs can be designed to target well-being. Similar work is also being done with social interaction as part of the art viewing (Igдалова et al., 2025), addressing art viewing compared to other activities like making art (Drake et al., 2024), or how extra sensory aspects can enhance art experiences (Camic et al., 2021).

Despite the growing body of research, a meta-analytic overview of the literature is still needed. In Specker, Fekete, Trupp et al. (2023), we conducted a meta-analysis that addressed how much looking at a ‘real’ work of art improves the experiences while also controlling for museum vs. lab effects. A similar type of meta-analysis could also be done regarding well-being outcomes, contrasting activity types, schedules, or activity components. At present, there has been no such synthesis, likely due to the nascence and the developing quality of the research on the topic. For instance, one key finding from Chapter One was that many articles do not clearly describe their methodologies or activities, making such an examination difficult. This prompted the creation of the Receptive Art Activity Research Reporting Guidelines (RAARR), which I developed in Chapter One, a checklist so other researchers can think more critically about what they include in their research designs and, ultimately, their final reports.

In conclusion, this part of the thesis reveals that diverse art experiences have been employed to enhance a visitor’s well-being. By testing one strategy to enhance the experience, I conclude that little is still understood about how these differing activities contribute to outcomes. These findings highlight the importance of further systematic exploration of holistic experiences beyond mere art-person interaction to inform evidence-informed intervention design.

Through what mechanisms? — We benefit from the art we like and find meaningful, as well as via 16 other likely processes

Prior to the work presented in this thesis, research and theoretical insights on the advantages of art viewing were disjointed, limiting mechanistic understanding. Through literature review as well as through empirical research, I found that many possible non-art-specific pathways help explain the well-being impact of art viewing, supporting future hypothesis generation and calling for confirmatory studies.

In the past, various theoretical frameworks were suggested, drawing from fields such as empirical aesthetics (Fekete et al., 2022; Mastandrea et al., 2019), positive humanities (Tay et al., 2018), music science (Howlin & Rooney, 2020), leisure (Fancourt et al., 2021), nature exposure (Kaplan, 1995), and overall creative arts involvement (Fancourt et al., 2020). In light of this, in Chapter One, I used thematic analysis to glean possible mechanisms from past literature and proposed a taxonomy to enhance our understanding of these mechanisms. This included identifying five primary categories and 18 sub-themes that explain how art viewing affects well-being, which include affective (i.e. emotion regulation, pleasure, etc.), cognitive (i.e. stimulating sense and attention, memory evocation, etc.), social, self-transformational (i.e. reflection, empowerment, etc.), and resilience-building processes (i.e. restoration, coping, etc.). This taxonomy not only builds on earlier conceptualisations but also integrates previously underexamined social and self-transformational mechanisms, broadening the perspective on art exposure's potential effects beyond just the immediate interaction of the viewer with the art (Mastandrea et al., 2019).

Overall, the mechanisms in the taxonomy describe broad processes applicable to various non-art activities and were diverse across settings and activity types. A central insight emerging from Chapter One is that the context of art viewing (e.g., museums, hospitals, digital settings) influences the mechanisms connecting it to well-being. For example, different demographic groups (e.g., elderly individuals with dementia, children, and healthy adults) may uniquely experience and benefit from art viewing. For elderly individuals, particularly those with cognitive challenges, art interactions can promote a sense of competence and independence when accompanied by caregivers (Camic et al., 2016; Jensen, 2018; Tyack et al., 2017), a benefit that might not extend to healthy adults on a museum visit. Similarly, identity preservation is often emphasised in clinical settings where illness and treatment can restrict individuals' ability to feel beyond being “just a patient.” Engaging with art in a medical environment is suggested to alleviate the clinical atmosphere, allowing individuals to identify themselves beyond their illness (Bowen, 2015; George et al., 2018; Ho et al., 2015; Karnik et al., 2014), which would likely not play a key role in other types of art viewing. This insight that well-being outcomes can be derived through different pathways can especially help future researchers to consider

more broadly how art viewing activities across contexts may differently influence well-being outcomes.

Aside from the theoretical culmination of mechanisms I provided, the findings of my empirical chapters offer some converging evidence. For instance, in Chapter Two, positive emotional profiles that individuals reported experiencing while viewing the artwork were associated with decreased negative mood and anxiety. Further aligning with this, we found that the positive emotion factor was linked to changes in negative mood, as observed in Künapful et al. (2025) and other recent studies (Cotter et al., 2022; Pelowski et al., 2023). This could support the category of *affective* mechanisms, which encompasses art viewing's capacity to elicit a range of emotions, including those that contribute to well-being. On the other hand, Chapter Two presented findings indicating that individuals with strong aesthetic responsiveness—who benefit more from art viewing, according to Fekete et al. (2023)—do so largely due to enhanced pleasure and meaningfulness during art engagement, representing mechanisms listed in the taxonomy (Affective: Pleasure and Self-transformational: Meaning in life/Cognitive: Memory evocation). However, despite this, the evidence largely remains limited for mechanistic pathways and much more work is needed to address what evidence already exists and is still needed.

Overall, these insights will likely help future researchers formulate hypotheses about why art viewing can support well-being or health outcomes, start testing mechanisms, and importantly, consider such mechanisms as general constructs valid beyond art-specific contexts.

Limitations and Future Directions

As with all scientific endeavours, this research has limitations that should be acknowledged when interpreting its findings. In each chapter, I have discussed specific restraints that readers should consider; however, I provide a few main points and future directions below. These limitations span methodological, conceptual, and analytical dimensions and reflect broader challenges in the field of empirical aesthetics and well-being research.

A methodological limitation concerns the design of appropriate control conditions. In Chapter One, I highlighted the state of the field regarding control conditions: who had used them, what types of conditions were used, and discussed how important they were when comparing significant results across papers. Turning to my empirical work, however, in Chapters Two through Four, despite consistent evidence suggesting positive effects of engaging with art from pre to post, the absence of robust comparisons with high-quality, non-art control conditions limits the strength of inferences about art-specific well-being benefits.

This issue is further compounded by the lack of a clear definition of “art viewing.” This ambiguity was salient in Chapter Two, as although the study aimed to compare art and non-art conditions, nearly 70% of participants in the non-art condition retrospectively reported their experience as “art”. This aligned with previous findings (e.g., Pelowski et al., 2017b), suggesting that individuals interpret appreciated visual stimuli as “art,” regardless of their objective categorisation. Yet, this fluidity of what art is complicates the internal validity of art-based interventions and raises theoretical questions about what differentiates art engagement from other forms of experiences.

Overall, this limitation points to a broader issue in the field: the need for clear distinctions between the effects of “art” and other stimuli. Without this clarity, it is difficult to attribute observed effects to art's intrinsic properties, rather than general features of engaging stimuli. Thus, without a strong control condition, my thesis does not provide a high level of evidence for the effects of art viewing on well-being. In the future, comparative studies could explore the unique contribution of the art context versus control conditions. For instance, researchers might compare social museum visits with informal social gatherings (e.g., coffee meet-ups) or joint attention experiences in non-art contexts (e.g., sports events). Such comparisons could help isolate the social and contextual elements that might make art-based interventions particularly valuable within social prescribing models.

Turning to my systematic review, an analytic limitation constrains the conclusions about the strength of the existing evidence base. In Chapter One, I identified that there is an uneven quality of the evidence base linking art viewing and well-being. While eudaimonic well-being appeared to be a consistently supported outcome across studies

with higher methodological quality, other well-being dimensions, such as mood or stress, had inconsistent findings. Furthermore, outcomes like pain or life satisfaction had more null results. The key limitation here lies in the over-reliance on null hypothesis significance testing in the synthesis of existing literature. That is, in categorising each outcome as significant or not compared to baseline or control, I provided a blunt measurement of the evidence. Given the small sample sizes in many studies, the statistical power is often insufficient to detect subtle effects, increasing the likelihood of Type II errors. As a result, beneficial effects may be underestimated. To resolve this field-wide issue, future work should incorporate more robust analytical approaches, such as the routine use of effect sizes, confidence intervals, or methods such as Bayesian frameworks to provide a more nuanced and reliable picture of intervention outcomes. Similarly, a shift toward preventative and longitudinal frameworks might be crucial. Future studies might assess outcomes over extended periods—e.g., a year-long museum-based course, with several follow-ups. Such work would provide valuable insight into the long-term efficacy and sustainability of arts engagement as a public health strategy. Finally, meta-analyses as an additional step to systematic review will play a critical role in clarifying the cumulative evidence by evaluating effect sizes across diverse studies, thereby offering a more accurate estimate of art's potential to enhance well-being.

The aspects of my thesis focusing on mechanisms are not exempt from the broader limitations noted above. For example, in Chapter Five, while I introduced a taxonomy of mechanisms that might underlie the effects of art viewing on well-being, the evidence supporting these mechanisms remains primarily correlational. The taxonomy serves as a conceptual starting point but requires further empirical development and, importantly, evidence for each pathway. Mechanistic claims would benefit from studies designed explicitly to test causal pathways, potentially through longitudinal designs, mediation analyses, and mixed-methods approaches combining physiological and experiential data. Research should aim to clarify the psychological processes that contribute to well-being outcomes, for example, by testing whether self-relevance meaningfulness moderates intervention effectiveness. This could be done by allowing participants to select personally meaningful pieces or engage in reflective discussions about the significance of the artworks. Further, future research should examine

intervention adherence and enjoyment. Art-based programs may promote greater engagement and sustained participation compared to more prescriptive well-being activities.

Strengths and Significance

While this thesis acknowledges several limitations, it also offers a number of strengths that, within the context of a growing demand for such research, contribute meaningfully to the ever-increasing field of Arts and Health. These strengths provide a methodologically rich and conceptually grounded investigation into whether, how, and under what conditions art viewing—a form of receptive art engagement—can influence well-being. They also underscore the work’s broader significance within both academic and societal contexts.

The body of work within my thesis, which delivers a comprehensive exploration of a relatively underexamined topic by integrating both primary and secondary research, including a systematic review, experimental studies, and clinical trial planning, has five key strengths. First, empirical work drew on large and diverse sample sizes, including participants of varying ages, nationalities, and backgrounds, from students to the general population, enhancing the generalisability of findings. Second, the research spanned a variety of art-viewing contexts, from online digital environments to physical museum spaces, strengthening the ecological validity and real-world relevance of the results.

Third, I examined the impact of engaging with artworks of varying degrees of aesthetic appeal, from highly liked styles such as Impressionism to less commonly preferred styles like Renaissance and through my collaborations, contemporary art (Kühnapfel et al., 2025; Pelowski et al., 2023). This diversity demonstrates that potential well-being effects are likely not limited to any single genre. Fourth, another key strength is my commitment to pre-registering study designs to improve empirical rigour, research transparency, and reproducibility. Fifth, the work’s interdisciplinary nature is also a strength. Chapter Four, for example, brought together an industry partner specialising in science-informed experiences, a world-renowned gallery, a philosopher, and psychology researchers to develop a video-based intervention and a multi-study design addressing earlier limitations. Similarly, Chapter Five benefits from collaboration with clinical trial

experts, leading to the design and preliminary validation of a novel 14-day intervention. This clinical trial protocol, submitted alongside the thesis, targets highly sensitive individuals with heightened aesthetic responsiveness and incorporates a mixed-methods evaluation.

These strengths, as well as the content of the thesis and the conclusions presented, position the thesis as a timely and valuable response to a shifting research landscape and societal momentum toward integrating arts into health and well-being practices. For instance, when this work began, the role of receptive arts in promoting well-being remained unclear. Early findings hinted at potential benefits, but many foundational questions remained unanswered. This thesis helped to refine those questions and provides evidence-based insights that address them. The shifts in public and institutional attitudes define the importance of the general body of work. Notably, although receptive arts have historically received less research attention than creative engagement, growing numbers of epidemiological studies suggest they may be even more strongly linked to positive health outcomes (Bone et al., 2024; Cuypers et al., 2012). This growing recognition from researchers, as well as applications and social prescription initiatives, created an apparent demand for systematic reviews and intervention research, which I conducted and presented here.

In sum, this thesis advances understanding of the evidence base, mechanisms, and contextual factors influencing the relationship between art viewing and well-being. Through interdisciplinary collaboration, methodological rigour, and applied relevance, it provides a foundation for future research and offers a valuable stepping stone toward practical applications in the arts and health sectors.

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Abstract

English Abstract

The arts are increasingly recognised for their potential to support well-being and prevent ill-being. Among the various effects, empirical evidence has shown that on-site art interactions, like a visit to a museum over lunch and hanging art in hospital rooms, have been associated with improved mental health (i.e., decreases in symptoms of anxiety and depression; Clayton & Potter, 2017; Hansen et al., 2015; Roberts et al., 2011), and increased mood and psychological wellbeing (Bennington et al., 2016; Binnie, 2010a; Davies et al., 2016; Hansen et al., 2015; Ho et al., 2015; Karnik et al., 2014; Roberts et al., 2011; Wang et al., 2020). Furthermore, in large cohort studies, those who report visiting arts and culture institutions more often are also those who have higher life satisfaction, are less lonely, and have fewer health problems (Davies et al., 2016; Tymoszuk et al., 2019, 2020).

However, there are still open questions about the evidence base for the claim that art viewing experiences can support well-being, what components are essential to the experiences, *how* well-being effects might occur, and how best art viewing activities can be applied for societal good. To address these questions, this doctoral dissertation includes five aims. First, (1) to review all proposed mechanisms and critical contextual factors of art viewing experiences and interventions, and review the evidence base. Second, (2) to systematically measure the beneficial outcomes of art viewing using experimental methodologies in various settings (in-person, online) and examine the circumstances under which art viewing can improve aspects of well-being, focusing on individuals' subjective experience (cognitive-affective states). Further, (3) to examine how individual difference factors like increased sensitivity and responsiveness to aesthetics predict the efficacy of art-viewing exposure mediated by pleasurable and meaningful art experiences. (4) To experimentally explore gallery augmentation strategies to enhance the well-being effects of art viewing. Lastly, (5) to test how appreciation of beauty can be transferred to everyday life and be used as an intervention for young adults, and highly sensitive individuals, who are more at risk of mental health complaints.

The result of this dissertation will provide a deeper understanding of how art viewing can improve well-being and be applied to protect against ill-being.

German Abstract

Die Künste werden zunehmend für ihr Potenzial anerkannt, Wohlbefinden zu fördern und Unwohlsein vorzubeugen. Unter den verschiedenen Effekten hat empirische Evidenz gezeigt, dass Kunstinteraktionen vor Ort, wie ein Besuch im Museum während der Mittagspause oder das Aufhängen von Kunst in Krankenzimmern, mit einer verbesserten psychischen Gesundheit (d.h. Reduzierung von Symptomen von Angst und Depression; Clayton & Potter, 2017; Hansen et al., 2015; Roberts et al., 2011) sowie einer gesteigerten Stimmung und psychischem Wohlbefinden verbunden sind (Bennington et al., 2016; Binnie, 2010a; Davies et al., 2016; Hansen et al., 2015; Ho et al., 2015; Karnik et al., 2014; Roberts et al., 2011; Wang et al., 2020). Darüber hinaus zeigen große Kohortenstudien, dass Personen, die häufiger Kunst- und Kultureinrichtungen besuchen, auch diejenigen sind, die eine höhere Lebenszufriedenheit aufweisen, sich weniger einsam fühlen und weniger gesundheitliche Probleme haben (Davies et al., 2016; Tymoszuk et al., 2019, 2020).

Dennoch gibt es noch offene Fragen hinsichtlich der Evidenzbasis für die Behauptung, dass Kunsterlebnisse das Wohlbefinden unterstützen können, welche Komponenten für diese Erfahrungen essenziell sind, wie die Effekte auf das Wohlbefinden entstehen und wie Kunsterlebnisse am besten zum gesellschaftlichen Nutzen eingesetzt werden können. Um diese Fragen zu adressieren, umfasst diese Doktorarbeit fünf Ziele:

Erstens, (1) alle vorgeschlagenen Mechanismen und kritischen kontextuellen Faktoren von Kunsterlebnissen und Interventionen zu überprüfen und die Evidenzbasis zu evaluieren. Zweitens, (2) die positiven Auswirkungen von Kunsterlebnissen systematisch mithilfe experimenteller Methoden in verschiedenen Settings (persönlich, online) zu messen und die Umstände zu untersuchen, unter denen Kunsterlebnisse Aspekte des Wohlbefindens verbessern können, mit einem Fokus auf die subjektiven Erfahrungen der Individuen (kognitiv-affektive Zustände). Darüber hinaus, (3) zu untersuchen, wie individuelle Unterschiede, wie eine erhöhte Sensibilität und Reaktionsfähigkeit gegenüber Ästhetik, die Wirksamkeit von Kunsterfahrungen beeinflussen, vermittelt durch angenehme und bedeutungsvolle Kunsterlebnisse. (4) Experimentell Strategien zur Erweiterung der Galerieerfahrung zu erforschen, um die

wohltuenden Effekte von Kunsterlebnissen zu verstärken. Schließlich, (5) zu testen, wie die Wertschätzung von Schönheit auf den Alltag übertragen und als Intervention für junge Erwachsene und hochsensible Personen genutzt werden kann, die ein höheres Risiko für psychische Beschwerden aufweisen.

Das Ergebnis dieser Dissertation wird ein tieferes Verständnis darüber liefern, wie Kunsterlebnisse das Wohlbefinden verbessern und zum Schutz vor Unwohlsein beitragen können.