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Title	Contextualizing information enhances the experience of environmental art.
Type	Article
URL	https://clok.uclan.ac.uk/35480/
DOI	https://doi.org/10.1037/aca0000213
Date	2020
Citation	Keller, Anna, Sommer, Laura, Klöckner, Christian and Hanss, Daniel (2020) Contextualizing information enhances the experience of environmental art. Psychology of Aesthetics, Creativity, and the Arts, 14 (3). pp. 264-275. ISSN 1931-3896
Creators	Keller, Anna, Sommer, Laura, Klöckner, Christian and Hanss, Daniel

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https://doi.org/10.1037/aca0000213

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Contextualizing Information Enhances the Experience of Environmental Art

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Abstract

Environmentally-themed art is increasingly addressed in research as a means to raise awareness for environmental problems and motivate pro-environmental behavior. However, as researchers begin to systematically study environmental art, influencing factors must be addressed - for example, the effect of presenting contextualizing information. In the present study, 123 participants saw an environmental artwork with or without contextualizing information in a between-subjects design and rated the artwork on various variables regarding its aesthetic value and pro-environmental impact. Additionally, eye movement was recorded using mobile eye tracking glasses to gain insight into the visual processing of the artwork. The results showed that information presentation increased personal meaning, which was in turn associated with increased liking, interest and emotional responses. The average duration of fixations was shorter for participants in the information group, indicating easier processing possibly due to the guidance of the provided information. However, information had no effects on participants' pro-environmental intentions and behavior. Taken together, the results strongly suggest that both researchers and practitioners should be taking the effect of contextualizing information into account when exhibiting environmental art, as it can impact a variety of relevant factors.

Keywords: environmental art, information, eye movement, processing, art experience

Contextualizing Information Enhances the Experience of Environmental Art

Environmental Communication Through Art

Scientists have known for a long time that climate change and related environmental problems exist and that a substantial change in human behavior is required to mitigate them (IPCC, 2014). A multitude of methods are being employed to engage citizens and to promote pro-environmental behavior among the public. One of such strategies are informational campaigns, which aim at increasing people's knowledge about a problem (Steg & Vlek, 2009). However, in many cases informational campaigns have been less successful in generating behavioral changes, with increased knowledge not translating into increased pro-environmental behavior (Klöckner, 2015; Steg & Vlek, 2009). As a result, alternative approaches to environmental communication are being tested to determine whether they can potentially add to the toolbox of environmental communicators. Examples of other communicational intervention strategies include reminding people in situations when they could act pro-environmentally (prompting) and frequently telling them about their behavior's impact (feedback), encouraging personal goal setting and commitment, and using social norms or role models to encourage pro-environmental behavior (Klöckner, 2015).

As alternative communicational methods are starting to be developed, artists have also been among those who are taking up the challenge of addressing climate change and related environmental problems in their work. In an introduction to the topic, Marks, Chandler, and Baldwin define environmental art as "any artwork that aims to stimulate awareness of people's relationship with nature as well as art which prompts discussion and/or action around environmental issues" (2016b, 311f). It is therefore the artist's intention which defines an artwork as environmental art. Examples of environmental art are manifold: in the biannual art festival Floating Land in Australia (Noosa Regional Gallery, 2017), artists and local citizens are brought together to create their own art, learn to appreciate nature and to take part

in discourse. Art festivals such as ART+CLIMATE=CHANGE (Climarte, n.d.) and ARTCOP21 (ARTCOP21, n.d.) house multiple exhibitions across a region to stimulate awareness and discussions about environmental challenges. Art organizations such as Cape Farewell (Buckland, 2012) bring scientists and artists together on transdisciplinary excursions to help communicate research to the public, and to creatively engage society in a discourse about climate change.

As diverse as environmental art itself are the roles it can play in environmental communication and beyond standard information strategies. In a synthesis of their previously published research, Curtis, Reid, and Reeve (2014) were able to combine psychological theory and art theory to propose a model of how art can influence environmental behavior. The model introduces three major pathways through which art can encourage pro-environmental behavior:

Communicating information in an engaging form. Many studies in this area have chosen to take a look at the combination of scientific research and art as a way to enhance the communication of scientific data to the public. Arce-Nazario (2016) found that an exhibition in Puerto Rico which blended scientific data and artistic presentation was successful in communicating scientific ideas and knowledge, specifically in changing visitors' misconceptions about Puerto Rico's history of landscape change. Neal (2015) provides an explanation for such beneficial effects of art. The author describes art as a frame for social and visual experiences, which have the ability to bridge people and institutions and lay open our emotional and aesthetic connections with the world we live in.

Other studies report, that environmental art has helped scientists disseminate their findings on a conference (Curtis, Reid, & Ballard, 2012), engage people in educational campaigns (Withrow-Robinson, Broussard, Simon-Brown, Engle, & Reed, 2002) and connect

practitioners and artists (Curtis, 2009, 2011). Additionally, studies have found environmental art to be especially effective in encouraging discourse and communication in participatory group settings (Chandler & Baldwin, 2010; Grant, Baldwin, Lieske, & Martin, 2015), perhaps due to its potent use of symbols, which helps present concepts in open and imaginative way.

Creating empathy towards the natural environment. Through strengthening place attachment, connection with the natural environment and encouraging contemplation, art can engage people in a way that other forms of communication struggle to. Emotions have previously been found to explain pro-environmental intentions and behavior (see section The Role of Contextualizing Information in Environmental Art), and this effect has also been documented in various published studies on environmental art. Nurmis (2016) concludes in an overview of visual climate change art, that encouraging contemplation and reflection is one of the main virtues of good environmental art. Generating concern for and appreciation of nature has been one of the main effects observed by art (Marks et al., 2016a), following the notion, that people are more willing to conserve what they value and appreciate (Fien, 2003; Curtis, 2009; Reid, Reeve, & Curtis, 2005).

Art as part of an ecologically sustainable development. Including art in sustainable development projects such as public transport or environmental restoration programs can make these measures more attractive and increase support and implementation of such projects (Curtis et al., 2014; Reid et al., 2005). If art is integrated in non-threatening, socially supported and prompting community projects, it may help promote positive attitudes towards sustainable development among resident. However, there are a lot of aspects relevant to environmental art as a form of environmental communication which remain unclear at this point. One such aspect becomes evident when including environmental art into an exhibition or an art festival, namely how the artwork is presented. One of the questions to be asked in this area is the following: Should environmental art stand on its own, or together with

contextualizing information about the artist or the topic? This question may be relevant in so far as contextualizing information may enhance viewers' experiences with environmental art.

Information and the Experience of Art

The effect of accompanying information on the experience of visual art has been addressed in several publications. Generally, studies have found that providing information in form of titles or short descriptions increases the understanding (Leder, Carbon, & Ripsas, 2006; Millis, 2001; Swami, 2013) and the meaningfulness (Cupchik, Shereck, & Spiegel, 1994; Russell, 2003; Russell & Milne, 1997) of an artwork. However, there is mixed evidence regarding the effect of providing information on the appreciation or the liking of an artwork: Russell (2003) found an increase in hedonic value when using a within-subjects design (study 2), but not in a between-subjects design (study 1). Leder et al. (2006) and Russell and Milne (1997) found no effect on appreciation and pleasingness, while Swami (2013) discovered an increase in appreciation which was in turn associated with higher understanding. The type of information seems to matter as well: in a study by Millis (2001) elaborative titles led to higher aesthetic ratings, while descriptive titles did not. Leder et al. (2006) also compared descriptive with elaborative titles, finding that when an artwork was only viewed for one second, descriptive titles increased the understanding more than elaborative titles, while at viewing times of 10 seconds the relationship was reversed. When comparing no information, titles, and content-specific information to each other, content-specific information had the strongest influence on the aesthetic experience of abstract artworks (Swami, 2013). Results also suggest that this effect is not due to the mere presence of a title or information, but to the actual content of the information. When presenting subjects with artworks accompanied by invented, nonsensical titles, an increase in meaningfulness could not be detected (Russell & Milne, 1997). Additionally, content-

specific, but non-relevant information was not found to increase understanding and appreciation (Swami, 2013).

As can be seen from the differences in terminology, the variables studied in recent publications are often very similar conceptually, but differ in their form of operationalization, making a reliable comparison difficult. Additionally, different types of information, ranging from short titles to a paragraph of information about the artist and the painting, were subject to the reported studies, as were paintings varying in level of abstraction and depicted themes. Nevertheless, evidence strongly suggests that contextualizing information does have some form of influence on the art experience. The results indicate that information can enhance viewing experience when it helps art viewers to contextualize and reflect an artwork beyond its obvious meaning – a process termed the *elaboration effect* by Millis (2001). According to the elaboration effect, metaphorical or elaborative titles enhance a viewer's experience "when they suggest an alternative explanation to what can be readily inferred from the explicit artwork" (Millis, 2001, p.328). In a similar vein, Bullot and Reber (2013) propose in their psycho-historical framework of art that a stronger understanding and interpretation of the art-historical context of an artwork will result in an enhanced experience. An example might be emotions which are triggered as a response to the understanding of the art-historical framework rather than the basic exposure. In summary, the psycho-historical framework suggests, as does the elaboration effect, that putting an artwork into context increases understanding and reflection of meaning, and thereby influences the art experiences.

The Role of Contextualizing Information in Environmental Art

Since environmental art has the clear intent of raising awareness about environmental issues and motivating pro-environmental behavior, artists and curators have to consider whether a different form of presentation could possibly benefit them in their communication with the public. A conceivable way of increasing the impact of environmental art might be to

provide information about the artwork or the artist when exhibiting the artwork. On the other hand, one could argue that environmental information in particular might limit the ways in which a viewer can experience environmental art, because that information might cause associations with the more common informational campaigns and could therefore minimize the unique position environmental art has.

It is unclear how exactly the provision of contextualizing information might impact the experience of environmental art. Consequently, the following research question was investigated in the present study: *Does the presentation of environmental art with vs. without contextualizing information influence the art experience?* This question can be divided into two parts. Firstly, do previous findings concerning the effects of contextualizing information (e.g. increased meaning, understanding, or aesthetic appreciation through information presentation) translate to the experience of environmental art? And secondly: Can additional effects, relevant to environmental communication, be attributed to presenting environmental art with (vs. without) contextualizing information? The answers to these questions are relevant to both researchers and practitioners such as artists and environmental communicators.

In the present study, a between-subjects experimental design with two conditions was implemented to investigate the proposed research questions. Participants were presented a work of environmental art either with (information group) or without contextualizing information (no information group), and measurements were taken on a series of variables relevant to the experience of environmental art.

Aesthetic experience. As seen above, *liking* of and *interest* in an artwork is an essential part of any art experience. However, no directional hypotheses were proposed for these variables in the present study.

With respect to the meaning of an artwork, previous literature is not consistent in which aspect of meaningfulness or understanding should be applied to researching the experience of art. For example, earlier research has often either focused on the (personal) *meaningfulness* (Cupchik et al., 1994; Russell, 2003; Russell & Milne, 1997), or the *understanding* (Millis, 2001). Since findings indicate that both meaningfulness and understanding are impacted by the presentation of information with art, both variables were measured in the present study, thereby following the approaches of Leder et al. (2006) and Swami (2013). It was predicted that participants in the information group would indicate higher understanding and meaningfulness than participants in the no-information group.

The *emotional reaction* to the artwork was included as an additional component of the aesthetic experience. Emotions are a central variable in many art studies, as they contribute substantially to the experience of art (Marković, 2012), even independently of art expertise (van Paasschen, Bacci, & Melcher, 2015). Emotions also play a role in motivating pro-environmental behavior. Studies have shown that emotions, especially guilt, significantly contribute to explaining pro-environmental intentions and behavior (Ferguson & Branscombe, 2010; Harth, Leach, & Kessler, 2013; Kaiser, 2006; Mallett, 2012; Mallett, Melchiori, & Strickroth, 2013; Rees, Klug, & Bamberg, 2015). In Curtis et al.'s (2014) model of pro-environmental art, the second pathway – creating empathy towards the natural environment – emphasizes this exact point of intersection. No directional hypothesis was formulated because previous literature does not provide any conclusive insight into how the emotional reaction would be influenced by the presentation of information with an artwork.

Eye movements. Gaze patterns have been used to study various aspects of the perception of art (Duchowski, 2017). Specifically, the number of fixations and the viewing time can indicate overt visual attention devoted to the artwork (Brieber, Nadal, Leder, & Rosenberg, 2014; Duchowski, 2017; Quiroga & Pedreira, 2011) and mean fixation durations can indicate

an increase in cognitive function (Duchowski, 2017). In order to gain additional insight into the process and mechanisms of the perception of environmental art, *eye movements* were included as a variable in this study. Research looking into whether the provision of contextualizing information affects eye movements when perceiving an artwork is scarce. One published study found, that a short title presented below abstract and figurative paintings of Kandinsky made participants gaze longer on areas that are associated with the given title. Also, participants generally liked figurative artworks with title better (Bubić, Sušac, & Palmović, 2017; Lin & Yao, 2018).

Given the limited amount of research in this area, no directional hypotheses were formulated regarding potential effects of contextualizing information on the eye tracking parameters. In fact, different effects seem plausible: information presentation could possibly increase the visual attention and cognitive function, because putting the artwork into context might allow for deeper processing. On the other hand, the provision of information might also work in the exact opposite direction, because less effort has to be invested by participants to process the artwork in order to find a personal meaning.

In addition to the overall visual attention, information presentation might influence how much visual attention is devoted to specific semantic regions of an artwork which carry its narrative. Franklin, Becklen, and Doyle (1993) found that the provision of titles (vs. no titles) did not predict where people looked in an artwork. However, they measured eye movement by having participants indicate where they looked using a flashlight pointer, which limits the validity of their findings. For the present study, it was predicted that participants in the information group would devote more visual attention to semantic regions of an artwork than the no-information group, assuming that contextualizing information would guide viewers to the semantically relevant features of an artwork – in addition to the visual saliency of the region.

Pro-environmental intentions and behavior. As one of the main goals of environmental art and environmental communication is to motivate pro-environmental behavior, *pro-environmental intentions* and actual *pro-environmental behavior* were assessed in the present study. This study is among the first to systematically investigate potential effects of environmental art on intentions and behavior. Therefore, it is yet unclear which specific factors determine pro-environmental intentions and behavior as motivated by environmental art and what role contextualizing information might play in this regard. Given the limited amount of research in this area, no directional hypotheses were formulated.

Control variables. The level of art expertise majorly affects an individual's experience of art (Pelowski, Forster, Tinio, Scholl, & Leder, 2017). For example, art expertise can influence which components of an artwork viewers pay visual attention to (Nodine, Locher, & Krupinski, 1993; Pihko et al., 2011), as well as the viewing time (Brieber et al., 2014), overall viewing strategy (Vogt & Magnussen, 2007) and viewers' ratings of beauty and liking (van Paasschen et al., 2015). In an EEG study which associated electro cortical indicators with art expertise, Pang, Nadal, Müller-Paul, Rosenberg, and Klein (2013) concluded that art experts' frequent observation of art led to increased neural efficiency when perceiving and contemplating an artwork. Additionally, participants with any above-average education in art were excluded from the sample in the recruiting process. Since environmental art is investigated as a form of environmental communication, a measure of pro-environmental tendencies had to be included as a control variable. In a comparison of frequently used measures, egoistic, altruistic and biospheric values have been shown to be the most effective predictor of pro-environmental intentions (Steg, Groot, Dreijerink, Abrahamse, & Siero, 2011)(Schwartz, 1977; Steg, Dreijerink, & Abrahamse, 2005). *Egoistic, altruistic and biospheric values* were therefore included as control variables.

Method

Participants

A statistical power analysis for sample size estimation was performed a priori using the GPower 3.0.10 software. For between group comparisons with a significance level of $\alpha = .05$ and power of .80, the projected sample size to discover a medium effect size ($d = .50$) is approximately $N = 128$, with 64 participants in each of the two conditions. This sample size would also be sufficient for correlations within the experimental groups (i.e. $n = 64$), assuming a medium effect size ($r = .3$), a significance level of $\alpha = .05$ and power of .80.

In total, 125 participants were recruited for the experiment. After excluding those who reported to have seen the artwork before, a net sample of 123 cases was included in the analyses, almost reaching the targeted sample size of $N = 128$. The majority (74%, $n = 91$) of participants was female. The age ranged from 18 to 54 years ($M = 23.58$, $SD = 5.96$). The highest completed education for most participants was the Abitur (German qualification for university entrance; 75%, $n = 92$), a university degree (14%, $n = 18$), vocational schooling (8%, $n = 10$), lower secondary education (2%, $n = 2$) or other education (1%, $n = 1$). Participants' familiarity with art[1] ($M = 3.39$, $SD = 1.32$; 7-point scale) and reported biospheric values ($M = 4.70$, $SD = 1.50$; 9-point scale) tended towards scale midpoints.

The majority of participants were recruited from [omitted for masked review]'s business psychology program, using email lists and social media for increased outreach. First year students of this program received course credit for their participation (41% of participants, $n = 51$). Additionally, flyers were distributed around the campus to recruit additional

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[1] To control for general familiarity with art, participants were asked about their interest and frequency of exposure: "How much are you interested in art?" (from 1 = *not at all* to 7 = *very much*) and "How often do you engage with art?" (from 1 = *never* to 7 = *very frequently*). Both items were combined to an index called *art familiarity* with an internal consistency of $\alpha = .87$.

participants from other programs. During recruiting, participants were only told that the

experiment would analyze "how people look at art", to avoid any pre-knowledge about the

subject of the artwork and the experiment. Participants who were extensively educated in art

were excluded from the experiment. Due to technical constraints of the eye tracking

apparatus, participants with visual impairment were admitted only if they wore contact lenses

and excluded when reliant on glasses.

After random assignment, 57 participants (46%) saw the artwork without any additional

information (*no-information group*), and 66 participants (54%) saw the artwork along with

contextualizing information (*information group*).

Stimuli

All participants were shown the painting "Landscape of Change" by Jill Pelto (Pelto,

n.d.b), printed on a 100cm by 70cm scrim banner. The painting was chosen, for several

reasons: In Landscape of Change, pictured in Figure 1, scientific data is used to visualize

changes in the natural environment. The main features of the painting are stylized data lines

which represent different indicators of climate change over time, and form a frame for the

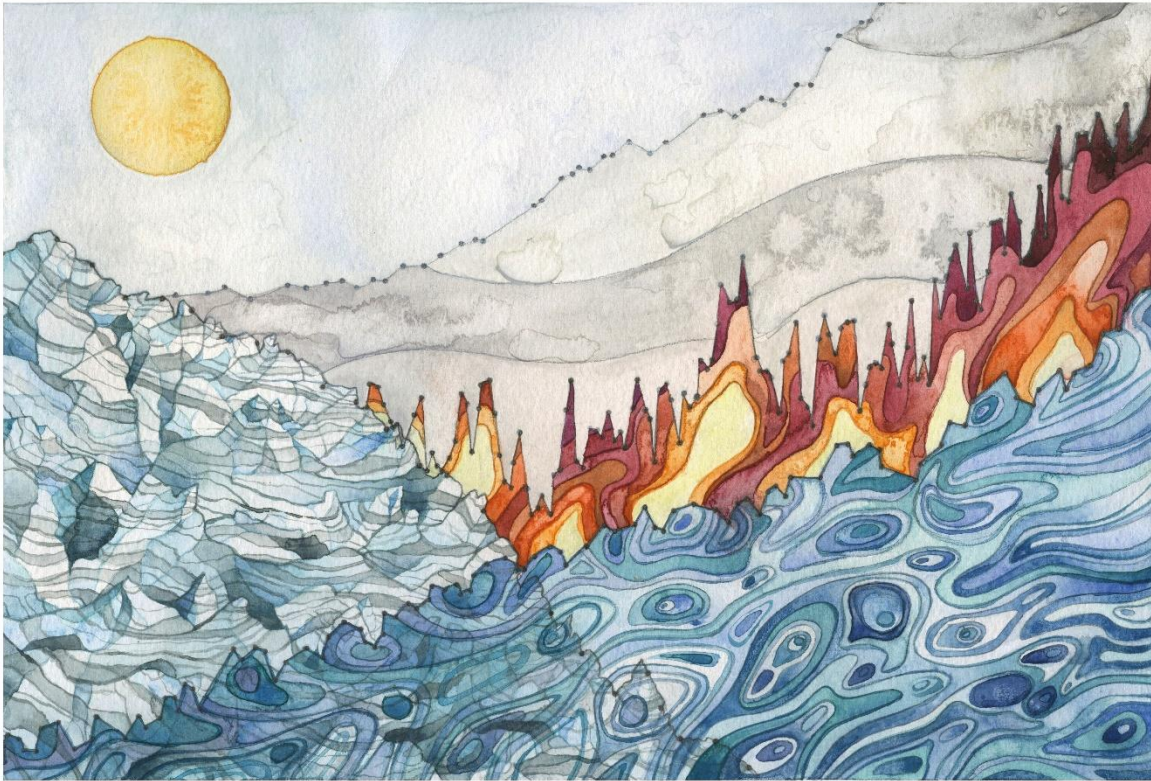different components present in the artwork (Pelto, n.d.b).

Figure 1. Landscape of Change by Jill Pelto (Pelto, n.d.b). Pictured with permission of the artist.

It was decided to present one artwork only. While increasing the number of artworks would have increased the generalizability of the findings, it would have also lead to several compromises. Gauging the direct and immediate reaction to each of the presented works of art as opposed to an exhibition as a whole is critical for clearly separating the effect of information presentation on the various measured variables. A study design involving multiple artworks with true randomization to account for order effects would have been complex and not within the scope of this study. It was therefore decided that presenting only one artwork was better suited to exploring the research question described above.

Several criteria were considered important for the selection of the painting: Firstly, viewers had to classify the artwork as art, which was confirmed for the presented painting in a pre-test with participants who did not later participate in the main experiment ($n = 5$). To

qualify as *environmental* art, the artwork had to be created with an intention to increase

awareness and inspire discussion (see introduction). The artist states that "my love of nature

and wilderness drives me to use creativity to communicate information about extreme

environmental issues with a broad audience" (Pelto, n.d.a). Therefore, Landscape of Change

can be considered environmental art. As a second criterion, the artwork had to have a

moderate degree of ambiguity, in order to have layers of interpretation, but not be too

abstract. . If there would be no or only minimal ambiguity about the artwork the presentation

of information would not have as much of an effect on the experience of the artwork.

Participants of the pre-test indicated associations with different variations of nature,

landscapes and the elements in general, thereby showing a reasonably diverse array of

possible interpretations of Landscape of Change.

Lastly, the artwork had to have some form of theme or technique that is in principle

generalizable. Having an identifiable theme or technique enables researchers to further

explore the results of the study and to reliably apply results to research and practice. It also

follows the trend in environmental and climate change art, that artists are taking their

inspiration from scientific findings, and are incorporating empirical data into their work

(Buckland & Lertzman, 2008). Landscape of Change has the theme of visualizing scientific

data and communicating scientific knowledge via art.

For participants in the information group, a 40cm by 20cm poster was created with

content-specific information about the artist and the artwork. The poster was designed in the

fashion of an information board and hung next to the artwork to simulate a museum or gallery

setting. Content-specific, elaborate information was chosen because it was shown to be more

effective in enhancing the aesthetic experience (Leder et al., 2006; Swami, 2013).

Information about the artwork and the artist was included rather than information about the

general topic of climate change. This way, the information would serve its primary function

of putting the artwork itself into context and facilitating increased elaboration – as opposed to providing additional information in the style of an informational campaign. The information was taken from the artist's website's description of the painting (Pelto, n.d.b) and herself (Pelto, n.d.a). The information sign read:

Landscape of Change - Jill Pelto

Jill Pelto *is an artist and scientist at the University of Maine. She strives to communicate information about interesting and important environmental topics through art to engage a broad audience with recent challenges. Scientific data is the basis of her work. As a scientist, she researches the arctic ice cover and has worked on projects in the USA, Canada, the Antarctic, the Falkland Islands and New Zealand – this spectrum of experience is resembled in her works of art, which present the multitude of ecological challenges today.*

For Landscape of Change, *Jill uses scientific data to picture rising sea levels, melting glaciers, rising global temperatures and the increased use of fossil fuels. These data lines construct a landscape which has been shaped by climate change – a landscape we all live in today.*

Measures

Aesthetic experience. Participants were asked to rate the artwork on several dimensions to assess their response to the artwork. In this block, participants rated statements on a scale ranging from 1 (= *fully disagree*) to 7 (= *fully agree*) in a randomized order. Liking and interest and were measured as an approximation of the overall appreciation of the artwork, represented by the statements "I like this artwork" and "I think this artwork is interesting", respectively.

Regarding the meaning and understanding of an artwork, a four-item scale from Swami (2013), originally adapted from Silvia (2005), was used to encompass the different aspects which could lead to finding meaning in an artwork: "I felt able to understand the artwork", "This artwork was easy to understand", "I could get a sense of what the artist wanted to express" and "This artwork was basically meaningless" (reverse scored). Reliability testing revealed that removing the item "This painting was basically meaningless" increased the scale's internal consistency from $\alpha = .82$ to $\alpha = .88$. Consequently, the scale was reduced to the first three items and an index variable called *meaning* was created by computing the mean across the respective items.

Emotions were measured by asking participants how strongly they felt "anger", "guilt", "pride", "shame", "sadness" and "emotional coldness" on a scale from 1 (= *not at all*) to 7 (= *very intensely*), adapted from Rees et al. (2015). "Fear" was added to the list of emotions because of its frequent association with climate change (O'Neill & Nicholson-Cole, 2009). The items were randomized for each participant. Following Rees et al. (2015), all items measuring emotions were entered into principal component analysis (PCA, oblimin rotation, eigenvalues greater one).[2] Two components with an eigenvalue greater one were extracted which together explained 68% of the total variance. The first component, consisting of the four items anger, shame, guilt, fear and sadness, explained 51% of the observed variance; the second component, consisting only of the item pride, explained 17% of the variance. Emotional coldness strongly loaded onto both components (-.49 and -.50, respectively) and

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[2] Assumptions for PCA were met in form of the Kaiser-Meyer-Olkin measure for sampling adequacy (KMO = .86) and Bartlett's test of sphericity ($\chi^2(21) = 339.59$, $p < .001$). A criterion level of .3 was selected for factor (cross) loadings.

was therefore removed.[3] An index variable called *eco-emotions,* essentially combining all

negative emotions experienced by participants, was created by computing the mean across

the items of the first component, with an internal consistency of $\alpha = .88$. As the other

component consisted of the item pride only, no index had to be computed. Due to the

prominence of the eco-emotions component, this index variable was focused on in

subsequent analyses.

Eye movements. Eye movement was recorded using SensoMotoric Instruments' mobile

eye tracking system. The system consists of mobile eye tracking glasses (ETG) attached to a

smart recorder, allowing full flexibility of participants' movements. The ETG collects

binocular data in a 60Hz sampling rate and has a manufacturer reported accuracy of 0.5° with

parallax compensation. Eye movements were calibrated with 3-point calibration before

recording and, if necessary, corrected offline. Eye tracking data preparation was done in

SensoMotoric Instruments' BeGaze software (Version 3.5; SensoMotoric Instruments, 2015).

After inspecting the gaze data for obvious flaws like failed calibration, a total of $n = 91$ cases

was retained for analysis. First, participants' fixations were automatically detected in BeGaze

with a dispersion-based algorithm and then manually mapped to a reference image, providing

a basis for the comparison of eye movement between participants. Secondly, the artwork as

well as the semantic regions of the artwork (the data lines) were defined as areas of interest

(AOI). The defined AOIs are shown in Figure 2.

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[3] Full results of the PCA can be found in the supplemental materials available online.
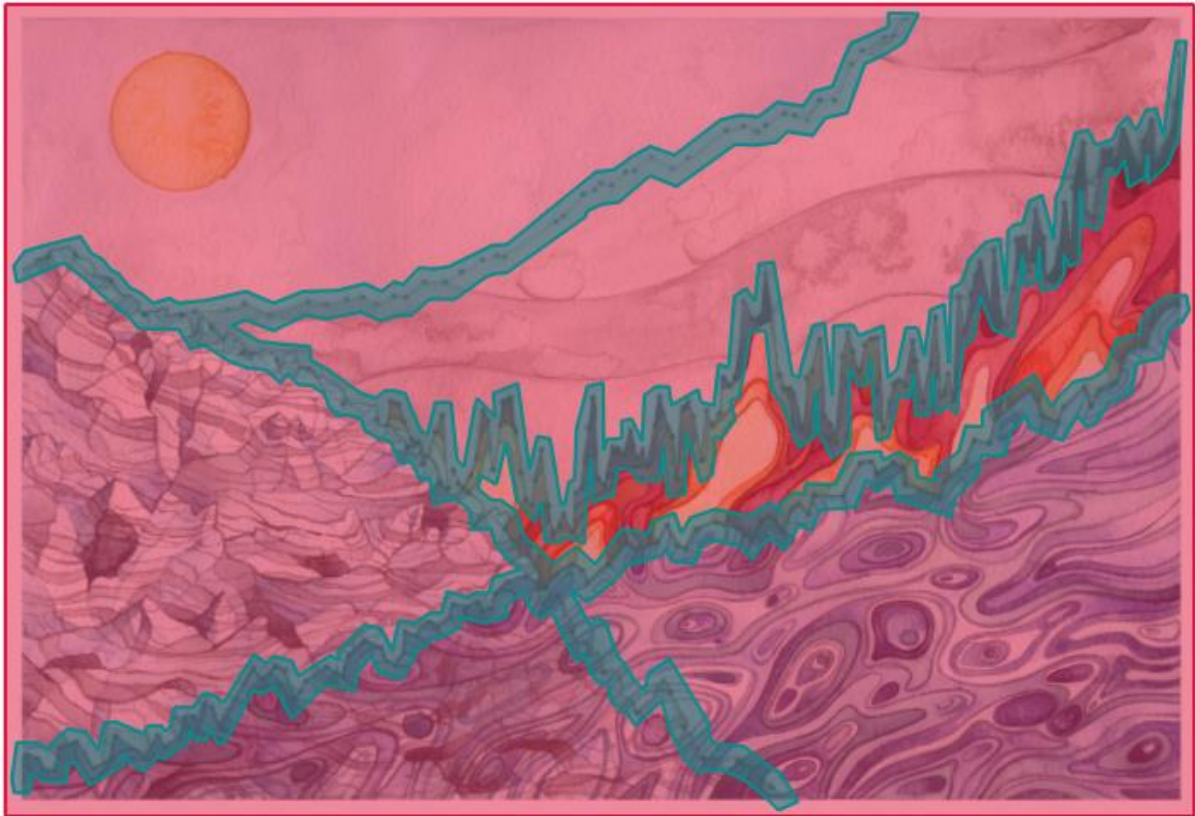
Figure 2. The areas of interest defined on the reference image: the artwork itself (red) and the data lines as semantic regions (blue).

Lastly, numeric eye tracking statistics were computed per AOI: the *viewing time* (starting with the first fixation on the AOI and ending with the last fixation before leaving the AOI), the *number of fixations* on an AOI, the *average duration of fixations* (computed over all fixations on an AOI) were exported for both defined AOIs. Additionally, the *number of revisits* to the data lines was calculated and exported.

Pro-environmental intentions and behavior. Pro-environmental intentions were measured by asking participants to rate the following statement on a scale ranging from 1 (= *fully disagree*) to 7 (= *fully agree*): "I plan to (continue to) deliberately act pro-environmentally in my everyday life". To introduce participants to the topic and distract from the purpose of the pro-environmental intention item, the two statements "I plan on looking

for more artworks of the artist" and "I plan on further engaging with the topic of environmental art" were posed before the pro-environmental intention. In addition to pro-environmental intentions, pro-environmental behavior was assessed by providing participants with a choice. Participants had been recruited with the incentive of participating in a raffle to win one of 4 vouchers (50€, 40€ and 2*20€) for the online retailer Amazon (www.amazon.de). After the experiment, participants were asked to write their email address on a paper slip and put the slip into one of two envelopes, which were marked with "In case of winning in the raffle, I choose to receive my win as an amazon.de voucher" and "In case of winning in the raffle, I choose to donate my win to an environmental organization (CO_2 compensation – www.climate.org). Choosing to donate to an environmental organization was interpreted as a form of spontaneous pro-environmental behavior.

Control variables. To control for prior knowledge, participants were asked whether they had seen the artwork before. To be able to track back understanding of the artwork and to gauge participants' associations during the art experience, especially in the no-information group, participants were asked to state in free form which topics they associated with the painting. The responses were coded into 1 (= association with climate change or environmental problems in general) and 2 (= other). Responses were coded conservatively, meaning that ambiguous responses such as "nature" or "environment" were coded as "other". Moreover, values were measured using a values scale adapted from Schwartz (1992) by Steg and colleagues (Steg et al., 2011; Steg, Dreijerink, & Abrahamse, 2005). Participants were asked to rate the importance of twelve values as guiding principles in their lives on a scale from 0 (= *not at all important*) to 7 (= *of supreme importance*) or as -1 (= *opposed to the value*). The twelve items constituted three subscales with four values each: Egoistic values (authority, wealth, social power, influential; $\alpha = .76$), altruistic values (social justice, equality, a world at peace, helpful; $\alpha = .69$) and biospheric values (preventing pollution, protecting the

environment, respecting the earth, and unity with nature; α = .84). Each of the subscales was combined in an index called *egoistic values*, *altruistic values* and *biospheric values* respectively.

Sex, age, education and visual impairment of participants were measured in a final block of sociodemographic data.

All items were presented to participants in German language and translated into English language for this paper.

Procedure

Upon arrival, participants gave their informed consent to participate in the experiment. They were then fitted with the eye tracking glasses. After calibration, participants were told to move to section two in the laboratory where they could take as much time as they wished to view the artwork, just as they would in a museum or a gallery. They were instructed to move around freely and to move their head as they wished. Participants of the information group were also told that they could look back and forth between the information poster and the artwork as often as they would like to. After participants had finished viewing the painting, the eye tracking glasses were removed, and participants were asked to fill in a questionnaire about their reaction to the artwork on a local desktop PC. Finally, participants were asked to leave their email address on a separate paper to participate in the raffle. Lighting was kept consistent throughout the experiment.

Results

The analyses were conducted in two steps. First, group comparisons for the dependent variables were calculated. Second, mediation analysis was used to gain further insights into the relationship between the presentation of information and the aesthetic experience. All

analyses were done using R (Version 3.3.2). Non-parametric descriptive statistics are reported whenever assumptions for parametric testing were not met.[4]

Group Comparisons

   Aesthetic experience. Figure 3 depicts participants' ratings of the artwork as a function of the experimental conditions. Group comparisons showed that participants in the no-information group liked the artwork significantly less (*Mdn* = 4.00) than participants in the information group (*Mdn* = 5.00), $W = 1468$, $p = .033$, $r = -.19$. Similarly, interest was significantly lower without information (*Mdn* = 5.00) than with information (*Mdn* = 6.00), $W = 1450$, $p = .025$, $r = -.20$. As predicted, participants in the no-information group also found significantly less meaning in the artwork (*Mdn* = 4.00) than participants in the information group (*Mdn* = 5.67), $W = 762$, $p < .001$, $r = -.52$ (one-sided testing). Lastly, reported eco-emotions were significantly weaker when the artwork was presented without information (*Mdn* = 1.60) in comparison to when it was presented with the contextualizing information (*Mdn* = 3.10), $W = 1070$, $p < .001$, $r = -.37$.

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[4] Where necessary, group differences for variables with rating scales were calculated using the Wilcoxon rank-sum test, which allows for a non-parametric distribution of data (Field, Miles, and Field, 2013).
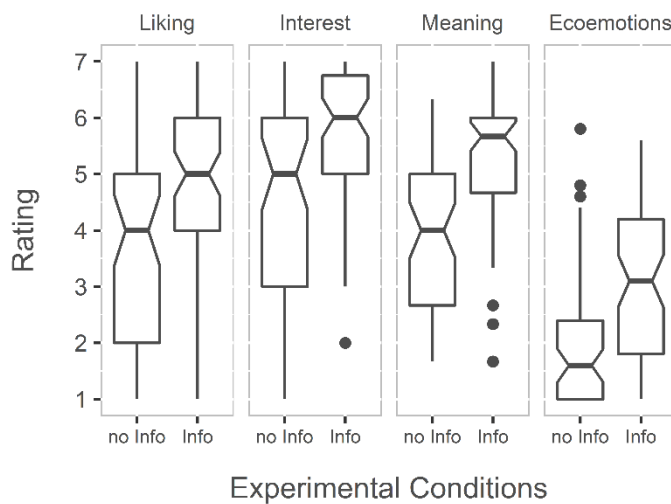
Figure 3. Notched boxplots displaying the rating of the artwork as a function of the experimental conditions. Notches display the medians' 95% confidence intervals, whiskers are set as a multiple of 1.5 of the interquartile range.

Eye tracking measurements. Significant effects were found for only one eye tracking parameter, the average duration of fixations: participants in the no-information group had significantly longer average fixations (*Mdn* = 272.10ms) than participants in the information group (*Mdn* = 235.00ms), *W* = 1308, *p* = .027, *r* = -.23. Viewing time of the artwork did not differ significantly for participants who saw the artwork without information (*Mdn* = 55.36 seconds) from participants who saw the artwork with information (*Mdn* = 43.93s), *W* = 1171, *p* = .261, *r* = -.12. Moreover, the number of fixations did not differ significantly between the no-information group (*Mdn* = 162.50) and the information group (*Mdn* = 147.00), *W* = 1131, *p* = .419, *r* = -.08.

Contrary to predictions, the visual attention to the data lines, the semantically important regions of the artwork, was also independent of the presentation of contextualizing information. Viewing times for the no-information group were *Mdn* = 12.25s and *Mdn* =

14.07s for the information group, $W = 959$, $p = .291$, $r = -.11$ (one-sided testing). The number of fixations of participants in the information group (*Mdn* = 49.00) did not differ significantly from the number of fixations in the no-information group either (*Mdn* = 42.50), $W = 915.5$, $p = .184$, $r = -.09$ (one-sided testing).

Pro-environmental intentions and behavior. Pro-environmental intentions did not differ significantly between the no-information group (*Mdn* = 6.00) and the information group (*Mdn* = 6.00), $W = 1924$, $p = .820$, $r = -.02$. Furthermore, the pro-environmental behavior exhibited by participants was not significantly associated with the experimental conditions ($\chi^2(1) = 1.94$, $p = .163$). Twenty-three of 55 participants (42%) in the no-information group selected the pro-environmental donation, as opposed to 36 of 66 participants in the information group (55%).

Mediation Effects

To explore the relationship between the experimental manipulation, meaning, and art experience, mediation analysis was used to test whether meaning would mediate the relationship between information presentation and the aesthetic experience. For each mediation analysis, four-step mediation testing (Baron & Kenny, 1986) was used as a first approach to calculate the separate effects in the mediation model, followed by testing the indirect effect for significance.[5]

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[5] When necessary, regression parameters were estimated using non-parametric bootstrapping with the R package boot Version 1.3-18; Canty and Ripley (2017) to account for deviations from normal distribution. Indirect effects were calculated using bias-corrected and accelerated bootstrapping (Hayes and Scharkow, 2013), using the R package mediation (Version 4.4.6; Tingley, Yamamoto, Hirose, Keele, and Imai, 2017).

The relationship between information presentation and liking an artwork was mediated by meaning, as depicted in Figure 4. When controlling for meaning, the direct effect (relationship between information and liking) was not significant with a very low effect size, suggesting full mediation or very strong partial mediation. Bootstrap testing for indirect effects estimated a significant average causal mediation effect at 0.67 ($p < .001$).[6]
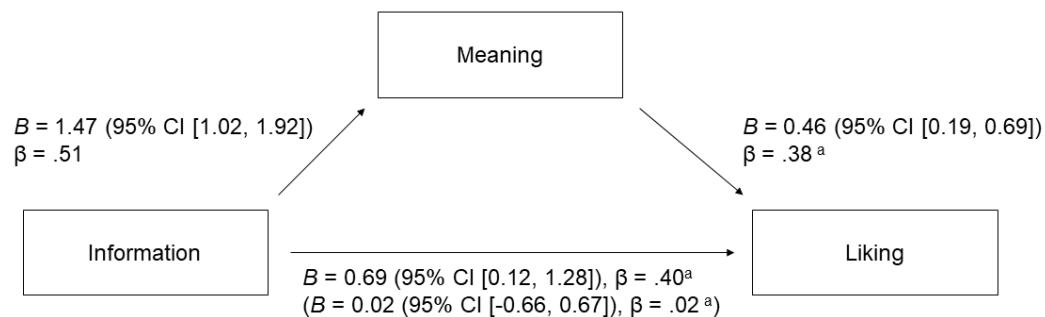

Figure 4. Standardized regression coefficients for the relationship between the presentation of information and liking as mediated by meaning. The regression coefficients between information and liking, controlling for meaning, are displayed in parentheses.
[a]estimated using non-parametric bootstrapping, r = 2000

Figure 5 displays the relationship between information and interest which is again mediated by meaning. The direct effect between information presentation and interest,

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[6] As suggested by Kenny (2016), an additional linear model was specified to gain confidence about the causal direction in the originally proposed mediation model. Meaning seemed to be more strongly predicted by information ($B = 1.29$, 95% CI [0.86, 1.72], $\beta = .45$) than liking ($B = 0.26$, 95% CI [0.13, 0.39], $\beta = .30$), deviating heavily from the originally specified model and providing further evidence in support of the originally proposed causal direction.

controlled for meaning, was close to zero and not significant, again suggesting full or a strong

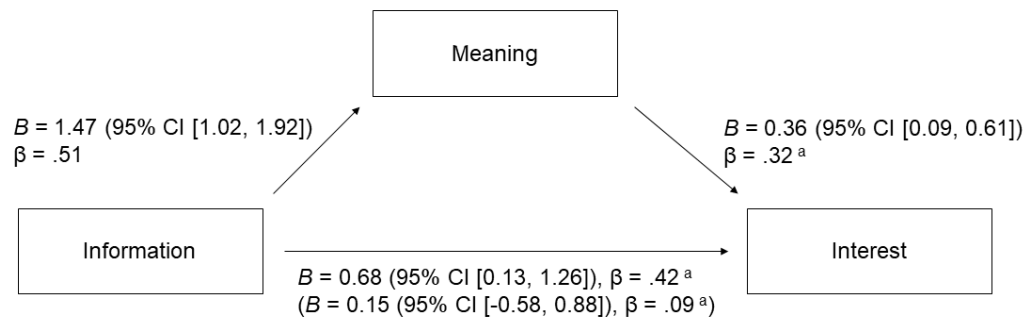partial mediation. The indirect effect was estimated at 0.53 ($p < .001$).[7]

Figure 5. Standardized regression coefficients for the relationship between the presentation of

information and interest as mediated by meaning. The regression coefficients between

information and interest, controlling for meaning, are displayed in parentheses.

[a]estimated using non-parametric bootstrapping, r = 2000

Lastly, the relationship between information and eco-emotions was mediated by

meaning, as depicted in Figure 6. Though the direct effect was not significant, its

standardized regression coefficient was relatively large ($\beta = .33$) even when controlling for

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[7] When investigating possible reverse causal effects as described above, both information (B

= 1.31, 95% CI [0.87, 1.76], $\beta = .45$) and interest ($B = 0.23$, 95% CI [0.09, 0.36], $\beta = .25$)

strongly predicted meaning, providing further support of the originally specified causal

direction.

meaning, indicating partial mediation. The average causal mediation effect of the proposed
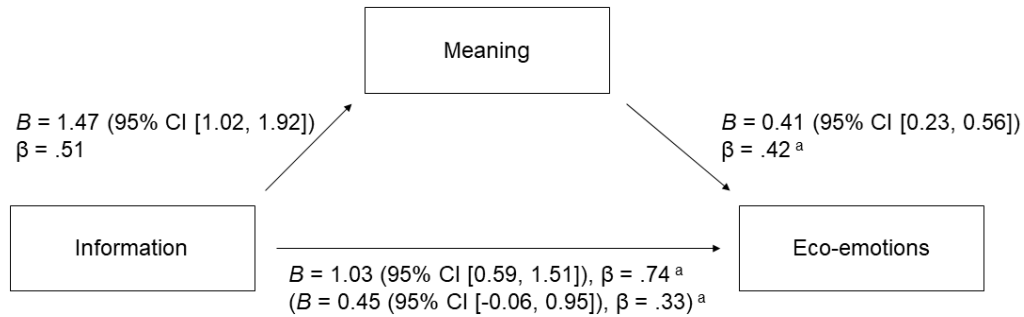
model was estimated at 0.59 ($p < .001$).[8]

Figure 6. Standardized regression coefficients for the relationship between the presentation of

information and eco-emotions as mediated by meaning. The regression coefficients between

information and eco-emotions, controlling for meaning, are displayed in parentheses.

[a]estimated using non-parametric bootstrapping, r = 2000

Discussion

Results

An experiment was conducted to investigate whether the presentation of contextualizing

information versus no information influences the experience of environmental art. In general,

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[8] Testing for reverse causal effects revealed that in a reversed model, both information

(B= 1.08, 95% CI [0.64, 1.53], β = .37) and eco-emotions (B = 0.37, 95% CI [0.21, 0.53], β =

.36) significantly predicted meaning with considerable effect sizes, supporting the original

mediation model pictured in Figure 6.

the results reported here suggest that it does matter whether a work of environmental art is presented on its own or with contextualizing information. As predicted, viewers in the information group found higher meaning in the artwork, indicating that both appraised understanding of the artwork and the personal meaningfulness is increased by contextualizing information. This is in line with previous findings which found meaningfulness and understanding to be increased by the presentation of information or titles (Cupchik et al., 1994; Leder et al., 2006; Millis, 2001; Russell, 2003; Russell & Milne, 1997; Swami, 2013; (Bubić et al., 2017). Regarding the potential effects of information provision on liking, interests, and eco-emotions, no directional hypotheses had been formulated. The results showed that participants in the information group liked the artwork more, found it more interesting and experienced stronger eco-emotions than participants in the no-information group. Further analyses revealed that the relationships between information provision and liking, interest, and eco-emotions were mediated by meaning. This is coherent with research by Bubić et al. (2017), showing that liking is increased by provisioning of a title.Furthermore, the elaboration effect (Millis, 2001), states that information can enhance viewer experiences – if the information is able to provide an alternative explanation to the obvious one which can be readily derived from the artwork. It seems that meaning provides the basis for appreciation of the artwork – as opposed to the notion that spontaneous appreciation of the artwork might lead the viewer to find more meaning in an artwork. Or as Lin and Yao (2018) put it, "information will work when it enhances viewers capacity to interpret the meaning of an artwork". This supports the psycho-historical framework proposed by Bullot and Reber (2013), which also sees understanding as the basis for the appreciation of art. In this framework, a viewer who can adopt the design stance (i.e. interpret the artwork in context) has an enhanced viewing experience as compared to a viewer who experiences only basic exposure – usually dominated by visual features of an artwork. Providing information could

have given participants in this study the necessary art-historical context to find meaning and increased aesthetic appreciation.

Moreover, the way in which observers spent visual attention varied significantly between the experimental conditions: Participants in the no-information group had longer average fixations than participants in the information group. As average fixation duration can be interpreted as an indication of the level of cognitive activity (Duchowski, 2017), these results suggest that participants in the information group expended less cognitive activity during their art experience. A possible interpretation would be that the contextualizing information guided participants in their experience, facilitating their search for meaning in the artwork, which could have resulted in less cognitive effort while trying to find a personal meaning and understanding. This is in alignment with results by Lin and Yao (2018), who also found that even though information disrupts visual attention, it makes it easier for participants to effectively process the painting. Taken together, these findings suggest that contextualizing information might facilitate the contemplation and reflection of art, allowing "easier" processing of an artwork.

Contrary to predictions, the visual attention dedicated to the semantically important regions of the artwork – the data lines representing climate change indicators – did not differ between groups. Possibly, the data lines were too prominent visual features, attracting attention independent of the semantic meaning: participants in the no-information group might have scanned the data lines due to their visual prominence, participants in the information group might have done so for the thematic content. Therefore, semantically inspired attention might not have added to visually inspired attention, as was originally predicted. Future research involving other works of environmental art should be able to gain more insight into the importance of semantic regions.

Pro-environmental intentions and behavior were not influenced by information presentation. This might indicate that while more spontaneous reactions of the aesthetic experience are impacted by the mode of presentation, factors which are more stable within a person, such as pro-environmental intentions and attitudes, are not. Nevertheless, this does not dismiss the possibility that cumulative differences in art experiences with versus without information, such as in exhibitions with multiple artworks, might collectively impact pro-environmental intentions and behavior.

In conclusion, the mode of presentation does seem to have an influence on the experience of environmental art. Findings of previous literature on the effect of contextualizing information largely translate to environmental art, and additional findings on relevant variables have given indications on possible research topics for futures studies.

Limitations

The present study is the first to systematically combine the two research areas of information presentation and perception of environmental art, arriving at important implications and suggestions for further research. However, due to its pioneering character, the following limitations should be considered: Firstly, only one artwork was presented to participants. While care was taken to choose an artwork which would not be too polarizing, future research should replicate findings with additional works of art, looking at whether distinctive styles, themes, or forms (e.g. sculptures or participatory processes) would produce consistent results. Lin and Yao (2018) investigated the effect of contextual information on 20 different artworks of the same art historical period. They found, that even though the information was guiding the gaze of the viewers, it did not impact the hedonic experience. Such studies, with several artworks, employing eye-tracking and investigating different forms of contextual information (factual vs. contextual, factual vs. emotional) are the direction in

which future research in the field of empirical aesthetics is pointing. Similar studies should also be conducted for environmental art.

Contextual information was presented in written form in this study. Other modes of presentation might be applied in future studies, including audio or video formats, to investigate if the mode of presentation might the strength and type of effects that contextual information has on the experience of environmental art.

As mentioned above, the data lines as only semantic regions might have been too obvious, as that there could have been a difference between the information and no-information groups. With a mixed method approach, including a short qualitative interview on what participants remembered, it might have been possible to reveal what specific aspects, like color and technique of the artwork, caught their attention.

When choosing the participant sample, the focus lay on representing a population which was neither especially environmentally- nor art-focused, because environmental art was to be assessed as a form of communication with the general public, even (or especially) "outside the choir". However, it is plausible that people with distinctively strong or weak pro-environmental tendencies or art familiarity might react differently to environmental art, and therefore might also be impacted differently by the provision of information. Future studies may investigate these aspects.

Due to the number of hypotheses being tested, a multiple comparisons problem cannot be ruled out. When p-values were adjusted using the Bonferroni method, almost all significant tests remained as such – however, the differences between groups for the variables liking (adjusted $p = .462$), interest (adjusted $p = .350$) and average fixation duration (adjusted $p = .378$) became insignificant. Future studies should re-confirm the effect of information presentation on these variables.

Finally, the experiment was conducted in a lab setting, which has been shown to impact factors such as viewing times and ratings (Brieber et al., 2014). Future research should aim at replicating findings in a field setting.

Even in view of these limitations, the results strongly suggest that the design decision of whether to provide art with vs. without contextualizing information should be taken into account whenever presenting environmental art, be it in a research or in an exhibition context.

Conclusion and Outlook

Environmental art has been increasingly addressed in past research, with promising indications on potential benefits of the inclusion of art in environmental communication. The research domain is evolving, with more systematic approaches such as literature reviews (Roosen, Klöckner, & Swim, 2017) and first models explaining the possible influence of art on pro-environmental behavior (Curtis et al., 2014) being published. As research is beginning to address more specific questions and to gain a more detailed view of the potentials of environmental art, it is important for researchers to consider factors which could influence the experience and impact of environmental art. In order to produce comparable and generalizable results, studies should control for or at least report on important contextual factors which might have influenced their findings. As this study has shown, the form of presentation of environmental art – with or without contextualizing information – is one of the factors that should be considered when designing studies on the topic of environmental art, as it can influence its visual perception and aesthetic experience.

The results of this study have important implications for everyone who is looking towards implementing environmental art as a tool of environmental communication. When presenting art, it should always be taken care of how context can influence the experience of art. The results of this study indicate that contextualizing information in particular is influential on

various levels, which is an important consideration for communicators: whether viewers like and are interested in an artwork is not only important when considering its value for environmental communication, but also, on a simpler level, for attracting visitors, funding exhibitions or creating campaigns. When looking back to the model of environmental art presented in the introduction, all three pathways of environmental art (communicating information in an engaging form, creating empathy towards the environment, enhancing sustainable development) involve factors that are influenced by contextualizing information.

Additionally, the results of this study have given rise to interesting questions that future research might investigate. For example, Jakesch, Leder, and Forster (2013) found that ambiguous images were rated by participants as more interesting and preferable, but also as more difficult to process. Assuming that contextualizing information has decreased the ambiguity of the artwork presented in this study, and that 'difficulty to process' would be indicated by higher cognitive activity in participants, it would be expected that in the present study, participants in the no-information group would have higher cognitive activity (i.e., longer average fixations) than participants in the information group – which was indeed the case. However, participants in the no-information group (with higher ambiguity) found the artwork less interesting and less preferable, which directly contradicts Jakesch et al.'s findings. Since the participants in the above studies were students without a background in the arts, i.e. members of the same general population as in this experiment, the reason for this discrepancy is likely to lie either within the topic of environmental art (maybe the message conveyed in environmental art does not inspire deeper elaboration) or within the specific artwork chosen for the experiment (the artwork might be too ambiguous without information, so that even an increase in elaboration did not result in higher ratings). This is a topic that future research might explore to gain further insights into possible peculiarities of environmental art and its possibilities.

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