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Abstract

We investigated visual attentional biases towards self-made artworks. Self-made objects tend to be favoured, remembered, valued, and ranked above and beyond objects that are not related to the self. On this basis, we set out to test whether the effects of self-relevance would apply to visual art, and via what mechanisms. In three studies, participants created abstract paintings which were then incorporated in a dot-probe task, pairing self-made and other-made stimuli. Our findings confirm that attention and preference are higher for self-made (vs. other-made) artworks. Furthermore, we show that visual attention assessed by a dot-probe task constitutes a reliable measure of preference for art.

Keywords: attentional bias; visual attention; self-relevance; dot-probe task; art preference

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Visual attention bias for self-made artworks

Introduction

Aesthetic preferences affect a wide range of human behaviours (Leder et al., 2004). They guide not only people's taste for artworks but also influence many day-to-day decision-making processes, such as what consumer products to buy, wear, or use (Crilly et al., 2004). Despite their obvious relevance, the complex cognitive mechanisms that shape aesthetic preferences remain poorly understood to this day (Pelowski et al., 2016, 2017; Schindler et al., 2017). To address this gap, our study focuses on one particular mechanism involved in aesthetic preference, visual attention, and how it is directed at self-made (vs. other-made) artworks.

Visual Attention and Aesthetic Preference

Visual attention is an adaptive mechanism that supports a fast and accurate perception of the environment (di Pellegrino et al., 2011). Because not all information can be processed in equal detail, visual attention is directed at stimuli with motivational significance (Lang et al. 1997). Adaptively significant, critical stimuli (e.g. snakes, attractive faces) are prioritized while less critical stimuli (e.g. inanimate objects, ordinary faces) are filtered out, generating attentional biases (Desimone & Duncan, 1995; Itti & Koch, 2001; Paschler, 1998). In this way visual attention can indicate, for example, vigilance (focus on negative stimuli) or preference (focus on positive stimuli). The link between repeated or sustained visual attention and preference is well recorded (Griffey & Little, 2014), and the correlation between the two is strong even when controlled for saliency (Gidlöf et al., 2017). Furthermore, the association of visual attention and subjective preference has been observed across different domains (e.g. faces, consumer products, food, art) and is supported by observations of neural activity underlying both states (Goto et al., 2017; Kawasaki & Yamaguchi, 2012). This consistent correspondence between attention and preference validates the use of visual attention as a methodological design to investigate aesthetic preference (Waitt et al., 2006), and opens the way for more objective preference testing. Because of its automatic nature, visual attention offers a more reliable measure of preference than the commonly-used self-report (Alvarez et al., 2015), where answers relate to subjective judgments of performance (Dang et al., 2020) and may be adjusted or affected by memory and distracters (Barrett, 2004). Measuring visual attention, thus, can inform us about the cognitive aspects that underlie how preference works in regards to art (Alvarez et al., 2015; Govers & Schoormans, 2005).

Attention Towards Self-relevant Stimuli

Several studies have recently determined a positive correlation between visual attention and aesthetic preference in different realms, including design and visual art (Goller et al., 2019; Rolke et al., 2019). These studies, however, do not usually address whether aesthetic preferences are due to the perceived characteristics of the object, or due to the object's relevance as assessed by the perceiver. Over the past two decades, research has substantiated that personal knowledge and past experience affect aesthetic preferences profoundly (Cupchik, 2011; Kuchinke et al., 2009; Pelowski & Akiba, 2011; Pelowski et al., 2017; Reber et al., 2004; Silvia & Nusbaum, 2011; Verhaeghen, 2018). The questions of why people favour one artwork over similar others, and why these preferences differ between individuals of similar cultural backgrounds remain uncertain but, brain-imaging studies have suggested a link to self-relevance (Vessel at al., 2012; 2013; 2019). That is, aesthetic preference seems guided by self-relevance, which refers to the perception and assessment of information that is personally meaningful to the individual (Macrae et al., 2018). Although the role of self-relevance in aesthetic preference is hinted at or implied in many empirical studies, it has not been examined directly yet. Here, we test whether preference for visual artworks is related to self-relevance, using a visual attention task.

The attentional processing of visual preference can be divided in three stages (Goto et al., 2017). First attention is directed at stimuli that have motivational relevance, followed by a more conscious identification of stimuli through the integration of perceptual and semantic information. Finally, attention is sustained on preferred stimuli, linked to evaluative and decisional processes. Since self-relevant stimuli are biologically and socially significant, there is a processing bias for self-related information across all three stages (Chen et al., 2011; Macrae et al., 2017). However, neural and behavioural responses may vary in intensity according to different degrees of self-relevance (Chen et al., 2011). That is, high self-relevant information, such as one's own name, is prioritized (Mack & Rock, 1998; Moray, 1959; Shapiro et al., 1997; Wood & Cowan 1995) above merely familiar and other-related stimuli (Frings & Wentura, 2014; Sui et al., 2012). Beyond own name, this effect has been observed, for example, with own face, own handwriting, and with place names and objects that are associated with the self (Chen et al., 2011; Gray et al., 2004; Kim & Johnson, 2012). Therefore, we expect a similar self-relevance bias to apply to self-made visual art as well.

Attentional Bias Towards Self-made Art

Self-made art is highly self-relevant. Artworks may serve as a social display signals and carry information about the identity and personal attributes of their creators, which may be of adaptive significance (Dutton, 2009). Belk therefore suggested that art may be perceived as an extension of the self (1988). Whether professional or amateur, artists tend to become attached to their own work and, we argue, they should demonstrate increased visual attention towards their own over others' artworks.

We hone in on three mechanisms that could explain this effect (Bloom, 2010). First, the *endowment* effect, refers to the feelings of ownership that people can develop towards objects perceived as 'mine'. Such feelings need not correspond to real ownership but can arise simply by touching an object (Peck & Shu, 2009), being in close physical proximity to it

(Truong et al., 2016), or by creating a mental association between an object and the self (Turk et al., 2011). Once objects are seen as ‘mine’, they receive more attention, are remembered better, preferred more, and even assigned a higher value than objects categorized as ‘not mine’ (Burris & Rempel, 2004; Cunningham et al., 2008; Kahneman et al., 1990; Kim & Johnson, 2012; Turk et al., 2011). The second effect is *effort*. It corresponds to the observation that investing labour, for example by making or modifying an object, is sufficient for people to assign greater value, positive affect, and more emotional attachment to their own creations against similar objects not made or modified by themselves (Kacelnik & Marsh, 2002; Marsh et al., 2018; Norton et al., 2012). The third effect is *familiarity*, when mere exposure to stimuli increases attention and liking, even if people do not recall having encountered the stimuli before (Kunst-Wilson & Zajonc, 1980; Zajonc, 1968). This exposure effect has been corroborated for visual art, showing that people prefer and give higher value to artworks that they have seen previously and more often, such as those included in the official art history canon (Cutting, 2007; Leder, 2003; Verghaeghen, 2018).

Our prediction is that if visual artworks become self-relevant through the processes of endowment, effort, and familiarity, we should observe increased visual attention and preference for artworks that are perceived as self-owned, self-made, and familiar, over non self-related and less familiar artworks. In turn, ownership and effort should correspond to the highest degree of self-relevance, with familiarity representing a separate but related effect.

Method

We designed three studies to test the predicted attentional bias towards self-made art. Instead of using existing artworks (Belke et al., 2010; Goller et al., 2019; Kuchinke et al., 2009), we asked participants to create their own abstract paintings, to avoid effects from previous exposure and to ensure the artworks’ self-relevance. We chose abstract art because recognizable motifs, such as persons, animals, landscapes or everyday objects could unwarily produce associations and semantic interpretations that could affect visual attention and aesthetic preference (Belke et al., 2010; Pelowski and Akiba, 2011; Russell, 2003). This study is the first time that visual attention in art has been investigated using paintings produced by the participants themselves.

In addition to measuring preference through a ranking task, the paintings were incorporated into a dot-probe task. The latter is one of the best standard methods for measuring attentional biases. In this task, subjects tap a dot that replaces relevant stimuli on a screen. Attention bias is determined by measuring and comparing participants' mean reaction times across stimuli over several trials, as they are expected to react more quickly to probes displayed on the attended stimuli (Cisler & Koster, 2010; Mogg & Bradley, 2005; van Rooijen et al., 2017). Previous studies using the dot-probe task have shown attentional biases for self-relevant stimuli as well as for appealing art and design objects (Rolke et al., 2019; Wójcik et al., 2018). We therefore deemed the dot-probe task suitable to test a visual attention bias towards self-made artworks in our three studies.

In Study 1, participants made and ranked their own and another participant's artworks. Subsequently, we compared preferential visual attention for self-made art (high self-relevance) vs. other-made art (low self-relevance) through a dot-probe task, in which faster reaction times would indicate a bias. In Study 2, we introduced a condition that would allow us to control for familiarity. To be precise, participants were asked to watch a video of a painting being made by another person (high familiarity) and, like in Study 1, they ranked a set of other-made paintings (low familiarity). We then paired all combinations in a dot-probe task to test whether familiarity with the stimuli would alter the reaction times. Study 3 was designed to test for ownership and effort at varying degrees of self-relevance. Participants again created their own abstract paintings (high self-relevance), but they also produced copies of another person’s paintings (moderate self-relevance). By pairing all combinations of their own artwork (high ownership and high effort), the self-made copies (low ownership and high effort), and other participant’s original artwork (low ownership and low effort), we hoped to gain a greater insight into the factors and concepts that drive the attentional self-bias.

All of our materials, including the results of the analyses, are open and publicly available through Dataverse.nl.

Experimental design and statistical analyses

In all three studies, dot-probe trials with reaction times over 2000ms or under 200ms were removed from the analyses in accordance with standard procedures for the removal of extreme values (Bradley et al., 1997; Chan et al., 2013; Glinder et al., 2007). Trials were also excluded if the participants incorrectly categorised artworks as being produced by themselves or someone else, as assessed in the questionnaire completed after the dot-probe task for each study.

We analysed reaction time data from each block in the dot-probe task trials using separate generalised linear mixed models (GLMMs) built in SPSS v25, which combine the characteristics of both linear mixed models and generalised linear models into a single analysis (McCulloch & Neuhaus, 2015). GLMMs have become an established analytical method in dot-probe research (Blaut et al., 2013; Wilson & Tomonaga, 2018), particularly because it extends the function of a typical ANOVA (Kret et al., 2016). The GLMMs allowed us to account for individual differences in reaction time by including the subject as a random effect, and was advantageous when assessing non-normally distributed data.

The response variable was reaction time (RT) for pressing the probe dot. As the RT data were skewed towards smaller values, a generalised model was used which is recommended when the data are not normally distributed (Tuerlinckx et al., 2006). We used a γ-probability distribution with a log-link function (Gamma regression), as previous dot-probe research has rendered this as the most appropriate match of the reaction time skew (Kret et al., 2016). In addition, a mixed effects model was used as it also allowed for the inclusion of fixed and random factors which can account for within-person and between-person variability (Nakagawa & Schielzeth, 2013). In this way, the GLMM approach can account for correlations between data points within subjects that may emerge from our repeated measures design. Consequently, the multilevel structure of the models was defined by the different trials, nested within participants.

The primary fixed effect was the probe dot's position, reflecting the type of artwork the dot appeared behind (self or other-made). In all three studies, the fixation dot was equidistant from the two probe dot locations. Subject number was included as a random factor. We also included handedness congruence with the dot position (e.g. dot appearing on the right for a right-handed individual) as an additional fixed factor, as previous research found that handedness accounts for significant variance in reaction times (Fiacchino, 2019).

Study 1

Study 1 compared the extent to which participants' attention was biased towards self- or other-made art and in relation to how they rated the two types of art independently. Collecting both attentional and self-reported preference measures would allow us to test directly whether an attentional bias was due to self-relevance or the individual liking of the artworks. Aesthetic preference ratings were obtained by asking participants to rank the self-made and other-made artworks on a scale from 'like best' to 'like least'. Attention was measured through reaction times in a dot-probe task pairing self- and other-made artworks.

By examining individual differences in attentional bias for self- versus other-made art in the dot-probe task and self-reported preference in the ranking task, we expected to determine empirically whether an attention bias was related to self-relevance or liking. If attention was related to ranking, independently of the self and other categories, then this would support the hypothesis that preference is based on individual liking. If the two were unrelated, and self-made art was favoured, then our data would be consistent with the hypothesis that preference has to do with self-relevance.

Participants

Participants consisted of 72 psychology students (65 female, *M age* = 23.26, *SD* = 8.96, 68 right-handed) recruited through the Leiden University Research Participation Scheme and they were offered course credit to complete the study. Over half of the participants (N=40) were of Dutch nationality and none were professional artists. We had originally planned to use an ANOVA. Accordingly, a G* Power calculation was done. The sample size was determined a priori using G*Power software (Faul et al., 2007) which indicated that 70 participants would suffice to detect a small effect size (f = 0.125, α = 0.05, power = 0.8). After switching to GLMM, we had a larger number of data points than we assumed in our power analysis. Therefore, it was likely that our sample size is more of an overestimation than an underestimation, rendering it suitable for the study.

Ethical approval was granted by the University of Leiden's Ethics Committee (CEP18-1024/401). All participants signed informed-consent forms and were fully debriefed about the purpose of the investigation.

Procedure

The experiment took place over two consecutive days. On the first day, participants were recruited in pairs. They were asked to produce 15 abstract paintings each (allocating 2 minutes per paintings) and were told that the artwork should not depict any object or person, and should have no representational or symbolic meaning (Figure 1). Paired participants sat opposite each other, separated by a screen and unable to see each other or each other's paintings. The 15 artworks produced were then laid out together and each participant was asked to rank their own paintings in silence from ‘like best’ (1) to ‘like least’ (15). Next, participants swapped seats and were asked to rank their partner’s art in the same way, confidentially. Participants were asked not to communicate during the experiment. At the end, they completed a short questionnaire about the painting experience, and their artistic background.

The next day, participants returned individually to complete the dot-probe task in which we paired their self-made art with their task partner’s art, to test our prediction that self-production would alter attentional bias towards own artworks. Participants were instructed to identify the dot location by touching it as quickly as possible, using only the index finger of their dominant hand throughout. Each trial began with a black dot presented in the lower middle part of the screen to focus the participant’s attention. The fixation dot was equidistant from the two probe dot locations. Upon pressing the dot, two paintings appeared side by side for 300ms. A dot then immediately replaced one of these images, remaining on the screen until tapped. Once this second dot was pressed, a new trial began with the presentation of another focus dot after a delay of 2000ms (see Figure 2).

The dot-probe task measured the Reaction Time (ms) for pressing the probe dot (dependent variable) as a function of the type of artwork the dot appeared behind (independent variable). This measured how quickly the participant pressed the dot which replaced one of two paintings presented simultaneously, reflecting an attentional bias towards a particular stimulus.

The dot-probe task consisted of five practice trials, followed by 4 blocks. Block 1 paired self and other-made art on the order in which the artworks were made. Due to the coupling format, both participants in each task couple completed exactly the same trials in this block. Block 2 paired self and other-made art according to ranking. To control for any potential effects of preference when measuring self-attentional bias, pairings were determined by how the participant who was completing the dot-probe ranked both their own, and their partner's art. Block 3 paired self-made art matched according to ranking, and Block 4 paired other-made art matched on ranking as well (see Table 1). Within each block, every individual trial type was repeated six times for each stimulus pair; three times with the dot appearing behind one stimulus, and three times appearing behind the other, adding up to 90 trials per block (15x6=90). This gave us a sufficient number of trials per condition. Participants completed all of the experimental conditions (within subject design). Block order was counterbalanced using a standard Latin square arrangement and the trial order within each block was randomised. Each block was followed by a short break.

Finally, participants were asked to state how much they liked each painting on a 7-point Likert scale, and to identify whether they had created that painting (yes, no, or not sure). This identification served as an inclusion criterion for analysis, to check if participants recognized their own paintings and to ensure that the manipulation of self-relevance was successful.

In Blocks 3 and 4, when pairing the paintings based on ranking preference, each artwork was consistently matched with an artwork ranked 5 places above/below (see Figure 3). Additionally, the highest ranked were paired with the lowest ranked, maintaining a constant ranking distance of 10. In order to verify the ranking procedure, the next day participants rated all 30 paintings (self- and other-made) on a 7-point Likert scale from (1) strongly dislike, to (7) strongly like, using the online survey platform Qualtrics. These rating scores were significantly correlated to the ranking scores in both participants' own art r_s = .635, $p < .01$, and other art $r_s = .470$, $p < .01$.

Materials

For the first part of the study, participants were provided with plain A4 bond paper, a set of water-based paints (red, yellow, blue, green, black, and white), a standard medium round paintbrush, and a pot of water. For the second part, the dot-probe task was programmed and presented using E-Prime version 2.0 (Psychology Software Tools, Inc.). The stimuli were presented on a Dell touch-screen monitor, (model S2240Tb, 21.5in diagonal size).

The dot-probe stimuli for each participant were 30 photographs of abstract paintings. These included the 15 self-made paintings and the 15 artworks painted by the participant's task partner, meaning each set of 30 stimuli was viewed by two participants. The artwork photographs were all taken from the same angle by the experimenter using a high-quality smart phone camera. All photographs were cropped to show only the painting, resized to the width of 400 pixels and presented on a white background. The experimenters procured that all photographs were of similar brightness and colour intensity. The diameter of the dot presented throughout the task was 200 pixels.

Analysis

We measured the reaction times on the dot-probe task to assess attentional biases. The dot-probe task consisted of four blocks of 90 trials with a randomised order. Reaction times that were too long (over 2000ms) and too short (under 200ms) were excluded.

When testing the prediction that self-production affects attentional bias (hypothesis 1), the independent variable was ownership, reflecting whether the painting replaced by the dot was self-made, or other-made (Block 1). When testing the prediction that attention is biased towards liked stimuli (hypothesis 2), the independent variable was preference, determined by the position of the paintings in the ranking task. As such, in Block 2 stimuli were coupled according to the outcome of the ranking task, (i.e. 1st-ranked own art with 1st-ranked other art). Moreover, in Block 3 we controlled for self-production by pairing only the participant's own art according to preference (liked vs. disliked, liked vs. neutral etc.). In Block 4, we used only the task partner's art, matched according to the preference ranking task (Fig. 3).

Results

In Block 1, results showed a significant main effect of dot position, $F(1, 6152) = 9.16$, $p = .002$. The participants were faster to press the dot when it appeared behind their own artwork ($M = 629.85$, $SE = 3.89$) compared to the artwork produced by their task partner ($M = 644.09$, $SE = 3.95$). In line with hypothesis 1, the participants showed an attentional self-bias towards their own artworks.

The results of Block 2 showed a significant main effect of dot position, $F(1, 6132) = 4.39$, $p = .036$. Thus, participants were biased towards their own artwork compared to artwork produced by the task partner. Again, the participants were faster to press the dot when it appeared behind their own artwork ($M = 635.57$, $SE = 3.84$) compared to the artwork produced by their task partner ($M = 646.13$, $SE = 3.92$). The similarity between the first two blocks suggests that the attentional self-bias was unaffected by reported preference, thus we decided to combine the data from Blocks 1 and 2 for the next analysis.

For the combined data, we found a significant main effect of dot position ($F(1, 12287) = 12.38$, $p < .001$) indicating that, in accordance with hypothesis 1, participants were biased towards their own art which was reflected in a faster reaction time towards the dot that replaced their own artwork ($M = 632.70$, $SE = 2.73$), compared to the dot that replaced the task partner's artwork ($M = 645.11$, $SE = 2.78$; Figure 4).

Next, we investigated the effect of reported preference of one's own art on reaction time (Block 3). Here, the two stimuli competing for attention were both produced by the participant, and were ranked according to preference (Figure 3). The results showed no main effect of dot position, $F(5, 6434) = 1.34$, $p = .246$, indicating that differences in ratings for one's own art did not significantly impact attention. In Block 4 we examined the effect of reported preference of the task partner's art on reaction time (Figure 3). Results showed no main effect of dot position, $F(5, 6443) = 0.65$, $p = .661$. As in Block 3, attention was not significantly affected by differences in ratings for art created by someone else.

In a final model, we combined data from Block 3 and 4. The GLMM showed no effect of dot position on reaction time, $F(5, 12884) = 1.44$, $p = .208$. This indicates that the relative likability of the paintings paired in each trial did not significantly impact reaction time, providing no evidence for an attentional bias grounded on aesthetic judgement (hypothesis 2).

Conclusion

Study 1 showed that attention was biased towards self-made artworks, presumably because these were perceived as self-relevant. Interestingly, expressed liking had no effect on the participants' reaction times in any of the test conditions, meaning that preference based on how much participants liked the artworks did not influence the attentional bias. This is the first study to demonstrate that self-made artworks can gain the same attentional biases that are commonly accredited to self-associated stimuli (Humphreys & Sui, 2016).

Study 2

While Study 1 provided evidence for the existence of an attentional bias towards self-made art, it did not rule out the role of familiarity in the observed effect. Namely, participants were arguably more familiar with their own art, as they spent two minutes painting each piece, but only saw their task partner's art during the short ranking assignment. Even though self-relevant stimuli generally tend to be more familiar than non-self-relevant stimuli, familiarity is distinct from self-relevance processing (Chen et al., 2011), meaning that preference due to exposure constitutes a different mechanism from preference due to self-creation. So, it became necessary to exclude the possible effect of familiarity on the observed attentional bias for self-made artworks.

Study 2 would determine if familiarity played a role in the attentional bias found in Study 1. The design consisted of three conditions. In condition one participants produced their own artwork (high familiarity), in condition two participants viewed and ranked others' artworks (low familiarity), and in condition three participants watched full-length videos of a third set of artworks being created by another individual (high familiarity) (see Table 2). By pairing all combinations of these three conditions in a dot-probe task, we expected to both, replicate the results of Study 1, and also test whether familiarity would alter the reaction times.

Comparing reaction times to participants' own vs. others' artwork in a dot-probe task would replicate Study 1. In addition, comparing reaction times to participants' own art vs. other's artwork *that was highly familiar* would reveal whether the self-bias effect found in Study 1 could be distinguished from a familiarity effect.

We outlined three predictions. First, that attention would be again biased towards self-made artworks. Second, that attention would be drawn towards more familiar art, compared to less familiar art. Third, that even when compared to equally familiar artworks, attention would still be biased towards self-made artworks, in correspondence with the self-relevance effect. In sum, we predicted that attention would be biased towards the artwork's familiarity, but that the self-relevance of the self-made artworks would facilitate an attentional bias beyond any familiarity effect. We assessed these predictions by measuring attentional biases with a dot-probe task.

Participants

Participants were undergraduates recruited through the Leiden University Research Participation Scheme and offered Psychology course credits, or €10. The sample included 70 participants (54 female, 15 male, 1 other; *M age* = 22.84, *SD* = 4.61, 61 right-handed). Four participants had already been involved in Study 1.

Procedure

As in Study 1, Study 2 used a within subjects design with all participants completing all conditions, and the dependent variable remained as Reaction Time in the dot-probe task. The independent variable reflected which painting the dot replaced in the dot-probe task, which changed according to the prediction in question (Table 2).

The study entailed a single 1.5 hour testing session. For practical reasons, participants completed the dot-probe task in the same session as the painting rather than the following day, as was the case in Study 1. Again, participants were asked to produce 15 abstract paintings with no representational or symbolic meaning. However, they were given 1.5 minutes to produce each painting, since in Study 1 many participants did not utilise the full 2 minutes provided.

In addition to following the procedure of Study 1, participants were asked to watch 15 full videos of abstract art being produced by someone else (1.5 minutes each), which created the high familiarity condition. The aim was to make participants as familiar with another person's art as they would be with their own, by exposing them to the individual artworks for the full length of the painting sessions. Next, participants were shown another set of 15 other-made paintings and were asked to rank them from 'like best' (1) to 'like least' (15), replicating the ranking procedure of Study 1 and creating the low familiarity condition. Whether participants first ranked the art or first watched the videos was counterbalanced.

Participants then completed a dot-probe task which consisted of five practice trials followed by three blocks of 90 experimental trials. They took a short break after each block. Similar to Study 1, the independent variable in Block 1 was whether the painting replaced by the dot was self-made or other-made. It paired highly familiar self-made art with lowly familiar other-made art seen shortly in the ranking task. Block 2 aimed to test the attentional bias by effect of familiarity alone. It paired other-made highly familiar art, from the watched videos, and other-made lowly familiar art, from the ranking task. Block 3 aimed to test the self-bias found in Study 1 under a more stringent familiarity control. Like the first block, it paired self-made and other-made art, but all the stimuli were highly familiar. Block 1 (replication) was always presented first, and the order of Blocks 2 and 3 was counterbalanced.

As in Study 1, each individual trial type was repeated six times; three times with the dot appearing behind one stimulus, and three times appearing behind the other. After completing the dot-probe task, participants were shown all 45 paintings again in an online survey (through Qualtrics). They rated each artwork on a 7-point Likert scale, and were asked to indicate if they had had created it. Response options differed from Study 1 to include, ‘Yes I created it’, ‘No, but I saw it in a video’, ‘No, but I ranked it’, ‘No, I have not seen it before’ and ‘I am not sure’. This was done to more accurately identify whether the participants recognised the different types of art, which in turn served as an exclusion criterion for analysis. We removed trials that contained a painting which the participant did not correctly identify (e.g., a painting that was seen in a video but the participant answered that they had created it), or a painting that they were “not sure” about. We made these exclusions to ensure that the data specifically captured the desired manipulated constructs of familiarity and self-relevance.

Finally, participants answered a number of questions regarding their painting experience and artistic background before completing self-consciousness and creativity scales.

Materials

Prior to testing, six individuals with no artistic background produced 15 abstract paintings each under similar conditions as the participants while being filmed by the researchers. We equated the exposure perspective by making the videos from ‘the artist’s point of view’, showing only the painter’s hand, paper, and tools (see Figure 5). The resulting artworks were the stimuli used as the other-made art in the video and ranking tasks.

The dot-probe task stimuli included 15 self-made paintings, 15 other-made paintings watched in a video, and 15 other-made paintings that were ranked.

The equipment was largely identical to Study 1, except a 19in. Iiyama touchscreen monitor was used. Due to the smaller touch screen size, photographs of paintings were resized to a width of 280 pixels, and the size of the dot in the task was reduced accordingly to 140 pixels.

Analysis

In addition to the exclusion criteria of Study 1, we further removed trials based on individual responses to the painting recognition questionnaire. The excluded trials contained paintings which were misidentified by the participants, and paintings of which they were uncertain about. In total, 8.3% of all trials were excluded.

Results

In Block 1, aimed at replicating Study 1, our GLMM showed a main effect of dot position, $F(1, 6125) = 20.92$, $p < .001$, where participants reacted significantly faster to pressing the dot when it appeared behind highly familiar self-made art ($M = 537.38$, $SE = 3.69$), compared to lowly familiar other-created art ($M = 558.78$, $SE = 3.89$).

Results for Block 2, aimed at testing the attentional bias by effect of familiarity with other-created art, showed no main effect of dot position, $F(1, 6146) = 0.14$, $p = .714$. Contrary to our prediction, participants displayed similar reaction times when the dot appeared behind other-created artwork of low familiarity ($M = 539.59$, $SE = 3.83$), compared to other-created artwork of high familiarity ($M = 541.75$, $SE = 3.90$).

Finally, Block 3 tested the self-bias found in Study 1 with a stricter familiarity control. The GLMM showed that participants reacted significantly faster when the dot appeared behind highly familiar self-made artworks (*M* = 533.65, *SE* = 3.85), compared to highly familiar other-made artworks (*M* = 558.51, *SE* = 3.68), $F(1, 6094) = 28.85$, $p < .001$. See Figure 6.

Conclusion

In Study 2 we reliably found that participants reacted faster to their own artworks in the dot-probe task, confirming an attentional bias towards self-relevant stimuli. Even strong familiarity with other-made artworks did not influence the reaction times towards self-made art. This means that among equally familiar stimuli, self-relevance plays a key role in attentional bias. This is consistent with previous research on the processing of self-relevant stimuli (Chen et al., 2011).

Our results demonstrate that the attentional-bias towards self-made art is still observed even under a more stringent control of familiarity. This suggests that the significant findings of Study 1 were not due to familiarity with self-made stimuli or a mere exposure effect.

Study 3

Study 3 aimed firstly at conceptually replicating the results of the self-bias effect found in the previous two studies. The conceptual replication entailed a slightly different and more stringent control of familiarity. Specifically, it equated both exposure time and the amount of cognitive effort involved in the familiarisation process. Arguably, in Study 2 participants may still have been more familiar with their own artwork than with the artwork from the videos. Although exposure time was equal, participants likely invested more cognitive and physical effort in the painting task than in the video task. Consequently, in Study 3 participants were asked to produce copies of paintings made by someone else in order to equate familiarisation time and to more strictly equate the cognitive effort involved in the familiarisation task. Replicating the previous findings with this modified and more stringent procedure would provide stronger evidence that the attentional biases for self-relevant stimuli (Sui et al., 2012) also apply to self-made art independently of familiarity. We therefore predicted that authorship would be associated with greater attention bias despite strongly controlling for familiarity.

Secondly, Study 3 intended to move beyond familiarity in explaining varying degrees of self-relevance by investigating the effects of physical effort and creative input as an alternative explanation for the self-bias. The tasks in this study were designed to assess how the degree to which participants were involved in the production of arworks impacted the ability of those artworks to capture their visual attention. In this context, we predicted that self-production would be associated with greater attention bias, and that authorship (high self-relevance) would be associated with an even stronger attention bias than mere self-production (moderate self-relevance).

The independent variable differed according to each prediction (see Table 3).

Participants

Recruitment and ethical procedures replicated Study 2. The sample consisted of 70 individuals (56 female, 13 male, 1 other; *M age* 22.11, *SD* = 3.10, 63 right-handed); seven of whom had participated in Study 1, and 27 had been involved in Study 2.

Procedure

The procedure was largely similar to Study 2. First, participants were instructed to produce 15 abstract paintings. Next, however, instead of ranking and watching videos as in Studies 1 and 2, they were asked to produce copies of complex abstract paintings made by someone else. Participants were presented with the other-made paintings individually, in the same order that they were originally produced and were given only 1.5 minutes to make each copy, as opposed to the 3.5 minutes that the originals took to paint. The point was to make sure that the participants would not be able to recreate the complex paintings accurately within the 1.5 minute time limit assigned to the copying the task. This would allow them to distinguish more easily their own copies from the original paintings in the dot-probe task, ensuring again the self-relevance of own production (Figure 7).

Next, participants completed a dot-probe task including five practice trials followed by the three blocks of 90 trials each, with a short break between blocks. Block 1 investigated the prediction that authorship would result in greater attention bias, even when controlling for familiarity. The first independent variable was whether the dot replaced self-made art (high ownership, high effort) or the original other-made art that the participants had copied (low ownership, low effort), in order to create a more stringent control of familiarity by further equalising the effort involved in the familiarisation task. Block 2 tested the prediction that self-production would be associated with greater self-relevance and thus greater attention bias. It paired the original other-made art that was copied (low ownership, low effort) and the participant's self-made copies of the same art (low ownership, high effort) in order to measure whether the sole physical effort of creating a painting could produce the self-bias effect, regardless of familiarity or creative input. Finally, Block 3 paired the self-made art designed by the participant (high ownership, high effort) with the self-made copies of the other-made complex paintings (low ownership, high effort), to test whether a self-bias could still be found when comparing two self-made paintings that differed in degree of self-relevance and creative input. The order of all Blocks was counterbalanced.

Participants were later asked to identify who had created each painting using the response options 'Me -I designed it', ' Me- I copied it from another painting', 'Not me', 'I have not seen this painting before' and 'I'm not sure'. Participants also completed a short questionnaire to assess their perceptions of the paintings. They were shown a selection of five paintings from each category (self-made art, original other-made art, and self-made copies) and asked to rate the extent to which they agreed with the statements: 'I feel that these paintings represent who I am' and 'I feel that these paintings belong to me' using 7-point

Likert scales (1=strongly disagree, 7=strongly agree). These items assessed the degree of self-relevance and ownership. Each participant was assigned an individual set of complex paintings which was counterbalanced.

Materials

The equipment was the same as in Study 2, but the stimuli differed. Prior to testing, six individuals with no background in art production made six sets of 15 paintings to be used as stimulus material for the participants to copy. These were complex abstract paintings created in 3.5 minutes each. In Study 3, the stimuli were the 15 self-made abstract paintings, the 15 original other-made paintings to be copied, and the 15 copies produced by the participants. We photographed the wet paintings using high-quality smartphone cameras, closely matching the angle, contrast and colour intensity of the pictures. Finally, we sized the images to a width of 280 pixels for the dot-probe task. The size of the black dot was 140 pixels in diameter.

Analysis

A total of 0.69% of trials were removed across all three blocks. In addition, all trials which contained paintings that participants were unable to correctly categorise as either their own, the original painting, or their self-made copy, were also removed. The number of misidentified paintings per participant ranged from 0 to 14 out of 45 (M = 2.74, SD = 2.86) and this resulted in an additional 12.38% of data being removed across all blocks.

Results

In Block 1, aimed at testing whether authorship would result in a greater attention bias even when controlling for familiarity. Our GLMM showed no main effect found for dot position ($F(1, 5545) = 1.06$, $p = .303$). This indicates that, contrary to our prediction, there was no significant difference in reaction times when the dot replaced participants' own art (M = 546.42, SE = 3.87) compared to the original other-made art (M = 550.76, SE = 3.92).

Block 2, tested whether self-production would be associated with greater self-relevance and thus greater attention bias. No significant main effect was found for dot position ($F(1, 5347) = 0.32$, $p = .569$), indicating that reaction times were not significantly faster when the dot replaced the original other-made art ($M = 549.81$, $SE = 4.14$) compared to the self-made copies ($M = 552.94$, $SE = 4.02$).

Block 3 was meant to test whether a self-bias would be found between two self-made paintings with different degrees of self-relevance and creative input. Again, no significant main effect was found for dot position ($F(1, 5681) = 0.84$, $p = .361$), showing there was no difference in reaction times when the dot replaced participants' own artwork ($M = 543.03$, $SE = 4.01$) compared to the self-made copies ($M = 547.57$, $SE = 3.89$; Figure 8).

While there were no significant differences in RT depending on which type of painting the dot replaced, this was insufficient evidence to accept the null hypothesis and conclude that the RTs were equal. Therefore, we used equivalence testing to determine whether the RTs in the different experimental conditions could be considered statistically equivalent, following the procedure outlined by Cook and DeMets (2008). First we calculated the zone of indifference using an effect size value ($d = 0.28$) from a meta-analysis of dot-probe studies which compared the responses of younger and older adults to emotional and neutral stimuli (Murphy & Isaacowitz, 2008), as this better reflected the sample used in our research. As our study looked at a more novel effect which was likely to be small, we took a conservative approach and halved the effect size value. The zone of indifference was +/- 1.49, calculated in accordance with equivalence testing procedure (Cook & DeMets, 2008). For the RT values to be considered statistically equal, the mean difference and lower and upper 95% confidence interval values should fall within this range. None of the values for each of the three blocks fell within this range, indicating that the RTs were not statistically equivalent for participant’s own paintings and original paintings when paired in block one, the original paintings and self-produced copies paired in block two or the participant's own paintings and self-produced copies when paired in block three.

To substantiate our null-findings across the three blocks, we conducted several Bayesian analyses in which we tested the evidence for the null hypothesis (Harms & Lakens, 2018; Lakens et al., 2018). Using the package brms in R (Bürkner, 2017, 2018), we ran one model per block with probe position and handedness congruence as fixed factors, and subject number as random factor. In order to calculate Bayes Factors (BF), we also ran a null-model including handedness congruence as fixed factor, and subject number as random factor for each block. We defined the models using a gamma-distribution with a log link, and used a normal prior (M = 6.21, SD = 0.1) for the intercept, and a normal prior (M = 0, SD = 0.01) for the beta-coefficients (note that these numbers are on the log-scale, with e.g., 6.21 reflecting an expected mean of about 500 ms based on prior findings [see dot-probe results of e.g., Kret & Van Berlo, 2021]). Model convergence was checked according to the WAMBS checklist (Depaoli & van de Schoot, 2017). To estimate the BFs, we performed 100 repetitions of the BF calculations and calculated an average BF in favor of the null-hypothesis for each of the three blocks. The BFs were as follows: Block 1: BF_{01} = 1.07, Block 2: BF_{01} = 1.35, and Block 3: BF_{01} = 1.08. In each case, we found only anecdotal evidence for the null hypothesis.

Although the generalized linear mixed effects models did not provide support for the hypotheses, neither these models nor equivalence testing provided evidence that the hypotheses could be rejected. The Bayesian analyses did not show any clear evidence for the null-hypothesis either. In sum, there was no significant difference found between the conditions.

Data from the self-relevance and ownership questionnaire were also analysed. As the data are not normally distributed and the study used a within-subjects design, a Wilcoxon signed rank test was used to assess whether there were significant differences in the ratings for self-relevance and ownership between the three groups of paintings, this is shown in Table 3. With regard to self-relevance, the questionnaire showed that participants rated their own paintings (*Mdn* = 4) significantly higher than the original paintings (*Mdn* = 1), (Z = -6.64, p < .00) and higher than the self-made copies (*Mdn* = 2), (Z = -6.79, p < .001). Participants also rated the self-made copies significantly of higher relevance to the self than the original paintings (Z = -2.42, p = .016).

A similar pattern was found with regard to ratings for ownership. Participants gave their own paintings (*Mdn* = 6) significantly higher ownership ratings than to the original paintings (*Mdn* = 1) (Z = -7.05, p < .001) and the self-made copies (*Mdn* = 3) (Z = -5.76, p < .001). Again, participants reported a greater sense of ownership over the self-made copies in comparison to the original paintings (Z = -5.63, p < .001). This indicates that the three categories of paintings were perceived differently by participants according to self-relevance, effort and ownership.

Conclusion

Study 3 looked to conceptually replicate and then extend the findings of Studies 1 and 2 by investigating the attentional bias for self-made stimuli. Contrary to our initial predictions, we found no evidence that individuals exhibited a visual attention bias according to intellectual authorship or the physical production of abstract paintings. However, the ranking task was consistent with the so-called IKEA effect which dictates that objects become self-relevant by creation or alteration, and is based on observations that labour investment alone leads people to overrate their own creations against tangibly similar objects which they have not made themselves (Norton et al., 2012). The correlation between effort and liking predicted by the IKEA effect is reflected in assigning greater value, positive affect, and emotional attachment to self-made objects (Marsh et al., 2018). Our rating tasks consistently found that self-made artworks and copies were ranked as more self-relevant and given higher ownership and liking values than other-made paintings.

The fact that the visual attention results from Study 3 departed from the previous studies may be explained in various ways. First, Study 3 implemented a much stricter control of familiarity than the ‘watch video’ condition of Study 2. The copying task equalised not only exposure time between self-made and other-made paintings but also the ‘quality’ of the familiarity, given the cognitive input and effort required to produce a copy. Our aim to control for familiarity may have caused participants to feel a greater sense of ownership towards the other-made paintings they copied, which could have biased their attention (Ashby et al., 2012). Second, it is possible that contrary to our predictions, authorship and mere physical production do not lead to differences in visual attention bias. Perhaps the self-relevance and sense of ownership over the self-made artworks was equalised in both the self-made and copied conditions despite the different levels of creative input (Franke et al., 2010; Marsh et al., 2018; Norton et al., 2012). Through the act of copying them, even the low-ownership, low-effort stimuli of the other-made artworks could have become perceived as ‘mine’ and therefore acquired moderate self-relevance by an endowment effect (Cunningham et al., 2008; Turk et al., 2011). Previous research has shown that high self-relevant and moderate self-relevant information is not clearly differentiated by the brain at the early processing stages (Chen et al., 2011), which may explain why the stimuli did not elicit attentional differences in the dot-probe task even though they were assessed distinctively in the questionnaire. Finally, the instruction to avoid representational meaning may have resulted in artworks that did not truly reflect the participants’ creative efforts hence lacking self-association, which is key for a bias towards self-made items (Pierce et al., 2003). The latter is partially supported by the questionnaire, as the ratings indicated that, in general participants did not consciously view their own paintings as highly self-relevant (*Mdn*= 4, on a 7-point Likert scale), even though participants' ratings for their own paintings were higher than for the other categories of paintings, demonstrating a distinction in the way the paintings were perceived.

Discussion

The goal of the three studies presented above was to test the main hypothesis that visual attention biases should reveal preference for self-relevant visual artworks. We created experimental conditions to test whether attention was biased towards self-production in aesthetic stimuli (visual art). Instead of using existing artworks, we had participants create their own abstract paintings, so as to avoid previous exposure and ensure self-relevance. This is the first time that the self-bias effect in art has been investigated using abstract paintings produced by the participants themselves. These artworks were then incorporated into a dot-probe task pairing self-made and other-made stimuli to measure and compare the participants' mean reaction times across stimuli.

Our experimental setup aimed to avoid certain limitations by asking participants to produce their own abstract paintings. For example, by making the art themselves, we made sure that the stimuli would be self-relevant and circumvented the problem of previous exposure (van Paasschen et al., 2015). In addition, by adhering to abstract art, we evaded the problem of generating preference for representations of biologically relevant categories, such as faces, animals, landscapes, or food, or due to cognitive mastery and interpreting the meaning of the painting (Belke et al., 2010; Pelowski and Akiba, 2011; Russell, 2003).

Throughout the three studies, we not only had subjects create their own artworks, but also observe the creation of artworks by others, and copy other people's artworks. The first condition was designed to test self-relevance, the second tested self-relevance controlling for familiarity, while the third tested the degree of self-relevance controlled for ownership and cognitive effort. We expected attention and preference to be higher for self-made stimuli in all conditions.

In agreement with our hypothesis, Studies 1 and 2 found a consistent attentional bias towards self-made artworks. This was found even when subjects had been exposed to other-made artworks that were highly familiar (Study 2). However, Study 3 failed to find a visual attention self-bias for copies of other's artworks. Despite that, the accompanying questionnaires did reveal that participants held their own artworks in higher esteem, including the copied ones, even if these did not induce greater visual attention in the dot-probe task.

Overall, our studies confirmed that artworks which are self-made and consequently self-relevant through ownership or effort get preferential visual attention and are judged more favourably than other-made, non-self-relevant artworks. Thus, self-made art seems to make a strong case for extended-self (Belk, 1988; Norton et al., 2012), generating ownership and effort biases that cause it to capture attention more effectively than merely familiar art. Our results largely confirmed our initial hypothesis that artworks associated with the self would be preferred above and beyond artworks with no self-association, regardless of aesthetic quality or content, and are also consistent with the hypothesis that self-relevance is a key component of aesthetic preference (Kim & Johnson, 2012; Pelowski et al., 2017; Silvia 2005; Vessel et al., 2013).

However, we have identified some limitations. The current studies focused only on the influence of self-relevance on visual attention biases. In the future we might want to expand our scope to investigate how self-relevance affects other aspects of attention and the aesthetic experience, such as evaluations of valence, arousal, and beauty. It is possible that especially those related to aesthetic judgements are rather dependent on the visual features of the artworks (e.g. line, shape, colour), less reliant on self-relevance, and more in line with traditional models of aesthetic appreciation. Furthermore, we did not equate the paintings for saliency and low-level visual features in the dot-probe task. Although this may not impact the self-bias effect, it may be important when looking specifically at aesthetic preferences at the individual level. Lastly, there is room to expand on studying the effects of the different degrees of self-relevance on visual attention for visual artworks. For example, our Study 3 only compared high and moderate self-relevant stimuli, but did not include neutral stimuli. Adding a condition with artworks that bear no effects of ownership or effort might clarify why we did not find an attention bias between self-made and other-made copied artworks in the dot-probe task.

In spite of these issues, the results of our studies do have implications for our understanding of aesthetic preference in general. Previous work has suggested that aesthetic preferences for artworks and design objects might have been co-opted from evolutionary-relevant stimuli, such as faces and food (Goller et al., 2019). Self-relevance offers an alternative interpretation. If artworks are somehow perceived as extensions of the self (Belk, 1988; Bloom, 2010), as our results indicate, it is possible that they play a role in social cognition and have been evolutionary relevant in themselves. Evidence that great apes and young children also prefer objects on the basis of endowment and effort (Brosnan, 2011; Gelman et al., 2012; Kacelnik & Marsh, 2002) points to the deep evolutionary roots of these effects and suggests that early humans might have already held self-made artefacts in higher esteem. In the social life of *Homo sapiens,* aesthetic objects are often symbols of identity, status and reputation, and they are frequently traded, gifted, inherited, and exchanged. Moreover, making aesthetic objects can show off one’s skills, while displaying them informs about one’s social history and affiliations (Wiessner, 1983). It is precisely because they become invested with the self of their makers and owners that aesthetic objects acquire value (Weiner, 1992). So, even when aesthetic objects and features may not be necessary for mere biological survival, they are fundamental in mediating social relations. The archaeological evidence indicates that at least over the past 100,000 years, our species has increasingly invested in aesthetic practices, from body ornamentation to sculpture and painting (Straffon, 2016). Although the media and forms of visual art have expanded greatly since the Stone Ages, art is still a social signal by which individual observers, audiences, and art critics alike can tell something about the artists or art owners, their background and intentions, and assess them accordingly (Dutton, 2009; Hebdige, 2012; Westfal-Fitch & Fitch, 2017).

It is perhaps due to this link with the self that visual art acquires attentional preference and affective value: the maker or owner will invest more in aesthetic objects to produce a positive effect in the observer, and the observer will pay more attention in order to accurately judge the social qualities of the maker or owner. As Belk suggested, “artworks to the artist may become a part of extended self, because we have intentionally worked upon or created these things, investing both energy and self in them” (1988, 151). If visual artworks offer a medium for expressing and assessing the self, this should be reflected on the cognitive mechanisms involved in the aesthetic experience, such as attention and preference. Our results show that is the case.

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Tables

Table 1

Study 1. Stimuli presented in each block, and how they were paired in the dot-probe task

	1	**2**	**3**	**4**
Block				
Stimulus 1	Self-made art	Self-made art	Self-made art	Other-made art
Stimulus 2	Other-made art	Other-made art	Self-made art	Other-made art
Method of pairing	Matched on production order	Matched on ranking	Matched on ranking	Matched on ranking

Table 2

Study 2. Stimuli type presented in the dot-probe task

Stimuli type compared			
Self-made paintings	Other-made paintings per ranking	Other-made paintings seen in videos	Manipulation
v	v		Authorship, self vs. other (low familiarity)
	v	v	Familiarity
v		v	Authorship, self vs. other (high familiarity)

Note: To manipulate authorship (low familiarity condition), we compared reaction times of self- vs. other-made ranked paintings. To manipulate familiarity we compared other-made paintings that were either ranked or seen in a video. To manipulate authorship (high familiarity condition) we compared self-made paintings to other-made paintings seen in videos.

Table 3

Study 3. Stimuli type presented in the dot-probe task

	Stimuli type compared		
Self-made paintings	Original other-made paintings	Self-made copies	Manipulation
v	v		Authorship (self vs. other)
	v	v	Physical effort
v		v	Creative effort

Note: To manipulate authorship we compared reaction times of self-made vs. the original other-made paintings. To manipulate physical effort we compared the original other-made complex paintings and the corresponding self-made copies. To manipulate creative effort we compared self-made paintings to the self-made copies of the original other-made paintings.

Figures

Figure 1

Study 1. Examples of paintings produced by two different participants.

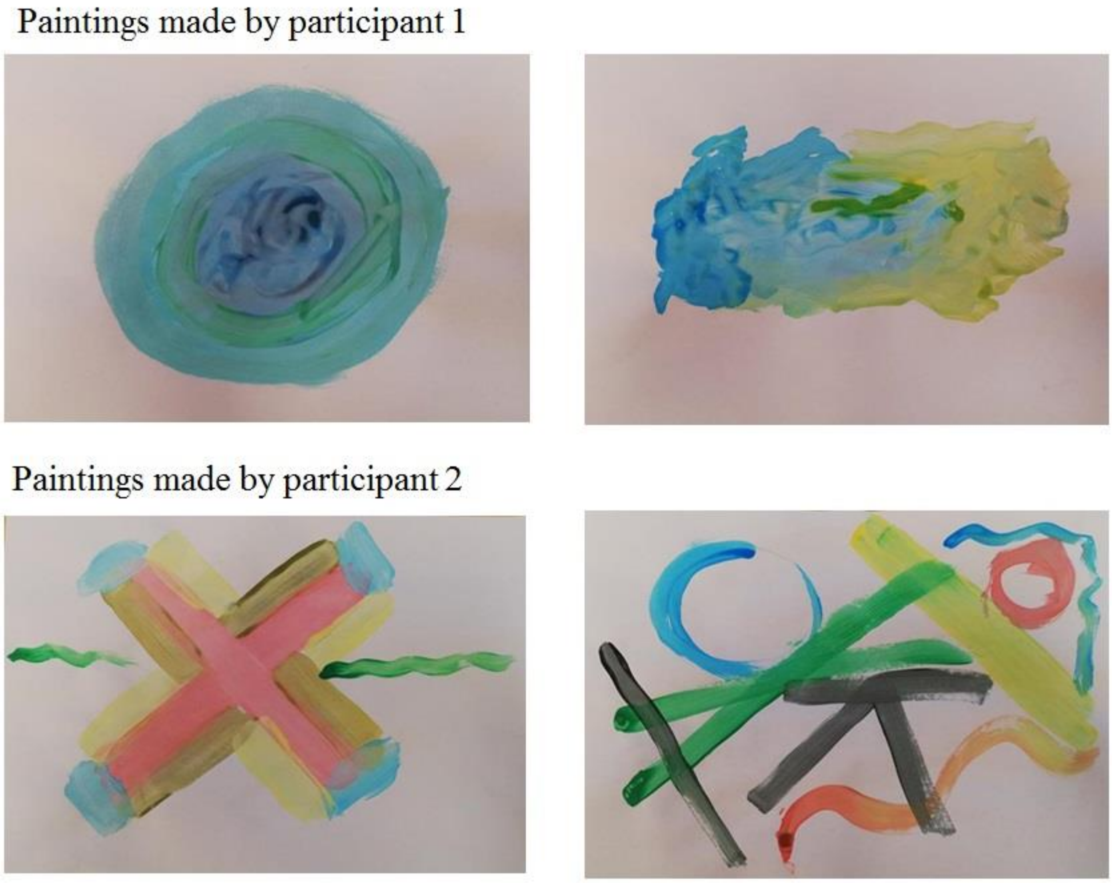

Figure 2

Procedure of the dot-probe task trials

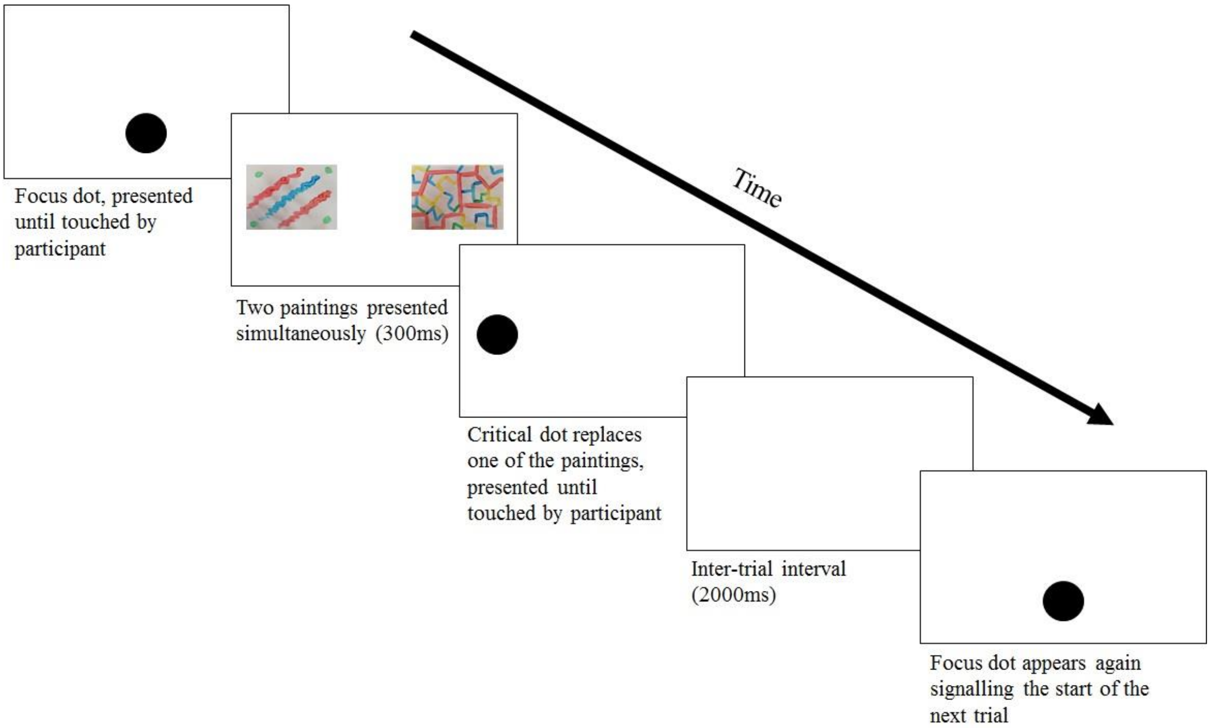

Figure 3

Study 1. Stimulus pairings based on ranking in Blocks 3 and 4 of the dot-probe task

Stim. 1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Stim. 2	6	7	8	9	10	11	12	13	14	15	1	2	3	4	5

Figure 4

*Study 1. Mean reaction time in milliseconds when dot appeared behind self-made artwork and other-made artwork using data from Blocks 1 and 2 combined. Error bars showing Std. Error.. **** p < .001.*

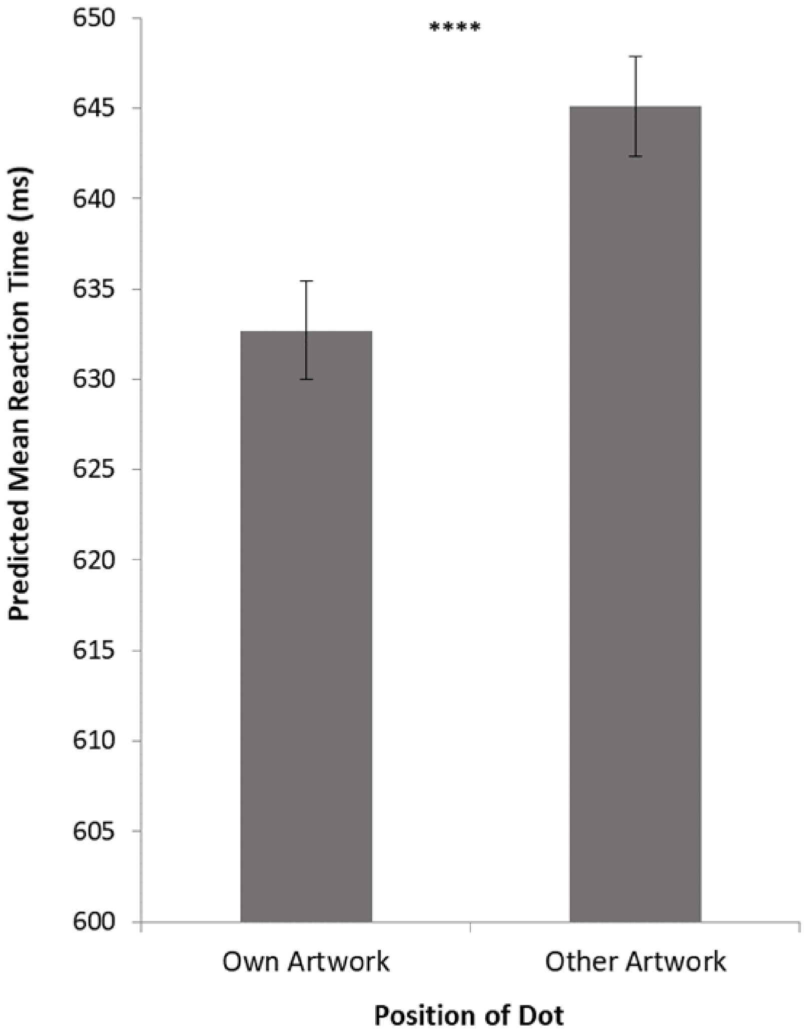

Figure 5

Study 2. Screenshot from a stimulus video.

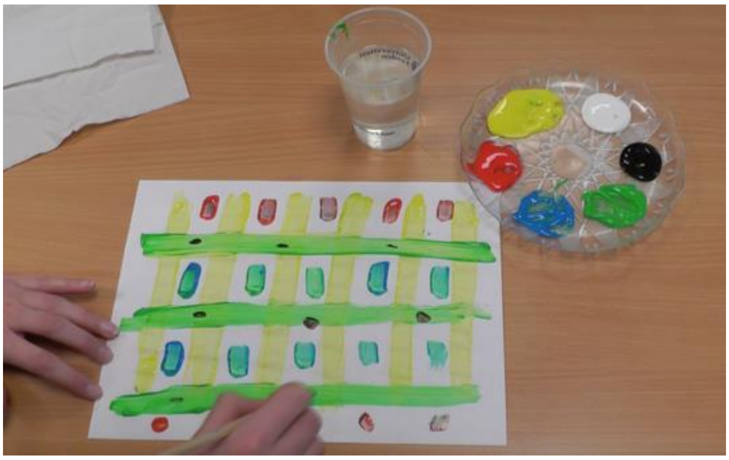

Figure 6

*Study 2. Mean reaction time in milliseconds when dot appears behind each stimulus in each block of trials. Error bars display Std. Error. **** p < .001*

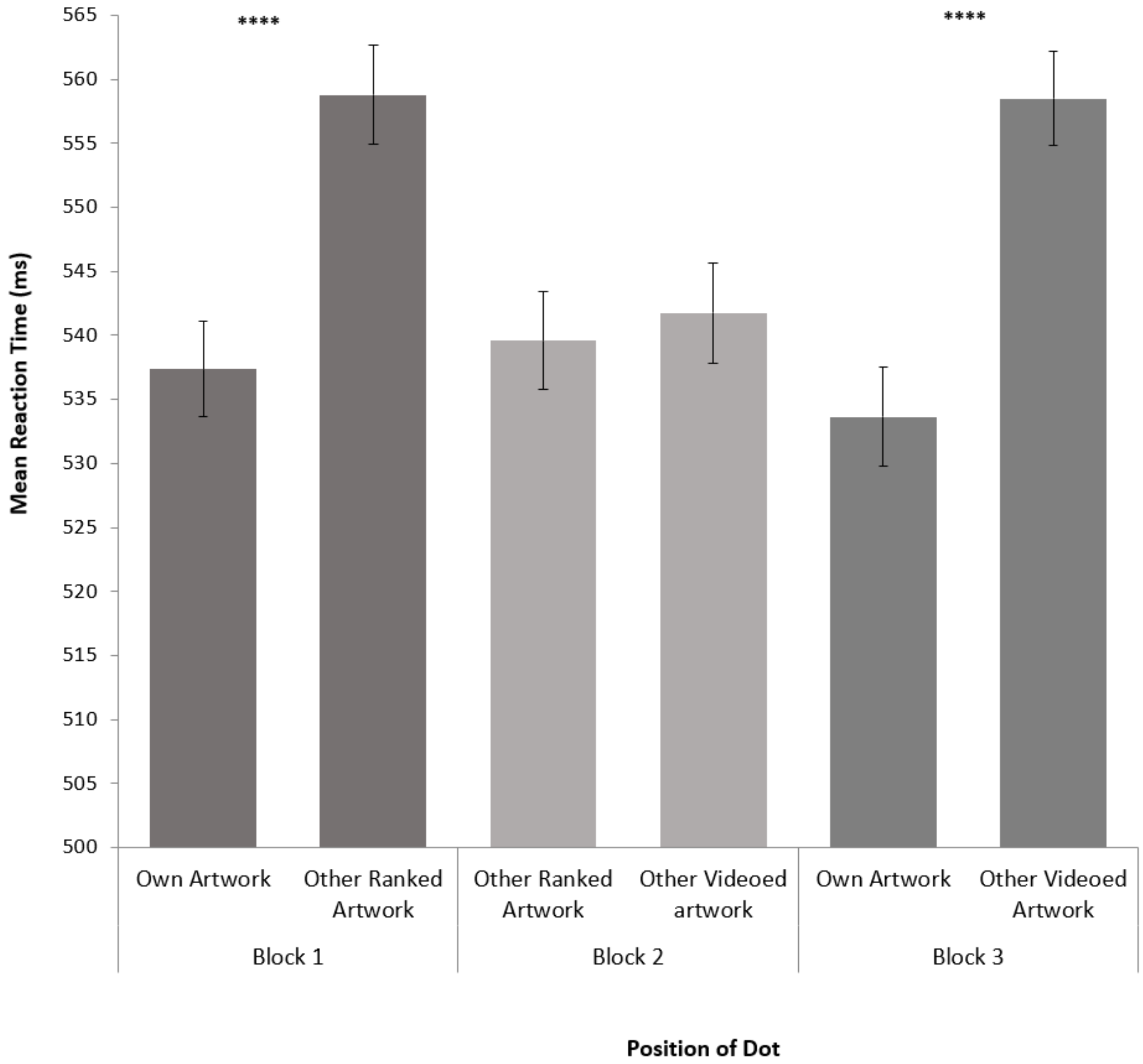

Figure 7

Study 3. Example of one piece of Original other-made art and a Self-made copy by one of the participants

Figure 8

Study 3. Mean reaction time in milliseconds when dot replaces each stimulus across the three blocks of trials. Error bars display Std. Error.