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„Classification of artworks as art or not and the role of the dorsolateral prefrontal cortex“

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Yasmine Chetouani, BSc

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Introduction

Not only do artists and art historians, but also lay people routinely choose to engage themselves with visual art. Looking at art is an enjoyable experience, as museum visitor numbers suggest. Even in a small country such as Austria, more than 18 million museum visits are reported per year (Statistik Austria, 2016). Research on aesthetic appreciation provides a number of explanations for art's importance: looking at art serves as an opportunity for pleasurable, cognitively challenging, and/or self-rewarding experiences (Lacey et al., 2011; Leder, Belke, Oeberst, & Augustin, 2004). More than this, the basic belief that something is an 'artwork' may change a beholder's expectations, perceptions, and may increase appreciation of the object (Cupchik, Vartanian, Crawley, & Mikulis, 2009; Kirk, Skov, Hulme, Christensen, & Zeki, 2009). When visiting museums and art galleries, visitors expect to see artworks, hence their expectations and perceptions as mentioned above are set in direction to interact with art.

In psychological research and research on aesthetic experiences, artworks also often serve as stimuli in experimental contexts. Be it aesthetic properties or arousal or Berlyne's assumption of the arousal curve of liking (easy versus complex), artworks seem to be excellent stimuli for empirical psychological investigations—representing visual entities that evoke myriad emotions and differ in complexity and other properties.

Research suggests that coming into contact with an object or even visual stimulus that we believe to be 'art' versus those considered to not be art, can make a profound impact on our reactions. When exposed to art, attention is shifted to more formal and stylistic properties like colour and forms (Kirk, Skov, Christensen, & Nygaard, 2009) and evokes a processing style that goes beyond simple object recognition and pragmatic thought about its possible

usefulness (Cupchik et al., 2009; Nadal, Munar, Capó, Rossello, & Cela-Conde, 2008). Similar changes may also be recorded at the level of the brain, where recent neuroaesthetic evidence has shown that priming people with a belief that something is art can lead to anticipatory activations of areas related to reward, pleasure or even visual attention. Believing something is art can even modulate emotional reactions, especially when the content is negative. As studies have shown (Gerger, Leder, & Kremer, 2014; Menninghaus et al., 2017), people react much more detachedly from heavily disturbing, even cruel content when presented in the form of an artwork than from photographs of real world scene. This finding is interesting as it reveals different coping strategies with emotions and suggests that detachment from emotions and observing these is automatically employed when dealing with art (Menninghaus et al., 2017).

Arthood classification—if often implicitly—is also a major means of experimental manipulation in empirical psychological studies. Researchers often present viewers with images that they expect them to believe are art vs. non-art controls. This can be done via overt priming with art labels, via implicit priming, providing of context through placing objects in a museum, or even by suggesting an aesthetic mode of processing. These manipulations then are a major means of uncovering art's importance and the above pleasure and perceptual processes.

However, while well-established that art classification is important and a major driver of our reactions, the actual processes and incidence of art classification—at the level of the viewer in psychological studies—is surprisingly under-investigated. Namely, (1) what is the actual incidence of art classification? This question is especially important due to laboratory studies that may assume a common classification among viewers, however without verification. (2) How do people classify images as art—behaviourally and cognitively? How does this interact with a range of art types as well as art appreciation? (3) And how does this

work at the brain level? As will be reviewed in further detail below, it is supposed that the left dorsolateral prefrontal cortex (DLPFC) is involved in art classification. If the left DLPFC's activation is enhanced, in which direction would classification strategies and patterns change?

In this thesis I answer these research questions through two connected empirical studies. The first study investigated which strategies are employed to classify stimuli of different art styles as art and which personality and sociographical factors correlate with the classification. This served to address the first main research questions, especially in regard to future empirical studies using 'artworks'. This section was also previously published in a peer reviewed paper (Pelowski, Gerger, Chetouani, Markey, & Leder, 2017). This also provided the verification of a paradigm and stimuli set for the second study, in which the role of a certain brain area in art classification was examined by applying transcranial direct current stimulation in an experimental setting.

The empirical portion is preceded by a literature review, which will address the main research questions. Afterwards, the exact methods and results of the two studies designed to answer these questions will be reported separately. Results will be discussed in the results sections of each study. This will be followed by a general discussion summarizing the research questions and the found results and addressing reasonable limitations and suggestions for future research.

Review – art classification strategies and empirical evidence for its importance

As good as it is to know that artworks elicit the mentioned responses in the beholder's psyche, it is still not entirely defined when a piece of work, a painting, a short movie clip and so on, is interpreted as art.

Hence, the classification of art in turn has been tied throughout history to a number of strategies or methods—from a reliance on beauty, to technical skill, to social agreement, or even modern aspects of social or institutional context. Many individuals may even simple employ a hedonic method of assigning arthood to objects that they like. It may also be related to several brain processes, tied to top down integration of memory, reward processing or seeking, or executive control.

The number of these different strategies and their contextual differences suggest that the art classification strategies employed by the researchers while collecting the stimuli for the experiment are not automatically the same used by the participants.

In this section, I review relevant studies leading to the main research questions as mentioned above. Art classification in present empirical studies will be described, followed by two main art classification strategies, namely basing the classification on visual properties or on hedonic value.

Art classification in present empirical studies. Numerous studies have shown the importance of art classification. Use of art/not art is a major means of experimental manipulation—modulating our perceptual and emotional responses. Most basically, this is shown by telling people that a stimulus is an artwork. Kirk and colleagues (Kirk, Skov, Christensen, & Nygaard, 2009) showed that the assumption that visual stimuli are artworks changed the perception of these stimuli, as well as activation patterns in underlying neuronal pathways of perception modes. They presented participants with abstract artworks and either told that these were originals which were hung in an art gallery or that these were created by a computer program. When believed to be sourced from a gallery, participants rated the aesthetic pleasantness of the stimuli significantly higher than when they were labelled to be

computer generated. In the gallery condition, the medial OFC, a part of the prefrontal cortex and the reward system, was activated. This cortical region is believed to be responsive to attributed hedonic values of stimuli. The gallery label assumingly altered the attributed value of the visual stimuli by heightening the expectation of experiencing a hedonic pleasure in form of rewarding visual input.

Studies may also manipulate context, presumably leading individuals to art classifications. This awareness was caused by the context as in museum studies (Pelowski, 2015) or by priming (Gerger et al., 2014) or it was obvious to the participants due to the selected stimuli (Cattaneo et al., 2014). The effects of context have been examined in different ways: textual information, e.g. the title primed for arthood of the stimuli (Leder, Carbon & Ripsas, 2006) or famous artists were expected to be the creators of the artworks (Leder, 2001), or priming through the exhibition space (Kirchberg & Tröndle, 2012) leading the beholder to expect to be exposed to artworks.

Hence, the context primes for the arthood of the stimuli (Kirk, Skov, Christensen, & Nygaard, 2009) and increases the expected or attributed value and pleasantness. Art is liked more than non-art, even if it is depicting content of negative valence (Gerger et al., 2014). The authors suggest that this happens due to the evoked aesthetic mode of perception that allows more distanced evaluation.

These increased levels of appreciation seem to be based on distinct neuronal mechanisms as neuroimaging studies reported. Believing something to be art may lead to altered perceptive processes. The expected pleasurable experience that comes with exposure to art (Leder et al., 2004) could be explained by the activation of reward areas in the brain as measured by Kawabata and Zeki (2004). Besides independence of the valence of the content that Gerger et al. (2014) found, Lacey et al. (2011) showed that these areas are involved even

when stimuli are not aesthetically pleasing and they assumed that the artistic status alone leads to this activation.

Lacey and colleagues (2011) presented artworks and corresponding photographs, showing the same content as the artworks but in a "real life" scene, to participants. Besides behavioural measurements, they used functional MRI to examine the involvement of parts of the reward circuit in each condition. They found that artistic status alone led to activation of the reward circuits, even independent of the participants' aesthetic preferences or the depicted content in the pictures. They reported that activity in the visual cortex led to activation in the ventral striatum when exposed to presumed art but not when exposed to presumed not-art. Seemingly, the aesthetic mode of perception was driven by the visual features and by the art hood of the stimuli. The content itself or familiarity with it had no effect. For this study by Lacey et al. (2011), one of the authors, an art historian, selected the art stimuli. Later, in the course of the experiment, they tested whether participants found the stimuli to be art or not art to ensure that the participants agreed with the arthood of the presented art stimuli. They found that the participants agreed in averaged 88.3% (SD = 2.6%) of the times. This result speaks of a good accordance but nevertheless, it says that even when selected by an expert and even when the art stimuli were contrasted with the photographs, it is not automatically assumable that the participants agree with the arthood of the objects. Being an expert, e.g. in this case an art historian, could lead to stronger categorical classification strategies than being a lay person. Experts are known to have a wider range of representations of objects and more sophisticated categorical systems for objects (or theories etc.) of their field of expertise (e.g. Hoffmann, 1998). These broader range of representations and its retrieval are tied to higher cognitive and categorical classification strategies.

Researchers may also employ a switch to "formalistic" or aesthetic viewpoint, that can presumably tie to art interaction. Cupchik and colleagues (2009) conducted an fMRI study in

which participants were exposed to representational and abstract artworks. They were instructed to consciously apply either a pragmatic, objective viewing orientation or an aesthetic one. Applying the pragmatic style, participants were asked to focus on object recognition, when applying the aesthetic style, they were asked to focus on the mood and feelings the artworks evoked. Individual contrasts (versus baseline measurements) showed that distinct neuronal networks were activated for each style. In the aesthetic perception approach, the left lateral prefrontal cortex was more active than in the pragmatic condition. The authors of the study suggest that aesthetic experience is evoked by top-down, attentional attributes and bottom-up cognitive functions that lead to eased processing. Their results suggest that by cognitive control of the viewing intention alone, participants were able to switch perception style. In Cupchik et al.'s (2009) experiment, no further behavioural task was done.

Studies like these suggest strongly that exposure to art leads to altered perception processes. However, the researchers assumed that the stimuli were treated as if these were art, and it was assumed tacitly that the beholders agreed that they were interacting with art. However, this was not actually determined.

This methodical gap raises many questions. Do participants also assume stimuli artworks to be art? Which strategies are actually applied in an experimental setting which uses artworks as stimuli? Is the assumption of researchers who present putative art to participants even met in experimental settings? Due to the strong dependence of the results of experimental manipulations, this question is of high importance. Study 1 of the present thesis was designed to shed light on this highly influencing factor in experimental designs.

Art classification strategies. At the level of cognition or decision making, there are presumably multiple ways that an individual can determine something to be 'art'.

Several approaches by multiple disciplines have occurred in the course of (art) history. In early 20th century art history, the approach of focusing on formal qualities only to classify stylistic groups of artworks was claimed by Wölfflin (1915). Advocates of this formalism assumed it to be the most objective way of art criticism and description because it was based purely on visually perceivable properties and not on iconographical interpretations, avoiding any symbolism. To some degree, this strategy of judging something to be art solely based on its visual features, corresponds to the approach of aesthetic research in psychology, while psychology of art examines the connection of art to emotional responses in the beholders, as well as in the artists while creating art. Art viewing is reported to induce a wide range of emotions and to help people to reflect on these. In contrast to this, the discipline of philosophy seeks to define the idea of art and apply it to the given piece of work. As Tröndle, Kirchberg and Tschacher (2014) point out, even works of Van Gogh, Rembrandt and all the artists who are nowadays in hindsight respected and not questioned, had to reach art status back when those were contemporary art. Tröndle et al. (2014) provide a good overview of the different points of view in the course of history of when something is considered to be art. All these points of view seem to be just pointed out at some point of history by several schools of thinking but still be current and representative for the variety of approaches between individuals and also dependent on the given situation. An artwork, hanging in a gallery, could therefore be judged differently than an artwork in a not artistic surrounding, and as the previously mentioned study by Gerger et al. (2014) shows, does even the notion of the context lead to altered judgements. Also the surrounding of the creation of the artwork has the power of influencing the reception of it as such, and as Tröndle et al. (2014) reported, known and researched as the surrounding “art world” by sociologists. Theorists like Danto (1964) made the classification of art dependent of the judge. He concluded that they need to have a certain qualification and are responsible for comparing pieces of work with each other, but again, while the work has to fulfill certain requirements itself. Another hint that for the reception of

art, the beholder and the work are not easily separable, not even theoretically. Two decades later, Howard S. Becker (1982) claimed according to Danto hat art is a social product, as it depends on a whole social system, e.g. of artists, galleries, critics, buyers, and therefore cannot exist or be created alone. Few years later, Dickie (1984) saw art as an institutional product, as art is defined by powerful institutions.

While art theorists will have to agree on the definition of art, for psychological research it is important, to consider all these aspects and points of view. All of those are reasonable and while art may be defined theoretically, within the single participant, every definition could come into play. It is important to consider this key information when designing studies using artworks as stimuli and measuring effects in connection with art perception, to avoid losing or disturbing informative content of the results of these studies.

Personality and sociodemographic influences on art appreciation. Tröndle et al. (2014) raised this question in regards of predominate sociologist's theories about art classification (Bourdieu & Darbel, 1991) which give the sociological, e.g. educational, economical, background of the gallery visitors a lot of meaning. They manipulated an exhibition by letting an acknowledged artist draw small figures on the walls which were commenting on, often in a sarcastic way, the exhibited artwork close to these. These drawings seemed rather naïve at first sight and could easily be confused with random acts of vandalism in the gallery. Participants were asked after their gallery visit if they recognized the drawings and if they thought these would be art. Sociological measurements were applied also and, interestingly, Tröndle et al. (2014)'s findings could not support the usual sociological theories on the importance of certain sociodemographic factors. This study was the only accessible one until now directly asking whether lay persons found something to be art that wasn't explicitly

claimed to be art. In this study, the cohort were lay people, but art interested ones, but despite this, they could not agree upon whether the drawings were art or not.

Hence, an explorative study, looking for the differences among participants in such studies and shedding light on the most frequent applied strategies of classification of art in lay people was more than necessary. Also, these strategies could differ for different art styles. In psychological research on art preferences different results were found for either abstract or representational art (e.g. Furnham & Walker, 2001). Using paintings of these two art styles may provide good insights in differences as these styles serve as main opposites to each other by their nature. Preferences for one of these two styles were investigated regarding the personality factors of the participants and it was reported that Openness for Experience correlates with preference for abstract art, while Agreeableness correlates with preference for representational art (Cleridou & Furnham, 2014). But as mentioned above, participants were primed to be interacting with art.

As mentioned above, personality traits and sociodemographic traits, e.g. parental social class, correlate with preference for certain art styles and may point to involvement in cultural/artistic activities (McManus & Furnham, 2006). Same goes for Need for Cognitive Closure. Need for Cognitive Closure, a trait which amongst other things describes the preference for predictability and the handling of ambiguity, had been reported to predict aesthetic preferences (Wiersema, Van der Schalk, & van Kleef, 2012). But as McManus and Furnham (2006) found, also other traits can explain variability in liking of certain art styles.

In this thesis to also address this difference of art appreciation and therefore perhaps classification in regards of different art styles, I used a wide range of artworks as stimuli, containing the most usual in psychological research, being abstract and representational art, as well as ready-mades, Kitsch/poorly executed art and hyperreal paintings. Readymades are due

to their nature, being everyday objects which are placed or configured by the artist and not obviously altered by the artist, perfect stimuli for this study on art classification. Readymades are normally presented in the museum or in an art exhibition, where the art hood of the object is often, as described in the review above, implicit to the beholder. In the experimental setting of the present study, the environmental clues of being presented or hung in a gallery or museum would be missing. To determine whether the readymade is an artwork or not would need abstraction on the side of the viewer and a deeper investigation on the sense or meaning the object could have and present. This process of abstraction and thinking of the meaning of the object would suggest that rather cognitive strategies and categorical thinking are employed than hedonistic strategies. In contrary, Kitsch and poorly executed artworks would serve as stimuli especially attractive to participants who classify art by applying hedonic strategies. As Kitsch is often referred to as being even too beautiful and lacking deeper meaning, stimuli of this group would please the beholders eye by being easily processable due to the simple, yet realistic painting style and additionally, by depicting harmonious, friendly and simple content, e.g. a winter wonderland or cute kittens. The poorly executed stimuli would also serve this hedonically pleasing category because of their obvious character of being drawn and the funny content they would provide. Again, no higher cognitive evaluation would be needed to understand the meaning of this group of artworks. This feeling of ease of processing is often referred to as fluency and was also reported to lead to higher liking ratings (Forster, Leder, & Ansorge, 2013). Liking and positive feelings of ease would serve the hedonic need for pleasuring experiences. Hyperreal artworks were also included in the study to examine exploratively whether these would be treated as artworks or not. We designed a study in which participants were presented with artworks (and control stimuli) and were asked to judge whether each stimulus picture showed art or not, how much they liked it and to what degree they felt it was art. This procedure ensured that participants were not knowingly

interacting with art or were primed to look at art, but to measure in an explorative study which stimuli were classified to be art and which not, and by whom.

It may also be possible that different art classification strategies are employed to recognize and judge different art styles. Therefore, emphasis on different factors that contribute to different art classification strategies might correlate with the classification of the different art styles.

Also, measuring the personality traits of people who prefer abstract over representational art or vice versa does not automatically mean that these personality traits would make people classify their preferred art style as art more often, although this could be assumed. Preference hints to stronger liking of the properties of the preferred stimuli and could therefore serve hedonic needs that are hypothesized to be a major art classification strategy (Pelowski et al., 2017). Still, many other factors could lead to preference and serve hedonic needs, for example to feel challenged, could lead to the rewarding feeling when handling the situation and so on. The limitation of using just the two major and opposite art styles in studies lies in the nature of main opposites. Nuances of the personality cannot be examined or clearly divided as long as the stimuli elicit strong and different responses in every person who interacts with it.

An inclination for aesthetic activities and corresponding attitudes to art is not only expressed in looking at artworks but can also lead to appreciation for other kinds of art like performing arts and listening to music. Additionally, not only consumption of art represents interest in the arts but also the active involvement. Perhaps active involvement shows even stronger appreciation for the arts. Nevertheless, not all artworks are drawn/written/expressed with the intention in mind to produce art but for example rather to express emotions. But again, one fixed definition, namely stating that the intention to create art must be made consciously for the resulting product to be an artwork, would be needed to classify those expressions as “not

art". Same goes for the consumption of art: different mindsets and personality factors may lead to a preference to consume art rather than produce art. Who is the (better) artist? The one who creates or the one who appreciates? As a number of studies showed, personality traits correlate with preferred art styles and socio-demographic traits often correlate with frequency of cultural and artistic activities (Fayn, MacCann, Tilipoulos, & Silvia, 2015; McManus & Furnham, 2006). For example, Agreeableness and Conscientiousness were reported to be negatively correlated to museum visits, as people scoring high in these traits tend to avoid unconventional activities like visiting museums, as Kraaykamp and van Eijck (2005) found.

As reviewed above, many correlational studies of personality traits and cultural involvement and art appreciation exist. But again, in these studies participants were presented with stimuli which were assumed to be art by the researchers or they just answered questionnaires in which they should state their preferences. In such experiments, it was not determined or investigated which exact artworks were thought of by the participant when they rated their preferences.

So again, to investigate personality traits and their indicators and correlational relations to art preferences, a backwards approach to correlational analysis must be taken. The present study should help to provide a basis for future research on – besides other – personality traits and their impact on art classification by testing whether each of the personality factors of the Big Five model of personality (Openness, Conscientiousness, Extraversion, Agreeableness, Neuroticism). We also included the often to art appreciation related (e.g. Wiersema et al., 2012) trait Need for Cognitive Closure as it could be correlated to the appreciation and therefore, if liking is found to be in relation to the classification, to the classification of art as such.

We hypothesized that as previous correlational studies suggested, different values of personality traits according to the Big Five Model would lead to different classification patterns.

We also expected that stimuli which were classified as artworks by the perceiver would be rather rewarding to the beholder than stimuli which are classified to be not art. Therefore, stimuli classified as art would receive higher liking ratings.

Experimental studies 1 and 2

As noted above, this thesis project consisted of two studies, designed to incrementally approach our main research questions. Study 1 involved a behavioral investigation of the nature of arthood classification - i.e., considering if and how individuals choose to make spontaneous classifications that images are art or not art. This further assessed this activity across a range of art types and also investigated underlying interpersonal differences in classification strategy and personality that might interact with the activity. Finally, this study also provided a test case for the design and verification for our classification paradigm, which could then serve as the basis for the following study 2. In Study 2, we then used this paradigm and the results found in Study 1 to investigate the specific neurological question of classification as it might relate to mechanisms in the brain.

Study 1. Behavioral investigation of arthood classification and interpersonal differences

Method

Participants. Study 1 had a final sample of 114 undergraduate psychology students (80 female, mean age = 23.31, SD = 5.16, covering a range from 18 to 47 years) of the University of Vienna. Participants were recruited through the Laboratory Administration for Behavioral

Sciences system (LABS) of the University of Vienna and were granted course credit for participation. All participants had normal or corrected vision and answered the survey on their personal computers. All participants were naive to the purpose of the study. The final sample was reduced from an original sample of 116 individuals with 2 removed due to incompleteness of their answers to the survey.

Materials/Stimuli. The stimuli set contained 140 pictures, consisting of six different styles of art: 30 abstract paintings, 30 readymade sculptures, 30 hyperreal paintings, 30 badly executed artworks and artworks very likely to be seen as Kitsch. As control stimuli, we also included 10 classic Renaissance/Baroque artworks as well as 10 photographs of real world items. All pictures were found through online search and were works from respected artists (except the non-art control stimuli and poorly executed artworks).

Further discussion for the chosen styles is as follows:

Abstract artworks: Abstract artworks were selected due to the finding that these have been shown to generally be the most polarizing art style amongst lay perceivers (Leder & Nadal, 2014). Abstract artworks reduce art to its aesthetic properties per se. While effects of patterns (e.g. Jacobsen & Höfel, 2002) or color combinations (e.g. Schloss & Palmer, 2011) on aesthetic judgements can be examined in relatively controlled ways, the sum of the whole is rather difficult to measure due to its great variance of confounding factors. Each part of the artworks alone elicits different inter- and intrapersonal effects on liking and reception of the artwork and as Gestalt theorists taught, the whole is even more than the sum of the parts. Therefore, aesthetic pleasure evoked by the (whole) artwork is not linearly proportional to the liking of the parts of the artwork. But indeed because of that are abstract artworks excellent stimuli. Liking or disliking of the abstract stimuli and spontaneous classification of these as art could be led by hedonic aspects (liking) or by implicit or explicit theories about art itself. Therefore, not famous to lay people, but respected abstract works of art were chosen to

examine which strategies lead to classification of artworks

Ready-mades: This type of artworks is defined by its materials. The artist uses objects that already exist in the final form, they can be arranged or placed in a special, untypical way but they can also be presented solely without any additional (visible, recognizable) influence of the artist. To ensure that it was possible to recognize the ready-mades as artworks from the pictures alone, it was necessary that the picture would differ from pure photographs of objects by artistic composition of the details or being placed unusually. In addition, the settings should not be too obvious, so no picture showed ready-mades obviously in the museum or other recognizable art context. Only aesthetic or even philosophical properties should influence the participants' decision.

Hyperreal paintings: This class of stimuli contained pictures of photorealistic paintings of objects or scenes. Hyperreal paintings are easily confused with photographs due to the high craftsmanship of the artists. Proportions are perfect and brush marks or other stylistic marks are not visible.

Kitsch/"bad" art and kids drawings: One part of these artworks were pictures of poorly executed artworks from the "Museum of Bad Art," kids' drawings which were found on the world wide web, or artworks depicting scenes which could be classified as Kitsch (e.g. winter wonderland, cats playing with each other etc.). These artworks were expected to serve the hedonistic drive to interaction with art, as they only depict pleasant and beautifully painted content which wouldn't employ higher cognitive processes.

Art controls: As control stimuli, classical Renaissance and Baroque artworks, predominantly painted by famous artists e.g. Rembrandt, were used. These were expected to be classified as art by the participants easily and continuously. Controls were used to check whether the participants ever actually classified artworks, and, in case they would not, to be able to exclude such participants from the analysis.

Not-art controls: This class consisted of photographs of random everyday life objects.

In contrast to the hyperreal and readymade stimuli, no artistic arrangement had been made and the photographs had no contextual cues suggesting placement in a museum.

In order to provide a basis for Study 2, which was expected to involve a within-subject comparison of transcranial direct stimulation (tDCS) and sham conditions, the image set was further divided into two sets. Each contained 70 pictures (15 abstract, 15 ready-mades, 15 hyperreal paintings, 15 poorly executed paintings/Kitsch artworks, 5 classic artworks and 5 real world objects), and each of these pictures was matched to another picture with similar style, similar depicted objects (or composition). Participants, however, were not made aware of the presence of the two sets, and all 140 artworks were presented to each participant with order of the artworks randomized per participant.

Procedure. The study was conducted as an online survey (Limesurvey, v. 1.92, Limesurvey.org). After logging in to the survey, participants were given a short, written instruction, saying that they would be presented with pictures and were asked to indicate for each picture whether they felt that it was an artwork or not. Each picture was presented once. One picture after the other was presented centered and all pictures were cropped equally into a size of 1000 pixel to prevent possible influence of the presentation of the stimuli from distorting the results. As pictured in Figure 1, for each picture participants had to answer if it showed an artwork or not by clicking on the corresponding checkbox. It was also possible to click on a third box for “no answer”. Participants were also asked to indicate how much they liked each picture on a sliding scale from 0 – 100 and how much each picture felt like art to them, again on a sliding scale, again reaching from 0 – 100. Answering time was not limited. After completing the main art classification survey, participants also answered several questions relating to classification strategies and personality items (see below).

Figure 1

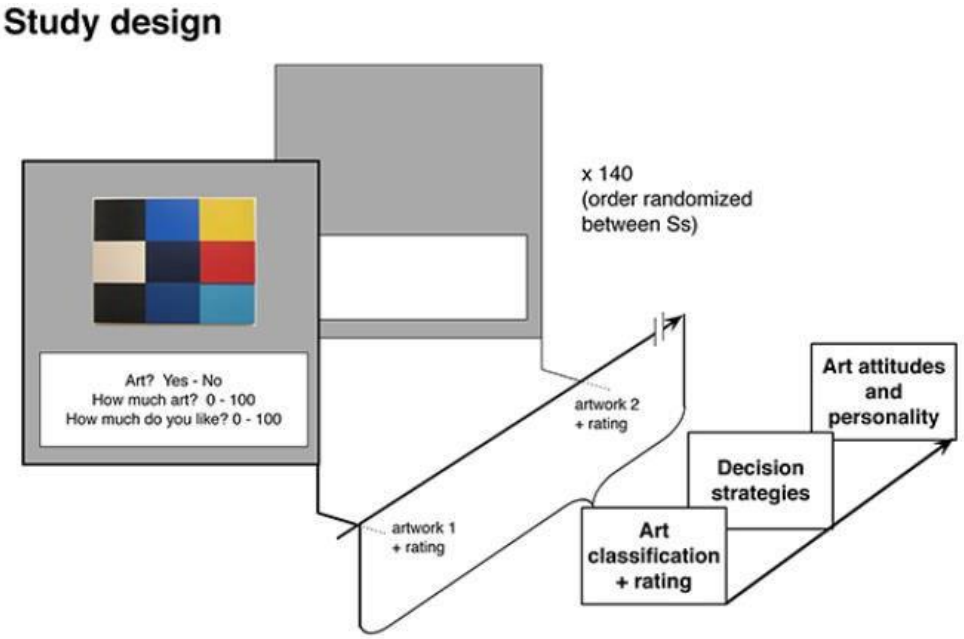

Figure 1. Study design (Pelowski et al., 2017)

Post-test questionnaires. Following the main study, participants then completed a post-test with batteries of personality and socioeconomic traits. These included the German short version (10-items) of the Big Five Questionnaire (Rammstedt & John, 2007), a 16-item version of the Need for Cognitive Closure questionnaire (Schlink & Walther, 2007) and the Creative Personality Scale (Kaufman & Baer, 2004). Also active involvement in the arts and regular exposure to art and art education were measured following Leder, Gerger, Brieber and Schwarz. (2014). Questions included frequencies of museum or theater visits and answers were given on a 7-point scale ranging from "less than once per year" to "once a week or more often". To measure art training and education, questions were taken from Chatterjee et al. (2010) (e.g. "How many art history classes have you taken at the high school level or above?") and had to be answered via a 7-point scale ranging from 0 to "6 or above". Additionally, the grade to which a participant sees themselves as an art person and is comfortable engaging with art was measured using a questionnaire by Pelowski (2015). Participants were asked to indicate on a 7-point scale how strongly they agree with certain

statements about themselves regarding art knowledge and interaction, ranking from 1- completely disagree to 7- completely agree. The same scale was applied with a list of questions about beliefs about artworks.

Also, statements of the questionnaire used by Tröndle et al (2014) were included in the post-test questionnaire and agreement with the statements had to be indicated on a 7- point scale, again ranking from 1 - completely disagree to 7 - completely agree.

Cultural taste and activities, as well as preferences for different styles of art, music, and books were measured using a questionnaire by Hanquinet (2013), answered on several separate Likert scales.

The order of the question batteries and questions within the batteries were randomized.

Last, participants had to report basic socio demographic information (age, sex, occupation, nationality).

Study 1. Results and discussion

Of the 114 participants, only 2 individuals, equalling 1.8 % of the participants, reported to visit art museums or galleries at least once a week or more often. 5.6% visit galleries once every 2 weeks and 7.9% reported to visit art museums and galleries once a month. This makes in total 15.3% of participants who could be classified as art interested individuals. With 42.9%, the majority of the participants visits museums and galleries moderately often, with 17.5% of the participants visiting those institutions once in every three, and 25.4% once in every six months. But this majority is nearly as big as the part of participants who seldom visit art museums and galleries (42.1%). Nearly a third of the participants report to do so only once in a year (28.1%) and 14% report to visit art museums and galleries even less often than once a year.

The majority of the participants (44.2%) also reported to have never had received active art training in form of studio classes. While 32.5% had taken a studio class once and 13.2 % took two classes, only in sum 9.7% of the participants had taken 3 or more art studio classes. Even less participants had ever taken art history classes, as 53.5% reported to have never taken one. About one third, 35.1%, had once taken one art history class, and only 11.4% of participants had taken more than one art history class.
The distribution of participants who had taken art theory or aesthetics classes follows the pattern of the art history classes with 66.7% of participants who didn't take one class at all. 22.8% had taken one class. More than one art theory or aesthetic classes was taken by 10.5% of participants.

Classification of images as art/not art. We were interested in the patterns of classification as art or not art for the different art styles. Would participants classify the artworks as such if they weren't told that it is art? Table 1 shows the general results from the classifications of images as art/not art. In column 1, mean values and standard deviations are representing the frequency with which stimuli of the different art styles were rated as art. Additionally, the range of answers of participants to the question if stimuli of this style were art is reported. As it shows, no class of art stimuli was continuously classified as art. The ranges are wide, suggesting strong interpersonal differences between participants and/or high ambiguity of the stimuli. Even classical artworks which were originally included to serve as control stimuli were classified to not be art in 5% of cases.

Table 1

Classification of images as "Art"/"Not-Art" and Liking ratings

	Classification as "Art" (% Yes)		How much do you like it? (0-100)	How much do you think it is art? (0-100)
	M (SD)	Range	M (SD)	M (SD)

Abstract paintings	76 (24.0)	3.4 - 100	26,68 (15.47)	45,64 (22.64)
Readymade sculptures	48 (26.42)	0 - 100	23,26 (15.21)	29,42 (19.03)
Hyperrealistic paintings	41 (24.96)	0 - 100	31.64 (16.73)	27,02 (18.04)
Bad/Kitsch paintings	78 (19.01)	10 – 100	27,18 (14.58)	52,64 (19.73)
Classical art (control)	95 (8.8)	70 – 100	38,82 (20.07)	77,84 (17.15)
Not art (control)	15 (24.49)	0 – 100	16,55 (14.96)	12,02 (15.19)

Note. M = mean, SD = standard deviation*;* Pelowski et al. (2017)

Participants classified Kitsch/poorly executed paintings in 77.7 % of all cases as artworks. Abstract paintings were classified as art in 76.0 % of all cases. Least often non-art controls were considered art, but still in 14.9% of cases.
These results show that it is neither certain that a stimulus is an artwork to all participants nor that a stimulus is not art to all.

Liking and subjective degree of art of the stimuli. The middle column of table 1 shows the liking ratings for stimuli of each art style and the right column shows the personal assessments about how much the stimuli are art for each class of artworks. Classical artworks received the highest liking scores of all art types (m = 39.0, SD = 5.2), followed by hyper-realistic artworks (m = 31.0%, SD = 10.3).
To investigate the relations between classification of stimuli as art or not art and the liking and degree of art-hood of these stimuli in more detail, correlations were calculated. Shapiro-Wilk-test of distribution showed significance for all art types ($p < .001$), hence non-parametric analyses are reported for all correlations.

Starting with the overall classification of abstract artworks as art, a significant correlation with the degree to how much these artworks were felt to be art (τ_b = .538, p <.001) was found and also a significant correlation with the strength of liking of these artworks (τ_b = .3, p <.001). Also, the overall classification of ready-mades as art correlated significantly with the degree to how much these artworks were felt to be art (τ_b = .556, p <.001) and also significantly, but to a lower degree, with the strength of liking of these artworks (τ_b = 0.3, p < 0.001). The same significant pattern was found for the other art styles.

So the correlation of the overall classification of hyperreal paintings as art with the degree to how much these artworks were felt to be art (τ_b = .583, p <.001) and also with the strength of liking of these artworks (τ_b = .381, p <.001).

The classification of Kitsch artworks/poorly executed paintings as art was also significantly correlated with the degree to how much these artworks are felt to be art (τ_b = .406, p <.001) and again, significantly with the strength of liking of these artworks (τ_b = .262, p <.001).

Again, the degree to how much the classical control artworks are felt to be art correlated significantly with (τ_b = .373, p < .001) and also significantly with the strength of liking of these artworks (τ_b = .175, p = .02). The classification of photographs of real world items that also served as control stimuli as art correlated significantly with the degree to how much these artworks are felt to be art (τ_b = 0.569, p < 0.001) and also significantly with the strength of liking of these artworks (τ_b = 0.249, p < 0.001).

To summarize, correlations of all classifications as art and the degree to how much these artworks felt like art were significant and moderate, only for the classical artworks the correlation was a little bit weaker. For the classical control artworks, the grade of liking was less important for the classification decision than for the other classes of artworks.

Next, a repeated measurement ANOVA with liking rating as dependent variable and independent factors of classification as art or not art (yes/no) and category of art (abstract, readymade, hyper realistic paintings, Kitsch/poorly executed artworks, classical artworks, everyday life objects) was calculated. Main effects of both independent variables, category of art $F(5) = 3.46$, $p = .08$, $p\eta 2 = .20$, and art or not art $F(1) = 33.42$, $p < .001$, $p\eta 2 = .71$., reached significance. The interaction between art or not art and category of art was not significant (p = 0.98). This result shows that the liking ratings for stimuli, which were classified as art did significantly differ from the liking ratings of stimuli, which were

classified to not be art. The significant main effect of the category showed that the liking ratings differed for the art styles. The fact that the interaction between the category and the classification did not reach significance shows that the liking of the stimuli does not depend on the style and the classification at the same time. It did not make a difference of which style the stimuli was, if it was classified as art or not art.

Impact on decisional factors on the classification of stimuli as art or not art. In a post-test questionnaire, participants were asked to indicate on a 7-point Likert scale how much importance they gave to several factors while their art/not art decision making. Therefore, next, non-parametrical correlations between the factors of the applied classification strategies and the classification of the different art styles were calculated. Results are reported in table 2. In the first two columns, means and standard deviations for the factors over all art styles are reported to gain an insight into the general importance of this factor. In the following columns, non-parametrical correlations of the applied decisional factors with the number of classified artworks are listed. Levels of significance are indicated by asterisks.

Table 2

Correlations of the factors of classification decisions with classification of art styles

	M	SD	Abstract	Readymade	Hyperreal	Kitsch/poorly executed artworks	Classical art (control)	Not art (control)
Beauty	4 .11	2.01	-.186*	-.115	.019	-.209**	.067	.023
Technical quality	4 .69	1.71	-.150*	-.138	-.005	-.145*	.018	-.059
Evidence of making	4 .77	1.94	-.111	-.090	-.124	.018	.128	-.131
Content	4 .60	1.86	-.079	-.021	.020	-.079	.127	-.007
Artwork style	5.53	1.50	-.140	-.189	-.110	-.118	.120	-.078
Composition	5.15	1.60	-.065	.064	.148•	-.062	.191•	.080
Form	3.61	1.71	.071	.106	.064	.014	.098	.093

Colours and contrast	4 .01	1.71	.059	.107	.107	.043	.139	.205**
Materials	3.69	1.72	-.078	.020	-.011	-.017	.157•	.066
Looks expensive	2.38	1.62	-.125	-.031	-.034	-.128	.060	.006
Evokes nostalgia	3.23	1.77	.032	.033	.003	.044	.087	.102
Challenges me	3.94	1.93	.125	.121	.022	.085	-.012	.093
Makes me uncomfortable	2.41	1.63	.171	.196**	.108	.048	.041	.151*
Makes me safe, comfortable	3.16	1.85	.015	.018	.039	.064	-.017	.169•
Novelty	3.94	1.88	.112	.098	.052	.030	-.037	.116
Aligns with beliefs and values	2.78	1.99	.036	-.006	-.032	.003	-.115	.065
Emotionally evocative	4 .95	1.85	.075	.085	.137	.007	-.012	.142*
Thought-provoking	5.06	1.85	.151*	.127	.129	-.013	.062	.088
Deeper meaning	4.59	1.84	.057	.086	.064	.028	.104	.041
Had no meaning or purpose	2.16	1.70	.114	.137	-.022	.174*	.112	.188**
l thought of experts' opinion	2.63	1.79	-.104	-.094	-.177*	-.094	.109	.084
Made me see the world through artist’s eyes	3.73	1.88	.099	.156*	.090	.024	.025	.117
Every painting is art	2.66	1.82	.269**	.238**	.164·	.385**	.107	.216**

Note. Kendall’s tau; *p< 0.05 ; **p<0.001; Pelowski et al. (2017)

Art education, art involvement and art knowledge. As mentioned in the beginning of this section, only few participants received art training on a regular basis or took art history or theory classes frequently. However, as the strength of art education, art involvement and art knowledge was measured using Likert scales, interesting correlations could be calculated. Table 4 shows the non-parametrical correlations of the separate indicators of art involvement with the classification of the different art styles. Significant correlations are marked with asterisks.

Table 3
Correlations of art education, involvement and knowledge with classification of art styles

	Abstract	Readymade	Hyperreal	Kitsch/poorly executed	Classical art (control)	Not art (control)
Art training and education (Chatterjee et al., 2010)						
number of studio art classes	.170*	.103	.139	.050	.006	.034
number of art history classes	.155*	.116	.084	.112	.089	.110
number of art theory or aesthetics classes	.183*	.103	.030	.090	.085	.030
hours spent making visual art	.100	.069	.159*	.125	-.016	.143*
Objective art involvement (Leder et. al, 2014)						
How often do you visit art museums?	.215**	.221**	.155*	.104	.043	.121
How often do you	.288**	.208**	.151*	.154*	-.078	.089

read art books?						
How often do you look at pictures of art?	.315**	.283**	.231**	.184**	.035	.103
How often do you visit art events (lectures, etc.)	.240**	.190**	.130*	.203**	.000	.187*
Art knowledge and comfort (Pelowski, 2015)						
I am comfortable looking at and discussing art.	.349**	.258**	.143*	.141*	.115	.037
I am knowledgeable about art	.333**	.270**	.198**	.199**	.025	.111
Art is important	.290**	.268**	.208**	.149*	.079	.110
I enjoy being challenged by art	.340**	.296**	.204**	.149**	.079	.133
I am interested in art	.376**	.287**	.214**	.189*	.124	.117

Note. Kendall's tau; *p< 0.05 ; **p<0.001; Pelowski et al. (2017)

As shown in table 4, the intensity of experienced art training and education (Chatterjee, Widick, Sternschein, Smith, & Bromberger, 2010) had a significant and overall influence on the classification of abstract stimuli as art. Interestingly, for hyperreal paintings the number of hours spent making visual art had impact on the classification of this art class, suggesting that people who actually paint or draw rather classified or even identified these stimuli as an artwork/painting. On the other hand, the hours spent making visual art also let participants

believe that the not art controls were art. It could be interpreted that these individuals could even see regular objects with an artist's eye.

Objective art involvement (Leder et al., 2014) of participants influenced classification of all art classes. The stronger the individual art involvement, the more artworks were classified as such. The same is true for the self-attributed art knowledge and comfort (Pelowski, 2015)

Expectations on art and factors for deciding if something is art. In this study, we were especially interested in the strategies of art classification. It was also hypothesized that factors, which are important for the classification, would differ for the different art styles as they employ different strategies, as described in detail above. On the other hand, preferred strategies could differ from person to person and would lead to higher numbers of as art classified stimuli of certain art styles. Both of these aspects would be reflected in correlational patterns between the factors for deciding whether a stimuli is art with the number of as art classified stimuli of the art styles. Therefore, correlations were calculated. These are listed in table 4 below, separately for each art style.

Table 4

Correlations of expectations on art with classification of art styles

	Abstract	Readymade	Hyperreal	Kitsch/poorly executed	Classical art (control)	Not art (control)
The best art is difficult or challenging	0.010	0.002	0.066	0.047	0.034	0.157**
The best art makes you feel	0.033	0.043	0.052	0.091	0.078	0.076
The best art makes you think	0.046	0.057	0.119	−0.017	0.036	0.098
The best art primarily is	−0.220**	−0.168*	−0.071	−0.104	−0.070	−0.080

pleasurable						
The best art makes you feel tranquil or harmony	−0.223**	−0.187*	−0.096	−0.082	−0.064	−0.108
The best art make you feel insight	−0.076	−0.028	−0.064	−0.114	0.083	0.014
The best art makes you feel Catharsis/relief	−0.058	0.001	−0.014	−0.049	−0.035	0.034
The best art makes you feel transformation	0.097	0.135	0.129	0.053	0.048	0.132
The best art makes you feel disrupted or uncomfortable	0.081	0.197*	0.124	0.016	0.001	0.162*
The best art makes you feel surprise	0.100	0.188**	0.131	0.049	0.008	0.010
The best art makes you feel curiosity	0.067	0.100	0.150*	−0.031	0.083	0.051
The best art makes you feel a sense of novelty	0.036	0.077	0.029	−0.018	0.086	0.010
The more realistic the painting, the better the artist	−0.279**	−0.029	−0.194*	0.043	−0.069	−0.214**
Anybody could produce abstract art	-0.142*	−0.093	−0.002	0.049	−0.007	0.080
Everyone who can draw realistically is a good artist	−0.041	−0.005	0.036	0.085	0.174*	0.046
Every painting automatically is art	.296**	.238**	.164**	.385**	.107	.254**

Note. Kendall's tau; *p< 0.05; **p<0.001; Pelowski et al. (2017)

Abstract art seems to be less pleasurable and therefore was significantly less often classified to be art by participants who think that art should be pleasurable. The same is true for readymades. Nearly exactly the same degree of negative correlation was found for participants who state that art should make you feel tranquil or harmony. But the readymade class of stimuli seemed to engage different classification strategies than the abstract stimuli, as only for readymades classifications as art were made significantly more often by

participants who feel that art should make you feel disrupted or uncomfortable and by those who think art should make you feel surprised. Interestingly, for these statements no significant correlations were found for the classification of abstract stimuli as art, indicating that readymades operate on a different abstraction level than paintings and are perhaps felt to be even more disturbing or surprising. The everyday life art control stimuli were also significantly more often classified to be art by participants who hold this believe true which could be based in the similarity to the readymades but also could be (based) on different levels of openness to art. It has to be kept in mind that all stimuli were presented randomly and neither ready-mades nor everyday objects had to be classified as art. In addition, some participants rated no stimuli of this group to be art, suggesting a latent personality difference, which is responsible for the different results. That art should make you feel curiosity, claimed participants who classified hyperreal paintings as art. Seemingly, more curious people than other seemed to firstly recognise the paintings as such, which also suggests that different strategies were applied by these people than by those who don't put great value in the feeling of curiosity.

The statement "the more realistic the painting, the better the artist" correlates negatively with the number of artworks classified as art of the abstract, readymade and Kitsch/poorly executed artworks. This suggests that expectations of art have a strong influence on the classification of artworks as such. The belief that "anybody could produce art" correlated negatively with the identification of abstract stimuli as art, a result that also speaks for itself. The belief that "every painting automatically is art" correlated significantly with the classification of artworks of all classes except for the classical control stimuli. This suggests that classical artworks were also classified as art by participants who do not hold this belief, a result that was also expected, considering the famous nature of the stimuli in it.

Preferences for art styles. Table 5 shows the correlations between preferred art styles (measured using Likert scales) of the participants with the classification of the different art styles in the experiment. In the last column, the preferences for the art styles with the overall liking of all art in the experiment.

Table 5

Correlation of art style preference with classifying objects as art

	Abstract	Readymade	Hyperreal	Kitsch/poorly executed	Classical art (control)	Not art (control)	Liking (all art)
Abstract	0.265**	0.207**	0.153*	0.051	0.033	0.110	−0.006
Readymade	0.234**	0.254**	0.100	0.081	0.100	0.082	0.188*
Classic	−0.056	−0.060	−0.040	0.039	0.133	−0.087	−0.080
Kitsch	0.062	0.000	−0.035	0.130	0.067	0.050	0.056
Avant Garde	0.378**	0.369**	0.304**	0.172*	0.087	0.203*	0.153**
Representational	0.149*	0.086	0.132	0.074	0.001	−0.031	0.049
Fantasy	0.022	0.001	0.041	0.144*	−0.007	−0.017	0.107
Graffiti	0.167*	0.106	0.127	0.178**	−0.007	0.152*	0.176*
Digital art	0.120	0.105	0.200**	0.157*	0.030	0.085	0.189**
Impressionism	0.077	0.008	0.046	0.070	0.088	−0.022	0.028
Cubism	0.184*	0.115	0.142	0.084	0.148*	0.055	−0.070
Surrealism	0.251**	0.222**	0.136	0.147*	0.136	0.009	0.115
Pop art	0.255**	0.169*	0.100	0.101	−0.040	−0.040	0.155*
Conceptual art	0.221**	0.227**	0.066	0.060	0.058	−0.031	−0.011

Note. Kendall's tau. *p < 0.05; **p < 0.01. Pelowski et al. (2017)

Expectations for visiting a museum. In their 2014 museum study, Tröndle and colleagues asked participants which expectations had led to the museum visit. In the present study, correlation coefficients between the classifications of the art styles and the specific expectations as listed in Tröndle et al. (2014) were calculated. Participants who expose themselves to art exhibitions in museums expecting that their "understanding of art" would

improve, rather rated abstract artworks as such, r = 0.171, p = .015. Participants who often rated abstracted art as art would also want to experience a deep connection to the art (τ_b = .234, p < .001). Interestingly, they would also like to see something familiar which they already know, (τ_b = .150, p = .034). This could be a hint that participants who like abstract art or recognize the stimuli to be art, do often visit museums or galleries or interact with art, otherwise they would not expect to be familiar with presented artworks. Another indicator for the interpretation of this expectation of familiarity as the familiarity with the art style and the museum context as such but not with the artworks as such, is that the expectation to see famous artworks is negatively correlated to the abstract art classification (τ_b = -.153, p = .028). This interpretation is further supported by the finding that the expectation to be surprised in a museum setting is positively correlated to the abstract art classification (τb = .154, p = .032). Higher frequencies of classifications of readymade to be art were found to be correlated with the expectations to "have my thoughts provoked" (τ_b = .145, p = .015), to experience a deep connection to art (τb = -.161, p = .020) and to be surprised when visiting a museum (τ_b = .186, p = .009).

Expecting to see famous artworks was found to be correlated with the classification of the classical artworks as such (τ_b = .242, p = .003). Due to the selection of the classical stimuli, which contained famous objects, this is an expectable finding.

Interestingly, only for the two art groups which are generally considered to be "difficult", expectations played a role for the classification of artworks. The expectations that led to these significant differences all contained intellectual rather than emotional interests, focusing on thoughts and understanding and not on experiencing joy ("enjoy the silence") or sensual involvement ("be part of the exhibition with all senses"). To experience "a deep connection to art" could hint to a "aha" moment or feeling of "cognitive consonance". It cannot be concluded that the classification of abstract art as such is a purely cognitive experience. On the contrary, all these factors could also hint to an element and desire for "emotional mastery". These artworks may not elicit joyful emotions or serve hedonic needs for pleasure, but elicit complex, difficult ambiguous emotions. People who feel the need to deeply connected to art could be people who are interested in surrendering to and subliming emotions. Detachment of emotions could be a useful trait for appreciation of abstract art, or it

could be the goal. Another study would have to be conducted to shed light on this difference. The wish to experience "surprise" could be emotionally or cognitively colored.

Correlations with the Big Five factors and tastes and interests. Next, correlations for the short Big 5 Inventory (German Version) (Rammstedt & John, 2010) and the patterns of art classifications were calculated. Significant relations were found for extraversion and decreased classification of ready-mades (τ_b = - .134, p =.049) and the corresponding control stimuli, the pictures of everyday life objects (τ_b = -.203, p = .006). Also, participants with a higher need for cognitive closure showed this pattern of lower frequency of classifying ready-mades as art (τ_b = -.133*, p < .001). Extraversion could be brought in connection with a higher need for cognitive closure, a possible explanation could be that extraversion generally operates on a more spontaneous, outgoing level and less on introspection, which could be needed to process the discomfort that comes with ambiguous situation or, in case of the ready-mades, with ambiguous stimuli. But extraverted participants did not only significantly less often readymades as art, but also significantly less often judge everyday objects as art (τ_b = -.203, p = .006). It could be that more extraverted persons more frequently use different objects as they are seeking more social events than introverted individuals would but certainly alternative explanations are possible.

Participants who scored higher on the conscientiousness scale classified the control stimuli as art more often (τ_b r = .182, p =.022). It could be that these participants engage more in detail or consider different aspects (style, content, etc.) before coming to a decision than participants who score lower on this scale. It could also had happened that the more conscientious individuals did take the experiment more seriously and/or made less mistakes due to hurry than the other ones. Anyway, this result speaks at least for the validity of the conscientiousness subscale of this questionnaire.

Openness is the one trait of the Big 5 that was reported repeatedly as a predictor for art interest in general (Kaufmann, 2013) and for enhanced liking or even preferences for abstract art (Feist & Brady, 2004). In this study we found that openness was the only trait which correlates significantly with the classification of abstract art positively (τ_b = .311, p < .001),

and positively with the classification of the other experimental stimuli as art (not controls). This trait which is known to predict or reflect curiosity, cognitive ability and emotional richness (Kaufmann, 2013) correlates with the classification of ready-mades as art significantly (τ_b = .239, p < .001), of hyper-real stimuli (τ_b =.199, p =.004) and of Kitsch/poorly executed artworks (τ_b =.141, p = .043). Looking at the overall liking ratings it can be concluded that this trait did not enhance liking, but the higher number of classified artworks seem to reflect cognitive strategies that include a wider view on art than of other participants.

For all participants creativity as measured using the creative personality scale (Kaufmann & Baer, 2004) did not influence how many and which artworks were judged as such in a statistically significant way.

Tastes and interests in cultural activities were measured using a questionnaire by Hanquinet (2013). Table 6 reports the correlations between the tastes and interests with the classification of the different art styles as art.

Table 6

Correlation with classifying objects as art: Hanquinet (2013) Social profile of tastes and interests

	Overall (without controls)	Abstract	Readymade	Hyperreal	Kitsch/poorly executed	Classical art (control)	Not art (control)
Taste in Music							
Prefer opera, classical music	0.008	0.007	0.045	0.055	−0.068	−0.044	−0.062
Jazz	0.095	0.109	0.073	0.074	0.067	0.095	−0.031
Electronic, dance	0.139*	0.181**	0.139*	0.114	0.074	−0.017	−0.018
Hard rock	0.082	0.100	0.059	0.061	0.144*	0.115	0.023
Pop	−0.162*	−0.147*	−0.205**	−0.103	−0.008	0.009	−0.082
World music	0.019	0.076	0.001	−0.004	0.061	0.072	−0.009
Folk	0.037	.026	0.066	−0.013	0.102	0.091	0.086

Schlager	−0.014	−0.043	−0.067	0.044	0.068	−0.137	0.145
Taste in Books							
Prefer reading practical books (e.g., cooking)	−0.018	0.013	−0.033	0.019	−0.034	−0.028	−0.061
Detective novels, comics	−0.045	−0.080	−0.039	0.012	−0.016	0.057	0.049
Classical literature	0.062	0.070	0.095	0.032	0.001	0.148	−0.004
History books, non-fiction	0.047	0.001	0.023	0.062	0.076	0.028	−0.036
Art books	0.218**	0.266**	0.182*	0.106	0.190**	−0.050	0.105
Essays	0.250**	0.240**	0.237**	0.194**	0.162*	−0.052	0.093
Highbrow activities							
I have gone to theater	−0.011	−0.029	0.026	0.076	−0.121	−0.154	0.001
Concerts of classical music or jazz	0.078	0.145	0.072	0.013	0.091	−0.032	−0.068
Dance performance	−0.019	−0.006	−0.053	−0.005	0.006	−0.028	−0.068
Opera	0.108	0.076	0.124	0.083	0.000	0.006	0.067
Commercial art galleries	0.220**	0.218**	0.183**	0.151*	0.119	−0.025	0.152
Contemporary art centers	0.190**	0.182*	0.199**	0.182*	0.053	−0.040	0.157
Museums, art exhibitions	0.162*	0.174*	0.157*	0.121	0.078	0.011	0.130
Ballet	0.045	0.005	−0.094	0.054	0.058	0.067	−0.004
Creative activities							
Dance	0.104	0.122	0.048	0.061	0.151*	0.105	0.085
Theater	0.091	0.061	0.056	0.071	0.114	0.108	0.079
Photography	0.289**	0.200*	0.230**	0.274**	0.248**	0.186*	0.227*
Painting/drawing	0.222**	0.153*	0.181**	0.186**	0.198**	−0.045	0.172*
Playing music	0.093	0.042	0.061	0.066	0.209**	0.021	0.132
Writing	0.100	0.074	0.074	0.044	0.074	0.056	0.055
Leisure activities							

I have visited friends, family	0.022	0.020	0.015	0.070	−0.036	−0.033	0.053
Watched TV	−0.005	−0.034	0.006	0.092	−0.020	−0.030	0.144
Read a book	−0.014	−0.046	0.011	−0.025	−0.081	0.153	0.028
Gone out to eat (dinner)	0.096	0.174*	0.120	0.035	−0.027	−0.135	0.083
Played sports	−0.093	−0.061	−0.080	−0.047	−0.030	0.076	0.016
Listened to the radio, music	−0.001	0.025	0.000	0.032	−0.095	0.134	−0.073
Gone to the cinema	−0.004	0.073	0.041	−0.061	0.005	−0.084	0.032
Attended a sporting event	−0.006	−0.034	−0.048	−0.003	0.068	−0.072	0.117
Played a board or video game	0.098	0.030	0.085	0.090	0.111	0.014	0.148
Purchase of art							
Have purchased genuine art	0.117	0.124	0.089	0.104	0.085	−0.066	0.005
Purchased an art reproduction	0.143	0.188*	0.090	0.113	0.088	−0.114	−0.022
Purchased an art book	0.216**	0.203*	0.242**	0.178*	0.097	−0.081	0.139

Note. Kendall's tau. *p < 0.05; **p < 0.01; Pelowski et al. (2017)

Study 1. Discussion and conclusion

We hypothesized that different styles of art would elicit or need different strategies to be classified as art. Therefore, we used a wider range of art styles as usually tested, besides our interest on the different classification strategies, also to avoid extreme results that could stem from the opposite nature of abstract and representational art and the preferences for one of these two styles. We found the hypothesis confirmed and could help to clarify which factors, which components that lead to different processing styles, lead to classification of the different art styles. The study also showed that the degrees to which participants felt that the artworks were art follow the classifications pattern. Liking ratings also follow this pattern, only for the abstract artworks the relation was weaker. This result could suggest that strategies, which are not based on evaluation of hedonic value to the participants, had been

employed. This finding on the other hand is limited due to the composition of the stimuli pool, which consisted of many abstract and ambiguous artworks like the ready-mades. Representational art, represented by the classical artworks received the highest liking scores of all art types (m = 39.0, SD = 5.2), followed by hyper-realistic artworks (m = 31.0%, SD = 10.3), which could have also been treated like representational art. This result suggest that representational art serves hedonic needs best of all art types, perhaps because it is easier to understand and the depicted content presents more familiar objects than abstract art. The ease of understanding the content could make higher cognitive strategies useless, at least in the short amount of time of the presentation of a stimulus in the experiment.

The mentioned processing styles reflect in the correlations, which were calculated for the factors, which were rated by the participants in regard to their importance in the classification processes, with the number of classifications as art. These factors could also be further examined and further evolved to creating a questionnaire or test that could be able to measure the "art personality" of the single participant and which could possibly predict which artworks are liked and which not and by whom. Further analyses of the classification strategies can be found in the publication of this study (Pelowski et al., 2017).

We found that art training and education made a significant impact on the classification of abstract art. This again suggests that abstract art employs cognitive processing patterns. Education and trainings lead to more or less enhanced expertise and expertise is reported to be connected to representations of more categories of stimuli (Hoffmann, 1998; Kirk, Skov, Christensen, & Nygaard, 2009; Leder et al., 2004). Retrieving representations from categories is a cognitive process and therefore the classifications of the abstract artworks as art by the art trained participants seem to be based on such cognitive instead of hedonic strategies. Detachment of hedonic strategies and emotions seems to serve the appreciation of abstract art. Abstract art was significantly less often classified to be art by participants who think that art should be pleasurable. These findings combined could also present a hint that people who like to interact with abstract or otherwise "difficult" art, like the ready-mades, are better able, or enjoy it better to detach from their emotions. This could be an interesting hypothesis for further research, with possible implications for emotional and mental health strategies.

This study also confirmed the frequently reported correlations between Openness for Experience and the appreciation of art in general (Fayn et al., 2015), in our case with classification as art overall all classes of stimuli. Also, the classification of abstract art was significantly correlated with higher scores in this personality trait.

On the opposite, we found that Extraversion negatively correlates with the judgement of ready-mades to be art.

Study 2 – effects of art classification of enhancing neuronal activity in the left dorsolateral cortex

The above empirical study addressed the question of if and when individuals classify images as art, and how this relates to personality and strategy. Here, we now go one step further and attempt to address how this might be neurobiologically accomplished.

The introduction to this study will start with a review section, in which I will look more closely at the brain regions investigated in some previous studies and bridge the gap between behavioral/cognitive classification patterns and their underlying neuronal mechanisms. The role of the left dorsolateral prefrontal cortex will then be singled out, and the few existing studies on this topic will be described, which leads to evidence for the good chance to influence the activity in this area by applying causative methods like transcranial magnetic stimulation (TMS) or tDCS.

Art classification and the brain

What part of the brain could be involved in classifying rewarding stimuli, like artworks, as such? One specific area is reported repeatedly to be involved in identifying and processing emotionally and visually pleasing stimuli, as for example a study by Cela-Conde et al. (2004) showed. Cela-Conde and colleagues (2004) found that the reward circuit was involved when participants were exposed to artworks when the researchers conducted an MEG study to investigate which brain areas are activated besides structures for visual perception when artworks were viewed. They found that the left dorsolateral prefrontal cortex (DLPFC) was activated significantly more when the presented artworks were rated to be beautiful by the beholders than when rated to be not beautiful. By using MEG, they were also able to determine latency of this activation. It took place starting about 400 ms after stimulus onset while the visual cortex showed activation earlier to that, about 130 ms after stimulus

onset. This time difference suggests that higher cognitive functions like classification were induced or that at least further processing had happened in a serial processing process.

Additionally, these results suggest that the left DLPFC responds to aesthetically pleasing stimuli. Aesthetic judgements involved prefrontal cortex activation but significantly greater in the left hemisphere when the stimuli was aesthetically pleasing to the participant.

In addition to the study conducted by Cela-Conde et al. (2004), the study by Cupchik et al. (2009) suggests that the reward areas are not only tied to higher appreciation but could be causative for the aesthetic mode of perception itself. They reported that one involved area, the left lateral prefrontal cortex, showed higher neuronal activity when participants were asked to consciously apply the aesthetic mode. This connection of the DLPFC with the switch in the aesthetic mode of art perception suggests that this region could be responsible for conscious shifts of attention to aesthetically pleasing and therefore rewarding stimuli. This finding goes hand in hand with the suggestion of Hayashi, Ko, Strafella and Dagher (2013) that the DLPFC would help in identifying possible rewarding stimuli. To be identified as a rewarding stimulus, a stimulus would have been classified as such earlier to that. If the stimulus was unknown earlier to the exposure to it, the stimulus has to be classified into either the class of rewarding or not rewarding stimulus, for example, it has to be classified as art or not art. Perceptions of rewarding stimuli, experiences and behaviours are known to lead to the release of dopamine. The DLPFC is on the mesocortical dopaminergic pathway in the brain and regulates the mesolimbic dopaminergic pathway.

Rewarding experiences were connected to dopaminergic pathways in the brain by numerous studies (Berridge & Robinson, 1998; Schultz, 1998; Wise & Bozarth, 1984). Hence, for a long time, rather interior parts of the brain, e.g. the nucleus accumbens, were thought to be related to rewarding stimuli, while classification, as it is a cognitive task, is reported to based on activation of the prefrontal cortex (Miller & Cohen, 2011). Hayashi and colleagues (2013) suggest in a study on cigarette craving that the left dorsolateral prefrontal cortex engages in identifying stimuli which serve as potential rewards. This would be one

region that is reported to be part of the reward cycle structures as well as it is part of the prefrontal structures of the cortex which are generally known to be involved to solve cognitive tasks.

Ballard et al. (2011) found that the DLPFC is activated as soon as information is available which could be rewarding to the recipient. In their experiment, Ballard and colleagues (2011) manipulated rewarding experiences by letting participants either win or lose money. Even only anticipated rewards led to enhanced activity in the DLPFC. Their fMRI measurements also showed that while the DLPFCs' activity was affected directly by anticipated rewards, deeper brain regions involved in dopaminergic reactions on the mesolimbic dopaminergic pathway like the ventral tegmental area (VTA) and nucleus accumbens (NAcc) were only affected indirectly, namely through enhanced activation via connectivity with the DLPFC. As mentioned above, applying the aesthetic mode of visual perception intentionally (Cupchik et al., 2009) or, on the other hand, finding artworks to be beautiful (Cela-Conde et al., 2013), seems to elicit reward mechanisms in the brain. From these results, it could be inferred that art perception is not only stimulus driven but also depends on top-down processes like classification and expectations about the stimuli and probably about art itself.

In more recent causative studies, the dorsal part of the lateral prefrontal cortex has been reported to mediate several responses to visual art (Cattaneo et al., 2013; Cattaneo et al., 2014). Cattaneo and colleagues (2013) presented participants with photographs and reproductions of abstract and representational artworks and asked them to rate how much they liked the stimuli in two separate sessions. In one of the sessions, participants received transcranial magnetic stimulation (TMS) on the left DLPFC. In these sessions, liking ratings for representational artworks and photographs were significantly higher than in sessions without stimulation. In another study, which will be described in further detail in the next section, Cattaneo and colleagues (2014) again found that TMS on the left DLPFC increased appreciation for the participant's generally preferred art style (representational or abstract).

Still, one question remains unanswered: is the DLPFC only involved in shifting attention to aesthetic properties of objects that are already classified as art, or will it first shift perception into this aesthetic mode, to appealing formal features and therefore help recognising and appreciating art?

In the mentioned studies, causative methods to increase or inhibit neuronal activation in the DLPFC were applied. Enhanced activity in the DLPFCs has been linked to certain different memory functions in the past decade. Petrides (2005) suggested that the DLPFC is responsible for manipulating information in the working memory.

The involvement of the left DLPFC in memory processes and its connection to positive judgements/valence of stimuli was also found by Balconi & Ferrari (2012). They reported that the left DLPFC stored memory of positive valence more efficiently when a stimulating (activating) repetitive transcranial magnetic stimulation (rTMS) paradigm was applied.

The left DLPFC seems to play a role in classification of stimuli regarding their valence. In a second step, this evaluation information is processed and leads to judgement as in rating tasks or it leads to memory storing and retrieval. Hence, the emotional evaluation of a stimulus evokes higher cognitive processes. Depending on the outcome of the emotional classification of stimuli or memory contents, different strategies for information encoding and also for retrieval may be promoted (Mikels, Reuter-Lorenz, Beyer, & Fredrickson, 2008).

If it is obvious that something is art as it most of the time is for representational paintings as reported in study 1, people's brains could activate reward mechanisms even for the expectation of being exposed to art. Also, representational paintings and photographs are probably processed more easily because representations of everyday, familiar objects can be classified faster than abstracted contents.

The "arthood" of an object could also be determined by the preference or validation of the beholder. Cattaneo et al. (2014) compared the impact on aesthetic appreciation of the left DLPFC with the impact of the right PPC, a region that was also linked to aesthetic appreciation (Cela-Conde et al., 2013). By applying TMS pulses, Catteneo et al. (2014)

inhibited neuronal reactivity in these regions temporarily while participants were evaluating abstract as well as representational artworks. Participants' preferred art style was measured also. They found a significantly reduced appreciation of artworks that were of the preferred art style when TMS was applied over the left DLPC. This result suggests that the left DLPFC is not only involved in the liking of stimuli due to its role in the reward circuit but could also be responsible for the initial identification of stimuli of preferred categories. In this case, this category would be art style.

To address this research question, I conducted a second study in which the activity in the right DLPFC was enhanced by applying tDCS.

My hypotheses were that if the DLPFC is responsible for finding rewarding stimuli and art was reported to be a such stimuli, then enhanced activation of the DLPFC would lead to identification of more stimuli as art. This would be measurable as a higher number of as art classified stimuli after the stimulation. The stimulation of this area would also lead to eased switching to the aesthetic mode of perception. Artworks would be rather judged depending on their visual properties which would be more salient in the aesthetic mode of perception. This would work only with stimuli which employ aesthetic modes of perception like abstract artworks.

Also, when art would be viewed in such an "aesthetic mode of perception" any aesthetic value should have more influence on the appreciation and should lead to increased liking of aesthetically pleasing stimuli.

The DLPFC has been linked to both, art perception and rewarding stimulus classification. The DLPFC has also been shown to be involved in classification of other, not art related stimuli (Hayashi et al., 2013). From studies until now it cannot be concluded with certainty if the DLPFC is involved in art perception only if a stimulus is already classified as an artwork and therefore as a (potentially) rewarding stimulus or if the DLPFC is responsible

for identifying objects as such rewarding stimuli. The present study aims to answer this research question by enhancing activity in the right DLPFC through application of tDCS.

Method

Participants. For Study 2, a final sample of 47 psychology students (34 female; M_{age} = 20.52 years, SD = 1.73) from the University of Vienna participated. All again were without formal education in the arts, were different from those who had participated in Study 1 and participated in the experiment for course credit and were naive to the experimental hypothesis. The final sample was derived from an original sample of 54 participants, with four individuals excluded from the analysis due to non-completion of all study participants or trouble with the E-Prime software, and with three participants omitted due to issues with the tDCS stimulator (due to shutting of the machine because of increased current resistance). In these cases, the participant was still granted course credit.

Using the online lab recruiting system, all individuals with neurological problems or medicine intake were also excluded. Additionally, those participants who were recruited via other means (Facebook groups or friends), had to fill out an additional lab questionnaire about neurological and health issues. Individuals who reported a case of epileptic seizure in their family health history were excluded from the study but were also granted course credit. All participants had normal or corrected-to-normal vision.

Material/stimuli. The stimuli were the same as in Study 1, in this case divided into the two sets A and B, and further refined in number due to testing time-window requirements. Artworks and their corresponding matches with the highest difference in variability of ratings were excluded from the original pool. Eventually, 10 abstract, 10 readymade, 10 hyperreal and 10 Kitsch/poorly executed artworks were used as stimuli. As control, 5 art controls were taken from the art control pool and 3 not art control pictures were taken from the not art control stimuli pool.

From the original pool of artworks, as reported in study 1, two sets were formed for the experiment in study 2. To prevent that the sets differed from each other significantly, matching stimuli for which the ratings influenced the overall ease or difficulty of classifying these as art, were systematically excluded from the remaining sets of stimuli.
To select the artworks, mean ratings for corresponding stimuli of each group of artworks were compared using paired sample t-tests. Table 7 shows the results of the analysis.

Table 7

Results of pairwise t-tests for original stimuli sets A and B from study 1

Pairs	M	SD	T(112)	p
Abstract	0.004	0.1247	0.324	.747
readymade	0.03	0.1685	1.876	.063
Hyperreal	0.085	0.1126	-7.985	<.001
Kitsch/poorly executed paintings	0.029	0.0884	3.528	.001
Control art	0.001	0.0912	0.052	0.959
Control not art	-0.051	0.1487	-3.669	<.001

Note. M = mean, SD = standard deviation

After identifying and excluding the pairs which's stimuli correlated highly with each other, the two sets didn't differ significantly from each other anymore. Table 8 shows results of pairwise comparisons of the remaining stimuli sets which were used as stimuli in the experimental procedure. To ensure that the set was not too big, only few stimuli of each art class remained in each set. This was done in order to lower the quantity of stimuli was necessary to ensure that the effects of the tDCS influenced the overall procedure with the same strength and therefore the overall classifications of artworks similarly and not only partly or with different intensity.

Table 8

Differences between stimuli sets A and B after excluding certain pairs

Pairs	M	SD	T	df	p
Abstract	0.198	14.688	0.052	14	.959
readymade	1.614	13.948	0.401	11	.696
Hyperreal	3.554	8.514	-1.446	11	.176
Kitsch/poorly executed paintings	2.922	6.035	1.677	11	.122
Control art	0.174	1.849	0.210	4	.844
Control not art	3.371	1.379	-4.233	2	.052

Note. M = mean, SD = standard deviation, df = degrees of freedom

As study 1 showed, is the selection of stimuli a mission critical factor to experiments. Therefore, high importance was given to the stimuli in this experiment. An additional correlation analysis between the two sets revealed that each art group correlated significantly (all $p < .05$) with its corresponding group except for the abstract artworks. In table 9, the correlation coefficients are listed for each matched set of stimuli. Due to the advantage of keeping an already pretested set of stimuli and the low correlation coefficient of $r = .343$, $p = .211$ the set was kept. Given the relatively small number of stimuli in each set and group, individual ratings of artworks could have had a huge influence on the overall rating of one stimulus. In addition, abstract artworks seem to evoke rather individual ratings within participants so the possibility was given that even another set would evoke similar responses.

Table 9

Correlations between stimuli in each group of artworks in the remaining stimuli set

Pairs	N	Correlation	p
Abstract	15	.343	.211
Readymade	12	.697	.012
Hyperreal	12	.900	.000
Kitsch/poorly executed	12	.968	.000
Control art	5	.982	.003
Control not art	3	.999	.020

The experimental stimuli sets were presented using E-Prime 2.0. One additional picture was shown as a practice test

Procedure. Participants had to sign up for both sessions. The second session took place at earliest 24 hours after the first and at latest one week after the first session. Participants were introduced to the method of tDCS and informed consent was ensured. Neurological and other relevant health issues were excluded using a lab questionnaire (see appendix) and by interview. All participants signed an informed consent form. Participants were seated in front of a computer display (xx inch) and then fitted with the tDCS electrodes.

The tDCS procedure used an offline method, following previous paradigms for the same location (e.g. Cattaneo et al., 2013). In the offline method, a period of pre-stimulation takes place and is then followed by the experimental task (Thair, Holloway, Newport, & Smith, 2017). Effects of 20 minutes of stimulation are still observable after 90 minutes (Batsikadze et al., 2013). Following paradigms of studies on art perception and appreciation and recommendations given in person by Professor Cattaneo who suggested that the enhancement of excitability given by the stimulation would be highest and also best comparable within the first 5 to 10 minutes after the end of the stimulation, we designed an experimental task which only took about 5 minutes to fulfill.

The testing procedure was further refined via training sessions in which the author visited Professor Cattaneo's laboratory. The anodal tDCS electrode was placed on the left DLPFC. Localization was conducted by using an EEG 10-20 cap, with Left DLPFC located in the midway between F3 and F7. The cathodal electrode was placed supraorbital, above the left eyebrow. The surface of the skin at both positions was cleaned using alcoholic cleansing liquid. Then the surface of the skin was scratched gently using a sterile needle in order to weaken the electric current resistance level of the skin. For the same reason, subsequently, natrium chloride was applied to the skin by using a NaCl spray (Signa Spray, Parker Laboratories Inc., Fairfield New Jersey). Plastic electrodes without sponges were spread with electrode gel (Ten20 conductive paste, Weaver and Company, Aurora, Colorado). Electrode gels' advantage over to the use of salt water (as used in the above Cattaneo study) is that it not only helps electrodes to stay at a certain location but leads to lowered, and more

consistent, current resistance. Lowered current resistance also means lowered itching sensation for the participant. This also eliminated potential for salt water getting in the eyes while performing the tasks. The level of impedance was checked using an impedance measuring device with the machine requiring a level of less than 5kΩ at all time.

After checking the impedance, the electrodes were additionally fixated using plastic bands which were wrapped around the participants' head. When the electrodes had been positioned, a photo was taken to compare the positions with those in the second experimental session. Transcranial stimulation was induced using the DC Stimulator Plus, NeuroConn GmbH, Illmenau, Germany. This allowed for a double-blind procedure, with a list of codes for each session (corresponding to either sham or real condition) given to the author by her supervisor. Participants were not told that one of the sessions was a sham session. If they asked about the difference between the two testing sessions, they were told that different stimulation settings were applied. Order of sham and stimulation sessions, as well as A and B art sets, was counterbalanced between participants.

Participants then received continuous stimulation of 2 mA for 20 minutes. During this time, they were asked to sit quietly and to watch one of two cartoon movies (both Disney's "Goofy & Max"). This procedure and the exact same movies followed recommendations from Prof. Cattaneo (personal correspondence). The watching of the movies ensured that all participants had the same general mental and behavioral conditions during stimulation in order to raise consistency (e.g., eliminating differences in rumination or other acts). Participants were instructed to just watch the movie and were informed that due to the stimulation, a slight itching sensation could occur and also a heat sensation in places of the electrodes could be felt. Nearly all of the participants reported experiencing this moderate heat sensation. Note also that, in sham sessions, the stimulator also induced the initial stimulation/sensations, thus neither participant nor experimenter could tell from stimulation sensations about those which session contained the real and which the sham stimulation. In the sham setting, the device would start the stimulation procedure in the exact same way as in the real stimulation setting but turns it completely off after 30 seconds. In real stimulation

sessions, itching and other sensations are also only felt in the beginning of the stimulation. Therefore, participants cannot tell which session was a sham session, as the initial sensations are the same in both sessions.

If any participant felt uncomfortable with the method or the itching sensation they were free to stop the experiment at any time. This happened in two sessions. Both participants reported no longer-lasting issues. In general, side effects of tDCS included red skin and minor headache, but most participants reported of no symptoms or only general tiredness.

After the 20 minutes of stimulation, the machine was switched off and the experiment started (note that electrodes were not removed in order to allow for quick transition to testing).. Participants were instructed to answer as quickly as possible, following their first impulse, whether a displayed picture showed an artwork or not. To indicate whether it was an artwork or not, two keyboard keys were used. Participants were instructed to steadily hold the keys and press “1” for art or “0” for not art as soon as they made up their mind. Between the presentations of artworks, a fixating cross was displayed for 1000 ms and participants were asked to focus on it until the following picture occurred. This was necessary to ensure similar/same eye gaze positions at the onset of the stimuli. Each experiment was finished in less than 5 minutes. Answers and reaction time for each presented stimulus picture were recorded by the software.

Questionnaires. After each session, each participant answered a paper and pencil post-test questionnaire. Firstly, participants had to indicate on 7-point Likert type scales (1) if and how strongly the stimulation had an impact on their behavior and/or thinking. Next (2), if they felt that the stimulation had changed the way he or she was responding to the task, (3) if they felt that the stimulation changed the way they perceived or interacted with art, and (4) if they felt that the stimulation changed the difficulty of the task in their opinion. All four questions came with a space for other possible written remarks by the participants.
Secondly, the list of factors from study 1, measuring the importance of the factors which

played a role in the classification process as art or not in the decision process of the participants, was given to the participants immediately after the experiment. Participants received this questionnaire after each of the both sessions because due to the altered decisional and/or perceptional processes in the stimulation setting, we were interested in measuring possible alterations in the classification strategies.

Also, the same further post-test questionnaires as in study 1 were given to the participants in both sessions. Subsequent to the two experimental sessions in the laboratory, participants had to answer an online questionnaire from home that also served as the post-test questionnaire in study 1. Applied scales and included questionnaires are specified above.

Study 2. Results and discussion

Participants were n = 46 students (12 male) of the University of Vienna in the age range of 18 to 25 years (M = 20.5, SD = 1.735).

To ensure that the stimuli sets A and B, which were used alternating in the different conditions per participant, were not different from each other, we calculated a repeated measures ANOVA with set (A, B) and art types (abstract, readymade, Kitsch, art control, not art control) as within participant factors. This showed no significant main effect for set $F(2.515) = 1.639$, $p = .192$; note, due to violation of sphericity (Mauchly's test = $\chi2(2) = 99.655$, $p < .001$) Greenhouse-Geisser correction was used). Similarly, no significant interaction between set and art type was found ($F (2.292) = .420$, $p = .685$, Greenhouse-Geisser corrected).

Effect of the stimulation on the classification of stimuli. To test our main question of the effect of the stimulation on the classification of stimuli as art or not art in each art group, a one-way repeated measurement ANOVA for the effect of condition (sham or real stimulation) on the classification of artworks of the different art styles was calculated.

No significant influence of the condition was found, F (1,1) = 0.66, p = .798. Ratings of groups of art styles differed significantly from each other, F (4, 1) = 154.761, p = .000. A nearly significant interaction between condition and art style was found, F (4, 1) = 2.411, p = .51). Exploratory Post-hoc, pairwise comparisons of the art styles were therefore conducted. To control for Type 1 errors, Bonferroni correction was applied. In each condition, classifications of all art groups differed significantly from each other. Overall, $p < .05$. As can be seen in table 10 below in the column listing the mean differences between the art styles, the directions between the differences are different.

Table 10

Pairwise comparisons between classification of art styles for each condition

Sham			
Style 1	Style 2	Mean difference (1-2)	SE
Abstract	Readymade	4.489**	.472
	Kitsch/poorly executed	-1.511*	.478
	Classical art	3.000**	.529
	Not art	7.489**	.504
Readymade	Kitsch/poorly executed	-6.000**	.481
	Classical art	-1.489*	.416
	Not art	3.000**	.359
Kitsch/poorly executed	Classical art	4.511**	.307
	Not art	9.000**	.316
Classical art	Not art	4.489**	.125

Real			
Style 1	Style 2	Mean difference (1-2)	SE
Abstract	Readymade	3.723**	.488
	Kitsch/poorly executed	-1.617*	.481
	Classical art	2.511**	.543
	Not art	7.000**	.521
Readymade	Kitsch/poorly executed	-5.340**	.499
	Classical art	-1.213	.430
	Not art	3.277**	.383
Kitsch/poorly executed	Classical art	4.128**	.271
	Not art	8.617**	.276

Classical art	Not art	4.489**	.091

Note. SE = standard error

Pairwise comparisons with Bonferroni adjustment of the ratings of each art group in the different conditions revealed no significant differences for the ratings. The changes are reported in table 11 below, listed as mean differences and p-values.

Table 11

Pairwise comparisons of art classifications between conditions

	Mean difference (real - sham)	SE	p
Abstract	.340	.300	.262
Ready-made	-.426	.235	.077
Kitsch/poorly executed	.234	.255	.363
Classical art	-.149	.096	.128
Not art	-.149	.101	.146

Note. SE = standard error

For the sake of completeness and to ensure that the decision to exclude the hyperreal stimuli from the analysis was reasonable, an one-way ANOVA for the effect of the condition on the classification of art styles was calculated, this time also including the hyperreal stimuli in the analysis. Again, so significant influence of the condition was found, $F(1,1) = 0.899$, $p = .348$. The ratings of the different art styles differed again significantly from each other, $F(5, 1) = 67.478$, $p = .000$. The interaction between condition and art style was not significant, $F(5, 1) = 0.262$, $p = .611$). While the interaction was close to significant in the analysis without the hyperreal stimuli ($p = .051$), including these made a huge difference for the result of the interaction analysis ($p = .611$).

Reaction times. Increased activity in cortical regions enhances processing of stimuli that correspond with this region. To test, whether the neuronal responsiveness of the dorsolateral PFC increased due to the stimulation, paired t-tests for the reaction times for the classification of the separate styles were calculated. As can be seen in table 12 below, the reaction times did not differ significantly between the sham and the real stimulation sessions.

Table 12

Differences in reaction times between sham and real stimulation condition

Pairs	Mean difference (sham vs. real)	SD	T (46)	p
Abstract	-63.714	737.782	-.592	.557
Readymade	81.484	634.547	.880	.383
Kitsch/poorly executed	-1.122	416.299	-.018	.985
Classical art (control)	1.821	355.219	.035	.972
Not art (control)	14.7	884.173	.114	.910

Note. SD = standard deviation

As table 12 shows, the changes of the reaction times were not significant for the classification of any art styles. Nevertheless, interestingly, the direction of the (not significant) changes of the reaction times is negative for the abstract stimuli and the Kitsch/poorly executed stimuli. While the differences of the mean reactions times are very small for the Kitsch/poorly executed artworks, it is relatively high for the abstract stimuli. Interestingly, classification processes were faster in the sham condition, but again, the result did not even nearly reached significance, so further interpretations of these results are not possible.

Study 2. Discussion and conclusion

In study 2, we applied tDCS over the right DLPFC. In two sessions, in which one session was a sham, the other was a real stimulation condition, participants again were asked to classify a selection of the artworks from study 1 as art or not. In this within subject study we measured whether the number of classifications overall and the number of classifications of stimuli of the different art styles changed, when the right DLPFC was stimulated. We hypothesized that stimulation would enhance the number of classifications as art. When we excluded the hyperreal paintings which proved to be highly ambiguous regarding the basis for participant assessments, we found a nearly significant interaction between art type and stimulation ($p = 0.51$). Post-hoc comparisons showed that this trend was significant for all art styles.

A closer look at the differences between the art styles revealed that the differences go in different directions. This result suggests that the DLPFC's responsibility in classification of putative rewarding stimuli like art could work in a more differentiated way than to be responsible for all stimuli of one class. This result is in accordance with findings of other studies. Cattaneo and collegues (2014) found when applying TMS over the left DLPFC, that liking ratings of art styles which were preferred previously to the experiment, decreased due to the stimulation. They suggested that aesthetic orientation towards features, which were normally appreciated by the participants, was disrupted. TMS is used to interrupt or decrease activation in the brain regions it is applied. While TMS usually decreases functions of the region is it applied to, tDCS usually enhances neuronal activity in such areas. In another study, Cattaneo et al. (2013) applied tDCS on the left DLPFC and liking ratings for representational art and photographs, but not for abstract art, increased. In our study, the difference between the classification numbers of abstract and classical art also decreased from sham to real stimulation setting. Abstract was classified more often as art in the sham condition. Unfortunately, the number of representational artworks was low in the present study and in contrast to the other stimuli, these were thought to be controls and therefore more obvious art than the other stimuli. Hence, comparisons between abstract and representational art could not be calculated or interpreted in the present study. It is also not possible to compare the results in regard to the previously preferred art styles as we did not measure the preferences for the exact same art styles as used as stimuli. In addition, a Likert scale was used for the measurement of art style preferences, which would make analysis not clear as participants could indicate many preferences.

The relatively low number of stimuli in sum, and of artworks from each art style, could explain the close to, but not fully significant result. Following best practice suggestions for the use of tDCS in art studies, we kept the number of stimuli consciously low to ensure that the intensity of the stimulation in the real stimulation condition would stay the same from the beginning to the end of the experiment.

It was also not possible to measure the level of activation of the DLPFC of the participants before testing. The stimulation is used to enhance the neuronal activity in the applied region, but that does not mean that all participants would have comparably high or low activity baselines in the beginnings. Differences in the activity level of the DLPFC between the sham and the real stimulation condition could have been smaller in some participants. It is thinkable that participants who generally like art, especially abstract art, had a higher baseline activation than participants who are less interested in it. In addition to this,

different places for the cathode are used throughout the literature and it is still not agreed upon which position would be the best for studies like ours. The current flows from anode to cathode but because this current makes it not exactly predictable way through the brain also other brain areas could have been effected by the stimulation. Effects of other stimulated brain areas can also lead to altered effects in the experiment. Stimulation by an alternative method, namely TMS, would have been preferable to control this factor. TMS influences cortical activity in a much more targeted way, anyways, due to this high accuracy also the exact position of the DLPFC of each individual participant would have had to be located.

Another methodical limitation comes with the strength of the applied current and the resistance. Stronger current could perhaps have led to a stronger shift in the perception, hence significant differences in the classification patterns.

Nevertheless, the close to significant result suggests that the right DLPFC is involved in the classification of artworks of certain art styles. To clarify its role, many following studies, which may optimise the method of this study, are possible and would also answer questions about the methodical issues of the use of tDCS in comparable studies, if the limiting factors of the present study would be altered systematically.

We did not find significant changes in the reaction times from sham to real stimulation condition. As mentioned above, interpretations of changes of mean reaction times are not possible for this study, but the missing significance could also be a result of the randomization of the sham and real condition. Training effects could have therefore have influenced the reaction times in the second session and possible effects could have been cancelled out. Also, the number of stimuli for each set was relatively low. A bigger set of stimuli could have made possible differences clearer and statistically significant.

General discussion

This thesis, which consisted of two exploratory studies, was aimed to answer several questions regarding art classification strategies and additionally aimed to enhance the quality of future research using artworks as stimuli. Due to the importance of the collection and selection of stimuli in any experiment, and the clearance of the resulting insights in the human psyche from experiments, this thesis offers valuable guidance for future research. In addition, in the second study, we examined the neuronal basis of art classification further by stimulation of the right DLPFC using tDCS.

Major finding of study one was, that it is not assumable that participants classify or process artworks as such when these are used as stimuli. Surprisingly, even the classical, famous artworks were not classified as art in all cases. Also, participants differ in their processing and classification strategies of artworks. Of course, this could hold true for many other classes of stimuli but must be examined separately. The findings of this study suggest for researchers in any field to question even long-established methods and study designs and approach their fields of work with open interest and continuous quality improves.

Study 2 revealed a nearly significant trend for altered classification of stimuli of the different art styles as art. Although not fully statistically interpretable and limited by several factors of the study design which originally should test other hypotheses, this result is interesting. It suggests that the DLPFC is indeed involved in classification of certain stimuli. In accordance to other research (Cattaneo et al., 2013; Cattaneo et al., 2014) it suggests that the classification of stimuli is based on previous preferences of the participants.

Both studies could influence future methods in research on art perception. We found that not even classical artworks painted by famous artists are felt to be art overall all participants. Attitudes to art, measured in this study as factors for classifying artworks, play a big role. Especially for artworks, the cognitive and/or emotional reception of the stimuli cannot be ignored, as it is a matter about stimuli, which are not easily agreed upon. Even representations of everyday life objects, for example, an apple are not the same for everyone when retrieved from memory or imagination. The idea, in the philosophical sense, of what is art and what is not, which is an abstract and complex idea, consisting of many classifications, ideas and attitudes, depending on personality factors and sociodemographic factors and perhaps much more, cannot be limited or assumed to be the same for the single participant as it is for the single researcher. More than this, art still cannot be defined entirely, not even by art institutions and experts. Magritte's picture of a pipe still is not a pipe. The idea of art is still not art, and obviously not nearly the same to everyone. This holds many implications and ideas for future studies. Brain research could use this information and reverse the study procedure, for example, a neuroimaging study could shed light on which patterns of brain activation lead people to feel that something

Magritte (1929)

is art. An objective point of view and therefore explorative approach would be needed here as well.

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Appendix A

Abstract

Numerous studies in psychological and aesthetic research used artworks as stimuli. Until now, it was assumed by the researchers but never confirmed whether the stimuli would be classified as art by the participants or not. This methodical gap raises questions about the reliability of the results of such studies. Classification of stimuli as art may employ different strategies which lead to different assumptions about art. In Study 1, behavioral measurements to examine the nature of arthood classification across a range of art types were taken. We found that stimuli of no art type were classified by all participants as art or not and interpersonal differences interact with the classification as art. Study 1 also served to provide a pretested set of stimuli for further investigation of art classification processes. In Study 2, we investigated the specific neurological question of classification by applying transcranial direct current stimulation. We found a close to statistically significant trend suggesting that enhancing neural activity in the left dorsolateral prefrontal cortex alters arthood classification. Directions of classification as art or not differ per art type. This result suggests that the left dorsolateral prefrontal cortex is involved in specific classification processes.

Appendix B

Abstrakt

In bisherigen Studien, in denen Kunstwerke als Stimuli eingesetzt wurden, wurde davon ausgegangen, dass jene Stimuli von den Versuchspersonen ebenfalls als Kunstwerke angesehen wurden. Diese Annahme wurde jedoch nicht in Frage gestellt und daher weder getestet, noch bestätigt. Diese methodische Lücke wirft Fragen über die Reliabilität der Ergebnisse besagter Studien auf. Die Klassifikation von Stimuli als Kunst könnte verschiedenen Strategien unterliegen, welche zu verschiedenen Ansichten darüber, was Kunst ist und was keine Kunst ist, führen können. In Studie 1 wurden daher behaviorale Messungen zur Untersuchung der Klassifikation von Kunst in unterschiedlichen Kunstgattungen durchgeführt. Wir entdeckten, dass Stimuli keiner Gattung durchgehend als Kunst oder nicht Kunst klassifiziert wurden und dass interpersonale Unterschiede mit den Klassifikationen interagieren. Studie 1 diente auch zur Validierung eines vorgetesteten Stimuli-Set für weitere Untersuchungen des Vorgangs der Kunst-Klassifikation. In Studie 2 untersuchten wir spezifische neurologische Vorgänge bei der Klassifikation mit Hilfe von transkranieller Gleichstromstimulation. Unsere Untersuchung zeigte einen statistisch annähernd signifikanten Trend auf, welcher nahelegt, dass die Intensivierung neuronaler Aktivität im dorsolateralen präfrontalen Cortex Kunst-Klassifikationsvorgänge verändert. Die Richtung der Klassifikation, also als Kunst oder nicht, unterscheidet sich bei erhöhter neuronaler Aktivität in diesem Gehirnareal je nach Kunststil. Dieses Ergebnis könnte ein Hinweis darauf sein, dass der linke dorsolaterale präfrontale Kortex in spezifischen Klassifikationsprozessen involviert ist.