ART AND COGNITION: DOES STYLE OF ART MAKING INFLUENCE MOOD AND HOW WE PERCEIVE VISUAL STIMULI?

by

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Abstract

Given the reported success of art therapy as a tool for improving psychological and physical health, there is much to be asked about the underlying mechanisms of creative activity that cause improvement in health. To date, specific components of art making have not been extensively studied in relation to improving well-being, mood and cognitive functions such as memory and perceptual abilities. It can be asked whether it is the personal, expressive aspect of engaging in art that makes it emotionally relieving, or if it is the technical aspects requiring cognitive focus and therefore distraction. Expression and technicality during art making are simultaneously investigated in relation to cognitive functioning, asking specifically if technicality during drawing can aid memory ability and attention. The purpose of this study was to examine characteristics of art-making in relation to both cognitive functioning and well-being, and to further research into recreational activities as tools for cognitive improvement. Following four sessions of different styles of art-making, we report general improvement in ability to detect change in a visual stimulus. However, improvement was not influenced by type of art activity. Moreover, expression during art-making was not effective in improving mood or stress. Future work into visual art activities should pay careful attention to baseline levels of creativity in individuals, to fully measure the effectiveness of exposure to art-making in novices.

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Introduction

1.1. *Thesis Overview*

The arts have long been believed to be effective in relieving symptoms of mental and physical ill health (Hogan, 2001). Only in recent years has more attention been paid to the study of creative practices and activities, and how each practice may benefit health and wellbeing. Several health enquiries have sought to highlight the benefits of the arts outside of clinical art therapies, by considering 'the arts' not as a singular activity but instead as separable activities including visual arts, crafts, writing and performance amongst other practices (Creative Health Inquiry, 2017). The present study will primarily focus on art making in the form of drawing and painting, in attempt to contribute to a growing body of evidence in favour of the benefits of making art. Within the empirical literature, research has recently attempted to decipher what it is about making art that elicits positive effects upon mental and physical health. The history and effectiveness of art as a therapeutic tool within clinical settings will first be discussed, followed by recent empirical research seeking to identify what it is about making art that allows for such benefits. Comparisons will also be made between art and writing therapy, to assess whether the visual nature of making art makes it a more effective creative outlet. Finally, the present study considers how visual art may be used as a tool for cognitive training, based on recent calls for research to acknowledge the benefits of recreational activities and hobbies upon brain functioning.

1.2. *Art Therapy and Art in Research*

1.2.1. *Early works*

Originally inspired by psychotherapy and Freudian techniques, art therapy uses forms of art such as painting, drawing and sculpture to allow patients to express thoughts and emotions that otherwise may be difficult to express through speech or alternative creative

therapies such as music or dance (Schouten, Niet, Knipscheer, Kleber & Hutschemaekers, 2014). The study of the effectiveness of art as a psychological therapy began in the early 20th century. Grace Pailthorpe, an artist, surgeon and psychological researcher in the 1930s was among the first to delve into the clinical effectiveness of making art. To assess effectiveness, her work focused on analysing the art of patients in terms of what was visually depicted and what the content could potentially reveal about a person's mental state. However, the subjective nature of this approach has critical empirical issues; what is interpreted by the observer may not be reflective of the artists intentions and mental state. Therefore, subjective analyses of works should be taken as conjecture. Despite these issues, art therapy has been a longstanding and established psychological therapy since the early 1900s (Uttley et al, 2015).

Despite issues with early investigations of art therapy, more recent enquiries have highlighted that art therapy is indeed effective for improving wellbeing, mood disorders, trauma, and non-mental terminal illnesses (Pizarro, 2004). The World Health Organisation (WHO, 2014) define mental health as a 'state of well-being in which every individual realises his or her own potential, can cope with the normal stress of life, can work productively and fruitfully, and is able to make a contribution to her or his community'. Similarly, Ryff (2016) argues components of wellbeing include holding purpose in life, self-acceptance, personal growth, autonomy and having positive relationships. To elaborate on these definitions, Ryan and Deci (2001) argue that well-being cannot be defined as simply the absence of mental illness. They propose that well-being can be viewed as hedonic, eudaimonic, or a mixture of the two, where hedonic refers to wellbeing based on increased pleasure and decreased displeasure, and eudaimonic refers to well-being in terms of self-realisation, meaning, and functionality. Importantly, these authors note that the way well-being is defined has significant practical and theoretical implications. In the context

of art therapy, seeking to improve ‘well-being’ may be too broad of an aim, and a tighter more specific definition could more usefully be applied.

Although it has been declared that art therapy benefits health and well-being in clinical circumstances (Sapouna & Pamer, 2014), there remains a limited body of research providing support for this claim. Parr (2005) notes that individuals did not know what to expect when beginning a programme or course of art therapy, suggesting the empirical knowledge base behind such therapies and art activities in general can be improved to give patients and the general population a clearer understanding of how the course or treatment may benefit them. Furthermore, Bungay and Clift (2010) acknowledge that claims of effectiveness come from individual project reports and qualitative literature, rather than a sound quantitative database. In addition, through review of the experimental literature since 2000, Slayton, D’Archer and Kaplan (2010) report only 35 studies providing support to the claim art therapy is effective for dealing with life challenges. However, not all existing literature focuses on art therapy as the sole intervention. Hence, there remains an issue where conclusions regarding effectiveness and applicability of art therapy alone cannot be made.

Slayton, D’Archer and Kaplan report that small progress has been made in that art therapy as a singular intervention has been studied. Through review of 35 quantitative studies, Slayton et al. highlight that art therapy has been proven to significantly improve symptoms of both clinical and non-clinical disorders and medical problems across the lifespan. Hacking, Secker, Spandler and Kent (2008) conducted research into the benefits of therapeutic art projects in people with mental health difficulties. Specifically, they measured feelings of empowerment, mental health and social inclusion in 62 participants who were new to arts projects. Using self-report measures of these factors at pre-test and 6 months later, it was found that the art projects unanimously improved all three. However,

not all improvements reached significance. For example, while experience of social inclusion did improve, scores only increased by 4%. In contrast, feelings of empowerment did significantly improve, with scores increasing by 9%. The most drastic improvement was found for ratings of self-efficacy, where scores improved by 37%. Importantly, Hacking et al. do not state the components of the participatory arts projects, only that sessions took place across England as part of a national assessment. The research, although supportive of the association between arts and mental health, therefore highlights how 'art projects' need to be dissected and discussed in detail within the literature to provide fuller understanding. In addition, Puig, Lee, Goodwin and Sherrard (2006) conducted a pilot study into the efficacy of semi-structured, group art therapy upon negative psychological affect following breast cancer diagnosis in female patients. Here, 39 newly diagnosed patients of Stage I and Stage II breast cancer took part in four therapeutic art sessions over four weeks, compared to 19 patients who took part in a delayed treatment control. Patients were encouraged to explore their breast cancer experience through art. Puig et al reported that patients experienced increases in self-awareness, connection with and expression of emotions, stress management and happiness amongst other factors. Overall, participation in the intervention resulted in less experience of negative emotional states, therefore increasing general wellbeing. However, studies such as Puig et al (2006) are in line with the early research in that the work focuses on the outcomes of engaging in art therapy, without looking specifically at the types of art being made and how. For example, their study utilised group as opposed to private sessions of art therapy. This raises the question of whether private sessions with an art therapist would yield the same, better or lesser effects as compared to group participation. Puig et al also argue for new research to tackle characteristics of such interventions, and to explore how art therapy and art in general may generate different outcomes for health and wellbeing.

Sapouna and Pamer (2014) argue that while the arts are a meaningful and effective tool for relieving psychological distress in clinical environments, improvements could be made to the way arts therapies are performed and instructed. Typically, sessions of art therapy begin with client assessment, followed by offer of individual or group sessions; in these sessions, patients are encouraged to create artwork based on inner experience, as opposed to external inspiration (Malchiodi, 2006). Already, focus upon art as a means of internal expression has dominated the practice. Sapouna and Pamer thus argue for less rigidity in the therapeutic process, arguing that once individuals become patients, the true components of art-making are lost to a confined and pre-determined set of instructions that detract from expression of anything the patient desires and whole, uninhibited artistic freedom. In line with Sapouna and Pamer's suggestions, Kaimal and Ray (2016) sought to delve away from traditional art therapy procedure, and how changes in the practice would influence those taking part. Importantly, their research did not involve traditional sessions of art therapy focusing on improving psychopathology in individuals, but rather focused on using an art space with the encouragement from an art therapist to express themselves and focus fully on the process. In general, Kaimal and Ray reported greater experience of self-efficacy and mood improvement in the majority of participants following the 45-minute session of free art-making. Importantly, these authors also accounted for previous art experience, in contrast to a vast majority of the existing literature. They reported no differences between participants with and without experience during their study. However, perhaps the nature of the research involving no specific arts task contributed to the lack of difference observed. It is plausible to consider that in research involving more specific tasks such as drawing or painting, individuals with limited experience may feel less able to engage fully in the task, thereby effecting feelings of self-efficacy, ability and confidence.

Nonetheless, Kaimal and Ray highlight that unconstrained art-making is beneficial for mental well-being.

1.2.2. *Characteristics of Art Making*

In recent years, focus has turned to the specific attributes of making art in an attempt to strengthen the quantitative and empirical evidence base behind arts therapies and participation in the arts in general (Table 1 describes the extant literature that will be described in this section). Stickley et al (2016) stress that a gap in the experimental literature is present, where the nature of practicing art should be studied. More specifically, Uttley et al (2005) suggest that randomised controlled trials are needed to identify the 'active ingredients' of making art, and hence art therapy, that allow for improvements in health (Kapitan, 2012). For example, Kapitan asks whether improvements in well-being derives from self-expression, from presence of an art therapist, or from visual processes involved in making artworks. Furthermore, Stickley et al argue that focus should be directed upon interventions themselves in order to improve the theoretical underpinnings of the benefits of art. In line with this, White (2006) highlighted that while previous work has exhibited positive association between arts and health, any causal relationships are yet to be studied and discovered. The following studies are among the first in the empirical literature to try and answer these questions.

Table 1.

Overview of literature to discussed in Section 1.2.2 highlighting experimental studies of art-making and well-being.

Authors	Topic	Intervention	Findings	Implications
Bell and Robbins (2007)	Creative freedom	Mood Compared art making to art viewing in a sample of health young adults	Making art was significantly more effective in improve mood than was viewing art	What happens specifically during art making? What are the cognitive processes?
Dalebroux, Goldstein and Winner (2008)	Positive versus Negative expression	Investigated whether producing postively or negatively valenced work based could influence mood post-art making	Mood was significantly improved following making art that was positive, and not an expression of negative emotions	Making art to distract is more beneficial than making art to express negative emotions
Curl (2008)	Positive versus negative expression	Participants engaged in one of two arts activities (drawing or collage making) and were instructed to either express positive or negative thoughts	Art activity was unrelated to outcomes, but expression of positive emotions left participants less stressed	Again, using art to vent negativity did not improve stress
Smolarski, Leone and Robbins (2015)	Positive versus negative expression	Sought to strengthen existing findings that drawing with positive focus improved mood more than drawing to express negative emotions	Drawing with positive focus improved mood more than drawing to vent negative inner states.	Art for expression of negative, personal matters does not improve mood
Curry and Kasser (2005)	Colouring and task structure	Investigated anxiety reduction with three colouring tasks varying in level of structure	Colouring a structured figure reduced anxiety below pre-intervention level	Structured art-making was beneficial for anxiety
Sandmire, Gorham, Rankin and Grimm (2012)	Art medium and task structure	Participants were assigned to either colouring/ free drawing/ free painting, and clay modelling.	Compared to control where no art making took place, all art-making conditions showed reduced experience of anxiety post intervention	Art-making can reduce anxiety, but this study did not compare between art groups due to small and uneven samples.

Eaton and Tieber (2017)	Colouring and anxiety reduction	Comparison of free colouring or colouring with pre-set colours.	Both experimental groups did show improvement in mood and anxiety; participants in free colouring showed greater mood improvement.	Authors interpreted that more creative freedom/less structure is more beneficial for mood.
Drake, Coleman and Winner (2011)	Compared visual and non-visual creativity	Participants were instructed to express negative mood through drawing or writing, or drawing/writing to distract	Drawing improved mood more than writing, and even more so when it was used as a distraction	This is in line with previous work that distraction/expression of positive emotions improves mood more than using art to express negativity.
Kaimal, Ray and Muniz, (2016)	Art making and physiological measures of stress	Asked if making art with creative freedom (no structure) could reduce levels of the stress hormone cortisol	After 45 minutes of art making, cortisol levels were significantly lower. However, there was no control in this study.	It cannot be determined whether stress reduction would be the same when people engage in other types of art-making. But it does suggest art aids brain functioning.

In a study of mood states (anxiety and current mood states), Bell and Robbins (2007) investigated whether freedom to create a piece of art in comparison to a control involving viewing and sorting prints of artworks improved experience of anxiety and mood in a population of young adults without mood-related disorders. Through pre and post intervention measures of states, Bell and Robbins determined that producing art reduced negative mood states greater than viewing art. Furthermore, the art making intervention was proven beneficial even to a mentally healthy population. Their results highlight perhaps the more generic and recreational benefits of making art, that could appeal to members of the general public who are under the impression that art therapy, or indeed any therapy, is only for individuals experiencing clinical difficulties.

Where Bell and Robbins compared art making to viewing, Dalebroux, Goldstein and Winner (2008) investigated short term mood improvement via expression in art making in a sample of undergraduate participants. Here, the authors asked whether positive or negative expression through art making could relieve experience of negative mood. Here, participants were exposed to a short, unhappy film in an attempt to induce negative mood. Following successful induction of negative mood (assessed using the Affect Grid, created by Russell, Weiss and Mendelsohn, 1989), participants were split into three groups: drawing to express reaction to the film (venting); drawing something positive unrelated to the film (positive expression); and a non-drawing visual task involving cancelling out symbols (control). Dalebroux et al reported that work produced by the positive expression and venting groups differed in regard to content and themes. Interestingly, they revealed that mood valence was significantly improved following positive expression, in comparison to no change following venting and control. To elaborate on this, they highlight that venting was no more effective in relieving negative mood in comparison to control. Similarly, Curl (2008) compared two types of art making. In this work, Curl sought to uncover whether

positive or negative mental focus during art making had different effects upon stress. Participants were split into two groups depending on activity (drawing or making a collage) with two subgroups focusing on content of the art (negative or positive focus). This method therefore allowed for assessment of type of art and expression upon reducing stress. Here, Curl found that form of the art making (drawing or collage making) was unrelated to stress outcomes, but that expression within the activity was related to outcome; participants involved in expression of positive emotions showed reduction in experience of stress, in comparison to participants using art to vent, who showed increased stress levels. Both Dalebroux, Goldstein and Winner (2008) and Curl (2008) provide interesting implications for art therapy, in that traditionally, it is assumed that improvements in well-being result from expression of things that trouble us. They are exemplary of the type of further research that must be conducted to broaden our understanding of how art is psychologically beneficial.

Smolarski, Leone and Robbins (2015) conducted a more recent study in line with that of Dalebroux, Goldstein and Winner (2008) and Curl (2008). They too induced negative mood in a sample of undergraduate students via encouraging recall of recent stressful events in their lives. Following this, participants either took part in drawing for happiness, drawing to express stress (venting) or a control (tracing and colouring). Their research provides support to previous venting versus positive expression interventions, in that they found drawing to express happiness improved mood substantially more than drawing to vent. Importantly, Smolarski et al argue further interventions are needed in order to study positive expression independently, and to determine whether this factor is the active ingredient causing mood improvements.

Drake (2016) conducted a study over the course of one month to determine whether expression through art or using art as a distraction had differential effects upon both

psychological factors (mood and life satisfaction) and physiological factors (heart rate and respiratory sinus arrhythmia (RSA)). After one session, it was found that drawing to distract improved mood more than drawing for expression and control. These effects persisted one month later. Physiologically, it was found that distraction and expression through drawing increased RSA significantly more than control conditions after one session, yet the physiological benefits of drawing to distract persisted one month later. Drake's study therefore highlights a short and long term psychological benefit of drawing to distract, and a long-term physiological benefit. In support of this, Drake, Hastedt and James (2016) report that after four days, participants who engaged in drawing as a distraction away from sad events experience greater mood improvements than did participants who drew to express the event. Furthermore, James, Drake and Winner (2018) conducted a comprehensive study investigating distraction and expression within drawing and also within other activities such as writing, talking and thinking. Here, the authors report that for all four activities, distraction significantly lowered experience of negative mood states in comparison to expression within the same activities.

The aforementioned studies successfully highlight how art-making and positive expression (or distraction) is more effective in improving wellbeing, in comparison to expressing negative emotions and experiences, viewing art or engaging in non-creative activities. While they do consider the subject matter in the work of participants, they do not tackle further intricate characteristics associated with arts activities. For example, inspired by 'colouring therapy' (Belchamber, 1997), Curry and Kasser (2005) attempted to alleviate induced anxiety through assignment of three colouring tasks: colouring a mandala (a symmetrical and complex circular figure); colouring a plaid, chequered design; and colouring a blank piece of paper containing no structure or outline of shape. After 20 minutes, it was found that colouring a mandala resulted in more anxiety reduction as

compared to colouring without structure. More specifically, whereas colouring without structure had no effect, colouring a mandala reduced anxiety to a point where levels experienced post-intervention were lower than before anxiety was induced pre-intervention. Colouring a plaid pattern also decreased anxiety to below baseline.

To elaborate on Curry and Kasser (2005) Eaton and Tieber (2017) investigated the effects of intricate colouring upon mood and state anxiety based on the recent popularity of adult colouring books, often featuring complex and abstract figures. Here, 85 undergraduate participants were administered state anxiety and mood measures before and after engaging in colouring for 30 minutes. Participants were involved in one of two groups: colouring with free choice of colour or colouring with regimented, pre-set colours to replicate an existing image. Eaton and Tieber's results are supportive of Curry and Kasser's findings in part; while they also report improved mood and anxiety reduction for both experimental conditions, the results cannot be fully compared due to lack of a free colouring (without structure) control as in Curry and Kasser's study. Despite lack of a control condition, differences were observed between groups; participants with free choice of colour experienced greater mood improvements, which the authors interpret as resulting from less structure, and therefore more creative freedom. However, these findings cannot be applied to real-world clinical populations due to the artificial experience and induction of negative mood, and to other mental health difficulties. Despite this, Curry and Kasser's and Eaton and Tieber's work supports previous work highlighting that creative freedom is important during art making. Furthermore, the work is reflective of the type of research that needs to be undertaken to truly understand how art benefits our mental health.

The aforementioned work by Curry and Kasser (2005) and Eaton and Tieber (2017) regarding colouring highlight that there is something about creative freedom that seems to differentially influence mood and anxiety. For example, Curry and Kasser highlighted that

colouring an intricate design was effective in the reduction of anxiety, whereas free colouring had no effect. Sandmire, Gorham, Rankin and Grimm (2012) suggest colouring a pre-made structure elicits a 'trance-like' state, whereby focus is mainly given to form and concentration on staying in line with the design. Given the nature of anxiety, perhaps the structured nature of colouring, or indeed other structured art activities, allows for distraction away from repetitive unpleasant thoughts. This would have implications for clinical uses of art-making and help address the debate as to whether art therapy for clinical groups should be structured or more free-ranging. In contrast, Eaton and Tieber note that lack of structure during art-making led to mood improvement. Thus, it seems that the two extremes may provide different benefits. Sandmire et al. argue for further exploration into creativity and argue that anxiety reduction and mood improvement may be influenced by the degree of structure and amount of creative expression.

Following on from the previous literature that drawing to distract is more effective for mood repair than drawing to express, Forkosh and Drake (2017) considered that distraction may be effective because it needs more cognitive attention. To study this, they compared colouring tasks to sessions where participants engaged in free drawing, with the idea that colouring is less cognitively demanding because features are already in place as a template for the colourer to follow. Distraction and colouring were also compared to expression through drawing. They hypothesised that drawing to distract (higher cognitive demand) would improve mood better than colouring, however, this was not supported in the results. However, drawing to distract did significantly improve mood where drawing to express did not. Therefore, it appears that level of cognitive demand matters less than does the mental focus of the activity.

In further attempts to isolate the effects of art-making, focus has been directed toward non-visual creativity such as writing therapies. Drake, Coleman and Winner (2011)

conducted a broader comparison study into visual and non-visual creative tasks. Post induction of a negative mood, participants engaged in either drawing or writing to vent negative emotions, or to act as a distraction. The results highlighted that mood was significantly more positive after drawing in comparison to writing, and even more positive when drawing was used as a distraction as opposed to a venting strategy. Furthermore, the authors concluded that drawing was an effective strategy for immediate mood improvement as opposed to writing. In continuation of drawing versus writing, Drake and Hodge (2015) considered that preference may play a part in how mood is affected following creative tasks. Following a negative mood induction, participants were assigned to drawing or writing conditions about the event based on their previously disclosed preference for each activity. They report that participants who preferred drawing were more likely to use this task as a distraction, and that participants who preferred writing used this for expression. Interestingly, even when the preferred activity was writing, drawing was still more effective in mood improvement. Future research could benefit from further investigation into how preference for creativity activity can influence mood, and whether using writing as a distraction technique and not an expressive technique would result in the same benefits as drawing to distract.

Finally, Kaimal, Ray and Muniz (2016) also investigated whether art making could physiologically alter the brain and behaviour. They asked whether creative expression, (such as that involved in art therapy) and use of different artistic mediums could alter participant experience of stress. Specifically, they asked whether making visual art with creative freedom could reduce levels of cortisol. Through pre and post intervention samples of saliva from 39 healthy adults, aged between 18 and 59, the authors reported that after 45 minutes of art making levels of cortisol were significant lowered. However, a critical limitation of this study is lack of a control group. Therefore, we cannot determine whether

different types of engagement in art would yield the same or lesser effects, and whether type of artistic medium is important. Despite this, their study provides promising preliminary evidence of the powers of art making in changing the brain.

1.2.3. *Summary of Art in Research*

In summary, the above studies provide evidence for the fact that making art is beneficial for improving mood and reducing negative emotional states. However, the majority of previous work has assessed mood improvement only in the short term. Long term effectiveness of engaging in drawing or other art activities therefore remains unknown. Furthermore, several of the discussed studies have studied mood improvement only in the context of artificially induced negative states. There remains the question of whether these states are similar to those experienced by people with mood disorders, and whether the improvements seen from art-making interventions can be generalised to real-world settings. (Smolarski, Leone & Robbins ,2015; Dalebroux, Goldstein & Winner, 2008; Curry & Kasser, 2005; Eaton & Tieber, 2017). In addition, it has been argued that a move should be made away from studying the people involved and the benefits, and instead focus on developing well-controlled interventions to determine the underlying causal mechanisms involved in well-being improvement via art-making (Stickley et al. 2016; White, 2006).

1.3.*Cognitive Training*

In addition to arts making as a tool for improving well-being, participation in the arts has been shown to be beneficial for sustaining psychophysiological health and cognition throughout life (Kaimal & Ray, 2016). In 2009, inspired by the artist Hilda Goldblatt Gorenstein, the documentary *'I Remember Better When I Paint'* featured experiences of patients suffering from Alzheimer's disease, and how engagement in art making improved quality of life via improvements in cognitive abilities such as speech and mobility. The

benefits of arts in health has been so influential that even definitions of art therapy have been adjusted to account for the cognitive and sensorimotor improvements resulting from arts participation (Dilawari and Tripathi, 2014; American Art Therapy Association, 2017). However, the literature to date is lacking in quantitative data highlighting sound physiological changes in brain functioning resulting from participation in art. It has been suggested that to keep cognitive abilities functioning at a high level, we must engage in stimulating activities (Ball et al, 2002). Based on the apparent effectiveness of art-making as a tool for mood and well-being improvement, we ask whether making visual art is also neurologically engaging like other cognitive training methods (e.g. video gaming), what this means for cognitive improvement (regarding memory, perception and abstract thinking amongst other functions, Gerrid & Zimbardo, 2002; Young, Camic & Tischler, 2014) and whether any associated effects extend to everyday life. Furthermore, we consider whether type of art participation and style, such as viewing, making, and creative freedom can have different effects upon cognition.

The present study will therefore investigate visual art as a cognitive training method, where training refers to attempts to improve mental functions when they are not executed to full potential, resulting either from impairment or age. Salthouse (2009) notes that cognitive decline is not exclusive to older ages. Instead, they report that decline in basic functioning begins early in adulthood, with decline becoming more prominent in later life. Cognitive training has therefore been developed in efforts to improve these abilities when performance begins to deteriorate. In a recent study, Brinke, Best, Crockett and Liu-Ambrose (2018) highlight that no clinical or curative therapy exists to prevent or reverse cognitive decline, both in impairment and in normal age-related decline. However, along with other authors, they do note that interest has recently been directed toward lifestyle and recreational behaviours, such as exercise, diet and complex mental activities, that could aid

mental functioning (Young, Camic & Tischler, 2014). This section first provides an overview of cognitive training irrespective of art making and is then followed by a review of evidence that discusses whether recreational activities and art making can physically change the brain and potentially train it. The present study will go on to investigate whether there is a specific component of art making that can aid cognitive functioning.

Ball et al. (2002) highlight some of the standard methods used within cognitive training. In an effort to improve mental abilities in older adults (between the age of 65 and 94) over the course of ten training sessions, Ball et al. utilised training activities such as word recall, problem solving and visual search tasks. Post intervention, it was found that training in a specific domain, for example, word recall for memory training, improved cognitive functioning. In the 2 years post training, these effects remained. However, Ball et al. note that training was not generalisable or transferable to everyday activities. This finding is supported by a wealth of literature, with reports acknowledging that training does not often extend beyond the skills or functions targeted (Delahunt, Hardy, Mahncke & Merzenich, 2006; Ball et al. 2002). Regardless of the transferability of cognitive training to other functions, Ball et al argue that as long as a task or activity is cognitively challenging and stimulating for an individual, then that task can be considered as effective cognitive training. We might assume from this statement that traditional methods conducted in controlled environments, often with professional support, are not personally or emotionally stimulating enough to allow for generalisation (Clare, Woods, Moniz Cook, Orrell & Spector, 2006). The present study will discuss research highlighting hat recreational activities such as video gaming effectively engage individuals, in comparison to standard cognitive training techniques. Furthermore, we speculate what the data from video gaming research can inform us about other recreational activities, specifically art-making.

In recent years, a body of new literature has evidenced the benefits of 'real-world' recreational activities. Given the prevalence and popularity amongst young adults, video gaming has become a topic of study in recent years. In relation to the present thesis, although video gaming has different behavioural demands, the recreational nature and subsequent enjoyment obtained through this activity can be compared to art-making. Firstly, Anguera et al (2013) provide evidence of cognitive training through utilisation of a custom-made video game, 'NeuroRacer'. Here, older adults between the ages of 60 and 85 took part in a 4-week intervention, with exposure to the video game occurring three times a week. The critical manipulation in this study involved playing the game in either 'single task' or 'multi-task' mode. Through the use of a battery of cognitive tests, Anguera et al. observed not only improvement in multitasking ability, but also improvement in cognitive functions that were not targeted through the game, such as working memory and attention. In comparison to the work by Ball et al (2002), the training used here extended across cognitive domain as tested within the game setting. Anguera et al therefore argue that video-gaming can not only highlight current cognitive capabilities but can also aid functioning in older adults. While their results highlight gaming to be beneficial, the generalisability of these findings should be questioned due to the game being made specifically for research purposes and applied only to older adults.

Despite the aforementioned limitations of Anguera et al's study, gaming in real world settings has been experimentally tested. Importantly, the findings are not exclusive to elderly cohorts. For example, Kuhn et al (2011) conducted a neuroimaging study with a sample of 154 14 year-old adolescents, where structural scans of frequent and infrequent game players were compared. Here, Kuhn et al reported that in frequent game players, volume of left striatal grey matter was higher than in non-players. Interestingly, they also report that this higher volume was negatively correlated with deliberation time in a task

focused on gambling and monetary incentives. That is, as grey matter volume increased, deliberation time decreased. Although the authors do not directly link these findings to cognitive training, these results suggest that gaming positively influenced ability to make quick decisions. On the other hand, quicker decision making could also reflect heightened impulsivity and loss of planning control, often associated with increased risk-taking behaviours. Moreover, due to the age of the participants findings cannot be generalised beyond post-adolescence and older adults; plasticity of an adolescent brain might suggest that video gaming is effective in these years due to the modifiable neural circuitry. Therefore, we can ask whether or not video gaming, and related visual tasks, can have the same effects upon cognition in later life when the brain has limited plasticity.

Kuhn and Gallinat (2014) sought to answer this question in a follow up study. As opposed to considering that gaming is not as effective in adulthood and later life, they suggest that the effects observed in adolescence may only reflect a portion of the potential benefits for adults and older adults. Through use of magnetic resonance imaging (MRI) of male adults, grey matter volume was explored in relation to amount of video gaming across participants lives. In line with their study with adolescents, Kuhn and Gallinat report that grey matter volume in the ventral striatum was positively correlated with amount of video game playing. Interestingly, they discovered that grey matter in the entorhinal cortex could be predicted by the genre of video game played. For example, cognitively taxing games requiring logic or puzzle solving were positively associated with increased grey matter volume in the entorhinal cortex and hippocampus, in comparison to action-based games. In relation to their earlier study with adolescence, the authors report that amount of gaming over the lifespan was positively associated with hippocampus volume, which was not highlighted in adolescents. Thus, it seems that continuation of video gaming playing into adulthood can still change the brain and is not constrained to adolescence. Furthermore,

Kuhn and Gallinat conclude that the regions identified in this later study are commonly associated with cognitive domains controlling visual attention, memory and spatial awareness, and that these functions are trained during video game play. From the recent research, it can be determined that video game playing has the ability to influence cognition both behaviourally and structurally. In light of the evidence from visual gaming activity, we can consider that training with different visual activities might also benefit cognitive functioning, such as attention, memory and spatial awareness.

Further to Kuhn and Gallinat's (2014) finding that brain structure was influence by genre of video game played, Green and Bavelier (2015) investigated whether action video games, (characterised by "complex 3D settings, quickly moving and/or highly transient targets, strong peripheral processing demands, substantial amounts of clutter and the need to consistently switch between high focused and high distributed attention", p.103) could also provide behavioural benefits in people who do not normally engage in video game play. Participants were subject to game training for either 10, 30 or 50 hours. Following game play, participants were assessed 24 hours later with a battery of cognitive tests covering perceptual, attentional and cognitive functions. Green and Bavelier report that in new players, action video game playing resulted in improved perceptual performance, ability to divide and focus attention and cognitive flexibility. However, although the authors argue that this is evidence of training extending beyond the context of the game, the results do not suggest that action video game playing can improve unrelated cognitive functioning. While performance on the psychological tests did improve following game play, the skills assessed post-play were highly relevant and utilised while training. Therefore, this again raises issues presented in past research that training with gaming does not generalise across task (Delahunt, Hardy, Mahncke & Merzenich, 2006; Ball et al. 2002).

Further to earlier work by Green and Bavelier (2015), Bediou et al (2018) also investigated a specific genre of video gaming: action games between the years of 2010 and 2015. They report that habitual playing of action video games had a positive effect upon individuals' cognitive profiles. Specifically, action video gaming was shown to positively influence top-down attentional processing and spatial abilities in habitual players in comparison to new players. Bediou et al therefore present promising evidence that training with visually stimulating video games that require greater cognitive focus, perception and attention to specific features can improve functioning in these cognitive domains. However, the work reviewed in this meta-analysis also leaves Bediou et al to conclude that training with action video games did not result in far transfer across cognitive domain. Therefore, they argue for more intervention studies with periods of game play exceeding 30 hours, in order to examine any longitudinal benefits of this genre of game play and recreational activity.

However, research is continuing to investigate the benefits of real-world, recreational activities upon cognition. In relation to the current thesis, focus has been directed towards participation in the visual arts as a means of cognitive training. Chamberlain, McManu, Brunswick, Rankin, Riley and Kanai (2014) investigated whether representational drawing could influence brain structure. A sample of 44 students, half of which were art students and half non-art students, took part in a drawing task. Here, they had to recreate a photograph of a hand holding a pencil to the best of their ability. Drawings were rated by the researchers, and later analysed in relation to images obtained from voxel-based morphometry. Chamberlain et al reported that grey matter density in structures responsible for motor control and procedural memory (the left anterior cerebellum and the right medial frontal gyrus) was significantly associated with the drawing task. That is, higher volume of grey matter was positively associated with quality of the work, and how much it resembled

the target object. Regarding the study of art versus non-art students, the authors report that experience was related to grey matter in the right precuneus structure, responsible for visual imagery. In relation to cognitive training, these results highlight that even in early adulthood, differences emerge in the brains between those who regularly engage in art and those who do not. It can be asked whether these differences become more profound in later adulthood and in the aging brain. Importantly, Chamberlain et al argue that further research must be undertaken to assess components of art making and artistic ability, in order to assess true neurological benefits of art training.

Secondly, Schlegel et al (2015) investigated three important aspects relevant to the practice of creating visual art: creativity cognition, perception and perception-to-action. They conducted a longitudinal study involving training over three months, where university students between the ages of 19 and 22 spent 4 hours per week in observational drawing and painting classes and 15-20 hours outside of class on the same work. The drawing and painting courses sought to develop technical ability of participants (targeting cognitive functions of attention, perception and spatial awareness), artistic expression and critical analysis. Following the intervention, participants were subject to tests of conceptual creativity, illusion detection and continuous during MRI and fMRI scanning. Schlegel et al report that while students became more creative (as detected through increased prefrontal white matter), no significant improvements were observed for perceptual skill. However, observable improvements were present for cortical and cerebellar activity as a result of art making in comparison to controls. Schlegel et al conclude that new engagement in art activities results in enhanced neural plasticity allowing for creativity and cognition to integrate.

In line with the aforementioned research tackling characteristics of art-making in relation to wellbeing, Bolwerk et al (2014) investigated whether producing art in comparison to simply viewing art in a sample of post-retirement adults could improve brain

functioning. Over the course of 10 weeks, participants took part in either art production, with a focus on exploring their own artistic expression, or in art appreciation within a gallery. Using fMRI before and after the 10-week intervention, Bolwerk et al assessed functional connectivity between frontal and parietal areas. In addition, psychological resilience of all participants was assessed pre and post intervention. The authors discovered that participants subjected to art production showed enhanced connectivity between brain areas and improved spatial abilities. Interestingly, the improved connectivity was significantly correlated with psychological resilience, in that participants felt better able to deal with stress and life challenges. For the art appreciation/evaluation group, no changes were observed. Bolwerk et al hence concluded that art production is beneficial in aiding psychological health in later life, for both biological aspects and well-being. The work also raises the question of whether cognition and wellbeing are related. The present study will therefore ask whether cognitive functioning is related to well-being.

1.4 *Aims and Hypotheses*

In light of the preceding literature, it appears that art-making has the ability to improve well-being, and potentially act as a cognitive training tool. However, critical questions remain unanswered regarding both of these aspects. Firstly, the present study will compare visual art making to other creative domains, to establish whether there are some components of visual art making that may make it more effective for improving well-being than non-visual tasks (Stickley et al, 2016). Over the course of a one-week intervention, we will assess whether regular engagement in different art-making activities has positive affect upon well-being, mood and stress. Through use of multiple experimental groups, the intervention will seek to elaborate on different components of art-making that have been previously studied such as expression or focus, and structure or technicality. For example, structure during art-making will be assessed using artistic tasks with varying degrees of

creative limitation, such as tracing (very structured), free copying (semi-structured) and expression (no structure). Critically, these conditions will be compared to a writing task to assess effect of non-visual creativity upon well-being, and to a non-visual, non-creative control involving listening to four podcasts.

Secondly, we ask to what extent making art can be cognitively beneficial. While studies have investigated the brain and its functioning following art-making interventions, the empirical research to date appears to neglect art as a cognitive training for younger generations. The present study will consider that training while cognitively healthy can potentially prevent cognitive decline before it starts. Based on research by Kuhn and Gallinat (2014) which suggests that recreational activities may improve cognitive functions such as memory and attention, we ask whether a week-long intervention of art-making will improve memory ability; this will be achieved through a computer-based task designed specifically to test these functions while keeping the task art-related. In line with our aims for improving well-being, we ask whether art activity involving more structure (copying and tracing images) can improve visual memory and ability to detect change in visual stimuli. In addition, a recent paper by Chamberlain (2018) summarises the existing research and concludes that representational drawing has been found to be significantly associated with performance on visual processing tasks and suggests that this activity requires local and global visual attention. In line with what the aforementioned authors have suggested for new research, Chamberlain argues that art-making should be studied with consideration given to innate art talent and pre-existing engagement in art throughout life.

In summary, the present study will attempt to simultaneously observe improvement in well-being and cognitive ability via manipulation of artistic tasks involving varying degrees of artistic freedom. First, we hypothesise that participants will experience greater improvement in mood following sessions of art-making with minimal structure (Bell and

Robbins, 2007). This will be attempted through instructing participants to create a piece of art inspired by another image. In contrast, we would expect improvements in anxiety and stress to be observed as a result of engaging in structured tasks, such as copying and tracing a given image (Sandmire, Gorham, Rankin and Grimm, 2012). Importantly, these conditions will be compared to a group involving writing about a piece of artwork, and a control, involving listening to four podcasts. We expect participants engaging in the writing task to experience some improvement in well-being, due to the task remaining creative and allowing for expression of the participant (Drake and Hodge, 2015). However, we expect engagement in visual art-making over writing to be more effective for mood-repair. Secondly, as cognitive training has been shown to improve cognitive functioning for the trained domain (Delahunt, Hardy, Mahncke & Merzenich, 2006; Ball et al. 2002), we ask whether visual art-making can train ability to detect features in a visual stimulus. For example, we ask if participants will be better able to notice changes in colour and orientation of images, and subtraction of existing (or addition of new content) to the image. Through copying and tracing during art-making tasks, we expect greater attention to be paid to lines, colour and placement of objects during recreation of an artwork and hypothesise that this enhanced focus and attention during drawing will generalise to improve attention for visual scenes and features (Chamberlain, 2018). In contrast, we would not expect improvements to be made following sessions of expressive art-making, as visual focus and attention to detail is not as prominent within the task. For writing and control groups, we do not expect to observe improvement in visual memory based on the non-transferable nature of the domains.

Finally, the study will incorporate measurement of extraneous factors such as underlying creativity of the participants and engagement with and enjoyment of the intervention. This will allow assessment of whether creative individuals and those who

spend more time on the intervention gain more from the task (greater mood improvement and greater performance on the cognitive task) compared to individuals who do not regards themselves as creative. This is to further research by Drake and Hodge (2015), who began investigating the role of preference for creative activities and the resulting effects upon well-being.

Through use of a singular intervention involving varying degrees of creative structure and freedom, the present study attempts to improve both well-being and cognition in a sample of undergraduate students. The following section will discuss in more detail experimental conditions and procedure.

Methods

Experiment 1

2.1. *Participants*

Participants were recruited through an online participant recruitment database, SonaSystems, at the University of Birmingham. Students in the following degree subjects were eligible to sign up to receive course credit: Psychology (Undergraduate and Postgraduate taught or research programmes), Liberal Arts and Neuroscience. The study was also open to people looking for paid participation. The initial cohort consisted of 99 undergraduate students between the ages of 18 and 22 (M= 18.8). 13 participants were removed from the sample due to equipment failure. A further 13 participants were removed from all analyses as their wellbeing scores, counterfeit detection performance or image recognition scores were 2.5 points above or below the standard deviation. Here, deviation from the mean well-being score indicated that participants were likely experiencing issues with their well-being e.g. depression or anxiety. As the study seeks to measure a mentally

healthy population, these participants had to be removed. Two participants did not return for the second day of testing and so Day 1 data was removed for these participants. A total of 71 participants were therefore included in the final analyses. Participants were randomly assigned to one of four experimental conditions (Copying (N=14), Expression (N=15), Writing (N=13) and Tracing (N=13), or to a control condition (N=16).

2.2. *Apparatus*

All questionnaire data were collected using an Apple iPad, using RateThis software. To measure participants' ability to detect change in visual scenes, a novel task was developed using MatLab 2017b software on a Stone Desktop PC. Visual image memory and counterfeit tasks were presented on a 27-inch, 3840 x 2160 UHD resolution BenQ monitor. To create counterfeit images, a free, online image editing software 'Pixlr' was used.

2.3. *Materials*

2.3.1. *Counterfeit Detection Task*

To assess counterfeit detection ability, participants were exposed to 100 artworks over the course of the two testing sessions. Artworks were either Abstract, Portrait, Still Life or Landscape, and created in the late 19th to early 20th century. Tables 2 and 3 (Appendix A) detail modifications made to the original artworks to make them a counterfeit. Main features such as objects and figures of the artworks remained, while basic components such as colour and orientation were altered. For some images, more than one component was altered. For example, Jackson Pollock's piece 'Naked man with knife' was horizontally rotated 180 degrees and enhanced in colour. Alterations to the images were consistent in nature, to avoid having images that were difficult to detect and images that were easy.

2.3.2. *Questionnaires*

The following questionnaires were administered.

Warwick Edinburgh Mental Well-Being Scale

The WEMWBS (Tennant et al, 2007), is a 14-item for assessment of mental wellbeing in the general population. Participants indicate to what extent they agree with statements concerning feelings of optimism and connectedness, and perceptions of their social functioning. Statements are rated on a 5-point Likert scale, ranging from 'none of the time' to 'all of the time'. Questionnaire items were all worded positively, with higher scores reflecting a higher level of wellbeing. A shortened, 7-item version of the test is also available. However, this study utilised the full version for its inclusions of items relating to both feelings and functioning, whereas the 7-item version concerned functioning only. The full version was therefore considered as a more well-rounded and complete assessment of well-being. The measure has been validated on students in England and Scotland, and on members of the general public, with an analysis revealing high test-retest reliability ($p<.001$), and internal consistency (Cronbach's $\alpha = 0.89, 0.91$ for respective populations; Tennant et al, 2007). The measure was therefore considered suitable for two separate administrations to our participants.

Perceived Stress Scale

The Global Measure of Perceived Stress (Cohen, Kamarck & Mermelstein, 1983), is one of the most accepted measurements of stress perception for use amongst non-clinical populations. The tool consists of 10 items, each questioning how much a situation has been considered stressful. Specifically, the test items target how much participants feel their lives are unpredictable or overwhelming, and if so, how well they cope in certain situations. The measure is answered with a 5 point-Likert scale, ranging from 'never' to 'very often'. Higher scores reflect a higher level of stress. Originally, the test was administered to two

samples of university students, and one sample of adult smokers. The measure has been shown to be internally consistent (Cronbach's α = .85), and is suitable for multiple administrations (Pizarro, 2004; Cohen, Kamarck & Mermelstein, 1983).

Profile of mood states- Short Form

Following the WEMWBS and the GMPS, participants were given a third wellbeing measure; the Profile of Mood States (McNair, Lorr & Droppleman, 1971). Participants were administered the shortened version of this scale (Shacham, 1983). Whereas the original measure contained 65 items, the shortened form contains 37. The items are one-word descriptors of mood and mood states. Participants respond via a 5-point Likert scale, ranging from 'not at all' to 'extremely'. Responses should reflect how much they are experiencing that state in the present moment. The measure groups items into sub groups of mood states: 'Fatigue', 'Anger/Hostility', 'Tension', 'Vigor', 'Confusion' and 'Depression' (Sacham, 1983; Pizarro, 2004). Higher scores reflect that participants have experienced such mood states. Validity of the shortened measure was confirmed by Shacham (1983), highlighting strong correlation between the full scale and the shortened scale (r>.95). Furthermore, Nyenhuis,Yamamoto, Luchette, Terrienn and Parmentier (1999) confirm the shortened form correlates with other measures of mood sates, and even measures of depression and anxiety.

Depression, Stress and Anxiety Scale

During the distractor phase of the procedure, participants were administered two additional questionnaires. The Depression, Stress and Anxiety Scale (DASS) was completed first in this phase (Lovibond and Lovibond 1995 for the full version). For the purposes of the study the 21-item measure was used instead of the longer 42-item original version. Shortened versions of all measures were used to keep testing time to a minimum.

The DASS consists of three scales, with each scale measuring experience of depression, anxiety and stress. Each scale consists of 7 items. The depression scale assesses mental and physical characteristics, such as fatigue and pessimism. The anxiety scale assesses both physical symptoms such as dryness of mouth and heart palpitations, and mental symptoms such as extreme worry and irrational thinking. Finally, the stress scale assesses behavioural characteristics such as irritability, nervousness and inability to relax. Studies using the DASS-21 in populations of adults with mood disorders and in clinically healthy students have reported good internal consistency. Henry and Crawford (2005) report Cronbach's alpha for the overall measure and the three subscales: $\alpha = .88$, $\alpha = .82$ and $\alpha = .90$ for depression, anxiety and stress respectively. Cronbach's alpha for the overall measure was estimated at $\alpha = .93$.

Ten Item Personality Inventory

The final questionnaire administered was the Ten Item Personality Inventory (TIPI; Gosling, Rentfrow & Swann, 2003). The measure consists of 10 pairs of attributes, such as 'Extraverted, enthusiastic' and 'Anxious, easily upset'. Participants had to indicate how much or how little they felt the pair of attributes applied to them. If one characteristic from the pair applied more than the other, participants were still advised to give a rating. Ratings were given on a 7-point Likert scale, ranging from 'disagree strongly' to 'agree strongly'. This questionnaire was administered solely for distraction purposes.

Engagement

Following completion of the counterfeit detection task, participants were required to indicate to what extent they liked the task through giving a rating between 0 and 100, where 0 meant did not like at all and 100 meant liked very much. In addition, levels of engagement

during the intervention was gauged by participants reports of how much time they spent on the homework tasks.

Creativity

First, participants were required to provide details of any extra-curricular participation in arts programmes or classes, and whether or not they took arts subjects at GCSE or A-Level. Finally, participants provided a simple report of how creative they felt they were, responding with 'yes' or 'no' to the question 'do you consider yourself a creative individual?'. Creativity was included as a dichotomous variable in order to broadly assess creativity levels. People are more likely to refer to themselves as either 'creative' or 'not creative', rather than saying 'a bit creative'. The nature of this measure therefore reflects how people are naturally likely to think of creativity. In addition, using a continuous measure may have resulted in people under-rating their own creativity so as to appear modest regarding their creative abilities, therefore providing inaccurate data.

2.3.3. *Leisure Time Intervention Materials*

Depending on group, all participants were sent home after Day 1 with materials to utilise over the course of the week. Participants were given instructions for the intervention task after Day 1 tests had been completed. Participants in all groups (except for the control) were sent home with an A4 report file containing instructions of the task, blank sheets of paper to work on and four A5 copies of artworks. Participants in the Copy and Expressive groups received 4 sheets of plain white A4 card, while the tracing group received 4 sheets of A5 tracing paper and the writing group received A4 lined paper. The control group were sent links to four online podcasts (obtained from The Lonely Palette), all lasting approximately 20 minutes (See Appendix A, Table 4 for full list of artworks and podcasts used for homework materials). Each podcast discussed a different painting. All items within

the file had a sticker to be completed by the participants after each task, detailing the amount of time spent on the task and the work they had responded to. Participants were required to keep all items within the report file together so as to build a portfolio for each person.

2.4. *Procedure*

Experimental conditions assessing the effect of different styles of creativity were: Copying, Expression, Writing and Tracing. The control (N=16) involved listening to four podcasts, thereby removing any active engagement in arts practices.

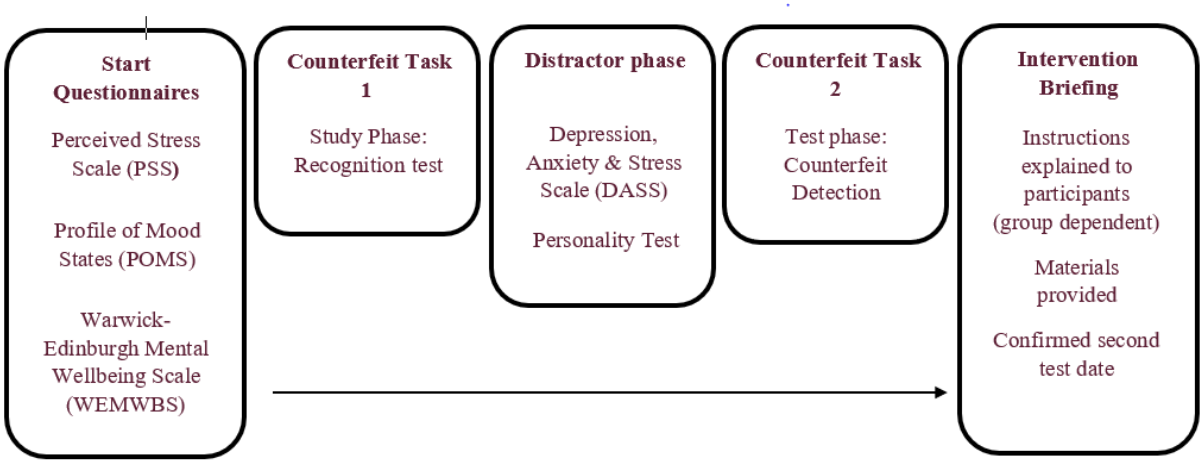

Figure 1. Depiction of procedure (left to right), on both Days 1 and 2 where tasks at each phase are listed.

Two 30-minute sessions were scheduled for each participant, with 7 days between each session. On Day 1, participants were given a brief overview of the study procedure and gave consent to take part. The brief overview informed participants that the study would follow the same procedure on both days, beginning with the WEMWBS, the PSS and the POMS. Following this, a screening questionnaire was completed to check for involvement in art classes or extensive art training outside of university studies. Participants were also required to make a judgement about how creative they regarded themselves, responding simply with a ‘yes’ or ‘no’. Based on self-reports of how creative individuals felt they were,

participants were classified as either creative (N= 40) or non-creative (N= 31). Next, participants were exposed to artworks for the first time within the study phase of the counterfeit task. Participants were given the DASS and the TIPI to complete before starting the test phase of the counterfeit task (described below) to limit rehearsal. These questionnaires acted as a distraction and lasted approximately 5 minutes. At the end of the first session, participants were given their intervention materials, and given a description of their task.

Counterfeit Detection Task

The task consisted of two phases: a study phase and a test phase. The study phase involved familiarising participants with a series of 50 artworks, presented centrally on a computer screen. On each trial, the artist's name was shown for 2 seconds Then, the artist's image was presented for 5 seconds. During the 5 seconds, participants had to decide if they had ever seen the image before. After image offset, a question appeared on the screen asking if the image was recognised, in order to check for prior knowledge and exposure. Participants responded with the left arrow key for "yes" and the right arrow key for "no". The task lasted approximately 8 minutes. Following the study phase, and before test phase, participants completed the DASS and the TIPI. The test phase followed a similar format to that of the study phase: images appeared on the screen for 5 seconds after the artist name was shown, followed by the recognition question. In this part, two additional questions were added. The second question asked whether the image was the same as it appeared in the study phase, and the third concerned how confident people were in their judgement of the image. The three questions followed every image. The test phase consisted of 55 images, 50 of which had appeared in the study phase, and 5 of which were added as foils. For the counterfeit aspect, 20 of the original 50 images had been altered in some way (see Tables for a full list of artist names, image names and changes made to each). The same task was

used on both Days 1 and 2, however all images from Day 1 were replaced with new images on Day 2 to prevent practice effects.

Intervention

Participants in the copy group were told to recreate each of the four images as accurately as they could without tracing, using any materials they wished. The expressive group were explicitly told not to copy each of the artworks. Instead, they were instructed to draw something inspired by each artwork. This group were also free to use any materials they liked. Instructions for the writing group included an approximate length for how much they should write and what the short response should include. For example, participants were told they could write about the image aesthetically, what they thought the work might be about, how it made them feel and so on. The tracing group were simply told to use the tracing paper on top of each artwork and draw as much as they could see from the image behind. The control group were simply told to listen to the four podcasts, without needing to do anything with the information. Importantly, all participants were told to spread the task over the course of the week. For example, they could either complete one artwork a day for four consecutive days, or one artwork a day non-consecutively over the course of the week. This was instructed as we sought to investigate the benefits of engaging in art consistently over time, as opposed to a single session. On the second testing day, participants returned their report files and again completed the questionnaires and the counterfeit task. Finally, a debrief was given detailing the study aims and the group they had been a part of. Participants were thanked for their time, and allocated course credit.

2.5. *Items Analysis*

Four items analyses were conducted to assess prior knowledge of each artwork, difficulty of the visual memory task and difficulty of the counterfeit task for individual

images. The analyses were performed on data obtained from both the Day 1 and Day 2 visual image tasks. Items remained in the main test analyses if fewer than 90% of participants had prior knowledge/recognition of the images, and if the item was correctly identified as real or counterfeit in nature by less than 90% of the cohort. If more than 90% of the cohort recognised the image or correctly identified it as counterfeit, then the image was considered as too easy and was therefore removed to avoid confounding results. All items in both study phases were not recognised to this threshold, and therefore remained in the analyses. Within the Day 1 test phase, a total of 6 items were removed. Two items were removed due to duplication and the remaining 4 items were removed (1 counterfeit, 3 real) for being correctly identified by over 90% of participants. Within the Day 2 test phase, only one item (Vincent Van Gogh) was removed.

2.6. *Analyses of Visual Memory, Counterfeit Detection and Well-Being Data*

A series of analyses of variance (ANOVA) were performed to compare mean scores on the Day 1 and Day 2 counterfeit tasks. Specifically, the ANOVA allowed for assessment of the intervention groups upon counterfeit task performance. A separate ANOVA examined whether any change in wellbeing score occurred as a result of the intervention. As well as examining the main effect of group on counterfeit detection ability and wellbeing, the data were examined in relation to whether their homework task was active or passive and how engaged they were throughout the study. Both ANOVAs and Pearson correlational analyses were performed to look at these factors, where alpha levels were set to .05 for all statistical tests. Corrections for multiple comparisons were applied using post-hoc tests (Tukey). Further correlational analyses were conducted using ratings of task enjoyment, time spent on the homework task and work quality in relation to counterfeit performance on Day 2 and all wellbeing measures on Day 2. Self-reports of creativity (creative versus not creative) were added to the profile of each participant and analysed in

accordance with the counterfeit task. Two analyses of variance were performed, assessing whether creativity meant participants were more likely to perform better on the counterfeit task pre and post of the intervention.

Results

Counterfeit Detection

Inconsistent with our hypothesis, Day 2 mean correct percentage scores on the counterfeit task remained largely similar across group: Copy (M = 36.5, SD = 4.42), Expressive (M = 34.6, SD = 6.7), Writing (M = 35.5, SD = 5.4), Tracing (M = 37.2, SD = 6.3) and Control (M = 36.3, SD = 5.1). A one-way between participants ANCOVA revealed that Day 2 performance on the counterfeit task did not significantly differ among groups, $F(4,66) = .444$, $p = .776$, $\eta p^2 = .017$. Within the ANCOVA, performance from Day 1 was also included as a covariate. Here, the analysis revealed a significant change in counterfeit performance from Day 1 to Day 2, $F(1, 65) = 31.405$, $p<.001$, where mean percentage correct rose from 62% on Day 1 to 76% on Day 2 (See Figure 2 for depiction of average performances for group).

Within a separate analysis, a Levene's test revealed a non-parametric nature of the data when split into two groups, active and passive. Here, tasks from the intervention (tracing and listening groups), were characterised as passive as they required less cognitive effort. Active tasks (expressive, writing and copy conditions) required the participant to expend more creative and cognitive effort. A Kruskal-Wallis test was therefore performed to examine effect of active versus passive creativity upon ability to detect change. The analysis revealed that active and passive creativity had no significant differential effect upon counterfeit detection, $\chi^2(1)= .359$, $p= .549$.

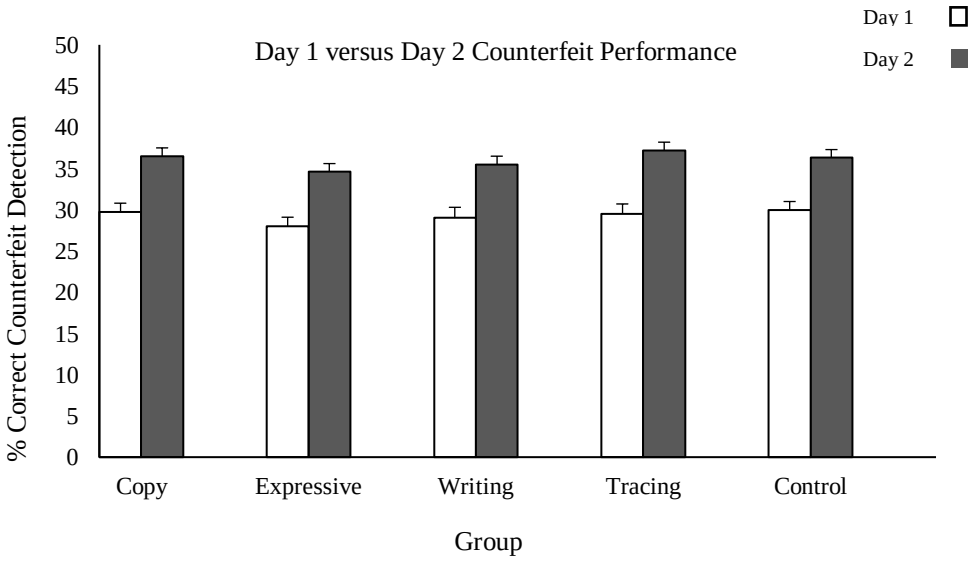

Figure 2. Average scores for each experimental and control group obtained on Days 1 and 2, where performance can be seen to increase across all groups.

To further the analysis of the counterfeit task, d' was also analysed, where d' refers to signal detection and a statistic to isolate noise or confounding data. A one-way between participants ANOVA revealed no significant effect of group in d' on Day 2, $F(4, 65) = .671$, $p = .614$, $\eta p^2 = .040$. Day 1 d' ($M = 1$, $SD = 0.56$) was also included as a covariate in the analysis, and was reported as significantly different from Day 2 d' ($M = 1.54$, $SD = 0.77$) where $F(1, 65) = 21.273$, $p < .001$, $\eta p^2 = .247$. Finally, a correlational analysis was conducted to examine whether recognition of the test images influenced how well participants identified a real or counterfeit image. On both Day 1 and Day 2, d' scores for recognition were significantly associated with counterfeit detection ability, $r(71)=.61$, $p<.001$ and $r(71)=.74$, $p<.001$ respectively.

Well-Being

Secondly, a series of analyses were conducted to assess the hypothesis that expression within art making is more beneficial for mental wellbeing as compared to technicality. Table 2 highlights that mean wellbeing scores did not change drastically, regardless of

group, from Day 1 to Day 2. To assess the effect of the intervention for all measures of wellbeing, several one-way ANOVAs were performed.

Table 2.

Average scores and standard deviations on the four wellbeing measures on Day 1 and Day 2 for groups engaging in Passive interventions.

	Copy		**Tracing**		**Control**	
Measure	Day 1 M(SD)	Day 2 M(SD)	Day 1 M(SD)	Day 2 M(SD)	Day 1 M(SD)	Day 2 M(SD)
WEMWBS	36.1(8.1)	36.9(8.4)	35(12.1)	34.3(6.1)	34.7(7.3)	33.6(9.5)
PSS	16.3(6.2)	17.4(6.2)	16.1(6.2)	18.8(5.9)	18.9(5.7)	18.4(6.8)
POMS	94.2(16)	98.6(18.6)	98.3(18.4)	96(20.9)	101.9(16)	95.9(18.3)
DASSdepression	2.9(2.5)	4.2(4.4)	3.8(2.9)	4.6(4.9)	3.8(2.9)	4.3(4.3)
DASSanxiety	2.8(3.3)	2.9(2.4)	3.5(3)	4.1(5.2)	3.3(3.3)	2.81(3.1)
DASSstress	5.6(4.3)	4.8(4)	5.5(4.4)	5.6(4.9)	7.4(3.6)	6.9(3.9)

Table 3.

Average scores and standard deviations on the four wellbeing measures on Day 1 and Day 2 for groups engaging in Active interventions.

	Expressive		**Writing**	
Measure	Day 1 M (SD)	Day 2 M(SD)	Day 1 M(SD)	Day 2 M(SD)
WEMWBS	39.9(3.1)	38.1(5.9)	37.1(4.8)	36.6(6.5)
PSS	15.2(3.5)	16.4(5.8)	17(4.5)	18.9(5.4)
POMS	90.1(3.1)	89(17.6)	94.7(14.5)	88.7(11.1)
DASSdepression	1.9(1.6)	1.6(2.1)	4.5(3.6)	3.3(2.8)
DASSanxiety	2.3(2.3)	1.9(2.2)	2.3(2.7)	1.4(1.7)
DASSstress	4.9(2.6)	3.8(3.9)	5.5(3.4)	4.5(3.6)

The analyses revealed that for all groups across all wellbeing measures, no significant change occurred: WEMWBS (F(23, 5) = 1.34, *p* = .403); PSS (F(20, 9) = 1.623, *p* =.230); POMS(F(27, 2) = .529, *p* = .829); DASS depression (F(12, 30) = 1.585, *p* =. 149); DASS anxiety (F(11, 32) = 1.210, *p* =.320) and DASS stress (F(15, 17) = .685, *p* =.767).

Following this, the groups were again analysed in regard to the active and passive subgrouping. For each measure, an independent samples t-test was performed. No significant differences were reported for active versus passive conditions; WEMWBS: t(69)=.121, p= .904; PSS: t(69)=-.082, p=.935; POMS: t(69) = -1.215, p =.228; DASSdepression: t(69) =-1.206, p =.232; DASSanxiety: t(69) = -1.500, p = .138 and DASSstress: t(69) =.076, p =.940.

Creativity

The ANOVAs revealed that creativity significantly influenced counterfeit detection performance on Day 1 (Figure 3), (F(1, 65) = 12.15, *p* =.001) and on Day 2 (F(1, 65) = 5.38, *p* =.023. It was observed that self-rated non-creative individuals performed better than creative individuals, as shown through higher average of correct counterfeit detection on both Day one and Day 2. Here, the non-creative group achieved an average that was 3 scores higher than the creative group for both counterfeit detection tasks.

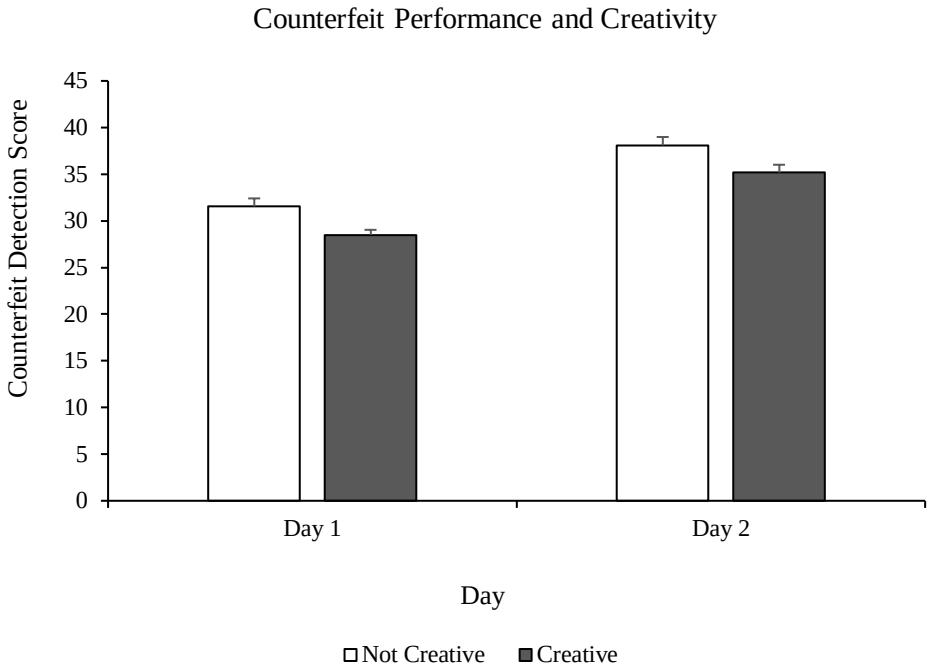

Figure 3. Graph highlights differences in performance on the Day 1 and Day 2 Counterfeit tasks, where self-rated non-creative individuals were better able to detect change.

Engagement

Engagement of the participants was also considered to identify whether the more effort put into the intervention tasks was more beneficial for cognition and wellbeing. For the copy and expressive groups, quality of the artworks was determined by how detailed each response was. For example, high quality works were more likely to have shading, more lines and in some cases colour. In the copy group, the more the responses resembled the artworks, the more they were considered as high quality. Similarly, responses were considered high quality in the expressive group if the work was detailed and had clear inspiration from the given artworks. Work was categorised as medium quality for both copy and expressive groups if some responses were of better quality than others. Responses from both the copy and expressive groups were categorised as low quality if the work looked

rushed, had few lines and were generally low in detail. Figure 2 highlights examples of high, medium and low-quality work from the copy group. Participants who produced higher quality works, who liked the counterfeit task and who spent more time on the homework tasks were therefore considered as more engaged. Time spent on the intervention task for all groups (excluding control) were as follows, where average time spent is shown in minutes: Copy *M* = 139.94 (88.34), Expressive *M* = 48.5 (5.34), Writing *M* = 46.29 (20.63) and Tracing *M* = 87.13 (88.97). Participant engagement/time spent was not measured for the control as this was a passive task and involved a set amount of listening time for all participants: Podcast 1 (Episode 18) 23:46; Podcast 2 (Episode 16) 22:52; Podcast 3 (Episode 12) 21:15; Podcast 4 (Episode 7) 18:08, (See Table 4 in Appendix A for full podcast Titles)."

Engagement was also measured through how much participants enjoyed the task. On Day 1, ratings of task enjoyment by group were as follows: Copy, *M* = 64.5 (24.6), Expressive, *M* = 69.5 (23.4), Writing, *M = 65.4, (24.9)*, Tracing, *M* = 67.7 (20.1) and Control, *M* = 56.3 (25.2). On Day 2, task enjoyment averages by group appeared to decline: Copy, *M* = 53.1 (24.7), Expressive, *M* = 64.3 (28.6), Writing, *M* = 59.8 (23.2), Tracing, *M* = 61.5 (24*)* and Control, *M* = 61 (21.2*)*.

Results of a Pearson's correlation indicated that there was a significant, positive correlation between task enjoyment and performance on the counterfeit task on Day 1 ($r(71) = .46$, $p < .001$) and Day 2 ($r(71) = .39$, $p = .001$). However, a separate correlation revealed that while time spent on the task was positively associated with quality of the work ($r(70) = -.42$, $p = .025$), time spent was not positively associated with performance on the counterfeit task ($r(70) = .12$, $p = .315$). The analyses revealed no significant association between engagement and wellbeing. These correlational analyses are supported by ANOVA reports, where group and quality of the artwork did not influence performance on the counterfeit task, $F(1, 26) = .678$, $p = .418$. Similarly, intervention effort combined with group did not significantly influence counterfeit detection ability, $F(1, 65) = .713$, $p = .402$.

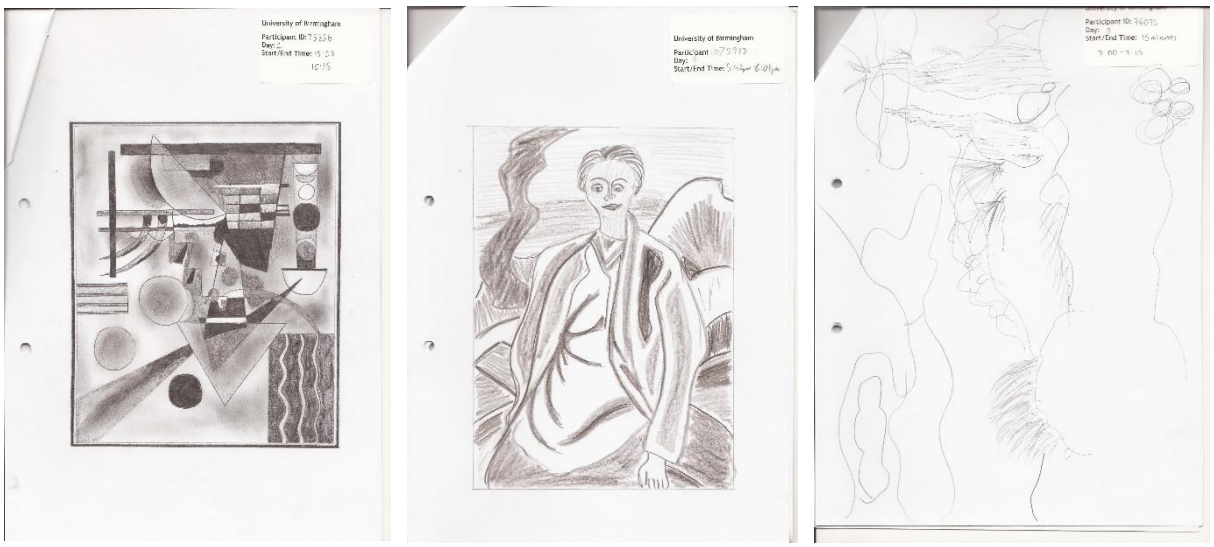

Figure 4. Examples of High, medium and Low quality (Left to right respectively) work produced by participants in the Copy group.

Discussion

3.1. *Restatement of Aims*

The present study sought to fill a gap in the empirical literature where interventions regarding art-making in different forms has not been extensively studied. We set out to simultaneously improve well-being and visual image memory following a one-week intervention in which undergraduate students were exposed to different art-making activities, such as copying, tracing and writing. It was hypothesised that engagement in the visually demanding tasks (copying and tracing) would improve ability to remember and detect change in artworks upon second exposure. Secondly, it was expected that participation in expressive creative activities (writing a personal response to artworks and creating inspired pieces) would improve self-perceptions of mood, stress and general wellbeing.

3.2. *Overview of Results*

We report no significant effect of the art interventions upon visual image memory and ability to detect change during the counterfeit test phase. However, performance did significantly improve between Day 1 and Day 2 for all groups. These results are suggestive of methodological limitations that will be discussed in the forthcoming chapter. The hypothesis that technically demanding arts tasks would engage visual focus and improve attention to detail is therefore rejected. In addition, our results highlight no significant improvement in well-being across measure following the intervention. As well as these aspects, creativity and levels of engagement during the task were controlled for. Significant differences were observed for both Day 1 and Day 2 counterfeit detection tasks between participants classified as creative and non-creative. Due to sampling limitations, the validity of these results will also be considered. Finally, we asked whether degree of creativity and

enjoyment in the task was associated with well-being and counterfeit detection performance. Task enjoyment was positively correlated with counterfeit detection scores on Day 1, but time spent during the intervention was not reported as significant. This chapter will discuss our findings in more depth and provide speculation as to why our hypotheses were not supported.

3.3. *General Discussion*

Art and Well-Being

In review of the literature influencing this study, we first consider our results in relation to Eaton and Tieber (2017), who concluded that creative freedom and lack of structure within art making has significant positive effects upon mood. We sought to elaborate on this finding and further manipulate the characteristics of art-making through inclusion of an intervention group involving free drawing (no structure) and free expression. Unlike Eaton and Tieber, our expressive intervention was compared to varying levels of structured tasks (tracing and copying). The present research does not report any significant differences in well-being following one week of unstructured and structured art-making. However, we acknowledge that unlike the present study, Eaton and Tieber conducted their research under laboratory settings. It is therefore difficult to assume that our participants were truthful in their reports regarding their activity during the week, or even that they participated at all. Going forward, it is important that studies first assess participants under laboratory settings to ensure the activities are performed correctly. Subsequent investigations may then take the research into real-world environments to assess the generalisability of the benefits that occur under laboratory settings.

Secondly, influential work by Smolarski, Leone and Robbins (2015), Curl (2008) and Dalebroux, Goldstein and Winner (2008) may also offer explanation as to why our

methodological techniques did not result in improvement. These various authors all sought to distinguish between positive and negative expression of mood and thoughts through art making. Consistently, negative expression of inner feelings is referred to as ‘venting’, and like clinical talking therapies, aims for participants to relieve their negative experiences and emotions through action. All three studies report that for both mood and anxiety states, engagement in art for positive expression and not venting left participants less stressed, less anxious and in better moods. Interestingly, Curl (2008) reports that even when the art activity is different (drawing versus collage making) the benefits upon mood are the same when the mental focus is positive. Thus, art for negative expression (venting) is not effective. Drake, Hastedt and James (2016) speculate that venting through drawing may not be beneficial for mood improvement as people may find it difficult to release traumas through a visual form when this would normally be done through language. This suggestion should be taken into consideration in future work as mention of visual forms compared to speech and language domains for emotional relief has not yet been made in the literature. In relation to the present study, we consider that our intervention task focusing on ‘expression’ was too vague. Participants were not instructed to have positive or negative focus and were only instructed to create a piece of art ‘in response’ to a given artwork. Participants were not asked whether their response was positive or negative. Therefore, it is possible that our cohort drew on different experiences when creating their responses. Future work should continue to investigate expression within art in comparison to more structured activities, but it should be ensured that clear instruction is given to distinguish between positive expression and using art to vent negativity. The present study would have benefitted from putting into practice the types of expression in combination with keeping participants in a laboratory setting.

In addition, after reflection of the literature informing this study, we acknowledge that a critical feature has been omitted: induction of negative mood. Particularly in studies investigating the components of art-making, it is apparent that all studies involved manifestation of a sad mood in the participants before art engagement began. For example, this involved asking participants to think of the saddest thing that had ever happened to them (Forkosh and Drake, 2017; Drake, Hastedt and James, 2016; Drake, 2016) watching a sad film (Dalebroux and Goldstein, 20008) or writing a list of stressful events (Smolarski, Leone and Robbins, 2015). Although it is beneficial to understand how art-making and recreational activities in general can influence mood states when they are not manipulated, the lack of negative mood induction for this study has likely prevented a significant effect from being found. Future work should continue to induce negative moods as well as furthering manipulation of arts activities to observe how components within art making can differentially improve the induced moods. Such research would have important applications to clinical environments where negative moods are present regardless of a mood induction.

An important factor to consider is the time at which the study was performed. Participant recruitment for the copy and expressive groups began at the start of the academic semester, when assessment deadlines were not imminent and educational pressure was lower. At the point of testing for the three remaining groups approximately four weeks later, academic pressures were likely to have been higher with deadlines being set. As groups were not exposed to the interventions simultaneously, it is possible that levels of stress were higher for some groups at the time of testing. This could suggest that as some participants were involved later in the semester, they consequently put minimal effort into the intervention as it was not a priority. This too is supported by the fact that participation was influenced by the need to obtain course credit, and not a desire to improve wellbeing. On the other hand, while it is assumed that students would be experiencing higher levels of

stress further into the semester, this was not formally examined and so remains conjecture. Despite the lack of explicit measure for time of testing, the means acquired from the Perceived Stress Scale for all groups at baseline indicate no significant differences in stress across the semester: Copy (*M*= 16.68, *SD= 5.9*), Expressive (*M= 16.83, SD= 5.7)*, Writing (*M= 17.06, SD= 4.6*), Tracing (*15.83, SD= 5.4*) and Control (*M= 20.28, SD= 7.1*). Moreover, the different time frames of testing lend further insight into the effectiveness of the overall intervention; neither low stress or high stress in students was influenced by engagement in art activities, as highlighted by the general lack of improvement in well-being. However, for the copy and expressive groups it is possible that no improvement was needed. Leckey (2011) reviewed evidence that concludes engaging in creative activities promotes relaxation, reduces stress and has positive physiological impacts (reduced blood pressure and improved immune system functioning). Participation shortly after the four-week Christmas vacation might suggest that participants were feeling suitably relaxed and stress free at the time of testing. Hence, desire to relax and to find stress-relieving mechanisms was likely to have been low. Furthermore, participants who did rate themselves as high in stress and low in mood were removed from the analyses, in attempts to assess effects of art-making on psychologically healthy individuals. In the case that these participants were included in the analysis, we might have observed improvement in their overall well-being. However, due to the small sample of participants with low mood and high stress, conclusions could not have been drawn. In addition to the time of test in the academic semester, it should also be acknowledged that the length of the intervention was not well-controlled for this study. For some participants, time spent on the homework tasks exceeded a few hours, while some spent less the half an hour on the tasks. Even for participants who spent 3-4 hours on the tasks, we might still ask whether this is long enough to observe improvements. For example, Drake (2016) conducted a study over the course of

one month in order to see improvement, and for some authors investigating cognition and art-making, studies were performed over the course of 3 months (Schlegel et al, 2015) or involved engagement in the activity for 10, 30 and 50 hours (Green and Bavelier, 2015). The study therefore would have benefitted from having controlled durations of time allocated to art-making, and varying levels of time for the task in order to compare whether the activity has short and or long term benefits.

Furthermore, a second limitation of the present study in regard to well-being concerns the solitary nature of the intervention task. Due to participants completing the intervention outside of laboratory conditions, we consider that completing the task alone and without the presence of other participants or the researcher was in part responsible for lack of well-being improvement. Greaves and Farbus (2006) provide support of this possibility, highlighting that arts programmes based on social contact, encouragement of creativity and with the presence of a mentor/professional, were more likely to improve well-being. It is possible that without presence of other individuals, productivity and motivation to complete the given tasks was low in our participants. In addition, given that participants were instructed to complete the intervention at home outside of laboratory conditions, we cannot be sure that participants completed the task themselves or were honest about the amount of time they spent on the task. Future work could compare effectiveness of art-making where participants are either surrounded by others and mentors to provide encouragement versus participants engaging in solitary art-making.

Art and Cognition

In consideration of the prevailing research within the cognitive training domain, researchers have attempted to highlight transferability across brain functioning through training with different tools. Sala, Tatlidil and Gobet (2018) conducted a series of meta-

analyses to explore whether cognitive training within a certain domain can extend outside of the areas trained. Studies concerning correlation between video gaming and cognitive skill, game players versus non players and video game training upon cognitive ability were assessed. Sala et al report that for all three analyses, the evidence for video games as an effective cognitive training tool was limited even for within domain functions. Specifically, experienced game players did not exhibit greater cognitive functioning over non-game players. When non-players were introduced to gaming, no significant effects upon cognition were observed. Importantly, video gaming was also not shown to improve cognitive functioning outside of the trained cognitive domain. Sale et al therefore argue that video game training, like other traditional methods, cannot offer far transfer across and generalisability to different cognitive domains. In relation to the present study, the meta-analysis by Sala et al suggests that just like recreational game playing, recreational art-making has no lasting effects upon cognition. However, the present study was also influenced by extraneous factors including methodological limitations, that may have prevented us from observing significant effect.

Firstly, we address the finding that visual image memory and counterfeit detection performance improved across all groups. While typically defined as an improvement in performance from one test score to another in the absence of an intervention (Bartels, Wegrzyn, Wiedl, Ackermann & Ehenreich, 2010), we consider that our findings were confounded by practice effects despite presence of an intervention. It is possible that prior exposure to the tasks on Day 1 prepared participants for the task on Day 2: completion of the tasks on Day 1 informed participants that they would view images of artworks before being required to detect change in them. At the start of the second session, participants were informed that the experiment would follow the same procedure as Day 1, although the featured artworks would be completely novel. Therefore, upon second testing participants

were not naïve to the task requirements. Consequently, participants may have been more likely to pay closer attention to the images upon first exposure during the study phase, thereby improving their chances of detection change in the test phase. A control group in which participants had no intervention task between the course of testing sessions would have clarified whether or not practice effects were present.

Posner and Patoine (2009) offer a critique of arts-based programmes in relation to improving cognition. They argue that training with art is unlikely to universally improve cognitive abilities, as not all arts activities are of interest to everyone. Moreover, not every individual is successful at all types of art activity. It is therefore difficult to quantify activities that provide individual benefits and experiences. While the aforementioned qualitative research (Curry and Kasser (2005); Eaton and Tieber (2017)) did suggest that training with artistic activity did improve well-being, it is possible that training to improve cognition requires more consideration of individual differences and ensures that participants are fully engaged in an activity they find fulfilling. In relation to the present study, allocation of participants to groups may have benefited from information detailing the type of art and related activities participants enjoyed.

Intervention Groups

In regard of our intervention tasks and the content administered, we first consider that the task required of participants in the control group was not an effective passive control. While the control succeeded in being non-visual, it could still be considered a creative activity much like that of art appreciation. For example, podcasts featured conversations about specific artworks, and spoke largely about the content and meaning of pieces. Although this may have been an effective task for the control of making art, it could be that listening to appreciative discussions caused participants to look more closely at artworks

during the Day 2 session. In line with this, Ishiguro, Yokosawa and Okada (2016) conducted a study into viewing behaviours of art novices following an intervention of art education. They note that expertise in art is associated with complex exploration of artworks, demonstrated through more eye-movements across the visual scene, and more complex appreciation of works. Ishiguro et al. therefore hypothesised that increased engagement in learning about art and how it is made would improve novice's abilities to appreciate artwork. Following participation in a fine art photography course, in which participants were educated in creative processes and techniques, it was found that participants made more eye movements across the visual scene and became more aware of technical and finer details of images. Thus, it was concluded that participation in visual art courses with a focus on creative processes, techniques and content improved novice ability to appreciate new artworks. In relation to our control group, it is possible that exposure to podcasts with strong focus on artistic content improved ability to scan a visual scene, as reflected in improved counterfeit detection ability on Day 2. However, without data regarding participant experience of the podcasts, and whether they found the intervention informative, it cannot be determined whether the podcasts were indeed effective in improving participants perceptual abilities. A control with no creative content would be needed to determine whether exposure to art, in visual, non-visual and auditory forms can influence visual memory and focus.

Another experimental group involved participants creating content in response to the given artworks. In contrast to the copy and tracing groups, these participants had less structure during the task, and were simply instructed to create something inspired by the given artworks. We consider two possibilities here; that the lack of task structure left participants unsure of what to create, or that task instructions given during the testing session were not clear enough. Our initial hypotheses that creative freedom/less structure

during art-making would improve well-being, due to enhanced emotional expression, are not supported by the results.

Finally, it is possible that while writing about emotions has been shown to be therapeutic, writing about art may not be. For example, Pennebaker et al. (1990) found that after writing about thoughts and feelings (as part of one 20-minute session per day for three days) undergraduate students made fewer visits to medical centres as compared to control participants who did not write about their emotions. Furthermore, Smyth (1998) highlights that writing therapy has been shown to improve not only physical health but also psychological well-being. Pizarro (2004) conducted a study comparing efficacy of writing therapy and art therapy upon psychological health. Here, 45 undergraduate participants were instructed to either write or draw about a traumatic event they had experienced. It was expected that drawing and writing about trauma would be more effective than a control (drawing a still life), that participants in the art condition would find the intervention more enjoyable and would be more likely to continue with a similar treatment. Importantly, Pizarro ensured the writing and drawing tasks had a strong therapeutic focus, with instructions emphasising that the work produced should address their deepest emotions and thoughts. They also suggested the work could tackle unspoken conflicts and experiences that had not been voiced to other people. The study reports that writing about life stressors significantly reduced social dysfunction as compared to art-making and control. On the other hand, participant reports of the writing task indicated that the session was not enjoyable, and that they would be unlikely to continue with such a treatment in real-world settings. While making art had no concrete effects upon well-being, it was reported as more enjoyable and more recommendable to others. The present study partially reflects these results; making art was reported as enjoyable, yet improvements on measures of mood, well-being and stress were not observed. Drake, Coleman and Winner's (2011) finding that

making art to act as a positive distraction is important here, as drawing about a negative life event (Pizarro) and making art with lack of detailed instruction regarding content (present study) yielded no effects. Thus, future work could tackle the benefits of art-making when clear instruction is given to explore positive experiences, in comparison to expression of negative experience in writing. Moreover, these findings might be applied to therapeutic settings in attempts to help clarify what type of therapy would benefit individuals and their preferences. In situations where life stressors or traumas do not want to be addressed, art therapy could provide a suitable alternative based on effectiveness via distraction.

Art Genres

In addition to potential issues regarding instructions and task requirements, we consider that the materials and genre of art used during the interventions confounded effects. Findings from Else, Ellis and Orme (2015) are considered in relation to our use of stimuli during the intervention task and the visual image memory/counterfeit detection tasks. In their study, they investigated whether viewing modern art of different genres (abstract, representational and indeterminate) affected emotional experience and cognitive functioning, and whether level of art expertise of participants further influenced responses to modern art. Participants were divided into artists and non-artists, where artists had formal education in Fine Art and were working in a professional creative domain. Alongside viewing art, participants made conscious judgements about their immediate and emotional responses to the stimuli. It was found that abstract art had limited emotional affect for both artists and non-artists, and that representational art had greatest effect upon non-artists. Else et al. concluded that level of art expertise influences emotional response to different genres of art. In relation to the present study, we consider that the type of art used as stimuli and expertise of participants limited emotional responses and consequently well-being. During the intervention task, four artworks of abstract, representational (still life), portrait and

landscape genres were utilised. Thus, it is possible that the abstract art task failed to engage participants on an emotional level, resulting in lack of well-being improvement. On the other hand, the finding that representational art had most emotional effect upon is not replicated in our results.

In addition, Else et al. refer to the Cognitive Mastery Model (Leder, Belke, Oeberst and Augustin (2004)) which proposes that to have an aesthetic experience in response to an art work, individuals must reach certain cognitive checkpoints. In particular, they suggest that perceptual analyses of simple visual aspects like contrast, symmetry and so on, precede explicit classification of an art piece, such as what style the work is in or the content it depicts. Following this, Leder et al. propose that individuals who are able to interpret a work and understand it are achieving cognitive mastery. Importantly, their model highlights how experience and art expertise aids individuals in achieving this cognitive mastery; the more we understand an artwork, and the more we understand art in general, the higher the probability we have of cognitive mastery and ultimately an emotional response. If we consider the cognitive mastery model and artistic genre in relation to the present study, it is possible that a combination of different art styles and lack of expertise was responsible for lack of well-being improvement. An inclusion of genre-specific ratings and more in-depth acquisition of participant's art knowledge would have been useful in providing a more well-rounded picture of the participant's experience of each intervention task. For example, such a measure might have indicated that the representational task was easier to understand and hence respond to as compared to the abstract task.

Furthermore, an important limitation highlighted by Else et al. within their study applies to the present study; it is argued that once an artwork is transformed into a two-dimensional image, it reaches the status of interesting stimuli only, and not art. The artwork used as stimuli both in the intervention and test phases were reproductions of visual art

presented on a two-dimensional computer monitor and A5 piece of paper. We therefore question the transferability of making art in its physical form to two-dimensional form, and whether art-making can improve perception of two-dimensional forms. For future research, investigations should include physical exposure to original art within art-gallery settings alongside creation of art to maintain consistency of mediums used.

Ishai, Fairhall and Pepperell (2007) conducted a study into memory and perception of representational versus indeterminate paintings, where indeterminacy in images occurs when formal features of the work such as colour and objects become dissociated from semantic aspects. As a result, a viewer may struggle to reach a conclusion or opinion of the image, as the content cannot be matched to semantic knowledge. Ishai, Fairhall and Pepperell hence sought to compare visual memory and perception of representational paintings versus indeterminate artworks. Through measurement of ability to recognise objects within the paintings, it was found that participants were significantly quicker at identifying objects in representational paintings as compared to indeterminate works. In addition, a memory test revealed that representational paintings were remembered more than indeterminate paintings. Finally, the authors highlighted that in additional memory tasks, 89% of abstract, portrait and landscape artworks were remembered by participants. In relation to the present study, the results show that participants significantly improved in their ability to detect change in abstract, portrait, landscape and still life artworks. It is therefore possible that such stimuli as used in the present study and in Ishai et al. are too easy for participants to remember; future studies should conduct preliminary memory assessments of different art genres to determine whether more unconventional styles, for example indeterminate (Else, Ellis and Orme (2015) are harder to recall in comparison to abstract, portrait and landscape works.

Artists, Novices and Creativity

Although the study was only open to students completing science-based programmes, it appears the study attracted individuals with a creative streak, as shown by the number of participants who rated themselves as creative (Creative, N = 51; Non-Creative, N = 21.). As well as aforementioned practice effects, we consider that pre-existing interest in and exposure to art meant that performance on the counterfeit detection task was confounded by baseline creativity and potential above average visual perception. To support this, Vogt and Magnussen (2009) conducted a study with 9 artists and 9 art novices, whereby eye-movement patterns were recorded in response to observation of 16 images depicting scenes, faces, objects and abstractions. It was found that artists, as compared to novices, spent significantly more time observing and scanning artworks for their structural and abstract features, whereas non-artists looked longer at human features and scenes. Interestingly, their results also highlighted that artists were better able to remember features of artworks compared to novices. In line with this, Rosenblatt and Winner (1988) found that compared to non-artists, artists were significantly better at identifying alterations within pictures they had previously been exposed to. While participants were not professional artists, they did hold interest in and experience with creating art. This raises interesting questions as to the long-term effectiveness of making art upon cognition; as participants were full-time students and had engaged in arts activities only in their free time or during earlier education, we might ask whether their previous exposure meant cognitive abilities were improved and stable over time.

The present study also did not allocate participants to specific intervention groups based on creativity. Due to uncontrolled division of creative participants, it is likely that there was too much variation in creativity, cognition and well-being within each group. Importantly, increased variability in individual differences is a common issue regarding low powered samples and must be accounted for when considering these results. Therefore,

it cannot be determined whether a singular intervention group was more effective than the other due to this unaccounted distribution of creativity. Future studies should effectively control for baseline levels of artist engagement and allocate participants to specific groups accordingly.

3.4. *Conclusion*

To summarise, the present study highlights that performance in detecting change in visual stimuli significantly improved following a one-week intervention. However, consistent improvement across all intervention groups would suggest critical flaws with the experimental design. In regard to well-being, it is essential that future research ensures that external stressors remain identical for all participants during time of testing to avoid between group differences. Furthermore, careful control of baseline well-being (through universal negative mood induction via recall of sad life events/exposure to sad stimuli, and controlled measures of well-being at time of testing) should be implemented. Possible comparisons to psychologically unhealthy participants should be made to determine whether art therapy benefits only those in need of well-being improvement. As a result of methodological limitations, we cannot determine whether type of art-making has differential effects upon both well-being and cognition. Cognitive research should carefully assess participant response to different art genres and baseline levels of visual perception to provide accurate data regarding memory and perceptual improvement following art-making. Finally, future research should continue to tackle the nature of arts practices and its effectiveness upon younger generations, to provide insight into how art-making can aid cognitive health and potentially prevent neurological disorders.

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Appendix A: Tables

Table 4.

Artworks and podcasts provided to participants for reference during the intervention between testing sessions.

Group	**Artist**	**Artwork/ Podcast**
Copy/ Expressive/ Tracing/Writing	Vincent Van Gogh Marie-Louise Von Motesiczky Frederick Etchells Wassily Kandinsky	"What Field with Cypresses" (1889) "Still Life with Sheep" (1938) "The Fair, fragment" (1911) "Swinging" (1925)
Control	Joseph Mallord William Turner Vincent Van Gogh Jackson Pollock Claude Monet	"The Slave Ship"- Episode 18 "Postman"-Episode 16 "Number 10"- Episode 12 "Rouen Cathedral Series"- Episode 7

Table 5.

List of modified artworks using during Day 1 counterfeit detection task, detailing artist names, name of the artwork, date of creation and modification made.

Category	Artist	Artwork	Date	Modification
Abstract	Jessica Dismorr	"Abstract Composition"	1915	Brightness and Contrast enhanced
	Giacomo Balla	"Abstract Speed- The car has passed"	1913	Overlay of green; 180° horizontal flip
	Rodrigo Moynihan	"Objective Abstraction"	1935-6	Brightness and Contrast altered to make darker
	Ivon Hitchens	"Coronation"	1937	180° vertical and horizontal flip
	Jackson Pollock	"Naked Man with Knife"	1938-40	180° vertical flip and colours enhanced
Portrait	Vanessa Bell	"Mrs St John Hutchinson"	1915	180° vertical flip; shirt colour changed from yellow to darker yellow
	Jacques-Emile Blanche	"Francis Poictevin"	1887	Background colour change (yellow to green)
	Edouard Manet	"Woman with a Cat"	1880	Local colour change to the dress (pink to orange)
	Raimundo de Madrazo	"Portrait of Lady"	1885-95	180° vertical flip
	Leslie Hurry	"Self-Portrait'"	1944	180° vertical flip; 'Swirl' visual effect added to distort the face slightly
Landscape	Georges Seurat	"The Seine seen from La Grande Jatte"	1888	Layer of blue colour to darken overall image
	Eugene Boudin	"The Entrance to Trouville Harbour'"	1888	180° vertical flip; Colour of sky and water changed to darker blue/grey
	Claude Monet	"Lavacourt under Snow"	1878-81	180° vertical flip; Lines sharpened
	Gustave Courbet	"The Pool"	1870-80	180° vertical flip; Colours brightened
	Edouard Vuillard	"La Terrasse at Vasouy, The Garden"	1901	180° vertical flip; Changed to black and white
Still Life	Otto Franz Scholderer	"Lilac"	19th C	Colours enhanced and sharpened
	Paul Cezanne	"Still Life with Water Jug"	1892-3	Changed to black and white; 180° vertical flip
	Georges Braquee	"Still Life"	1924	Addition of two apples and lines to the glass
	Odilon Redon	"Ophelia among the Flower"	1905-8	Effect added to colours to distort them
	Paul Cezannne	"The Stove in the Studio"	1865	180° vertical flip; Brightness enhanced

Table 6.

List of modified artworks used during the Day 2 counterfeit detection task, detailing artist names, name of the artwork, date of creation and how the work was modified.

Category	Artist	Artwork	Date	Modification
Abstract	Vanessa Bell	"Abstract Painting"	c.1914	180̊ vertical flip; 90̊ rotation; Yellow made bolder
	Josef Albers	"Beta"	1939	Lines sharpened; lines drawn in
	Winifred Nicholson	"Moonlight and Lamplight"	1937	180̊ vertical flip; yellow made red; pentagon made brown
	Paul Nash	"Equivalents for the Megaliths"	1935	180̊ vertical flip; changed to black and white
	Charles Sims	"I Am the Abyss and I Am Light"	1928	180̊ vertical flip; shadows altered and brightness reduced
Portrait	Camille Pissarro	"Portrait de Felix Pissarro"	1881	180̊ vertical flip; background colour changed to yellow
	David Bomberg	"Self Portrait"	1932	180̊ vertical flip; lines sharpened; orange turned to grey
	Unknown- Italian	"Portrait of a Woman"	19th C	180̊ vertical flip; dress colour changed to green
	Imitator of Thomas Couture	"Caught by the Tide"	1860-90	180̊ vertical flip; image made brighter for more detail to be highlighted
	Unknown	"A Man and a Child eating Grapes"	19th C	180̊ vertical flip; colours brightened
Landscape	Georges Seurat	"The Rainbow: Study for 'Bathers at Asnières"	1883	180̊ vertical flip; river bank made darker through addition of green
	Claude Monet	"Water-Lilies, Setting Sun"	1907	180̊ vertical flip; lines sharpened; colours enhanced to be brighter
	Adolphe Monticellli	"Sunset"	About 1882-4	180̊ vertical flip; Contrasts altered to make colours darker and more orange
	Pierre-Auguste Renoir	"Moulin Huet Bay, Guernsey"	1883	180̊ vertical flip; yellow and red colours made brighter; increased saturation of colours
	Adolphe Monticellli	"The Hayfield"	1860-80	Colours changed to black and white; colour contrasts enhanced
Still Life	Vincent van Gogh	"Van Gogh's Chair"	1888	180̊ vertical flip; colours auto enhanced; filter 'engrave' added to give cartoon like effect
	Frances Hodgkins	"Still Life"	c.1929	Emboss' effect added to define lines
	Phillipe Rousseau	"Still Life with Oysters"	1875-87	180̊ vertical flip; colours sharpened; colours made brighter with effect 'glamour glow"
	Ignace-Henri-Thèodore Fantin-Latour	"Still Life with Glass Jug, Fruit and Flowers"	1861	180̊ vertical flip; colours made brighter; effect 'glamour glow' added to increase brightness
	Imitator of Jean-Simeon Chardin	"Still Life with Bottle, Glass and Loaf"	19th C	180̊ vertical flip; colours made bolder and lighter