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The Relationship between the Creation and Perception of Art

Thesis submitted for the degree of Doctor of Philosophy

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DECLARATION OF ORIGINAL AUTHORSHIP

I confirm that this is my own work and the use of all material from other sources has been properly and fully acknowledged.

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Abstract

It is suggested that similar cognitive processes are involved with both the creation and perception of art. However, a lack of research examines this relationship, whether this is just from the perspective of the artist, or in relation to the artist and perceiver of the final product. To do so, we examined the experience of artists and non-artists investigating initial stages of art-making by examining relationships between aesthetic and drawing preferences of geometric stimuli (Experiments 1 & 2). To further understand this experience, we allowed artists and non-artists to be involved in actual drawing activity (stippling and stroking) whilst making drawing preferences. We also examined how being involved in drawing influenced aesthetic preferences (Experiment 3), this led to conducting studies considering perceivers (artists/non-artists) of artworks. Here, we investigated how congruent actions (simultaneously produced or learnt during pre-training) with the artists behind the artwork influenced aesthetic responses (Experiments 4 & 5). Examination of gaze behaviour throughout these studies provides further insight into the aesthetic experience by revealing the processes behind formations of judgements. Overall, we conclude that there are similarities between experiences (gaze and judgments) involved in the creation and perception of art. We find similarities between aesthetic and drawing preferences and find gaze to be impacted in a similar manner when observing images in comparison to making a drawing choice. We do not provide support that these drawing choices are influenced by being involved with drawing but do show that the more experience a perceiver receives with these actions of the artist the more their aesthetic judgements are influenced by these, supporting the relationship between artist and perceiver depicted in the mirror model of art. We provide a foundation for future research to empirically analyse connections between the creation and perception of art and the relationships between the artist and perceiver.

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Chapter 1: Literature Review

1.1 Introduction

The aesthetic experience involves interactions with artworks, music, movies, performances and products, which result in responses ranging from pleasure, preference, liking, and interest to disgust, anger, and surprise. Current models which outline the stages of the aesthetic experience show this experience to develop from early perceptual processes through to more deliberate processing using knowledge and experience (Leder, Belke, Oberst & Augustin 2004; Chatterjee, 2004; Silvia, 2005; Tinio, 2013). Studying the aesthetic experience involves examining what impacts the experience but also how the aesthetic experience influences further choices and decisions.

There is argued to be an interaction between the aesthetic and artistic experiences involved in producing an artwork (Tinio, 2013). The acts of production, perception and enjoyment are suggested to be integrated as the artist behind the artwork conceptualises the artwork and imagines how the perceiver will interact with the final work. The artist visually evaluates their work as a perceiver of the final product in order to create something they believe to be aesthetically pleasing (Dewey, 1934; Zeki & Nash, 1999; Arnheim, 1954). Therefore, the cognitive processes involved in the creation of art can be suggested to be similar to the perception of art (Martindale, 2001; Tinio, 2013). Embodiment and engagement with art must be considered as well as visual observation, as physical creation and perception is important for understanding the overall aesthetic-creative process (Getzels & Csikszentmihaly, 1976; Piechowski-Jozwiak, Boller & Bogousslavsky, 2017). Nevertheless, empirical research largely investigates the experience of the perceiver (those perceiving final works of art) with less work examining the experience of the artist. The art-making process arguably differentiates art from other aesthetic forms that can be aesthetically appreciated, as the artist, their behaviour, intentions and actions are important here unlike designers of products and/or objects (Tinio, 2013). Surprisingly, research tends to not consider the aesthetic experience and the aesthetic characteristics that can impact experiences during the creation of art (Kozbelt, 2017) and little emphasis in current empirical

aesthetic research is put on examining the connection between the perceiver and the artist.

Therefore, this research is concerned with both the artist and perceiver examining the relationship between art-making and aesthetic experiences. In order to ground this work, it is necessary to discuss the theories and models behind art-making and the aesthetic experience which leads to considering the stimuli which impact these experiences. Here, we also consider the current methods used to analyse aesthetic and art-making experiences, and how such experiences can differ dependent on artistic expertise.

1.2 The Aesthetic Experience: Implicit Processing Theories

Theories including processing fluency, familiarity, prototypicality and the mirror neuron system provide explanations for how aesthetic experiences arise. Such processes are not necessarily deliberate but lead to an aesthetic experience. In addition, artists' implement features in their works of art to affect these forms of processing (Leder et al., 2004; 2014). Understanding these theories provides greater detail on why and how the art-making process and the final product impact perceivers' aesthetic experience. We first present processing fluency which can have a great impact on aesthetic experiences and perception during an initial encounter (Reber, Schwarz & Winkielman, 2004). Familiarity is then discussed and is regarded as a collative variable, a feature incorporated within an image or manipulation with a task /stimulus, for example; novelty, complexity, uncertainty and symmetry, which can influence aesthetic experiences (Leder et al., 2004; Silvia, 2005). Prototypicality is shown to be influential due to having a greater understanding of the object being observed and judged (Martindale, 1984; 1988). Finally, the mirror neuron hypothesis focuses on a biological effect of the artworks and perceived motion of the artist that impacts the perceiver (Freedberg & Gallese, 2007). However, it is apparent that the former theories can modulate the effect of mirror neurons. Here, we discuss these implicit processing theories to further understand the aesthetic experience.

1.2.1 Processing Fluency

Processing fluency is proposed to be a contributing factor to the aesthetic experience. An object is perceived to be more pleasing the easier it is processed. Perceptual fluency is the ease of identifying and relating with a stimulus. This can be influenced by perceptual priming, presentation time and repeated exposure (Reber, Schwarz & Winkielman, 2004). Increased fluency has been found to influence aesthetic appreciation as well as speed of object identification, however it is difficult to measure the impact of fluency, therefore further exploration is needed (Leder, 2013). Ticini, Rachman, Pelletier and Dubal (2014) found an effect of artistic style as paintings were liked more when participants were exposed to a congruent hand image (hand grip posture matched how the art was created). Their results can be interpreted as support for the perceptual fluency theory, as observation of the hand image and the knowledge of the action required in order to produce the paintings may have influenced aesthetic responses. Moreover, the paintings may have been processed more easily as participants observed their own hand actions, thus reference can be made with the actions of the artist leading to a positive aesthetic experience. This is evidence for both visual and motoric fluency.

Ease of processing an object is not only through perceptual means but can also be through motoric action and action simulation. Observing objects that represent action can lead to covert simulations allowing an object to be easily processed. This is known as motor fluency, and has also been found to be a contributing factor of the aesthetic experience (Ping, Dhillon & Beilock, 2009). Further evidence for motor fluency and the aesthetic experience comes from Leder, Bär and Topolinski (2012) who requested participants to consistently produce a painting action (stippling or stroking) whilst forming aesthetic judgments on these. The results showed that when actions made by participants were congruent with the art style and actions of the artist, then liking for these artworks was greater than artworks of incongruent nature. They further suggest that these results can be linked to the mirror neuron hypothesis (later discussed) but McLean, Want and Dyson (2015) who replicated the methods used by Leder et al. (2012) found that only when motor fluency was enhanced by making the actions of the artist clearer in

productions and by using artworks not familiar to participants, then congruent actions increased liking. Woltin and Guinote (2015) suggest that there is no need for explicit awareness of motor fluency in such studies analysing how the actions of artists can influence perceivers; however, their results suggest otherwise as most participants aesthetic judgments were not affected by congruent action. Topolinski (2010) found that increased motor fluency through ocular-muscle training, which is training the eyes to follow a moving stimulus without explicitly being aware of this learning, impacted aesthetic preferences of movements. They found that congruent trials where dot movements matched eye movements were liked more in support of a motor fluency hypothesis as trained movements were more fluent. Further testing showed the effect to be due to motor training and not just the apparent visual similarities during matched trials. Thus, both perceptual and motor fluency are important to consider.

1.2.2 Familiarity

Aesthetic experiences can be influenced by familiarity due to mere or repeated exposure. However, there are inconsistent results regarding the impact that mere-exposure has on the aesthetic experience (Leder et al., 2004). Leder (2001) found that familiarity with paintings led to more positive aesthetic judgments, but only when originals were presented. When participants were aware of fakes (van Gogh paintings) then the effect of familiarity on ratings was reduced. Further information and elaboration about stimuli can therefore influence the effects of familiarity.

As well as using mere and repeated exposure methods, familiarity has been shown to have an impact on aesthetic judgements using more engaging tasks. Kirsh, Drommelschmidt and Cross (2013) found that when a dance sequence was actively completed by participants and they were physically involved with the training rather than merely observing the movements, then the participants had greater motor familiarity with the sequences which led to greater liking. In addition, Carbon and Leder (2005) introduced an elaboration method where participants could repeatedly evaluate and gain insight into the stimuli.

Attractiveness ratings increased due to repeated evaluations but only for stimuli that were familiar and prototypical. Familiarity has not always been found to have an impact on aesthetic judgements and in fact can be modulated by other collative variables. Complexity, originality and novelty have all been shown to affect familiarity and its influence on the aesthetic experience (Berlyne, 1970; Leder, 2001; Hekkert, Snelders & van Wieringen, 2003; Tinio & Leder, 2009).

1.2.3 Prototypicality

Prototypicality involves experience and understanding whether an object is representative of the typical class of objects. The more typical an object is of its class the greater the aesthetic experience and more appealing that object is, as prototypical forms are preferred to non-prototypical ones (Martindale, 1984; 1988). Preferences for colours, faces and paintings have all been found to be effected due to prototypicality (Martindale, Moore & Borkum, 1990; Rhodes, Jeffery, Watson, Clifford & Nakayama, 2003; Hekkert & van Wieringen, 1990). In addition, Veryzer and Hutchinson (1998) demonstrate that prototypicality also affects many different judgements of design features of products as well as attractiveness. However, it is apparent that individual experience is important. As well as the typicality of the object, expertise is crucial as awareness and experience of the object or style of painting/clothing for example would impact an artist more due to prototypicality than a novice. On the other hand, Smith and Melara (1990) found that musical chords with prototypical progressions were preferred by novice musicians but atypical progressions were preferred by expert musicians.

1.2.4 Mirror Neuron Hypothesis

Perceptual and motor fluency, as previously discussed, suggest that ease of processing, whether due to perceptual or motor interactions, positively impact aesthetic judgements. The mirror neuron hypothesis presents a similar process but suggests that mirror neurons are activated both when an action is performed by the person and when the same action is performed by another individual. This

interaction leads to the fluency between action and observation increasing preference (Rizzolatti & Craighero, 2004; Freedberg & Gallese, 2007). There is a large amount of evidence which suggests that a mirror neuron system exists in monkeys, but some recent research also shows that one exists in humans. The actions we observe activate our own perceptions of the behaviour required. Viewing art, even in a static form, is suggested to influence the aesthetic experience, thus the way in which art is produced and the actions of the artist (i.e. texture and brushwork) can impact the aesthetic experience of the perceiver perhaps due to activation of embodied mechanisms provided by the mirror neuron system (Freedberg & Gallese, 2007). Umilta, Berchio, Sestito, Freedberg and Gallese (2012) state that the role of the mirror neuron system in relation to the aesthetic experience requires more investigation, but their research did find the motor system to be involved with observation of artworks. When observing original artworks cortical motor activation was evoked in the brain, but there was no activation apparent when participants observed the same artwork when it was generated by a computer. Viewing cuts in the canvas made by an artist were experienced differently than computer generated lines suggesting that the motor system is important when viewing art. In addition, the aesthetic ratings were higher for the original artworks. However, these images were also rated to portray more movement and be dynamic, thus the aesthetic ratings could be affected by the participant's knowledge of how the art was produced rather than the impact of the mirror neuron system.

1.2.5 Conclusion

After discussing the processing theories; processing fluency (perceptual & motor), familiarity, prototypicality and mirror neuron system, it is clear that there are different factors during early stages of processing that can impact aesthetic experiences. Despite different claims being made on how art and stimuli are processed and consequently evaluated, there is an apparent thread between the various theories. Familiarity and prototypicality can lead to an increase in perceptual and motor fluency, and this ease of processing can also be explained by

the mirror neuron hypothesis which all leads to an aesthetic experience. Models of the aesthetic experience depict how these processes lead to an aesthetic experience, particularly during early stages of processing.

1.3 Models of Aesthetic Experience

A number of models have been created that outline the development of an aesthetic experience from perception through to making an aesthetic judgement. While there are differences in the details of the models there are many similarities in relation to the temporal development of an aesthetic experience. Across all models of the aesthetic experience, when taken at a more general level, it is apparent that the aesthetic experience is generally claimed to involve early phases of perceptual processing that leads to more in-depth analyses involving higher level cognitive processes. In this section, a brief outline of the major models which consider the cognitive processes involved in the aesthetic experience is presented (Pelowski, Markey, Lauring & Leder, 2016).

1.3.1 Leder et al. Model

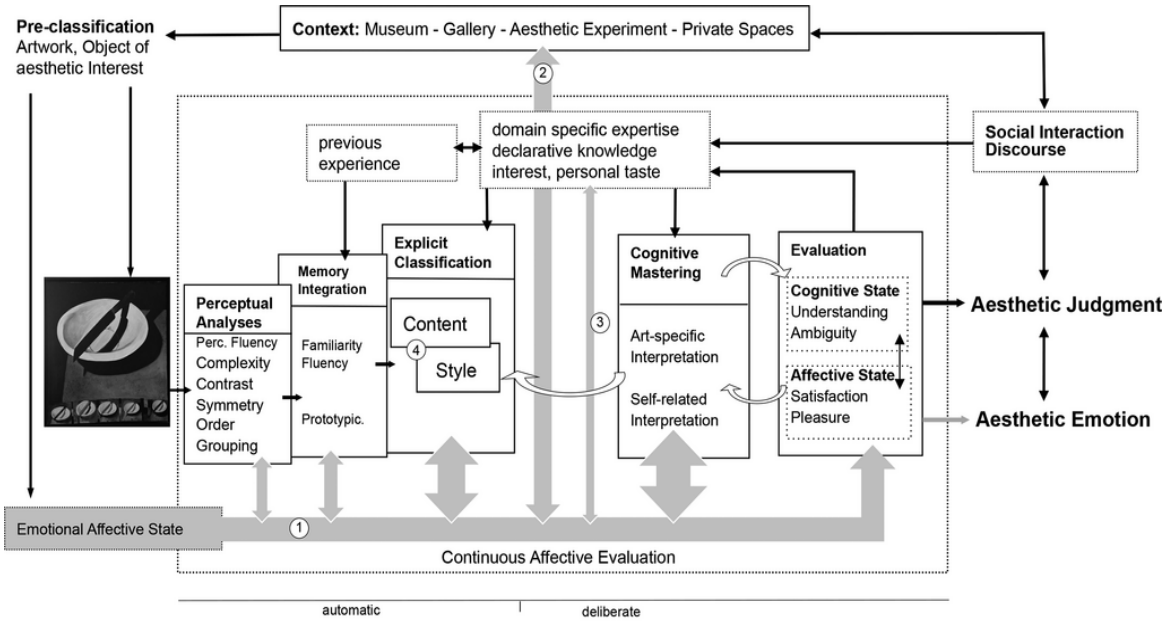

Figure 1.1-Leder & Nadal (2014) model: Adapted version of the model of aesthetic experiences from Leder et al. (2004)

Leder et al. (2004; 2014) constructed a model explaining how aesthetic experiences to art arise (see figure 1.1). This model highlights early automatic processes that then lead to intermediate and later deliberate processes showing how aesthetic judgments and emotions are affected from observation to evaluation. During early automatic processes perceptual features, collative variables and low-level features such as symmetry, complexity, colour and texture are important and can impact initial experiences. The model then shifts onto implicit processes that have been discussed which involve familiarity, fluency and prototypicality, all of which may have an influence on the aesthetic experience. Style and content can be influential dependent on the awareness of the technique used to create art, its stylistic features and elements, therefore expertise is important here. More deliberate processing is required to classify art styles, but the style can be processed quickly and automatically when viewing artworks regardless of expertise. The focus in the model then shifts to how more deliberate processing effects judgements and emotions. During cognitive mastering, meaning is formed about artworks; here expertise is important as those with little art experience may create understanding relative to their situation and emotions. This understanding of art also influences the overall aesthetic experience. The more knowledge and experience the perceiver has about the art, artist and art style the greater impact these factors have on the overall aesthetic experience. Prior to forming aesthetic judgements, the perceiver evaluates the art dependant on the experiences leading up to this involving the understanding of the art and the pleasure it provides. However, it is important to note that this model does not portray a linear direction but demonstrates that stages of the aesthetic experience can loop back, for example after meaning-making then consideration of content and style may be revisited.

1.3.2 Chatterjee Model

Chatterjee's (2004; 2011) model includes an early processing stage where colour, brightness and other low-level features influence the aesthetic experience. Intermediate stages involve incorporating smaller visual elements into a larger

more holistic image. Later processing involves knowledge and background experiences that impacts understating of art and aesthetic judgements. In addition, Chatterjee's model emphasised and provided a basis for exploring the role of brain regions during the different stages of viewing and processing art which later led to the development of the aesthetic triad (see figure 1.2). Chatterjee and Vartanian's (2014) aesthetic triad integrates the early, intermediate and later stages of processing presented in the Leder and Chatterjee models. Here, a sensory-motor system links to the early and intermediate stages of processing where visual processes and mirror neuron activity can impact experiences. The emotion-valuation system relates to emotions ranging from awe to disgust which increases or reduces pleasure. Knowledge-meaning relates to the context, cultural setting and the individuals' expertise, which is represented to be particularly influential during later stages of processing, to impact aesthetic experiences. However, they place further emphasis on the brain and portray how visual objects and properties presented in art lead to positive and negative responses that can be associated to brain regions, specifically the sensory-motor and reward systems. However, knowledge and experience can also be associated to brain regions, this is further discussed below.

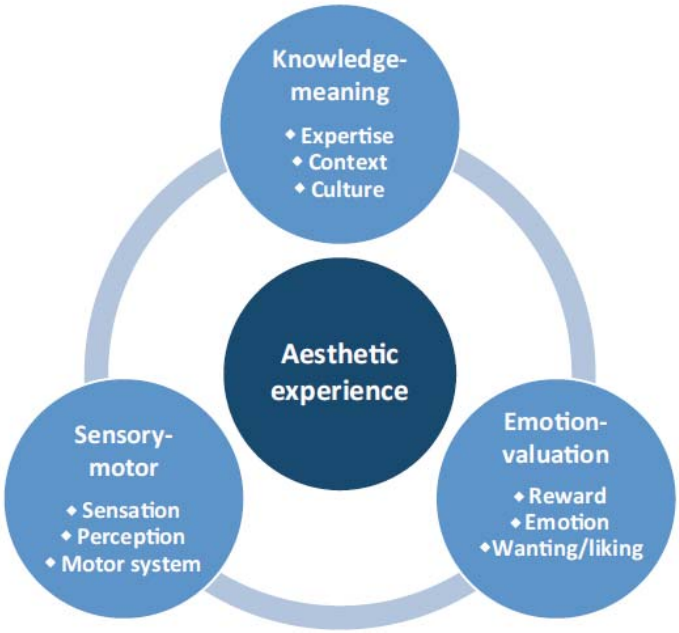

Figure 1.2-Chatterjee & Vartanian (2014) model: The Aesthetic Triad

Regarding the sensory-motor system, brain areas such as medial-temporal (MT) are found to be activated during early stages of viewing due to the sense of movement when observing art. The fusiform gyrus (FFA) is activated when observing faces and the parahippocampal place area (PPA) is activated when observing places. The mirror neuron hypothesis also indicates that perceived action can activate mirror neurons at this time. When observing beautiful images, brain regions such as orbito-frontal and medial-prefrontal cortex, ventral striatum, anterior cingulate, and insula activate as these regions are associated with reward and pleasure. This is found even when freely-viewing art and not explicitly considering the beauty of the image presented. Finally, knowledge of the background, title and authenticity of art pieces have also been found to activate brain regions, with orbitofrontal regions in particular being activated when considering the background of art, not necessarily the content, and when observing authentic art. All sections of the aesthetic triad are suggested to impact the aesthetic experience both individually and when coupled with other factors (Chatterjee & Vartanian, 2014).

1.3.3 Locher et al. Model

Locher et al's. (2007, 2010) model extends the aesthetic experience of art to a more general aesthetic experience that involves interactions with products. Like the Leder and Chatterjee models, theirs also involves early and later stages of the aesthetic experience. The early stage of processing involves initial perception where an initial understanding is formed from the elements that make it. This allows an evaluation to take place prior to later processing that is more deliberate, focusing on content and details in order to form aesthetic judgements. In terms of the user experience, Locher et al explain that the underlying thoughts and interactions with a product lead to forming aesthetic judgements. The product and the context in which it is tested and evaluated are important here as the product provides the user with information regarding visual, tactile and functional use. Moreover, the experience of the user and their knowledge has an impact on the aesthetic experience of products.

1.3.4 Silvia et al. Model

The model proposed by Silvia (2005) suggests a more personal approach in regards to the aesthetic experience. This appraisal theory suggests that cognitive appraisal leads to a more emotional experience, thus greater knowledge of the stimulus enhances the experience. They argue that the individuals' evaluation and appraisal of the artwork is important to the experience, more so than the object or artwork that is being evaluated. Here, interestingness is important as the appraisal of this effects emotions more so than judgements. Prior to an experience there is importance of the perceivers' goals and values and the context in which the stimulus is observed, less emphasis is placed on the earlier stages of the aesthetic experience where perceptual processes have an impact. This model focuses more on the later stages of the aesthetic experience; interestingness can be influenced by novelty and complexity of the stimulus and the understanding of the stimulus or artwork. The model therefore addresses the variation between personalities that can lead the same stimulus to affect perceivers in different ways resulting in varied responses and emotions. These responses can then relate to more than simple preference including interest, surprise, anger and confusion which can influence physiological responses such as heart rate and skin conductivity, and also actions such as eye and physical movements. The variations in emotions that can be identified can relate back to the initial goals of the perceiver and the context. Certain emotions including interest reflect latter stages of the aesthetic experience where further thinking and exploring of the art is conducted influencing the overall personal aesthetic in order for the perceiver to learn and develop.

1.4 Models of Art-making

In the previous section, we present models which consider how perceivers of a final product observe and evaluate art, but little emphasis is placed on the artist or designer behind the product. However, much like the perceivers' experience is affected by the artist, so the artist is influenced by potential perceivers of the final product. Thus, the art-making process can be influenced by visualising their

progress and making decisions with their perceiver in mind. The artist may manipulate their work in order to influence the perceiver in a similar manner suggesting that there are similar cognitive processes involved in both the perception and the creation of art (Dewey, 1934; Zeki & Nash, 1999; Martindale, 2001; Tinio, 2013). There are a few models of art-making which have been constructed from interviews with artists, but there is a lack of empirical research that supports these models. We present models below that explain the art-making processes; these have been useful for the development of more recent models where the art-making processes have been examined in relation to aesthetic processes.

1.4.1 Sapp Model

Sapp's (1995) model was developed using previous models designed to explain creative problem solving. These models were developed from examining the experiences of scientists, students, artists and professionals requesting them to draw and illustrate the processes they use to solve problems in order to gain a greater understating of the creative process (Isaksen, Dorval & Treffinger, 2010). However, Sapp's (1995) model was designed specifically regarding the creation of art. Much focus is placed on the initial stages of art-making and conscious decisions made involving the generation of ideas. The model explores the processes of making ideas and examines both divergent and convergent stages of thinking. Divergent thinking is unconscious thought processes, whereas convergent thinking refers to conscious decision-making processes. Therefore, convergent thoughts are identified as the conscious decisions during the production of potential ideas and specific focus is put on how one idea is selected amongst others, indicating that throughout the idea-making process these conscious decisions are made in order to transition onto the next stage.

Five stages are outlined in the model; the first stage is exploration where the flow of ideas takes place. Many artists may sketch or make notes about ideas. These ideas are then clustered to form groups of ideas ready for stage 2 (decision 1). During the next stage, the artist examines the ideas and provides boundaries to

enable the potential ideas for creation to not be too broad but to also not be too restrictive. The third stage involves reducing idea clusters; selections are then made on the most significant clusters (decision 2). Here the ideas within these clusters will share many similarities but this does not ignore the potential of new ideas arising. One set of clusters is then selected to be explored as a final product (decision 3). Focus is then placed on the content of ideas and maybe exploring these further by experimenting with the medium selected, i.e. painting on a canvas. At this stage one idea is then selected to be the final product (decision 4). Finally, the artist works with this idea on the selected medium and refines their artwork.

1.4.2 Mace and Ward Model

Sapp's model provides an outline of how artists develop ideas; however, Mace and Ward (2002) look in more detail into the wider stages of art-making and begin to consider the artist and their experience within the model. Sixteen professional artists were requested to produce an artwork for exhibition or commission during which interviews were conducted gathering data on the artists' process. Artists were required to explain their activities whilst developing their work and were interviewed on three occasions; when the ideas were first initiated, during the developing stages and when finishing the artwork. A grounded theory approach was used allowing a theory to emerge from the data gathered. Four phases are represented in the model that an artist completes before an artwork is suitable for exhibition. The first phase is artwork conception, this addresses when and how ideas develop and reasons behind selection. As demonstrated by Sapp (1995) stages of idea conception occur, these ideas can arise unintentionally or may be more deliberate. Ideas or clusters of ideas are then explored until one idea is selected to be created. The idea development phase follows as the idea selected is adapted and modified if necessary. Artists are engaged with deliberate development of the idea where it may now be explored physically if it was not so prior to selection. The multiple ways in which an idea can be created is important exploring ideas through sketching and drawing. At the end of this process the idea is evaluated and is then taken further to be developed into an art piece or past

ideas may be revisited and explored with the current idea being abandoned. The third stage is the actual production of the artwork; the physical process of making the artwork is important here where the artist considers the materials that are needed or are ideal. The artist builds and develops their work through conversation between themselves and the artwork where they evaluate the progress of their work and the aesthetic qualities it has or lacks. Again, at this stage of the process decisions are made regarding whether to finish the artwork. This is the final stage of the process and involves finishing the artwork, evaluating and preparing it for exhibition if this is what the artist desires.

In this model emphasis is placed on the artist. The researchers explain how throughout the art-making process artists use their own aesthetic experiences to guide decisions during the development of their work. In addition, they explain how this experience with making art and engaging in such activities has an impact on the artist and their future aesthetic and artistic experiences. Here, the researchers consider the art-making process of the artist and also their aesthetic experience. The artist is particularly important and is deemed to aesthetically judge their work until it is finished. The aesthetic experience of an intentionally produced work of art begins with the artist. They are the one to generate and develop ideas and physically produce the artwork (Beardsley, 1965; Fiore, Kimle & Moreno, 1996). Regarding creative problem solving that led to the development of Sapp's (1995) model in relation to art, further examination supports the importance of the aesthetic experience of the artist during the art-making process. Kay (1991) empirically examined creative problem solving in relation to artistic expertise. Here a range of spatial ability, problem-solving and problem-finding tasks were given to non-artists, semi-professional and professional artists. Different strategies for such tasks were found dependent on artistic expertise; but professional artists were particularly found to use their experiences from art-making. As aesthetic experiences are used to construct ideas and aid thought processes when creating art (Mace and Ward, 2002) so were they used here. Current research further extends this examination of the art-making process by also considering the aesthetic experience of the perceiver of the final product.

1.5 A Model of Aesthetic and Art-making Experience

Tinio's (2013) "Mirror Model of Art" presents stages of the art-making experience that are then related to the aesthetic experience of the perceiver. Further conclusions are made on creation and perception being linked, as is pleasingness. The acts of production, perception and enjoyment are suggested to all be integrated as the artist behind the artwork conceptualises the artwork and imagines how the perceiver will interact with the final work. The artist visually evaluates their work as a perceiver of the final product in order to create something they believe to be aesthetically pleasing (Dewey, 1934; Zeki & Nash, 1999, Zaidel, 2010). Therefore, the cognitive processes involved in the creation of art can be suggested to be similar to the perception of art (Martindale, 2001). Despite an attempt to draw the fields together a division remains between aesthetic and artistic research as empirical studies fail to investigate the aesthetic experience in relation to creative behaviour. The aesthetic and creative experience is suggested to interlink thus the artist considers the perceivers aesthetic response during creation and in contrast the perceiver considers the artists' creative process during their aesthetic experience. Here, Tinio's model and the stages of aesthetic and artistic experience that form the relationships between artist and perceiver are explained in more detail.

1.5.1 Tinio Model

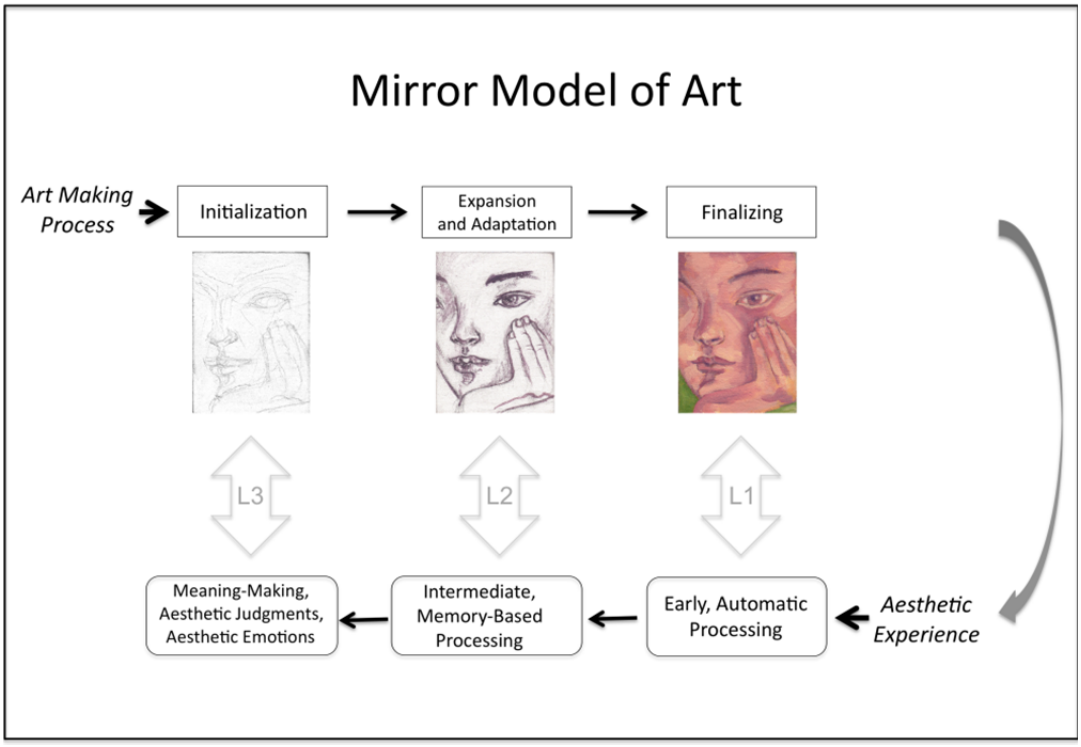

Figure 1.3-Tinio (2013) Mirror Model of Art

From the work of Mace and Ward (2002), Tinio (2013) suggested a mirror model of art that posits a direct relationship between the artist and perceiver (see figure 1.3). The process it takes to construct an artwork is experienced in a reversed fashion by the perceiver. The initial, early, automatic processes during observation which relate to colour, texture and style link to the final stages of art-making where the artist emphasises these features. More on-going experiences which are memory based relate to the actual content that is included in the artwork during the expansion stage. More in-depth evaluations and aesthetic judgements relate to the motivations and decisions of the artist and link to the initial stages of art-making. These stages of art-making and the aesthetic experience are not linear and can be revisited during the process. The art-making stages relate to the phases represented in Mace and Ward's (2002) model, and the aesthetic experience stages relate to the line of processing found in Leder et al, Chatterjee and Locher et al's, models of aesthetic experience. Here, Tinio explicitly links the artists' art-making process to the aesthetic experience of the perceiver. The connections

between the different stages of art-making and aesthetic experiences are depicted but a lack of research has been conducted examining these relationships (Tinio, 2013).

1.5.1.1 Stages of Aesthetic Experience

In line with all major models of the aesthetic experiences (Leder et al., 2004; Chatterjee, 2011; Locher et al., 2010), the stages of the aesthetic experience of Tinio's (2013) model build from early to late processing that culminates in a response. Initial aesthetic responses when art is observed are influenced by bottom up processing of the low-level features. The colour, texture, luminance and motion from the art are processed in early visual areas such as MT. The individual elements that make up the artwork are perceived before the content and an overall gist or impression of the image is made (Chatterjee, 2011; Chatterjee & Vartanian, 2014). The initial exploration of an artwork enables the perceiver to get a general impression of the work prior to a second phase where more focus is made on the detail and specific features presented in order to form aesthetic judgements (Locher et al., 2007). The intermediate stages of the aesthetic experience can be both automatic and deliberate where the content and artistic style of the artwork becomes important. The perceiver uses more of their memory and experience with art when examining the image. The elements perceived early on are grouped together in order to visualise the image as a whole. The later stages of the aesthetic experience lead to an aesthetic judgement being formed. This stage involves deliberate evaluation of the artworks where experience of art and knowledge becomes important. The viewers attempt to understand the meaning of the work. At this stage, top down processing is involved as active and effortful cognition is required to analyse the artwork (Leder et al., 2004; Tinio 2013).

1.5.1.2 Stages of Art-making

Building on the work from Sapp (1995), and Mace and Ward (2002), Tinio suggests three major stages of art-making that moves from idea creation, to the

execution and the finalising of the art piece. The initial stage of art-making involves exploring ideas before considering which idea is most ideal and viable to complete. During early stages of art-making an artist must decide which of their ideas they will further develop (idea selection). This decision is important and is classified as the idea selection step which may be influenced by the artist's aesthetic experience. Idea selection can be influenced by rough concepts that have a personal impact which relate to an artist's project that is interesting but also feasible (Mace & Ward, 2002). During this stage of art-making sketches can be produced in order to develop the idea further and outline the overall structure of the artwork. This can be an extensive process before one idea is selected (Sapp, 1995). Finally, underdrawings, particularly when painting, are produced after making a decision on which idea will be taken further. Initial marks are produced on the canvas for example, as the first layer of the artwork is created. The intermediate stage of art-making involves expanding and modifying the current artwork. Here, underdrawings can be further developed, content can be added or removed and the shading of elements may begin. Adjustments are made in order for the artist to be satisfied; some things may appear to no longer be feasible or certain features were not considered in the initial stages of art-making. This stage involves continuous change and development and the original intentions of the artist may also be modified due to the amendments made here. The content is therefore very crucial here in order to portray the characteristics of the artwork. The final stages of art-making involve making enhancements to the artwork demonstrating that it is near to completion. Here, there is less importance put on the content and structure of the artwork but more emphasis on fine-tuning the colours, textures and the layer that first captures the perceiver. The additions made here lead to the completion of the artwork and can make low level features of the art-making process more apparent. The prior stages of art-making which can involve the layering and brushstrokes for example, are emphasised here as these aspects can influence the visual appeal of the artwork (Tinio, 2013).

The models presented by Mace and Ward and by Sapp explaining the art-making process are complemented by Tinio's model where a connection is made between the art-making and aesthetic experiences. However, direct research has not been

conducted looking at the artist's aesthetic and art-making experience which should be carried out if the fundamental aspects of art-making and perception are related. In addition, it is also important to directly analyse how the perceiver can be influenced by the artist (Tinio, 2013; Vartanian, 2014).

1.6 Measuring Aesthetic and Art-making Experiences

1.6.1 Aesthetic Measures

When conducting research on the aesthetic experience it is important to use suitable measures to accurately understand aesthetic responses. To measure aesthetic experiences, both subjective measures and more objective measures can be used. Aesthetic ratings can be gathered using two-alternative forced choice tasks and likert scales, for example by rating pleasingness of stimuli from very displeasing to very pleasing (Plumhoff & Schrillo, 2009). Pleasingness and interestingness scales for example have been implemented in past experimental procedures, however Kirsch, Urgesi and Cross (2016) state that there is a need of better measures of aesthetic preference. Understanding responses to art can be further examined using scientific methodology and techniques including self-reports, measurement of brain activity, analysis of the artworks themselves and examining the observers' viewing behaviour (Saunderson, Cruickshank & McSorley, 2013), more specifically using galvanic skin response (GSR), functional and magnetic resonance imaging (fMRI) and eye-tracking (Palmer, Schloss & Sammartino, 2013).

GSR is a measure of physiological arousal which is particularly useful to understand emotions. When presented with an image the emotional arousal can lead to the skin sweating producing changes in its electrical resistance. Therefore, GSR is a more direct approach of how an image impacts the perceiver. This may be more ideal than using likert scales measuring emotion (Ramachandran & Hirstein, 1999). In addition, aesthetic ratings of images have been found to correlate with increases in arousal. Krupinski and Locher (1988) found more complex stimuli to induce greater arousal leading to participants giving higher aesthetic ratings to such images. Such methods have been more widely used with music. For example,

both joyful and horrific forms have been found to elicit higher arousal, with exciting music increasing arousal more so than neutral music (VanderArk & Ely, 1993; Zimny & Weidenfeller, 1963).

Recent studies have introduced neuroimaging techniques in order to explore brain activation during aesthetic experiences (Chatterjee & Vartanian, 2016). fMRI has been particularly used to examine how aesthetic appreciation affects the brain. When viewing paintings, different areas of the brain have been found to be activated dependent on the paintings being perceived as beautiful or ugly (Kawabata & Zeki, 2004). Neuroimaging studies have examined aesthetic evaluation of paintings, faces, music and geometric stimuli showing brain areas linked to reward to be particularly activated. In addition, artistic expertise has been found to modulate activation of brain areas (memory and reward related) during aesthetic evaluation (Kirk, Skov, Christensen & Nygaard, 2009). Moreover, Chatterjee and Vartanian (2016) indicate how neuroimaging studies have found similar areas within the limbic system to be activated due to both pleasure and reward, and with the pleasure and wanting of art. They therefore suggest that this can explain why we tend to want what we like.

Eye-tracking can be used to measure aesthetic responses and is a technique which provides objective data. Eye-tracking is a useful measure for understanding preference and the aesthetic experience with visual art (see section 1.6.1.2). The aesthetic experience can be influenced by bottom up and top down processing, eye movements can also be subject to both bottom up and top down processes (Locher, 2006; 2015). Eye movement data provides an understanding on the manner of which the structure and content of stimuli are observed and processed, thus gaze and preference can be influenced by the low-level visual features of the images which support the bottom up processing hypothesis (Locher et al., 2007). However, dependant on the task, stimuli and the experience of art-viewers, then gaze and aesthetic responses can also be influenced by top down processing (Hristova, Evgenia, Severina Georgieva, Maurice & Grinberg, 2011).

Many new developments have arisen providing useful research methods to further understand aesthetic experiences and responses. Laboratory studies are more

advanced allowing for various measures, such as eye-tracking, to be used to gather aesthetic responses. Additionally, this allows for multiple measures to be simultaneously used in studies gathering both objective and subjective responses (Leder & Nadal, 2014). Although we explain the usefulness of many methods examining the aesthetic experience, here we provide further explanations of aesthetic ratings and eye-tracking methods that are particularly useful for exploring the links between art-making and aesthetic experience.

1.6.1.1 Pleasingness and Preference Ratings

Responses to pleasingness and interestingness have been used to understand which stimuli are aesthetically preferred. However, interestingness and pleasingness are suggested to be two separate entities. It may be important to measure preference as a whole, although the majority of studies isolate one aspect and generalise results as aesthetic preference (Russell, Gray & Grey, 1991). Turner and Silvia (2006) explain that to determine something as interesting does not necessarily require appraisal of its pleasingness, an interesting item can also be unpleasant. On the other hand, interestingness can also be translated into what is pleasing in some circumstances (Ramachandran & Hirstein, 1999). Therefore, some studies intertwine the meanings of pleasingness and interestingness. Christman and Pinger (1997) requested participants to make aesthetic judgements based on the pleasingness or interestingness of the stimuli with no clear definition of the two and assumed that the result of each would correlate. When Russell (1994) compared aesthetic preferences, pleasingness and interestingness, their findings showed strong correlations between the three factors, particularly for visual stimuli. These results may be difficult to generalise dependent on the stimuli being measured, but in terms of visual stimuli, in this case colour preferences, then aesthetic preferences, pleasingness and interestingness appear to lead to similar judgements, thus use of any one measure would lead to a similar overall aesthetic rating. More recently Blijlevens et al. (2017) found five scales to highly correlate and be regarded as reliable measures of aesthetic pleasure, these include; “beautiful”, “attractive”, “pleasing to see”, “nice to see” and “like to look at”.

However, Calvo-Merino, Jola, Glaser and Haggard (2008) conducted a study on dance and found that only aesthetic ratings relative to liking and disliking and no other aesthetic criteria, such as interestingness, led to increased activity in the right premotor cortex and visual regions. The participants were aware that the study was dance related, but conclusions suggest that an implicit aesthetic evaluation of dance is made during observation. Such research has led to the aesthetic dimension of liking being utilised more commonly.

Aesthetic preferences can be measured to understand the aesthetic experience, as aesthetic preferences are part of the overall aesthetic experience and are largely accepted as an outcome of this (Leder et al., 2004; Chatterjee, 2011; Locher et al., 2010; Tinio, 2013). However, there are discrepancies between the accuracy of understanding the experience from an artistic and philosophical perspective compared to a scientific and psychological view. From a philosophical perspective, strong aesthetic experiences may not be simply about preference and beauty as it is suggested that artists may in fact create something ugly and displeasing and not necessarily beautiful. However, art that depicts beauty and ugliness are made to be aesthetically appealing as the artist considers the perceiver during creation (Küplen, 2015). In addition, people have been found to enjoy disgusting objects when framed as artworks and artistic photographs, as a disgusting object can be presented in an aesthetically appealing way (Wagner, Menninghaus, Hanich & Jacobsen, 2014). Chatterjee and Vartanian (2016) do however express a greater need for exploring more than aesthetic preference to understand more of the aesthetic experience. Thus, they explain the need to consider other experiences and emotions such as sadness, fear, interest and surprise. Aesthetic experience involves more than preference and can be influenced by a range of emotional responses (Vessel, Starr & Rubin, 2013). In addition to this, aesthetic experiences can lead to wanting and reward thus it is important to consider other decisions associated to the aesthetic experience (Chatterjee & Vartanian, 2016). Moreover, more objective measures as presented are required to further understand aesthetic experiences (Palmer, Schloss & Sammartino, 2013).

1.6.1.2 Gaze Behaviour: A Measure of Preference

Eye movements enable us to perceive the world allowing detailed information from a scene to be processed. Within cognition and perception research, eye-tracking is widely used to measure gaze patterns as a proxy underlying information processing. When viewing a scene, attention appears to be linked to fixation and saccadic patterns in eye movements (Rayner & Pollatsek, 1992; Findlay, 2009). Thus, eye movements can be found to be influenced by informative parts of visual scenes or task relevant information (Yarbus, 1967; Hayhoe, Shrivastava, Mruczek & Pelz, 2003). Eye- tracking methods can also be used to understand the decision-making process as gaze has been found to reflect decisions. When presented with two images and requested to make a preference, gaze has been found to gradually shift towards the preferred item with fixations made prior to selection being on the image preferred (Shimojo, Simion, Shimojo & Scheier, 2003). Glaholt and Reingold (2009) introduced a non-preference related task and continued to find a similar effect showing the importance of last fixations during a decision-making task. Further research from Glaholt, Wu and Reingold (2009) enabled preference and choice for the image an individual found most attractive to be predicted. Gaze correlated with images selected and rated as preferable enabling the researchers to accurately and consistently predict preference.

Current research further portrays eye-tracking methods to be useful for understanding aesthetic preferences. Plumhoff and Schrillo (2009) identified that images rated as pleasing led to greater fixation durations over time than those rated as displeasing. To understand the effect of preferences on gaze; fixation durations, number of fixations and first fixation directions have been used (Holmes & Zanker, 2012), where gaze is found to be towards aesthetically preferred stimuli, even when a large number of images are displayed. However, Isham and Geng (2013) did not find gaze (fixation duration and last fixation) to be influenced by aesthetic value during both an irrelevant and a free-viewing task. They conclude that more time was spent fixating on participants' choice when making a decision and that preference had no effect on gaze when free-viewing. In contrast, Leder, Tinio, Fuchs and Bohrn (2010) found attractiveness to relate with

fixations, fixation duration and first fixations when free-viewing. They showed that higher face attractiveness led to greater gaze towards that face when no instruction was provided. Gaze, particularly when free-viewing, has been found to lead to a greater feeling of movement from the displayed stimuli (illusions). Thus, providing no instruction encourages more interaction with the stimuli (Kapoula, Lang, Vernet & Locher, 2015).

Eye movement data is suggested to be sufficient to form conclusions of an individual's experience without the need to gather responses in other forms. Eye-tracking is a good measure that is less susceptible to gathering socially desirable and appropriate responses that may arise from subjective measures. Furthermore, preference can be acquired efficiently and quickly using a range of diverse stimuli and by presenting fewer trials, as multiple images can be evaluated per trial (Glaholt, Wu & Reingold, 2009). The usefulness of gathering both objective and subjective responses in aesthetic research promotes the use of eye-tracking which can be combined with other measures (rating scales, GSR, fMRI) (Leder & Nadal, 2014).

1.6.2 Art-making Tasks

When conducting research on art-making it is important to consider the best methods for understanding art-making processes, particularly when considering artists. Methods for studying the stages of artistic creativity largely fall into two types, those that directly observe artists or interview artists, and those that reconstruct the working method by examining archive material. However, empirical research is lacking to support current aesthetic and art-making models and research particularly fails to study the interactions between art-making and aesthetic responses (Tinio, 2013; Vartanian, 2014). Here, we present methods that have been used in past empirical research than can provide more understanding of the relationship between both aesthetic and artistic experiences. These methods include a method of production where preference can be derived through participants' own creation, and we also discuss how actual art-making activity influences aesthetic preferences. Laboratory and real-life settings can be used to

explore art-making activities and are encouraged to be used collectively. When combining creative and aesthetic tasks to investigate the overall aesthetic and artistic experience; perception, drawing activity, artist's feelings and decisions become important, thus laboratory studies are required. Methods that promote naturalistic behaviours are ideal, but it is difficult to achieve a greater understanding of the relationships between artist and perceiver without gaining more objective and quantitative data (Davis & Do, 2012).

1.6.2.1 Production Preference

Fechner in 1876 introduced the method of production, where a participant is encouraged to create the image they find most pleasing, as another measure of studying the aesthetic experience (McManus, 1980). Methods of production are important and are useful, but such methods are lacking in existing empirical aesthetic research (Palmer, Schloss & Sammartino, 2013). Little research has been conducted using production methods, but such research does indirectly show similarities between production and preference. More complex designs were created and aesthetically preferred by more creative artists, and less complex designs were created and aesthetically preferred by less creative artists (Taylor & Eisenman, 1964). In addition, methods of production may involve the selection of an image in order for it to be produced. Here, preferences have been found to be dependent on the content of the stimuli to be drawn, despite prior drawing experiences. This can potentially be due to the complexity in producing images, but stimuli preferred for drawing were also aesthetically preferred (Kozbelt, Seidel, ElBassiouny, Mark & Owen, 2010; Guggenheim & Whitfield, 1989). Tal and Ariely (2009) also found that items selected for drawing was dependent on perceived sophistication (complexity/simplicity) where greater complexity was evaluated more highly and thus were more likely to be selected for creation. Boyatzis and Eades (1999) consider children's production, preference and production choice. They found that the productions created and those selected were influenced by gender stereotypical content, further showing a relationship between preference and production. Symmetry has been found to impact art

production with use of symmetry in creations differing dependent on gender and age, however here it has been emphasised that there tends to be disparities between the types of symmetry preferred and those found in productions (Humphrey, 1997; Washburn & Humphrey, 2001). To date studies fail to explore the relationship between preference and production directly considering those familiar with the art-making process and those with less experience.

Current art-making models explicitly outline the artistic experience; thus, it is ideal to explore this artistic experience in empirical studies. Drawing is a behaviour that begins at an early age that has been studied with a range of cultures, age groups and expertise. Drawing is a useful method for research that aims to combine art-making practices with aesthetic measures. Drawing tasks, although are lacking in aesthetic research are widely used in creativity research involving for example, drawing after viewing stimuli, drawings of animals and objects, drawing in response to verbal stimuli and gathering drawing preferences (Chen et al., 2002). There is little evidence supporting the relationship between drawings, cognitive processes and the aesthetic experience, as well as ideas for drawing production (Garner, 2008). Drawing choices have been examined to understand what individuals select to draw or recreate but have not been empirically investigated inside the realm of art-making. However, when Groenendijk, Janssen, Rijlaarsdam and van den Bergh (2013) used a self-report measure to gather information about peoples' creative drawing activity they included the question "which image would you choose to further develop?" Participants were found to spend very little time making this decision, especially in comparison to other decisions and activities that were recorded.

1.6.2.2 Drawing Behaviour

In conjunction with the impact of production, or specifically drawing preference, the actual form of drawing can also be used as an art-making creative task to understand links between production and the aesthetic experience. As ideas develop and are selected during the art-making process, the act of drawing can become important in allowing the artwork to take shape. This behaviour may not

be deliberate and can be unconscious as the concept and feelings towards it develop (Mace & Ward, 2002). From field study observations of artists, it is not uncommon for an artist to move their paintbrush in the air before painting. Their hand movements may be an important function in the art-making experience. However, there is a lack of research which investigates the importance of hand movement behaviour (Yokochi & Okada, 2005). When drawing Kanji characters (Japanese ideographs) participants were also found to move their fingers in the air concluding that people use their body to remember Kanji Characters. Similar activity may be required when drawing a picture as a form of memory or practice and preparation for drawing (Sasaki & Watanabe, 1983).

1.6.3 Aesthetic and Art-making Experience

While the aesthetic experience of the viewer and the art-making process has been examined using multiple methods, there has been very little attention examining the relationship between the aesthetic and art-making experience. Indeed, to date only a few studies have isolated behaviour associated with the art-making process to examine how interactions with and knowledge of these behaviours influence the aesthetic experience of the perceiver. Generally, these studies focus on the artists' actions when creating art and its impact on the perceivers' aesthetic experience. Three key papers that have presented research that examined this are Leder et al. (2012), McLean et al. (2015) and Ticini et al. (2014).

Leder et al. (2012) aimed to understand how aesthetic experiences could be related to the artists' actions when creating a painting. To examine this, participants were asked to mimic artists' actions whilst viewing artworks. It was hypothesised that the aesthetic experience of the viewer would be dependent on the relationship of their actions with the artists' actions such that congruent actions would induce an increased liking rating. They were presented with brushstroke and pointillism paintings while they manipulated their hand action to match the action the artists' performed when creating the artworks. Three groups of participants were either requested to tap a pencil at their own pace on a table (a stippling action to match that used to create pointillism paintings) or move a pen

in stroke lengths of approximately 20 cm on the surface of the table (a stroking action to match the action used to create brushstroke paintings). One group, the control group, made these actions five minutes prior to observing the artworks and making their judgements. The other two groups performed one of these actions (either stippling or stroking) during observation. Their hand actions could not be viewed during the experiment. After viewing each artwork, participants gave a liking rating using a computer keyboard. In line with their hypothesis they found an effect of congruency: participants making stippling actions preferred pointillism paintings compared to brushstroke paintings, in contrast those making stroking actions preferred brushstroke paintings compared to pointillism paintings. From this they suggest that artists' actions influence the perceiver's aesthetic judgements of art, such that simulating the painter's style provides a feeling of embodiment in the perceiver that positively influences their aesthetic experience.

There are many aspects of this study which should make us hesitate before we accept such an interpretation. First, the participants were informed that the aim was to consider the impact of repetitive actions on aesthetic experiences encouraging them to consider all factors of the artwork such as painting technique specifically. These instructions are questionable and could lead to demand characteristics in that participants may be more aware of their own actions and how this could influence their overall aesthetic judgements. It is interesting to note that the introduction of these demand characteristics may have acted to circumvent their efforts to minimise the potential confound of participants viewing their own hand movements on their aesthetic experience. Second, aesthetic liking ratings were collected using a key press. This is a form of tapping motion that may have interfered with the aesthetic experience of the participant. Leder et al's. (2012) results suggest that there is little interference; however it remains less than an ideal method of collecting responses in these types of tasks. Third, stimulus presentation duration was not reported, thus making it difficult to know exactly how long participants spent producing stippling and stroking actions. Finally, Leder et al. (2012) report potentially important results that are not raised for further discussion. They find a main effect of art style, but it is

unclear which style was preferred. They report a three-way interaction between art style, hand actions and participant group which they don't fully explain. It is unclear the extent to which those participants carrying out actions during the trials differ to the control group.

Following on from this, McLean et al., (2015) initially replicated Leder et al's. (2012) method to test the robustness of their results. Although it is worth noting, that unlike Leder et al., where no marks were made, here participants produced lines or dots on paper with a pencil. Furthermore, participants were required to tick aesthetic ratings on paper instead of using a key press. In contrast to Leder et al's., findings, they report no effect of action congruency on aesthetic liking but there were generally higher ratings for brushstroke paintings. They suggest that greater awareness of the link between participants' actions and actions of the artist may be required for liking to be influenced. It is unclear why they make this suggestion as in both studies participants were not explicitly aware of the link.

In an attempt to make the link more explicit they used the pencil marks of participants from experiment one as stimuli for experiment two. While participants in experiment two are not explicitly aware of the link between their action and the stimuli, the assumption is that the use of pencil marks provided a more direct connection between the participants' actions and that used to create the stimuli. An effect of congruency was found. Those who made stippling actions preferred stipple images and those making stroking actions preferred stroke images. One clear advantage of using such stimuli is that there are fewer potential confounding factors associated with the content, familiarity and style of the artworks and the technical expertise of the artists that may play a role in the formation of aesthetic liking. On the other hand, one potential problem is that such stimuli may not be classed as art or art-like and thus it may be difficult to relate aesthetic judgements associated with such stimuli to those made when viewing artworks. Supporting this, it is clear that there was a general reduction in liking ratings for these stimuli compared with the first experiment.

In a final experiment participants were shown artworks and some were made explicitly aware of the link between their own actions and the actions of the artist performed while creating them, although the direction of this relationship, i.e. potential to enhance aesthetic appreciation was not made known. In addition to this a number of other changes were made to the design. Familiarity with the artworks was recorded as they suggest that this may account for the lack of congruency effect found in experiment one. Furthermore, a large number of participants with a range of artistic expertise took part. They had a range of training from zero to fifteen years. This change was introduced in order to examine if the effect was stronger for those with more expertise. Participants were asked debrief questions about whether they were aware of the link between their action and the actions of the artist and whether this had an effect on their aesthetic judgements. No differences were found due to expertise. However, those participants who were more aware of the action links showed an effect of congruency but only when making stippling motions. Those who believed their aesthetic judgements would be influenced by their actions and those of the artists showed an increase in liking. As with experiment one brushstroke paintings were liked more, but they were also found to be more familiar. However, this was not found to impact the effect of congruency. They conclude that when using a stimulus that shows a clear representation of action, which relates more to the simultaneous action produced, and when a more obvious connection between the action produced and that used to create the artwork is presented, then this impacts the aesthetic experience more so than implicit, covert links.

In the final study to be considered in this section, Ticini et al. (2014) further explored the associations between the aesthetic experience and the putative links between actions produced by the viewer and those used by the artist to create the artworks. They did this by attempting to strengthen those links by introducing a training phase in which they asked participants to produce a movement on the basis of an image of a hand holding a paintbrush. If shown a hand which was poised to make a stippling movement then participants were required to elicit a stippling movement using paint and a paintbrush. If shown a hand poised to make a stroking movement then participants were required to elicit a stroking

movement using paint and a paintbrush. Finally, if the image showed a hand placed palm down on a table, participants were asked to place their hand on the table in front of them. After taking part in the training phase the assumption was that the links between the images and the participants' action responses would be strengthened such that they could be used to act as primes to produce covert sub-threshold activation in the motor system. This covert sub-threshold activation would then have an interactive effect with artworks that were created with congruent action.

In the testing phase only pointillism artworks were employed. A random hand prime was presented briefly prior to each artwork. These were the same images as used in the training phase and could represent stippling, stroking or no action. Each artwork was shown for three seconds. A liking rating was gathered using a key press. They found artworks to be liked more when preceded by a congruent hand prime (stipple prime) in comparison to an incongruent hand prime (stroke prime), but no differences were found in relation to the no action prime. A number of potential explanations of these results are presented. They conclude that covert action simulation leads to greater aesthetic appreciation of art. To account for this, they put forward two potential explanations: mirror neuron mechanisms and processing fluency. Brain areas in non-human and human primates have been shown to systematically respond to the actions of others (Rizzolatti & Sinigaglia, 2010). These have been labelled mirror neuron mechanisms. Aesthetic experiences could then be suggested to be the result of a sympathetic response in the mirror neuron system whilst viewing artworks. In terms of the results reported here, the hand primes activate mirror neuron mechanisms which have a differential effect on the aesthetic experience of incongruent and congruent artworks. With regards to the processing fluency explanation, the ease with which artworks were processed could be enhanced by observing congruent hand primes prior to artworks. Greater processing fluency would lead to greater aesthetic liking of artworks.

It is worth emphasising that only pointillism paintings were included here. In order to generalise conclusions further then it would be ideal to also use other styles of artworks. Furthermore, participants were allowed to observe their own

hands and productions which may induce an explicit link between the perceivers and artists actions similar to that shown by McLean et al. (2015).

While it is the case that there are mixed results, generally the three studies considered in this section do show a relationship between the aesthetic experience of the viewer and the actions carried out by the artist in order to create artworks. Leder et al. (2012) show a congruency effect with an implicit link between viewers' actions and artists' actions having an effect on aesthetic liking. However, McLean et al's. (2015) results suggest that this is dependent on that link being made more explicit. Furthermore, Ticini et al. (2014) show that a congruency effect can be induced through a training and priming regime which may also depend upon an explicit link between the perceiver and artists actions.

1.6.4 Conclusion

It is apparent that art-making and aesthetic experiences need to be investigated to understand relationships between the artist and perceiver. Different aesthetic and art-making tasks have been discussed in order to produce effective studies that examine the artist and perceivers' experience. A review of this literature demonstrates that use of both subjective and more objective measures is useful for understanding aesthetic experiences, however eye-tracking is a tool which can uncover aesthetic experiences, highlights aesthetic preferences and reveals initial aesthetic responses which can reflect overall aesthetic judgements. Regarding art-making, drawing is a useful act of art-making that is most common and has been used in creativity studies. Drawing preferences and choices can be collected providing information about the artist, and use of drawing activity tasks can provide perceivers with a greater understanding of the artist behind the artwork, subsequently influencing aesthetic responses. After considering the methods that can be used to understand relationships between art-making and aesthetic experiences, it is apparent that studies to date can be improved. It is also important to consider the stimuli that is presented, judged and used as options for production.

1.7 Stimuli

Before conducting research into the aesthetic and art-making relationship it is important to consider the stimuli used to investigate these. For example, images which have been used in previous aesthetic research may not be appropriate for understanding initial art-making decisions. Here we will discuss the types of stimuli that are useful for aesthetic and art-making research and the collative variables that can be manipulated within stimuli or by the artist to impact aesthetic experiences. The style of the stimuli is important for the aesthetic experience and style relates to the way in which the artwork was created and can differ between each artist. Here, we further discuss the factor of style, the automatic and more deliberate processes of style that impact the aesthetic experience, and the features used by artists in order to create certain styles of art. Thus, the artist behind the artworks being presented is also important to consider.

1.7.1 Artistic/Non-artistic Stimuli

To understand aesthetic experiences, the perceivers perception of the artwork or art-like stimuli and the properties manipulated in these are important (Leder et al., 2004). Artworks are not the only forms that elicit an aesthetic experience but the art-making process is a factor that differentiates art from many other forms that can be aesthetically appreciated, as the artist and their behaviour, intentions and actions are important here unlike the designer of products and/or objects (Tinio, 2013). Berlyne suggested that art is a stimulus that could be measured and the consequential behaviour observed, and much current research utilises art-like stimuli in experiments analysing the collative variables which will be discussed (Silvia, 2005). Abstract patterns and geometric shapes (non-art) have also been used in research to understand aesthetic judgments. However, such studies are suggested to be better supported if art-like stimuli are also included in similar methods (Gartus & Leder, 2013; Jacobsen, Schubotz, Höfel & Cramon, 2006).

Many aesthetic models have been developed using results from simple non-art stimuli. Use of such stimuli is not a disadvantage thus there is no need to neglect using these (Chatterjee & Vartanian, 2016). In addition, when we consider

combining aesthetic and artistic methods then non-art stimuli are useful to include. Geometric shapes are commonly used in drawing tasks and are regularly incorporated into drawings as preferences for shapes can vary largely due to individual differences, thus the variation in preference allows for rich data to be gathered (Chen et al., 2002; Chen, Tanaka, Matsuyoshi & Watanabe, 2016). As geometric stimuli can be novel, then researchers are able to reduce the factor of familiarity which has been found to have a significant impact on aesthetic judgements and gaze, particularly due to art expertise (Leder, 2001; Kristjanson, Antes & Kristjanson, 1989). Therefore, the use of both art and non-art stimuli can be ideal for understanding the aesthetic and artistic experience, especially when considering the experience of both perceiver and creator.

1.7.2 Collative Variables

Berlyne identified collative variables as features that are incorporated or can be manipulated within an image that can influence the aesthetic experience. Such factors include novelty, complexity, uncertainty and symmetry (Silvia, 2005). Factors of novelty and familiarity have been previously discussed (see section 1.2.2). Familiarity can be tested in two ways; participants can be presented with stimuli that vary from very unfamiliar to very familiar. Secondly, novel stimuli can be used and the number of times or amount of time this image is presented can be manipulated. Both methods have been found to positively impact aesthetic judgements (Leder et al., 2004).

Symmetry and complexity are considered as important collative variables related to many aspects of science and beauty in the world and for visual design principles (Mainzer, 2005; Creusen, Veryzer & Schoormans, 2010). These two variables are robust and useful for understanding aesthetic judgements when using different forms of stimuli, participants, testing environments and methods (Eisenman, 1968; Eisenman & Gellens, 1968; Tinio & Leder, 2009). Jacobsen, Schubotz, Höfel and Cramon (2006) found symmetry to be the most important element for making aesthetic judgments. Their results showed that symmetrical cues were consistently used to form judgements and symmetrical patterns were generally

rated as the most beautiful. On the other hand, when considering creative tasks, the complexity variable is important (Taylor & Eisenman, 1964; Kozbelt, Seidel, ElBassiouny, Mark & Owen, 2010; Guggenheim & Whitfield, 1989). Kaplan and Kaplan (1989) suggest that complexity is important for aesthetic judgments due to the increase in the number of elements. Complexity is able to be manipulated through the number of elements inside the outer shape, the difference in elements is able to categorise a pattern as simple or complex (Silvia, 2006). Complexity in action has also been found to influence aesthetic ratings. Cross, Kirsch, Ticini and Schütz-Bosbach., (2011) found that dance actions that were harder to physically perform were liked more. Both complexity and symmetry can be important variables to manipulate in stimuli when investigating the aesthetic experience in relation to artistic creation.

When considering art productions in relation to aesthetic experiences there are few studies that have been conducted manipulating the factors of symmetry or complexity. Collative variables are important features which can impact the aesthetic and art-making experience as shown above. Some collative variables, specifically symmetry and complexity can be classified as low-level features of art and images that impact the perceivers' initial aesthetic responses but also later aesthetic responses. On the other hand, these features are also considered by artists in order to attract and influence their observers and can be made part of the artwork at early and later art-making stages. These low-level features which also include the techniques of the artist, colours and textures all impact on the artistic style of the artwork which can strongly influence the aesthetic experience (Tinio, 2013).

1.7.3 Style

One useful method for understanding aesthetic experiences is to present paintings of different styles and gather aesthetic responses of these in order to evaluate how ratings correspond with other measures of the aesthetic experience, for example brain activation (Chatterjee & Vartanian 2016). Style can link the perceptual features to the knowledge used when evaluating art. Being informed about the

artist, art history and different styles of artwork can influence responses when perceiving the low-level features of the artwork. Style can be processed quickly and automatically when viewing artworks, but classification of this style is influenced by expertise (Leder et al., 2004; Belke, Leder & Augustin, 2006). Style classification of abstract or Renaissance art for example was better identified by artists as they had greater knowledge with these than non-artists (Stojilovic & Markovic, 2014). However, artistic understanding is not required to classify artworks into basic styles, mere perceptual exposure to artworks can allow for this classification (Bullot & Reber, 2013). Low-level features in art include techniques, brushstroke thickness, materials used, textures and colours (Wallraven et al., 2009). Style can impact results of studies as there are differences between abstract and representational art. Including abstract images which contain no specific themes can be advantageous. This allows for the pictorial elements within the image to have a stronger effect on the aesthetic experience (Stojilovic & Markovic, 2014). Augustin, Leder, Hutzler and Carbon (2008) found an effect of style. Participants viewed artworks that were different or matched for content with artworks made by different artists. After short presentations of 50 ms participants' ratings for matching artworks were affected due to the different artist, showing that style can be identified after a short period of time. Reid, MacDonald and Du (2012) found that the time spent fixating images that were the same regarding the content, differed dependent on the image being portrayed as a realistic image or a computer sketch.

As previously mentioned, Leder et al. (2012) showed how style had an impact on the aesthetic experience when the techniques of the artist, which impact style, are consecutively made by the perceivers. It was found that when congruent actions to the artist were made, then these images were liked more. Here, brushstroke and pointillism paintings/actions were employed as a form of action and style that was made by the artist. Brushstroke actions can present the artists' original movement providing information about the artists' behaviour. Motor processes are visually presented using brushstrokes, thus motor simulation is able to be evoked in observers. Stippling action can also present information of the artists' actions portraying the tapping and dabbing movements made which can also evoke motor

simulations in the observers (Taylor, Witt & Grimaldi, 2012). Within the first seven seconds of viewing it has been found that the initial reaction to the content of an image could be identified. Within two seconds, reactions to pictures begin although experiences here are influenced more by the low-level features, the pictorial elements, the style and form and not necessarily the overall beauty of the image (Locher, 2006).

1.7.4 Effect of the Creator

It is also important to consider the artist behind the art being perceived. Providing details such as the title and information about the artwork and artist have been found to impact aesthetic experiences (Millis, 2001; Temme, 1992; Kirk, 2009). Alvarez, Winner, Hawley-Dolan, Snapper (2015) found artist abstract paintings to be fixated on more and evoke greater pupil dilation in comparison to abstract paintings produced by children or animals when participants were considering the quality of paintings, despite participants not being informed about the background of the artist.

The authenticity of artworks themselves can lead to drastic effects on the aesthetic experience. It has been found that when providing participants with information on an artwork being a fake or original it affects perceived pleasure, familiarity and aesthetic judgements as well as other variables including the quality and talent of the artist (Leder, 2001; Wolz and Carbon, 2014). Knowledge of original and fake copies have also shown difference in brain activity where the original artworks evoke greater activation (Umilta et al., 2012; Huang, Bridge, Kemp & Parker, 2011). It is suggested that the perceivers of art can distinguish between those that are computer-generated and those that are man-made and this impacts the aesthetic experience with man-made art. Computer-generated artworks were found to be less pleasing. However, when the production process of computer generated art was observed during aesthetic evaluation, then higher aesthetic responses were found (Chamberlain, Mullin & Wagemans, 2015; Chamberlain, Mullin, Scheerlinck & Wagemans, 2017). In relation to this, Sbriscia-Fioretti et al. (2013) found participants to perceive more movements in real artworks in

comparison to modified computerised versions and higher aesthetic ratings were given to these artworks. The researchers suggested that the dynamics of the artworks, where the brushstrokes made by the artist can be perceived, affected these results.

1.7.5 Conclusion

It is clear from the preceding discussion that the choice of stimuli employed when examining a perceiver's aesthetic experience is an important one. There are many features within artworks or stimuli that can be manipulated, and how these are presented to observers can have a dramatic impact on the aesthetic experience. It is apparent that the style of the artwork may impact perceiver's aesthetic experience from early to later processes, and this effect can be modulated by expertise. Moreover, the artist behind the artwork, their expertise, behaviours and ability to portray greater dynamism is important to consider, and more research is needed in this area. In addition, all factors discussed can also influence the artist and their art-making decisions that are made during art production.

1.8 Artistic Expertise

Individuals vary on their knowledge of art and art history, and there have been found to be distinct differences between artists and non-artists regarding art production and aesthetic experiences. Specifically, while models of the aesthetic experience demonstrate how early aesthetic experiences are influenced by low level features such as the collative variables and style of stimuli as previously discussed (see section 1.7), the later stages of the aesthetic experience are influenced by knowledge and thus the experience is suggested to be modulated by the expertise of the perceiver (Leder et al., 2004; Chatterjee, 2011; Locher et al., 2010; Silvia, 2005; Tinio, 2013). Differences in aesthetic experience, art-making experience and gaze has been found due to expertise, thus we discuss further reasons for examining the experiences of both artists and non-artists when making and observing art.

1.8.1 Aesthetic Experience

Models of how art is produced are supported with research (interviews and observations) that has been gathered from artists (Mace & Ward, 2002; Tinio, 2013), and current aesthetic studies involve participants with varied artistic abilities. Therefore, when investigating the relationship between aesthetic experience on art-making decisions and how art is created it is important to consider individual skill and ability. Differences in response to artworks have been found due to expertise. For example, past research shows that complex images influence preference dependent on expertise, thus it is important to gather responses from both novice and more experienced artists (Reber, Schwarz & Winkielman, 2004; Tinio & Leder, 2009). Experienced art viewers and more skilled artists have been found to have a greater preference for complex and asymmetrical stimuli (Winston & Cupchik; 1992; McWhinnie, 1971).

In terms of the aesthetic experience, it has been suggested that the development of this experience can differ between an artist and non-artist particularly considering artworks. It is suggested that each individual has a personal aesthetic that drives aesthetic preferences, but this is used more frequently and can be generalised to other situations more easily by artists (Kay, 1991; 1996). Expertise further influences observation of art, artists are interested in the creative process, thus consider and desire to understand the process and materials used in order to create the art piece. They consider the ideas behind the work as well as the aesthetic appeal (Pitman & Hirzy, 2010; Gombrich, 1995). Reasons behind differences between artists and non-artists' observations of art, particularly paintings, may be due to artists visualising the underdrawings of artworks, whereas non-artists cannot visualise beyond the surface features (Chatterjee & Vartanian, 2016).

1.8.2 Art-making Experience

When we consider the thoughts and decisions of artists it is clear that art-making practices and decisions may also differ due to expertise. The personal aesthetic is more prominent in an artist or designer with greater artistic skills and is used to

direct thought process and decisions, particularly when creating an artwork (Mace & Ward, 2002; Kay, 1991; 1996). Taylor and Eisenman (1964) found that production preferences differed between more and less creative artists, such that more creative artists preferred to produce more complex shapes. Artists regularly analyse their visual world, the elements, objects and scenes which make this and they consider this information in regards to rendering them. Artists have been found to be better at both drawing and perceptual tasks due to their training. Results correlated well between the two tasks and analysis shows that the role of visual processes common for both drawing and perception is influenced by expertise (Kozbelt, 2001). Arnheim (1954) explains how acts of creation and perception are similar as both consist of visually understanding the structural features and patterns presented. Both artists and non-artists undergo this process during creation and perception, but artists' greater art-making abilities and experience leads to them also having greater perceptual abilities. In addition, Kozbelt et al. (2010) found artists' drawings to be more accurate than non-artists; artists were found to make better decisions on what features to include in their drawings, for example their drawings captured specific features of the face being copied, whereas non-artists' drawings were more generic. Artists have been found to possess greater cognitive abilities when completing drawing tasks where actual production is required, but also during mental imagery performance (Calabrese & Marucci, 2006).

1.8.3 Gaze Behaviour

It is apparent from previous research that high level visual processes when exploring artwork differ dependent on expertise. When observing art, gaze patterns have also been analysed and differences due to artistic experience have been reported (Nodine, Locher & Krupinski, 1993; Pihko et al, 2011). Participants untrained in art have been found to fixate longer on individual elements in a composition. More experienced artists however, explore the relationships between these elements; they are interested in the global image and overall composition; thus, it has been suggested that artists process art more deeply (Nodine, Locher &

Krupinski, 1993; Pihko et al, 2011). When presented with different scenes gaze has been found to differ dependent on artistic expertise. Vogt and Magnussen (2007) found that when free-viewing, artistically trained participants spent more time fixating on abstract and structural features within the scene whereas non-artists fixated more on the human features and objects presented within the scenes. In addition, when participants were provided with a second task which was to view the images in order for them to be remembered, then differences in gaze was again found dependent on expertise. The artistically trained participants made more fixations now in comparison to the free-viewing task whereas non-artists made less fixations compared to the number of fixations they made previously. In addition, gaze appears to differ between artists and non-artists dependent on the familiarity with artworks. Artists were found to make longer fixations when viewing familiar artworks whereas non-artists made longer fixations when viewing unfamiliar artworks (Kristjanson, Antes & Kristjanson, 1989).

It is also apparent that gaze differs dependent on expertise when physically engaged in art-making. Miall & Tchalenko (2001) demonstrated that artist's eye movements when drawing differed to when not drawing such that average fixation durations were almost double when drawing. Expertise has been found to impact artistic creations with artists not surprisingly performing better on drawing tasks. In addition to artists having a clear motor advantage, differences are apparent from gaze when drawing. Artists were found to process stimuli more easily (spend less time fixating on the stimulus to be copied) than non-artists regardless of the variations in stimuli (familiarity/complexity) and this is suggested to be due to artistic training and experience (Glazek, 2012).

1.9 Thesis Aims

The aesthetic experience involves interactions with artworks as well as other media which result in responses ranging from pleasure, preference, liking, and interest to disgust, anger, and surprise (Silvia, 2005). Theories associated with the aesthetic experience suggest many ways in which the experience occurs. In addition, there are multiple models that depict how the aesthetic experience

develops, some of which incorporate such theories of familiarity, fluency, prototypicality and mirror neuron activity. Despite differences and emphasis placed on different factors within the various models of the aesthetic experience, they do suggest that the experience begins with perceptual bottom-up processing through to using relevant knowledge and experience involving higher order top down processing. Tinio's (2013) mirror model of art explicitly links this aesthetic experience and the stages from early processing to overall aesthetic judgements to the art-making stages completed by the artist. Thus, the artist and their art-making process are suggested to be considered by the perceiver, influencing their experience and, in reverse, the artist and their art-making process are suggested to be influenced by considering the potential and desired experience of the perceiver. The model provides a foundation to explore the relationships between artist and perceiver.

In order to effectively test the relationships between the creation and perception of art this thesis will present a body of research examining different art-making and aesthetic tasks that investigates art-making decisions and actions of the artist. In order to carry out this work aesthetic preferences and eye movement behaviour of both artists and non-artists are reported. Aesthetic preferences, are part of the overall aesthetic experience and are largely accepted as a good proxy outcome of the aesthetic experience (Leder, Belke, Oeberst, & Augustin, 2004; Tinio, 2013). Eye movements present gaze behaviour throughout the aesthetic experience and provides further understanding of the formation of aesthetic judgements.

The first aim of this research is to examine the suggestion that there are similar cognitive processes involved in the creation and perception of art as both creation and perception consist of visually understanding the structural features and patterns presented (Arnheim, 1954; Martindale, 2001). Art-making models further suggest a link between the aesthetic experience and art-making decisions of the artist (Mace & Ward, 2002). However, current empirical research does not directly explore these relationships. In Chapter 2 we investigate artists and non-artists' aesthetic preferences, drawing preferences (initial art-making decisions) and gaze when presented with geometrical figures to examine the relationships between

preference, production and the process of forming aesthetic and art-making decisions.

A second aim of the thesis is to examine the impact of being involved in an art-making experience on the art-making and aesthetic experience. Art-making models indicate the importance of sketching and drawing prior to making initial art-making decisions, as it aids exploring the ideas generated and ways in which to present these ideas (Mace & Ward, 2002; Tinio, 2013). However, a lack of research has examined how art-making experiences impact art-making decisions. One study that did examine this relationship did not find drawing experience to have an effect on drawing decisions, nor did it impact aesthetic judgements (Guggenheim & Whitfield, 1989). In addition, Tinio's (2013) model suggests that a perceiver's aesthetic experience is influenced by considering the art-making processes of the artist. Some studies have tested these relationships by allowing participants to create congruent and incongruent actions (stippling and stroking) with the art observed showing liking to increase for artworks when producing a congruent action (Leder et al., 2012; McLean et al., 2015; Ticini, 2014). In Chapter 3 we adopt a similar method combining the research discussed by investigating artists and non-artists' aesthetic preferences, drawing preferences and gaze during such processes when presented with geometrical figures (differing in style) and when involved with art-making experiences (making stippling and stroking actions).

A third aim of this thesis is to explore the impact of art-making experiences on aesthetic experiences when observing artworks prepared for exhibition. Many major models of the aesthetic experience highlight an initial stage of aesthetic experience where perceptual properties of the artwork impact automatic responses (Leder et al., 2004; Chatterjee, 2011; Locher et al., 2010; Tinio, 2013). However, Tinio (2013) also suggests that these stages of the aesthetic experience are influenced by the later art-making procedures of the artist, the low-level features of the artwork, the style, technique, texture and colour that can impact early aesthetic responses are particularly emphasised prior to exhibition. Chapter 4 involves a similar method to Leder et al. (2012) incorporating eye-tracking methods to examine the formation of aesthetic judgments when perceivers are presented with artworks and engaged with congruent or incongruent action. In

addition to this, we provide a deeper experience of art-making by training participants and presenting them with hand postures of different artistic actions using a similar method to Ticini (2014).

This research examines part of the framework of the mirror model of art and particularly investigates differences between artists and non-artists' aesthetic and art-making experiences. This thesis begins by directly examining relationships between preference and production of both artists and non-artists providing a foundation to then explore how greater engagement with art-making experiences influence both preference and production choices. Finally, the thesis considers the perceiver of art and their expertise when artworks are introduced examining the impact of artistic actions (simultaneous and trained) on aesthetic preferences. Different stages of art-making progressing from early initial decisions to diverse actions are examined, the effect of expertise, and both aesthetic ratings and eye-tracking measures are used throughout capturing the process of forming aesthetic judgements. This work outlined in this thesis examines the processes that take place during the art-making experience alongside those involved in the formation of aesthetic experiences and provides support for linking existing art-making and aesthetic models as it empirically allows conclusions to be made on the artist, perceiver and artistic-aesthetic experiences. As such, the work provides a foundation for future research to explore relationships which have been previously ignored but recently suggested to be an important area to focus on.

Chapter 2: Aesthetic and Drawing Preference Relationship

2.1 Abstract

There are suggested to be similarities between what is aesthetically preferred and artistically produced, however little research has been conducted that directly examines this relationship and its links to expertise. Here, we examined the artistic process of artists and non-artists using geometric shapes as stimuli, investigating aesthetic (how pleasing they find the shapes) and drawing preferences (which shape they would prefer to draw out of a choice of two). We examined the cognitive processes behind these preferences using eye-tracking methods both when viewing stimuli and when making drawing preferences. Positive correlations were found between images aesthetically preferred and those preferred for drawing regardless of expertise. We find gaze behaviour when free-viewing to reflect behaviour when making a drawing preference as both artists and non-artists fixated on aesthetically preferred stimuli first, for longer and more often. Artists' gaze behaviour during the drawing choice task was influenced by images they aesthetically preferred, and their free-viewing gaze behaviour was influenced by what they would prefer to draw. For non-artists, their gaze behaviour during the drawing choice task was also influenced by images they aesthetically preferred, but only when aesthetic judgments were made beforehand. This suggests that artists have a more fluid relationship than non-artists between images aesthetically preferred and those preferred for drawing. Overall, we demonstrate that there is a relationship between aesthetic preference and artistic preference for production, and this varies with expertise.

2.2 Introduction

There is argued to be an interaction between the aesthetic and artistic experiences involved in producing an artwork (Tinio, 2013). The acts of production, perception and enjoyment are suggested to be integrated as the artist behind the artwork conceptualises the artwork and imagines how the perceiver will interact with the final work. The artist visually evaluates their work as a perceiver of the final product in order to create something they believe to be aesthetically pleasing (Dewey, 1934; Zeki & Nash, 1999). Therefore, the cognitive processes involved in the creation of art can be suggested to be similar to the perception of art (Martindale, 2001; Tinio, 2013). Empirical research largely investigates the experience of the perceiver (those perceiving final works of art) with less work examining the experience of the artist. The art-making process arguably differentiates art from other aesthetic forms that can be aesthetically appreciated, such as products and/or objects that are designed. The artist, their behaviour, intentions and actions are important here. Yet less emphasis in current empirical aesthetic research is put on understanding the artist and their aesthetic experience during the art-making process (Tinio, 2013).

One notable attempt to understand the artistic process was put forward by Mace and Ward (2002). They developed an art-making process model from the perspective of the artist. Through interviews with professional artists they aimed to understand the processes of the artist during the creation of their work. They identified four phases. The first phase is artwork conception, which concerns when and how ideas are initially conceived. The second idea development phase follows as an original idea is adapted and modified if necessary. The third stage is the actual production of the artwork. The final stage involves finishing the artwork and evaluating it prior to exhibition. Sapp's (1995) model specifically focuses on the initial stages of art-making and conscious decisions made. Here, they explore the processes of making ideas and identify the importance of making conscious decisions during the production of potential ideas. Specific focus is put on how one idea is selected amongst others. Mace & Ward suggest that these decisions made by artists, including idea selection as presented in Sapp's model, are influenced by

the artist's own aesthetic experience demonstrating that there is a relationship between the artists' aesthetic and art-making experience.

2.2.1 Aesthetic and Art-making Experiences

Initial art-making stages involve making conscious decisions on what to create. Within Sapp's (1995) model for art idea conception it is explained how multiple ideas of a concept are developed and a process of exploring and selecting ideas occurs until one option is selected to be the most significant for a final concept. However, the model does not explore what influences the decisions that are made during these early stages of art-making. Mace and Ward (2002) also present an idea selection stage where a decision is to be made on what to create and they suggest that the artists' aesthetic experiences impact upon decisions made at this stage and indeed at any stage of the art-making process. They further state how engaging in art-making activities can equally influence the artists' personal aesthetic experience. Kay (1991) also suggests that this personal aesthetic experience is used by an artist to construct ideas and aid thought processes when creating art, and that aesthetic preferences, which are part of the overall aesthetic experience and are largely accepted as an outcome of the aesthetic experience (Leder, Belke, Oeberst, & Augustin, 2004; Tinio, 2013), help guide new art-making and other similar forms of experience. However, no empirical research has directly investigated this relationship. Kozbelt (2017) further addresses how no studies have directly examined how the artists' ideas and development of an artwork is guided by aesthetic characteristics which impact perceiver's aesthetic experiences.

There is some empirical evidence that examines how idea selection takes place, Groenendijk, Janssen, Rijlaarsdam and van den Bergh (2013) used a self-report measure to gather information about adolescent students' (non-artists) creative drawing activity and found that very little time was spent making a decision on what to create. This may be explained by a lack of expertise leading to a failure to consider alternative ideas, thus one initial idea can quickly and directly become the final artwork (Sapp, 1995). Alternatively, it may be because aesthetic preferences are formed in a short period of time that a quick drawing decision can

be made (Locher et al., 2007; Willis & Todorov, 2006). No research to date explores these initial art-making decisions in more depth, however indirect evidence does show some similarities between preference and production which are discussed next.

2.2.2 Aesthetic Preference and Art Production

Indirect evidence from studies of the content of productions shows similarities between images aesthetically preferred and produced. More complex designs were created and aesthetically preferred by more creative artists, and less complex designs were created and aesthetically preferred by less creative artists (Taylor & Eisenman, 1964). In addition, images preferred for drawing have been found to be dependent on the content of the stimuli to be drawn, despite prior drawing experiences. This could potentially be due to the complexity in producing images, but those images preferred for drawing were also aesthetically preferred (Kozbelt, Seidel, ElBassiouny, Mark & Owen, 2010; Guggenheim & Whitfield, 1989). Boyatzis and Eades (1999) consider children's artistic productions, preferences and production choices. They found that the productions created and those selected were influenced by gender stereotypical content, further showing a relationship between preference and production. Furthermore, symmetry has also been found to impact art production with use of symmetry in creations differing dependent on gender and age, however here it has been shown that there tends to be disparities between the types of symmetry preferred and those found in productions (Humphrey, 1997; Washburn & Humphrey, 2001). So, research has reported similarities between preference and production, however there has been no direct exploration of the relationship between preference and production considering those familiar with the art-making process and those with less experience.

To provide more detailed evidence on the cognitive processes involved here, we employed eye-tracking measures in addition to common ratings scales. Eye-tracking is a useful method for understanding preferences and studies have found gaze to reflect aesthetic preferences and choices when observing multiple images (Shimojo, Simion, Shimojo & Scheier, 2003; Glaholt, Wu & Reingold, 2009). Holmes

and Zanker (2012) found greater fixation durations and number of fixations to be made to aesthetically preferred stimuli. In addition, free-viewing tasks, which do not provide the participant with specific instruction, have further shown fixation to be influenced by preference with greater fixation being towards faces regarded to be more attractive (Leder, Tinio, Fuchs & Bohrn, 2010). Thus eye-tracking was used as another measure of preference and to further examine the formation of aesthetic and drawing preferences. Gaze metrics such as first fixation, fixation duration, fixation count and last fixation are useful to examine and have been analysed in past research (Holmes & Zanker, 2012).

2.3 Experiment One

Although previous research suggests that there is a relationship between artistic production and aesthetic preference which may be moderated by expertise, there is little research that directly tests these relationships. Here, we seek to examine these relationships in more depth. Using geometric shapes as stimuli, we examine artists and non-artists' aesthetic (how pleasing they find the shapes) and drawing preferences (which shape they would prefer to draw out of a choice of two). To provide further insight into the process of forming these preferences, we also track their eyes whilst they free-view the images and whilst they make their drawing preferences. To be clear, drawing preference is a term we use in relation to the idea selection/drawing decision stage of art-making. In an attempt to reflect this early selection stage, two geometric shapes are presented, and participants select which "idea" they would prefer to draw. This study aims to provide a greater understanding of how aesthetic preference relates to drawing preference using eye-tracking to further examine these relationships when viewing stimuli and when making a drawing preference:

1. We examine whether aesthetic preferences relate to drawing preferences: are those stimuli that are aesthetically preferred also those preferred to be drawn? Theories suggest relationships between an artists' aesthetic and art-making experience (Mace & Ward, 2002; Kay, 1991) and some empirical research suggests that there are similarities between images aesthetically preferred and produced

regardless of artistic experience, yet no direct test of this has been conducted (Taylor & Eisenman, 1964; Boyatzis & Eades, 1999). Thus, we hypothesise that there will be positive relationships between how pleasing participants find the geometric images to be and how much they desire to create these.

2. Theories suggest that similar cognitive processes are involved when making and observing art (Martindale, 2001; Tinio, 2013). We introduce two tasks (Free-viewing and Drawing Choice) where stimuli are freely-viewed and where a drawing preference is made, we examine gaze to further explore the relationships between aesthetic and drawing preference during their formation. Gaze has been used as a measure of preference and it has been previously found that gaze (fixation duration and count) tends to be greater for aesthetically preferred stimuli. However, it is not clear how aesthetic preferences relate to gaze when freely-viewing images, and as we explore the aesthetic and drawing preference relationship it is interesting to examine if similar findings are found in relation to images that are preferred for drawing (Holmes & Zanker, 2012; Leder, Tinio, Fuchs & Bohrn, 2010). When drawing preferences are made then gaze is expected to be directed by choice, thus by images preferred for drawing (Shimojo, Simion, Shimojo & Scheier, 2003; Glaholt, Wu & Reingold, 2009). If aesthetic preference relates to drawing preference as suggested, then images aesthetically preferred should also influence gaze in a similar manner. Thus, we hypothesize that similar gaze behaviour will be made during the Free-viewing and Drawing Choice task as we expect similar relationships between images aesthetically preferred and those preferred for drawing with gaze (first saccade latency, first fixation direction, fixation duration, fixation count, last fixation duration, and last fixation direction). In addition, we hypothesise that this relationship will be more prominent the more an image is aesthetically preferred and preferred for drawing.

2.4 Method

2.4.1 Participants

A total of thirty psychology students (ages 18-42; 26 females, 4 males) were recruited from the University of Reading and are regarded as non-artists using a background questionnaire. The questionnaire requested the participant to provide the number of years of formal art training (A-level qualification and beyond) they had received (see appendix 2). A participant was regarded as an artist if they had at least 5 years of formal art training and were involved in art-making on a weekly basis. All participants were regarded as non-artists in this study as they had less than 2 years with a mean of 0.13 years of training. All participants had normal or corrected-to-normal vision and each stage of the study was completed by all participants.

2.4.2 Pilot Study

In order to select a representative set of stimuli that would elicit a range of aesthetic and drawing preferences and which would be verified as symmetrical, asymmetrical, complex and simple, a pilot study was carried out. Ten non-artists were involved in a pilot study (they were not involved in the experimental study). Participants categorised stimuli as symmetrical or asymmetrical. They also analysed the complexity of stimuli by rating images on a 7-point scale ranging from 1(very simple) to 7(very complex) on difficulty to draw the image (see Appendix 4). A main effect of image was found for the complexity rating, $F(7, 63)=33.117$, $MSE=0.994$, $p<0.001$, $\eta^2 = 0.786$. However, pairwise comparisons showed complex-asymmetrical images to be perceived as significantly more complex than all other images, including complex-symmetrical images, $p<0.05$. A chi-square was run to test perceived symmetry of each image; all participants rated presence of symmetry or asymmetry accurately, $p<0.05$.

A second pilot study was required due to the results from the first pilot study. The number of elements in a complex-symmetrical image was increased. Ten different non-artists participated in the second pilot study (they were not involved in the

experimental study) and all images were matched for level of complexity and presence of symmetry. A main effect of image was found $F(7, 63) = 28.861$, $MSE = 0.997$, $p < 0.001$, $\eta^2 = 0.761$. According to pairwise comparisons a significant difference was apparent between all complex and simple images; $p < 0.05$. A chi-square was run to test perceived symmetry, all participants rated presence of symmetry or asymmetry accurately, $p < 0.001$. 8 images were selected amongst thirty-two and were grouped into four subsets based on these ratings, each containing two images (see figure 2.1); [complex-symmetrical (subset 1), simple-symmetrical (subset 2), complex-asymmetrical (subset 3) and simple-asymmetrical (subset 4)].

2.4.3 Materials

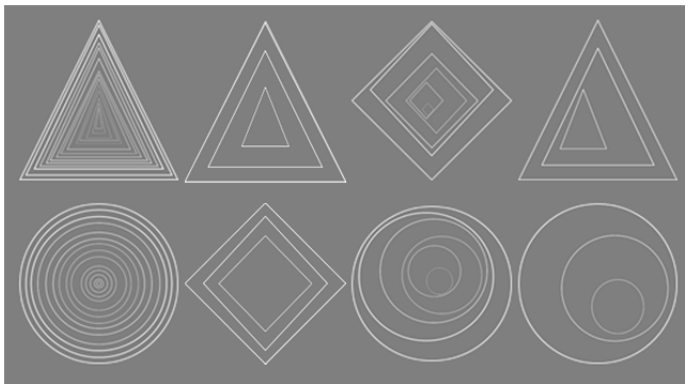

Figure 2.1- Stimuli used in the four subsets. Column one: complex-symmetrical (subset 1); Column two: simple-symmetrical (subset 2); Column three: complex-asymmetrical (subset 3); Column four: simple-asymmetrical (subset 4).

The stimuli included 8 computer-generated geometric shapes that were fully constructed of triangles, diamonds or circles (see figure 2.1). Geometric stimuli provide the participant with potential ideas that do not give too much detail of a final product (i.e. colour and texture) which will not be available at such early stages of art-making. Both complexity and symmetry are manipulated here in order to evoke differences in aesthetic response not as primary experimental

dimensions of interest in their own right (Eisenman, 1968; Eisenman & Gellens, 1968; Tinio & Leder, 2009).

Two scales were used:

- A 7-point scale was used to gather aesthetic ratings [1(very displeasing) to 7 (very pleasing)] (see Appendix 5).
- A relative preference scale was used to categorise drawing responses [1 (indicating a strong preference for the left image) to 7 (a strong preference for the right)] (see Appendix 6). Relative preference towards the two images was calculated by a key press of numbers 1-3 indicating a preference for the left image or 5-7 for the right image (the more extreme values represent a stronger preference), with 4 representing no preference (Park, Shimojo & Shimojo, 2010). This scale provided drawing preference scores for each image from one response and provided detail on how much more the participants wanted to draw one image over another.

2.4.4 Apparatus

Stimuli were presented on a 21" colour desktop PC that had a refresh rate of 75Hz. The distance between the monitor and participant was 57cm. All images were presented on a grey background and sized to 480 x 480 pixels. Stimulus width and height subtended 11.9° and 11.9° of visual angle. Eye movements of the right eye were recorded using an Eyelink II tracker with a sampling rate of 500Hz. A chin rest was used to constrain head movements and participants were placed in a set position. At the beginning of each eye-tracking task a standard 9-point grid was used to calibrate eye movements. All participants calibrated successfully (average error less than 0.5 deg). Calibration was maintained for each trial using a drift correct procedure between each trial that corrected fixation errors due to small movements in camera alignment (e.g. caused by head band slippage).

2.4.5 Procedure

A repeated measures design was used; all participants completed all sections of the experiment. Initially participants read the instructions provided and completed a consent form (see appendices 1 & 2). At the end of the study participants were provided with a debrief form (see appendix 3).

2.4.5.1 Aesthetic Rating Task

Half of the participants gave aesthetic ratings (see section 2.4.3) for all images prior to the eye-tracking tasks (Free-viewing & Drawing Choice) while the remaining participants completed this task at the end of the study. All images were presented for 5000ms prior to making an aesthetic judgement.

2.4.5.2 Free-viewing Task

24 possible image pair combinations were viewed whilst eye movements were recorded and were randomised for all participants. For the free-viewing task a fixation cross was displayed before each trial for 1000 ms then participants were presented with two images for 5000 ms (see figure 2.2). 48 trials were completed at random (all stimuli combinations were presented twice allowing each image in a pair to be presented on either side of the screen); no further information was provided for this task. The Free-viewing task was always completed prior to the Drawing Choice task to avoid bias, and eye movements were recorded during both tasks.

2.4.5.3 Drawing Choice Task

Participants then completed a Drawing Choice task during which eye movements were recorded whilst participants made a preference on which image of two they would prefer to draw (see figure 2.2). 24 possible image pair combinations were viewed; this order was randomised for each participant. A fixation cross was first

displayed for 1000 ms; images were then presented until a preference was made as no time limit was imposed. 96 trials were completed at random (all stimuli combinations were presented four times allowing each image in a pair to be presented on either side of the screen twice). Here, more trials were incorporated as it was expected that the drawing preference scores would be less stable (for example, due to naïve participants' lack of familiarity with making this drawing preference judgement rather than a more common aesthetic preference judgement). We measured drawing preference using a relative preference scale to gather responses on what participants would choose to create and how much they preferred to create this compared to the other image displayed (see section 2.4.3).

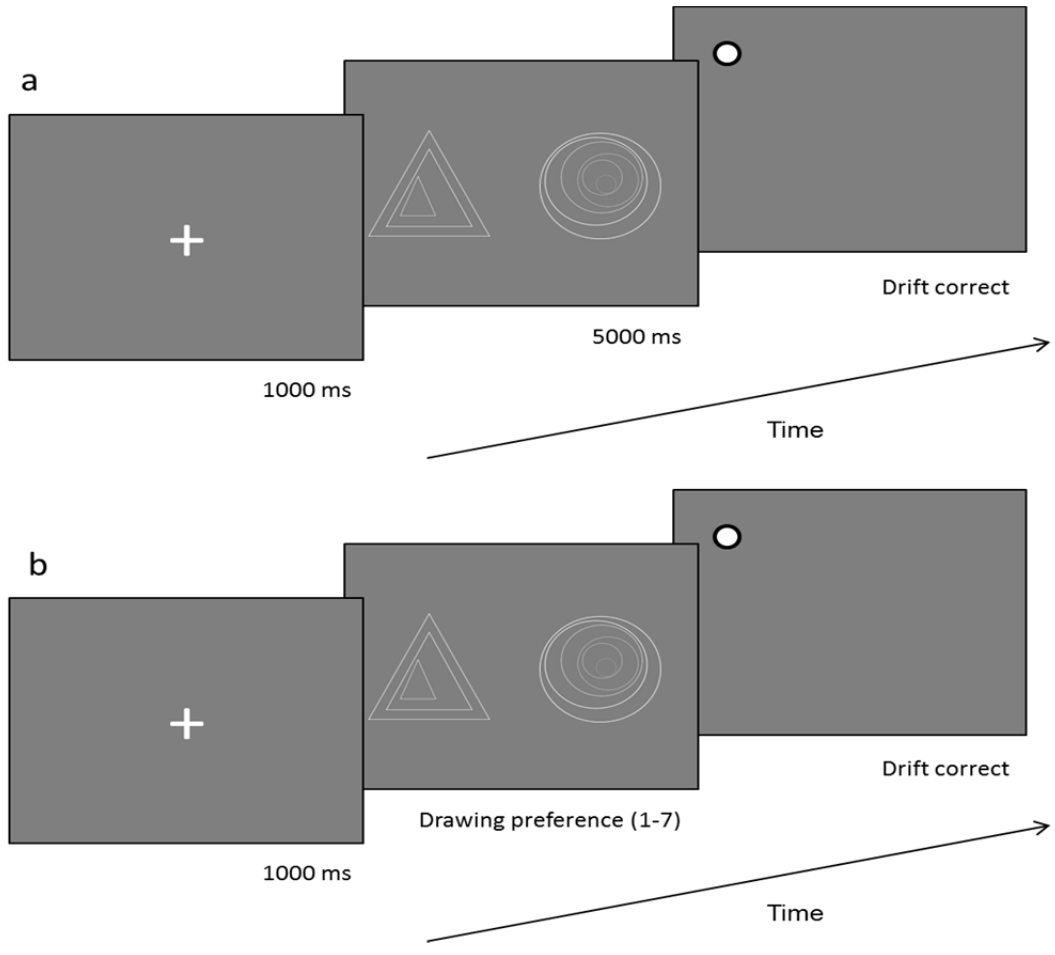

Figure 2.2- Free-viewing (a) and Drawing Choice (b) task trial examples

2.4.6 Eye-tracking Analyses

A variety of gaze metrics were used including first fixation direction (to the left or right stimulus), first saccade latency (the response time from stimuli onset to the start of the first saccadic eye movement response), total fixation duration (the total amount of time spent on each stimulus), and number of fixations (the total number of fixations on each stimulus). In addition, for the Drawing Choice task in which a choice between stimuli is made, the last fixation position (image that was being fixated when choice was made) and last fixation duration (how long the last image was fixated as choice is made) were also reported. Such gaze metrics are useful to examine and have been analysed in past research (Holmes & Zanker, 2012). Fixations were classified as such if they exceeded 100 ms, if fixation along the x-axis was less than 800 pixels then this was regarded as fixation to the left image, if greater than 800 pixels then fixation was to the right image.

2.4.7 Data Handling

Each trial of both the Free-view and Drawing Choice tasks was categorised and the listed gaze responses derived on the basis of the aesthetic rating that participant gave for each image, e.g., the duration and number of fixations made on the most preferred image and the duration and number of fixations on the least preferred image on each trial (answering the question of whether gaze behaviour relates to the images aesthetically preferred). The same trials from both tasks were then reclassified on the basis of the drawing preference score given for each image (answering the question of whether gaze behaviour relates to the images preferred for drawing). Note that trials in which there was no preference found between the images were removed.

2.5 Results

We first report similarities between drawing and aesthetic preferences (Aesthetic Preference and Drawing Preference Relationship Section). Then we report gaze behaviour during the Free-viewing task where trials are classified first by aesthetic preference (Free-viewing and Aesthetic Preference) and then by drawing preference (Free-viewing and Drawing Preference). Finally, we report gaze behaviour elicited during the Drawing Choice task in the same manner as the Free-viewing task: trials classified first by aesthetic preference (Drawing Choice and Aesthetic Preference) and then by drawing preference (Drawing Choice and Drawing Preference).

2.5.1 Aesthetic and Drawing Preference Relationship

To examine the hypothesised relationship between aesthetic ratings and drawing preference scores, separate correlations between these were conducted for each participant and their correlation coefficients were Z prime transformed and subject to a one-sample t-test. This was carried out to examine whether these correlations significantly differed from zero. A significant positive correlation between aesthetic ratings and drawing preference scores was found, r=0.57 (SD=0.432), $t(29)$=6.695, p<0.001, d=1.22. Comparisons were made across the time points at which aesthetic ratings were made and no differences were found.

2.5.2 Free-viewing and Aesthetic Preference

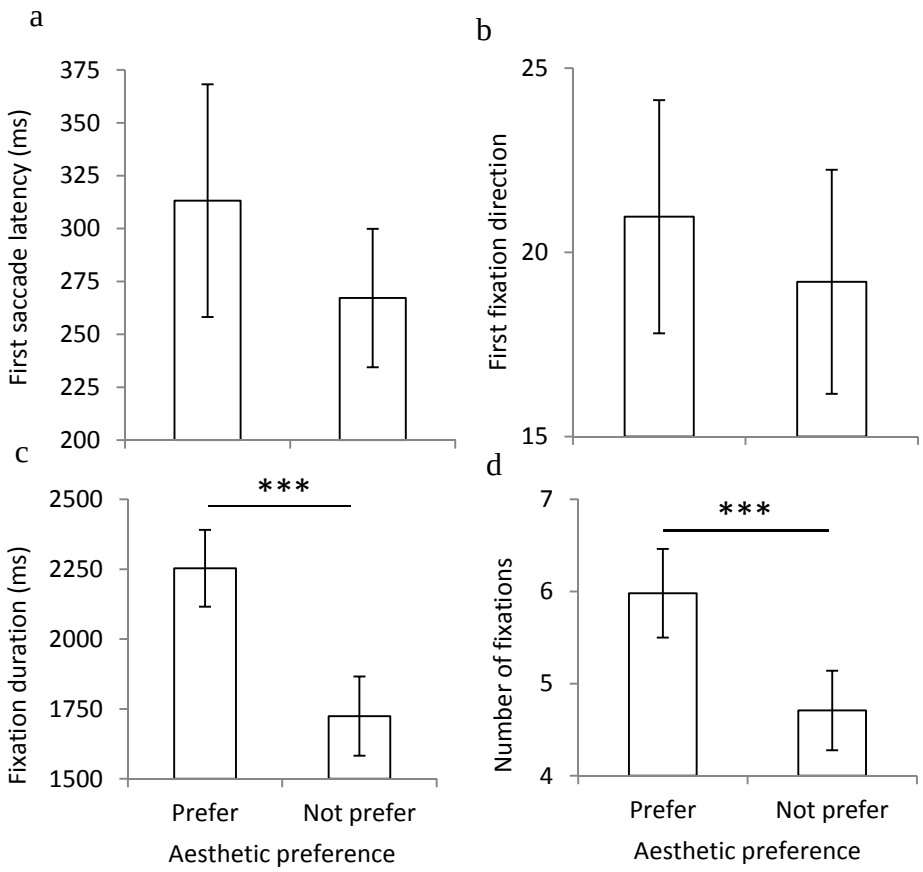

Figure 2.3- Free-viewing task (Aesthetic Preference) shows gaze behaviour when image pairs are classified on the basis of aesthetic preference: gaze on the aesthetically preferred drawing and that on the non-preferred drawing. Upper row shows first saccade response: the latency of the response in milliseconds (Left) and its direction (Right). Lower row shows overall fixation behaviour: mean total fixation duration in milliseconds (Left) and the mean number of fixations (Right). * p<.05; **p<.01; ***p<.001.

	Prefer Means (S.D.)	Not Prefer Means (S.D.)
First saccade latency	313.2 (153.77)	267.19 (91.45)
First fixation direction	20.97 (8.85)	19.2 (8.5)
Fixation duration	2240.75 (372.3)	1733.24 (379.5)
Number of fixations	5.92 (1.32)	4.74 (1.2)

Table 2.1- Free-viewing task (Aesthetic Preference): Descriptive statistics

Figure 2.3 shows gaze behaviour elicited during the Free-viewing task when images are classified by aesthetic preference on a trial-by-trial and participant-by-participant basis. Overall aesthetic preference was found to impact upon free-viewing gaze behaviour: fixation duration (fig. 2.3c) shows participants fixated for a longer period of time on those images they aesthetically preferred ($t(29)=3.984$, $p<0.001$, $d=0.727$) coupled with a greater number of fixations (fig. 2.3d) ($t(29)=4.027$, $p<0.001$, $d=0.735$), however, neither the first saccade latency (fig. 2.3a) ($t(29)=1.923$, $p=0.064$, $d=0.351$) or first fixation direction (fig. 2.3b) ($t(29)=0.581$, $p=0.566$, $d=0.106$) show a difference (see Appendix 10).

A correlation was carried out examining the relationship between aesthetic preference and fixation duration to examine whether participants spend longer fixating on stimuli the more they aesthetically prefer it. Firstly, differences in the aesthetic preference ratings given to each image on each trial were calculated. The proportion of time spent fixating each image was then calculated. The correlation between differences in aesthetic preference ratings and proportion of fixation time was computed for each participant and the correlation coefficients were Z prime transformed. A one-sample t-test was carried out to examine whether these correlations significantly differed from zero. A positive correlation was found, $r=0.111$ ($SD=0.230$), $t(29)=2.584$, $p=0.015$, $d=0.472$. The greater the difference in aesthetic ratings the greater proportion of time they fixated on their aesthetically preferred image. Comparisons were made across the time points at which aesthetic ratings were made and no differences were found.

2.5.3 Free-viewing and Drawing Preference

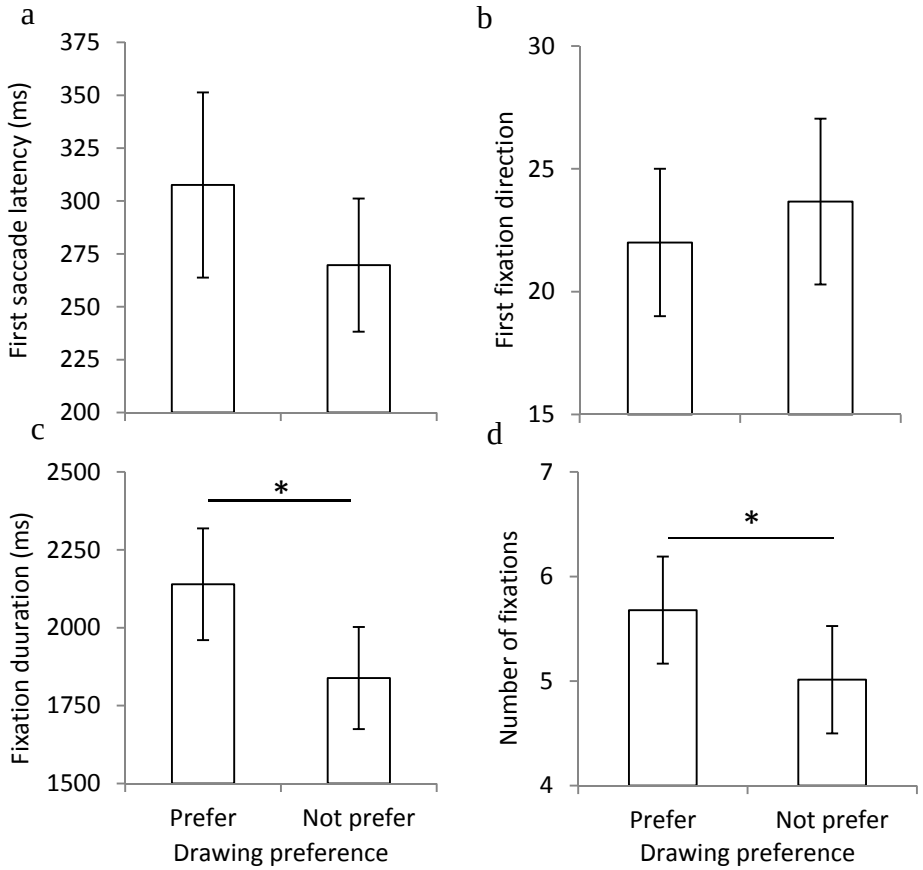

Figure 2.4- Free-viewing task (Drawing Preference) shows gaze behaviour when image pairs are classified on the basis of drawing preference: gaze on the image that would be preferred to be drawn and that on the non-preferred to be drawn. Organisation of figures corresponds with Figure 2.3. * p<.05; **p<.01; ***p<.001.

	Prefer Means (S.D.)	Not Prefer Means (S.D.)
First saccade latency	307.56 (122.28)	269.69 (88.0)
First fixation direction	22.0 (8.39)	23.67 (9.43)
Fixation duration	2153.4 (466.23)	1828.62 (425.97)
Number of fixations	5.82 (1.24)	4.85 (1.15)

Table 2.2- Free-viewing task (Drawing Preference): Descriptive statistics

Figure 2.4 shows gaze behaviour elicited during the Free-viewing task when images are re-classified by drawing preference on a trial-by-trial and participant-by-participant basis. Overall drawing preference was found to impact upon free-viewing gaze behaviour: Fixation duration (fig. 2.4c) shows that images aesthetically preferred were fixated on for longer, (t(29)=2.091, p=0.045, d=0.381) and a greater number of fixations (fig 2.4d) were made to these, (t(29) =2.049, p=0.05, d=0.374). However, no effects were found on first saccade latency (fig. 2.4a) (t(29) =1.560, p=0.130, d=0.285) or first fixation direction (fig. 2.4b) (t(29) =-0.517, p=0.609, d=-0.094) (see appendix 10).

Taking the same approach as adopted in the previous section we examined the relationship between drawing preference and proportion of fixation time in order to establish whether those stimuli that were more strongly preferred for drawing were looked at for longer. No correlation was found, r=0.062 (SD=0.229), t(29)=1.457, p=0.156, d=0.266. The greater the difference in drawing preference scores did not impact the proportion of time spent fixating the image preferred for drawing. Comparisons were made across the time points at which aesthetic ratings were made and no differences were found.

2.5.4 Drawing Choice and Aesthetic Preference

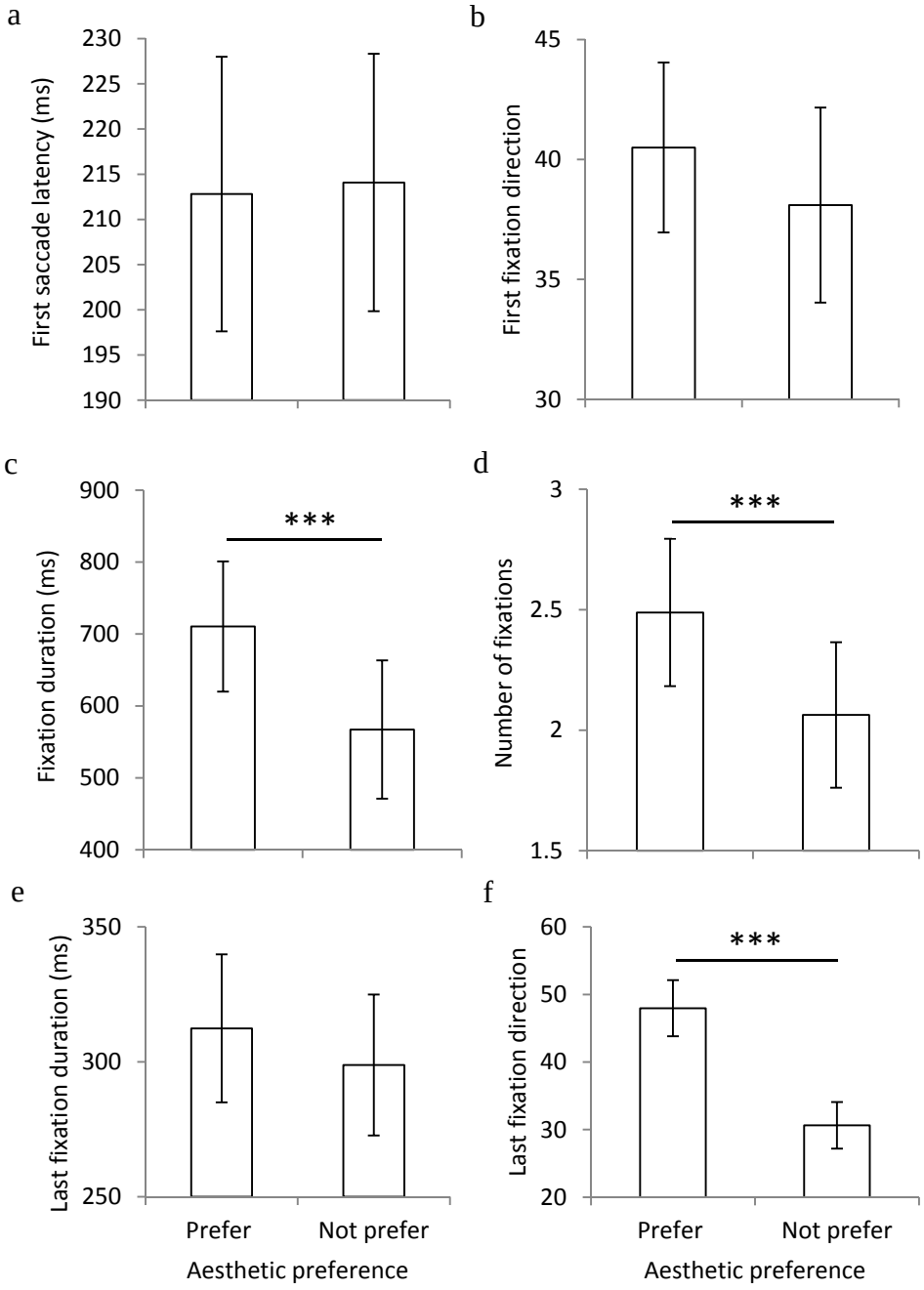

Figure 2.5- Drawing Choice task (Aesthetic Preference) shows gaze behaviour when image pairs are classified on the basis of aesthetic preference: gaze on the image that was aesthetically preferred and that on the non-preferred image. Upper row shows first saccade response: the latency of the response in milliseconds (Left) and its direction (Right). Middle row shows overall fixation behaviour: mean total fixation duration in milliseconds (Left) and the mean number of fixations (Right). Lower row shows last fixation behaviour: total number of last fixation position on each image (Left) and the last fixation duration (Right). * $p<.05$; ** $p<.01$; *** $p<.001$.

	Prefer Means (S.D.)	Not Prefer Means (S.D.)
First saccade latency	212.81 (42.44)	214.18 (39.79)
First fixation direction	40.5 (9.9)	38.1 (11.36)
Fixation duration	710.43 (252.97)	567.18 (268.81)
Number of fixations	2.49 (0.85)	2.06 (0.84)
Last fixation duration	312.39 (76.63)	298.82 (72.91)
Last fixation direction	47.97 (11.59)	30.63 (9.61)

Table 2.3- Drawing Choice task (Aesthetic Preference): Descriptive statistics

Figure 2.5 shows gaze behaviour elicited during the Drawing Choice task when images are classified by aesthetic preference on a trial-by-trial and participant-by-participant basis. Overall aesthetic preference was found to impact gaze behaviour: Fixation duration (fig. 2.5c) shows that participants fixated for a longer period of time on those images they aesthetically preferred ($t(29)=4.212$, $p<0.001$, $d=0.769$) coupled with a greater number of fixations (fig. 25d) ($t(29)=4.320$, $p<0.001$, $d=0.789$), however, neither the first saccade latency (fig. 2.5a) ($t(29)=-0.493$, $p=0.626$, $d=-0.09$) or first fixation direction (fig. 2.5b) ($t(29)=0.693$, $p=0.494$, $d=0.127$) were impacted by preference. The last fixation direction (fig. 2.5f) at the point of making a choice was found to be significantly more likely to be on the aesthetically preferred image ($t(29)=5.008$, $p<0.001$, $d=0.914$), however last fixation duration (fig. 2.5e) was not found to be significantly longer ($t(29)=1.011$, $p=0.320$, $d=0.185$) (see Appendix 11).

We examined the relationship between aesthetic preference and proportion of fixation time in order to establish whether those stimuli that were more strongly preferred were looked at for longer. A positive correlation was found. Comparisons were made across the time points at which aesthetic ratings were made and differences were found, $r=0.089$ ($SD=0.181$), $t(29)=2.648$, $p=0.013$, $d=0.483$. Only those who rated aesthetic rating scales prior to drawing preferences showed significant positive correlations, $r=0.173$ ($SD=0.178$), $t(14)=3.574$, $p=0.003$, $d=0.923$. Those who made aesthetic ratings after did not, $r=0.005$ ($SD=0.114$), $t(14)=0.141$, $p=0.890$, $d=0.0367$. We conclude that for those making aesthetic judgements at the start of the study, the greater the difference in

aesthetic ratings the greater proportion of time they spent fixating the image they aesthetically preferred.

2.5.5 Drawing Choice and Drawing Preference

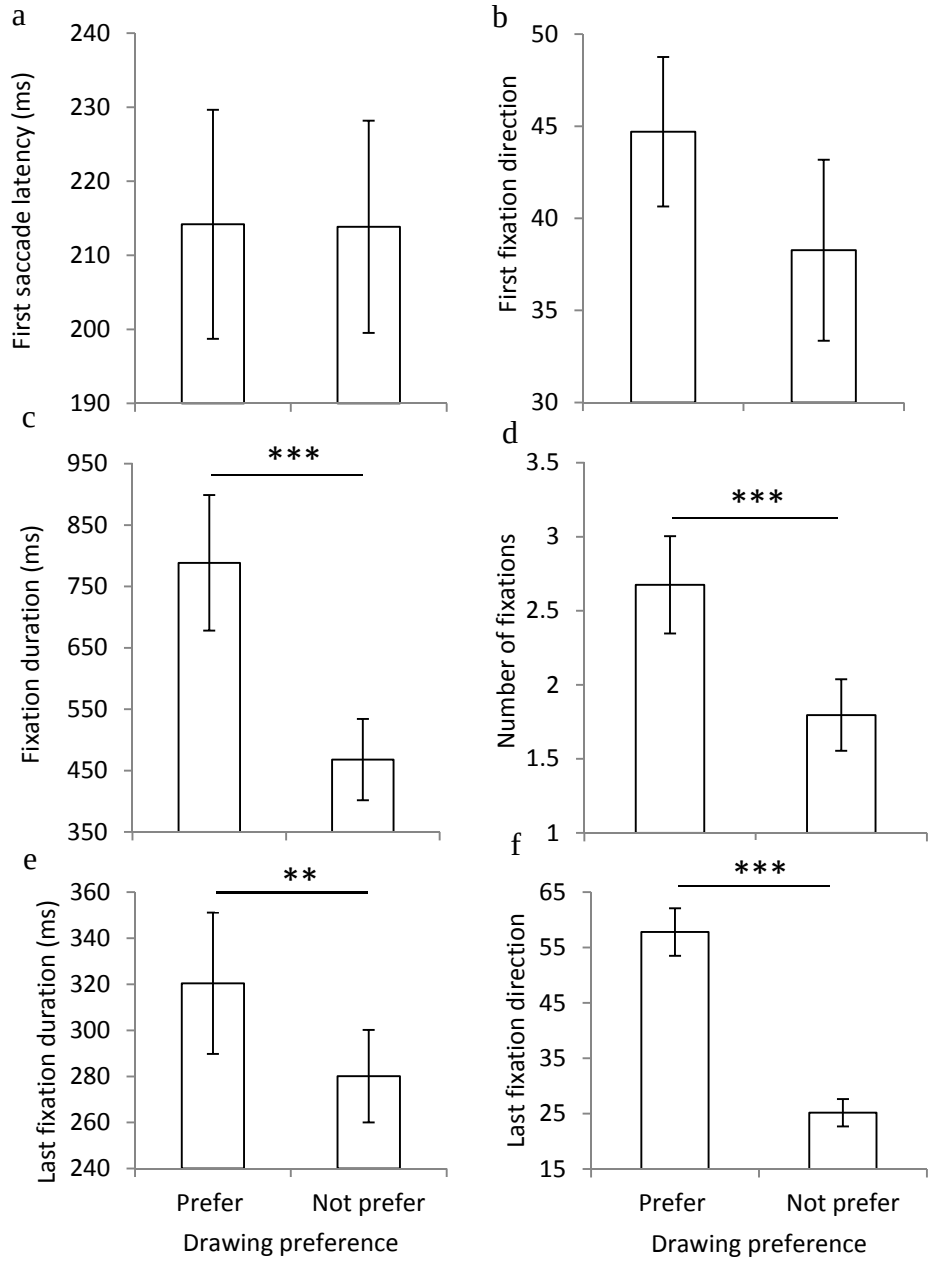

Figure 2.6- Drawing Choice task (Drawing Preference) shows gaze behaviour when image pairs are classified on the basis of drawing preference: gaze on the image that would be preferred to be drawn and that on the non-preferred to be drawn. Organisation of figures corresponds with Figure 2.5. * $p<.05$; ** $p<.01$; *** $p<.001$.

	Prefer Means (S.D.)	Not Prefer Means (S.D.)
First saccade latency	212.81 (42.44)	214.08 (39.79)
First fixation direction	44.7 (11.34)	38.27 (13.73)
Fixation duration	788.42 (308.62)	468.0 (185.26)
Number of fixations	2.68 (0.92)	1.80 (0.68)
Last fixation duration	320.41 (85.72)	280.1 (56.12)
Last fixation direction	57.8 (11.99)	25.17 (6.93)

Table 2.4- Drawing Choice task (Drawing Preference): Descriptive statistics

Figure 2.6 shows gaze behaviour elicited during the Drawing Choice task when images are classified by drawing preference on a trial by trial and participant by participant basis. Overall drawing preference was found to impact gaze behaviour: Fixation duration (fig. 2.6c) shows that participants fixated for a longer period of time on those images they preferred for drawing ($t(29) = 8.980$, $p<0.001$, $d=1.64$) coupled with a greater number of fixations (fig. 2.6d) ($t(29)=10.376$, $p<0.001$, $d=1.894$). There was no effect of drawing preference on first saccade latency (fig. 2.6a) ($t(29)=0.1$, $p=0.921$, $d=0.018$) or first fixation direction (fig. 2.6b) ($t(29) = 1.544$, $p=0.133$, $d=0.282$). The last fixation direction (fig. 2.6f) at the point of making a choice was found to be significantly more likely to be on the image preferred for drawing ($t(29)=10.880$, $p<0.001$, $d=1.986$), and last fixation duration (fig. 2.6e) was significantly longer ($t(29)=2.844$, $p=0.008$, $d=0.519$) (see Appendix 11).

As before, we examined the relationship between drawing preference and proportion of fixation time in order to establish whether those stimuli that were more strongly preferred to draw were looked at for longer. A positive correlation was found, comparisons were made across the time points at which aesthetic ratings were made and differences were found, $r=0.079$ ($SD=0.117$), $t(29)=3.625$, $p<0.001$, $d=0.662$. Only those who made aesthetic ratings prior to drawing preferences showed significant positive correlations, $r=0.109$ ($SD=0.103$), $t(14)=3.944$, $p<0.001$, $d=1.02$. Those who made aesthetic ratings after did not, $r=0.045$ ($SD=0.122$), $t(14)=1.489$, $p=0.159$, $d=0.385$. We conclude that for those making aesthetic judgements at the start of the study, the greater the difference in

drawing preference scores the greater proportion of time they spent fixating the image they preferred to draw.

2.5.6 Complexity and Symmetry Validation

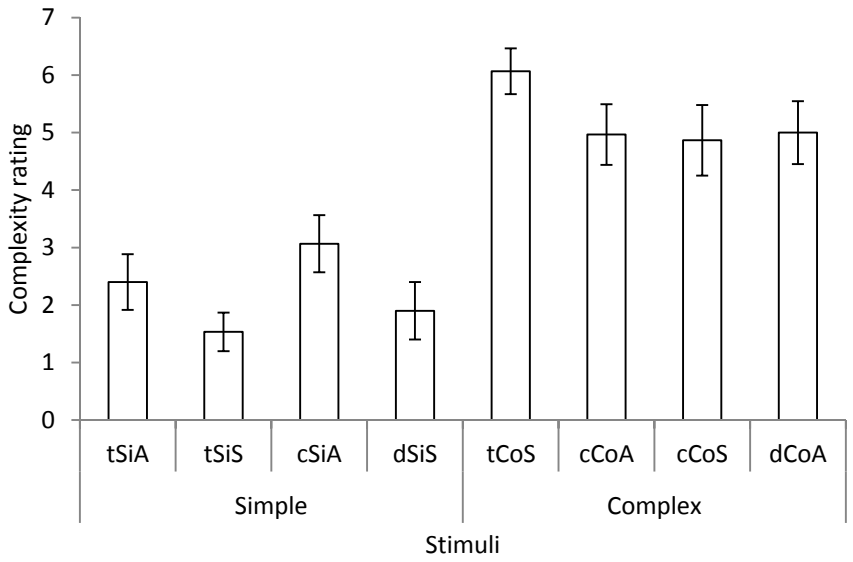

Figure 2.7 - Ratings of perceived complexity. The simple-symmetrical images were rated less complex than simple-asymmetrical images. Therefore, some stimuli were altered for Experiment 2.

We piloted the images used in Experiment 1 prior to conducting this study in order to verify that images created were simple, complex, symmetrical and asymmetrical. We also requested the participants in Experiment 1 to complete a task similar to the pilot study categorising images as either symmetrical or asymmetrical and rating the level of complexity to draw each image (1-7) to verify classifications from those engaged in the task (see Appendix 4). A main effect of image complexity was found, $F(7, 203)=65.965$, $MSE= 1.317$, $p<0.001$, $\eta^2 = 0.695$. However, simple-symmetrical images were rated as significantly less complex than all images including simple-asymmetrical images, $p<0.05$ (see figure 2.7). Therefore, these images were manipulated for experiments presented later. A chi-square was run to test perceived symmetry, all participants rated presence of symmetry or asymmetry accurately, $p<0.001$.

2.6 Discussion

Aesthetic and drawing preference appear to be inherently linked as positive correlations are found between the images aesthetically preferred and those preferred for drawing. Gaze behaviour further supports this link suggesting that similar cognitive processes are involved with the creation and perception of art (Martindale, 2001). The results provide some empirical evidence in support of Mace and Ward's (2002) conclusions and current studies (e.g. Taylor & Eisenmann, 1964; Boyatzis & Eades, 1999) that indirectly show a relationship between preference and production.

To summarize the results, we found positive correlations between the aesthetic ratings and drawing preference scores participants assigned to each image. We found images aesthetically preferred and those preferred for drawing to direct gaze when free-viewing (fixation duration and fixation count). Participants also fixated more on aesthetically preferred stimuli the more they preferred them, but no effect was found here in regards to drawing preference. Similar results to this Free-viewing task were found in the Drawing Choice task, images aesthetically preferred and images preferred for drawing influenced gaze (fixation duration, fixation count and last fixation direction). Again, aesthetic and drawing preferences affected fixation duration with participants fixating more on images aesthetically preferred and those preferred for drawing the more they preferred them, however there was a test order effect, the relationship between drawing preference and gaze was only found for those who were involved in making aesthetic judgements at the start of study.

When participants were freely-viewing pairs of stimuli we find aesthetically preferred images to be fixated on for longer periods of time and more often; in fact, the more a stimulus was aesthetically preferred the more it was fixated on. This supports previous research that suggests gaze is influenced by preference (Shimojo, Simion, Shimojo & Scheier, 2003; Holmes & Zanker, 2012). When we re-categorise trials by drawing preference we find a similar effect on gaze, further supporting the similarities we find between aesthetic and drawing preference ratings. But we do not find participants to fixate on drawing preferences the more

they would prefer to draw them. When a drawing preference was being made, we find similar gaze patterns compared to having no instruction which supports the suggestion that similar cognitive processes are involved in both the perception and creation of art (Martindale, 2001). Images aesthetically preferred and those preferred for drawing were fixated on more, for longer, prior to making a drawing preference and for longer during the subsequent duration of this fixation (only drawing preference had an impact here) which further supports the idea that gaze is influenced by preference and reflects choice (Holmes & Zanker, 2012; Shimojo, Simion, Shimojo & Scheier, 2003; Glaholt, Wu & Reingold, 2009).

Overall, for the Drawing Choice task we find participants to spend more time fixating on stimuli the more strongly they aesthetically prefer them and would rather draw them, thus during this process art-making decisions and aesthetic judgements effect gaze in a similar manner. However, we find an interesting effect as this correlation is only significant for those non-artists who made formal aesthetic judgements at the start of the study. This suggests that participants rely heavily on their aesthetic ratings assigned to each stimulus when making a drawing preference.

It is notable that the art-making models discussed are about artists (Mace & Ward, 2002). In addition, general research in the area of aesthetics and artistic ability tends to investigate both non-artists and artists' experiences as differences can be found due to expertise. There is some suggestion that stimuli preferred for creation are similar to those aesthetically preferred and that this varies as a function of expertise. Individuals differ in their knowledge of art and art history, and there are also distinct differences between artists and non-artists regarding aesthetic experiences. Expertise influences general observation of art as more experienced viewers are interested in the work itself but also in the creative process, thus they consider the ideas behind the artwork and desire to understand the process and materials used in order to create the art piece (Pitman & Hirzy, 2010; Gombrich, 1995). Artists are suggested to visualise more of the underdrawings of artworks, particularly regarding paintings, and consider more of the art-making process whereas non-artists cannot visualise beyond the surface features (Chatterjee & Vartanian, 2016). When observing art, gaze patterns have

been analysed and differences are apparent due to artistic training and experience. Participants untrained in art have been found to focus more on individual elements in a composition. Fixation time towards these elements, for example to human and object features, supports this. More experienced artists however explore the relationships between these elements; they are interested in the global image, overall composition and structural features depicted (Nodine, Locher & Krupinski, 1993; Pihko et al, 2011; Vogt & Magnussen, 2007).

Differences due to expertise are also found with regards to the art-making experience. Kozbelt et al. (2010) found artists' drawings to be more accurate than non-artists; artists were found to make better decisions on what features to include in their drawings thus their drawings captured specific features of the face being copied, whereas non-artists' drawings were more generic. Artists have been found to possess greater perceptual and imagery abilities when completing drawing tasks where actual production was required, but also during mental imagery performance (Calabrese & Marucci, 2006). Expertise has been found to impact artistic creations with artists, not surprisingly, performing better on drawing tasks. In addition to artists having a clear motor advantage, differences are apparent from gaze when drawing. Artists were found to process stimuli more easily (spend less time fixating the stimulus to be copied) than non-artists regardless of the variations in stimuli (familiarity/complexity) and this is suggested to be due to training (Glazek, 2012). A replication of Experiment 1 was therefore conducted also analysing artists' initial art-making decisions which are useful to support claims made depicting differences due to expertise.

2.7 Experiment Two

The previous study showed a significant relationship for non-artists between the images they aesthetically preferred and those that were preferred for drawing; however, it is unclear whether these similarities are also reflected in artist's choices. Artists are more familiar with making such art-making choices, therefore here we examine the relationship between aesthetic and drawing preferences and

look into gaze patterns when free-viewing and when making a drawing preference for both non-artists and artists.

1. As in Experiment 1 we examine whether aesthetic preferences relate to drawing preferences: are those stimuli that are aesthetically preferred also those preferred to be drawn? And is this affected by expertise? Differences that have been found in responses to art, production preferences and art-making abilities lead us to expect differences in aesthetic and drawing preference relationships dependent on the expertise of the participant. Kay (1991) states how artists' art-making experiences are particularly guided by aesthetic experiences/preferences. Thus, we hypothesise that there will be positive relationships between how pleasing participants, particularly artists, find the geometric images to be and how much they desire to create these.

2. In Experiment 1, we found similarities in gaze when viewing stimuli and making drawing preferences. Given the expected differences with expertise as presented above, we would expect that how gaze is directed during a Free-viewing and Drawing Choice task is likely to differ dependent on expertise. Artists may use similar visual processes when drawing and when observing stimuli and are found to have greater perceptual and drawing skills due to training (Kozbelt, 2001). Artists have been found to process artworks differently to non-artists when observing and creating art, in fact they are more likely to consider the artistic process during mere observation (Pihko et al, 2011; Glazek, 2012; Pitman & Hirzy, 2010; Chatterjee & Vartanian, 2016). Therefore, we hypothesise that participants, particularly artists, will show similarities in the way in which they observe images when Free-viewing and during the Drawing Choice task, with artists particularly fixating on images aesthetically preferred and preferred for drawing (first saccade latency, first fixation direction, fixation duration, fixation count, last fixation duration, and last fixation direction). In addition, we hypothesise that the more an image is aesthetically preferred and preferred for drawing the more it will be fixated, especially for artists.

2.8 Method

2.8.1 Participants

A total of forty participants took part in this study. Twenty psychology students were recruited from the University of Reading and were regarded as non-artists (11 females, 9 males; range 19-42). Twenty student artists (16 females, 4 males; range 20-35) were recruited from the Fine Art department at the University of Reading. Participants were classified on the basis of a background questionnaire. The questionnaire requested the participant to provide the number of years of formal art training (A-level qualification and beyond) they had received (see appendix 2). A participant was regarded as an artist if they had at least 5 years of formal art training and were involved in art-making on a weekly basis. Artists ranged from 5 to 7 years with a mean of 5.6 years of training. The non-artists in this study had less than 1 year with a mean of 0.05 years of training. All participants had normal or corrected-to-normal vision and each stage of the study was completed by all participants.

2.8.2 Pilot study

Results from post experiment classification of the stimuli used in Experiment 1 (see section 2.5.6) showed that simple-symmetrical stimuli were categorised as being less complex than simple-asymmetrical images. While not being particularly problematic in the context of these experiments we remained concerned that the stimuli employed were not ideally suited to elicit a sufficient range of aesthetic and drawing preferences. In order to broaden this range some new versions of the simple-symmetrical images were manipulated. A pilot study was conducted with 15 non-artists and 15 artists (2 or more years of formal art training), who were not involved in the experimental study, who categorised the stimuli (6 of the existing images and 2 new ones) as being symmetrical or asymmetrical and rated perceived complexity between 1 and 7, from very simple to very complex (see Appendix 4). All images were matched for level of complexity and presence of symmetry. A main effect of image complexity was found, $F(7,203) = 25.463$, $p<0.001$. Pairwise comparisons show all complex images to be significantly more

complex than simple images, $p<0.001$. A chi-square was run to test perceived symmetry. All participants rated presence of symmetry or asymmetry accurately, $p<0.05$. The new 8 images were grouped into four subsets based on these ratings (see figure 2.14) [complex-symmetrical (subset 1), simple-symmetrical (subset 2), complex-asymmetrical (subset 3) and simple-asymmetrical (subset 4)].

2.8.3 Materials

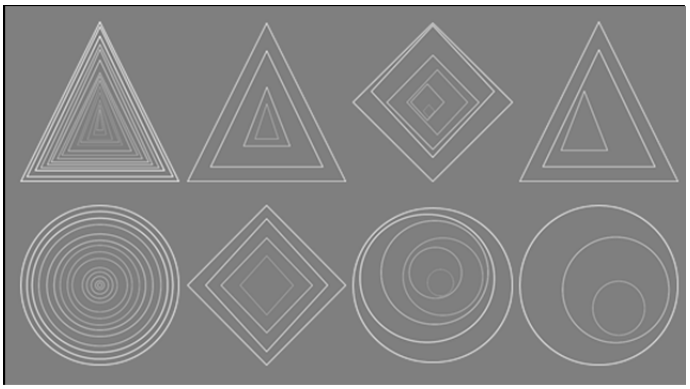

Figure 2.8- Stimuli used in the four subsets. Column one: complex-symmetrical (subset 1); Column two: simple-symmetrical (subset 2); Column three: complex-asymmetrical (subset 3); Column four: simple-asymmetrical (subset 4).

The stimuli included 8 computer-generated geometric shapes that were fully constructed of triangles, diamonds or circles (see figure 2.8). A 7-point scale was used to gather aesthetic ratings [1(very displeasing) to 7 (very pleasing)] (see Appendix 5). A relative preference scale was used to categorise drawing responses [1 (indicating a strong preference for the left image) to 7 (a strong preference for the right)] (see Appendix 6).

2.8.4 Procedure, Eye-tracking Analyses and Data Handling

A similar procedure to Experiment 1 was carried out. In addition, the eye movements analysed and the treatment of the eye-tracking data in this study was identical to Experiment 1.

2.9 Results

As in Experiment 1 we first report similarities between drawing and aesthetic preferences (Aesthetic Preference and Drawing Preference Relationship Section). Then we report gaze behaviour during the Free-viewing task where trials are classified first by aesthetic preference (Free-viewing and Aesthetic Preference) and then by drawing preference (Free-viewing and Drawing Preference) for artists and non-artists. Finally, we report gaze behaviour elicited during the Drawing Choice task in the same manner as the Free-viewing task: trials classified first by aesthetic preference (Drawing Choice and Aesthetic Preference) and then by drawing preference (Drawing Choice and Drawing Preference).

2.9.1 Aesthetic and Drawing Preference Relationship

To examine the hypothesised relationship between aesthetic ratings and drawing preference scores, separate correlations between these were conducted for each participant and their correlation coefficients were Z prime transformed and subject to a one-sample t-test. This was carried out separately for both artists and non-artists to examine whether these correlations significantly differed from zero. Those images aesthetically preferred were found to significantly correlate with those preferred for drawing for both non-artists and artists, Non-Artists: $r(19)=0.506$ (SD =0.335), $t(19)=5.568$, $p<0.001$, $d=1.25$; Artists: $r(19)=0.636$ (SD=0.380), $t(19)=6.268$, $p<0.001$, $d=1.40$. No difference was found between artists and non-artists, $t(38)=1.269$, $p=0.212$, $d=0.401$. Comparisons were made across the time points at which aesthetic ratings were made and correlations were found to be positive regardless.

2.9.2 Free-viewing and Aesthetic Preference

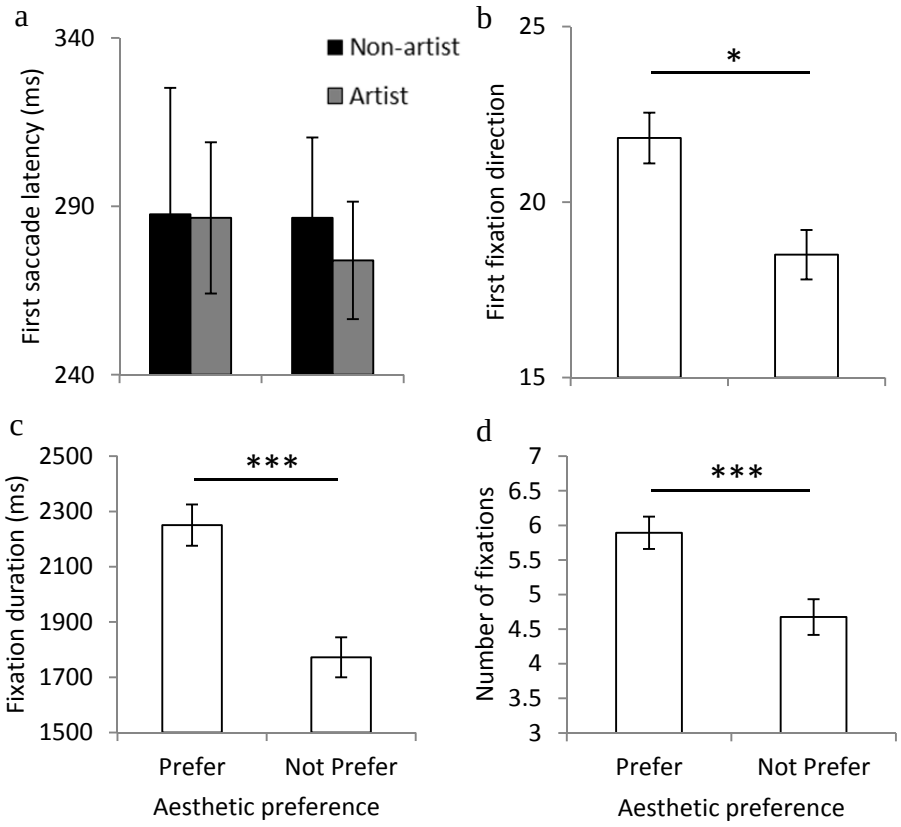

Figure 2.9- Free-viewing task (Aesthetic Preference) shows gaze behaviour when image pairs are classified on the basis of aesthetic preference: gaze on the aesthetically preferred stimulus and that on the non-preferred stimulus. Upper row shows first saccade response: the latency of the response in milliseconds (Left) and its direction, which is collapsed across expertise, (Right). Lower row shows overall fixation behaviour collapsed across expertise: mean total fixation duration in milliseconds (Left) and the mean number of fixations (Right). * p<.05; ** p<.01; *** p<.001.

	Non- artist		Artist	
	Prefer Means (S.D.)	Not Prefer Means (S.D.)	Prefer Means (S.D.)	Not Prefer Means (S.D.)
First saccade latency	287.64 (167.93)	286.59 (106.81)	286.57 (100.40)	273.94 (78.03)
First fixation direction	22.05 (4.36)	18.0 (4.72)	21.6 (4.86)	19.0 (4.24)
Fixation duration	2237.36 (464.39)	1779.53 (463.91)	2385.03 (507.42)	1657.15 (448.29)
Number of fixations	5.58 (1.14)	4.89 (1.83)	6.2 (1.73)	4.47(1.41)

Table 2.5- Free-viewing task (Aesthetic Preference): Descriptive statistics

Figure 2.9 shows gaze behaviour elicited during the Free-viewing task when images are classified by aesthetic preference. A two-way ANOVA was conducted examining first saccade latency (fig. 2.9a) with aesthetic preference and expertise as factors. No main effects or interactions were found, all *p's*>.737. A series of separate two-way ANOVAs with the same factors were conducted examining first fixation direction (fig. 2.9b), fixation duration (fig. 2.9c) and number of fixations (fig. 2.9d) showed an effect of aesthetic preference with participants fixating more on preferred stimuli: First Fixation Direction: $F(1, 38)=7.097$, $MSE=31.1155$ $p=0.011$, $\eta^2=0.157$; Fixation Duration: $F(1, 38)=17.092$, $MSE=411278.275$, $p<0.001$, $\eta^2=0.310$; Number of Fixations: $F(1, 38)=12.717$, $MSE=2.329$, $p<0.001$, $\eta^2=0.251$, respectively. There was no main effect of expertise and no significant interaction, all *p's* >0.135 (see Appendix 12).

A correlation was carried out examining the relationship between aesthetic preference and fixation duration to examine whether participants spend longer fixating on stimuli the more they aesthetically prefer it. Firstly, differences in the aesthetic preference ratings given to each image on each trial were calculated. The proportion of time spent fixating each image was then calculated. The correlation between differences in aesthetic preference ratings and proportion of fixation time was computed for each participant and the correlation coefficients were Z prime transformed. A one-sample t-test was carried out separately for both artists and non-artists to examine whether these correlations significantly differed from zero. A positive correlation was found for both artists and non-artists, Non-artists: $r(19)=0.104$ ($SD=0.199$), $t(19)=2.297$, $p=0.033$, $d=0.514$; Artists: $r(19)=0.135$($SD=0.225$), $t(19)=2.606$ $p=0.017$, $d=0.583$. This shows that the greater the difference in aesthetic ratings the greater proportion of time they fixated on their aesthetically preferred stimulus, regardless of expertise. Comparisons were made across the time points at which aesthetic ratings were made and positive correlations were found regardless.

2.9.3 Free-viewing and Drawing Preference

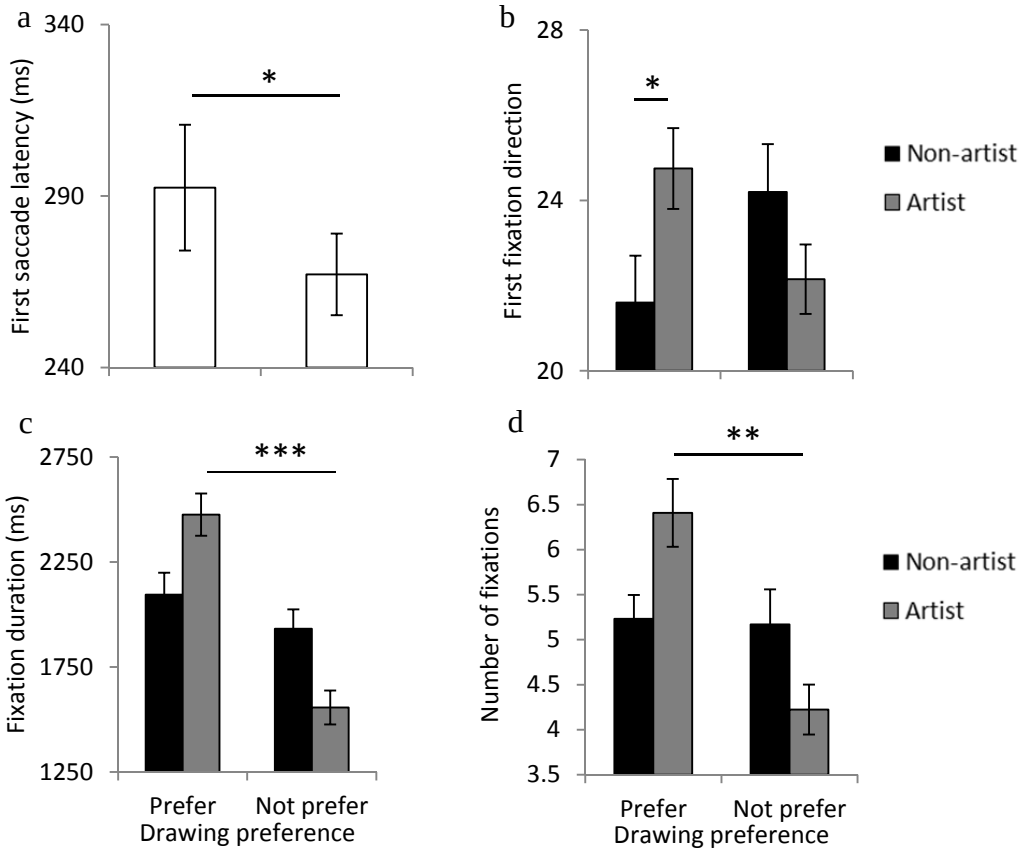

Figure 2.10- Free-viewing task (Drawing Preference) shows gaze behaviour when image pairs are classified on the basis of drawing preference: gaze on the image that is preferred for drawing and that on the non-preferred. Upper row shows first saccade response: the latency of the response in milliseconds, which is collapsed across expertise (Left), and its direction (Right). Lower row shows overall fixation behaviour: mean total fixation duration in milliseconds (Left) and the mean number of fixations (Right). * p<.05; ** p<.01; *** p<.001.

	Non- artist		Artist	
	Prefer Means (S.D.)	Not Prefer Means (S.D.)	Prefer Means (S.D.)	Not Prefer Means (S.D.)
First saccade latency	303.0 (139.29)	267.03 (81.66)	281.88 (89.42)	267.23 (70.75)
First fixation direction	21.6 (4.92)	24.2 (5.02)	24.75 (4.24)	22.15 (3.65)
Fixation duration	2094.66 (465.02)	1932.27 (413.32)	2475.20 (449.68)	1557.36 (361.84)
Number of fixations	5.23 (1.19)	5.17 (1.74)	6.41 (1.68)	4.22 (1.24)

Table 2.6- Free-viewing task (Drawing Preference): Descriptive statistics

Figure 2.10 shows gaze behaviour elicited during the Free-viewing task when images are classified by drawing preference. A two-way ANOVA was conducted examining first saccade latency with drawing preference and expertise as factors. First saccade latency (fig. 2.10a) was found to be quicker towards stimuli less preferred for drawing (M=267.15) than preferred (M=292.44), $F(1, 38)=4.592$, MSE=2785.269, p=0.039, η^2=0.108, there was no main effect of expertise or any significant interactions, all *p's*>.371. A two-way ANOVA was conducted examining first fixation direction (fig. 2.10b) showed no main effects, all *p's*>.101, but did show a trend in the interaction between drawing preference and expertise $F(1, 38)=3.536$, MSE=135.2, p=0.068, η^2=0.085. Pairwise comparisons show that artists made more first fixations (M=24.75) to images preferred for drawing compared to non-artists (M=21.6), $F(1, 38)=4.698$, MSE=99.225, p=0.037, η^2 =0.110. Further two-way ANOVAs examining fixation duration (fig. 2.10c) and then number of fixations (fig. 2.10d) showed only an effect of drawing preference with participants fixating more often and for longer on the stimulus they preferred to draw: Fixation Duration $F(1, 38)=17.765$, MSE=328432.033, p<0.001, η^2=0.319; Number of Fixations: $F(1, 38)=12.724$, MSE=1.979, p<0.001, η^2=0.251. There was no effect of expertise, all *p's*>0.744, however, an interaction between drawing preference and expertise for fixation duration and number of fixations was found, $F(1, 38)=8.688$, p<0.001, η^2=0.186; $F(1, 38)=11.403$, p=0.002, η^2=0.231, respectively. Pairwise comparisons show that artists fixated significantly longer on images preferred for drawing (M=2475.2) than less preferred images (M=1557.4), $F(1, 38)=25.650$, p<0.001, η^2=0.403, and made more fixations to images preferred for drawing (M=6.4) than those less preferred (M=4.2), $F(1, 38)=24.108$, p<0.001, η^2 =0.388 (see Appendix 12).

Taking the same approach as adopted in the previous section we examined the relationship between drawing preference and proportion of fixation time in order to establish whether those stimuli that were more strongly preferred to draw were looked at for longer. No correlation was found for non-artists, Non-artists: $r(19)=0.091$(SD=0.289), $t(19)= 1.384$, p=0.182, d=0.310, but a positive correlation

was found for artists, Artists: $r(19)=0.193$($SD=0.222$), $t(19)= 3.690$, $p=0.002$, $d=0.825$. For artists, the greater the difference in drawing preference scores the greater proportion of time was fixated on the stimuli preferred for drawing. Comparisons were made across the time points at which aesthetic ratings were made and positive correlations were found regardless.

2.9.4 Drawing Choice and Aesthetic Preference

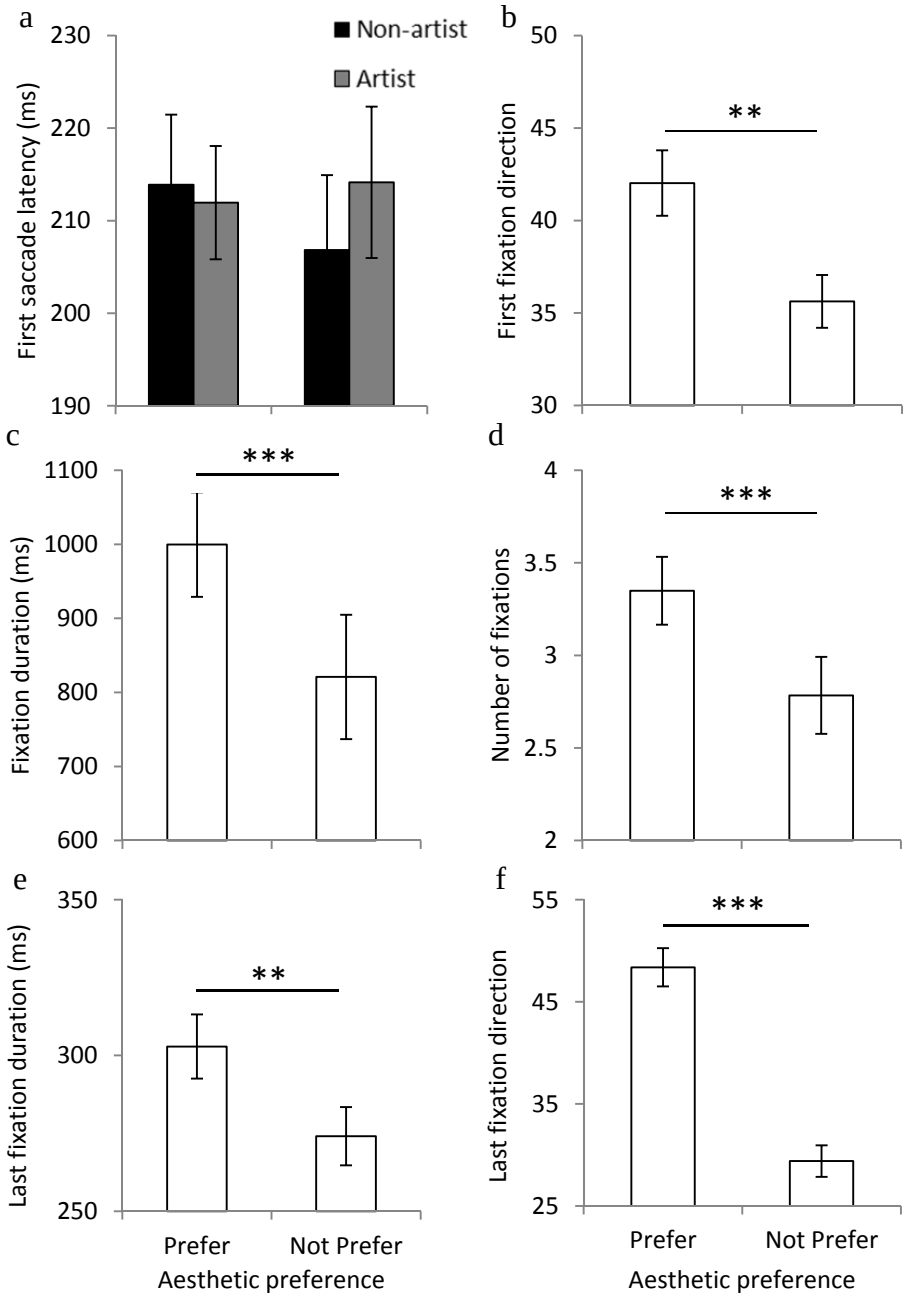

Figure 2.11- Drawing Choice task (Aesthetic Preference): shows gaze behaviour when image pairs are classified on the basis of aesthetic preference: gaze on the image that was aesthetically preferred and that on the non-preferred image. Upper row shows first saccade response: the latency of the response in milliseconds (Left) and its direction, which is collapsed across expertise, (Right). Middle row shows overall fixation behaviour collapsed across expertise: mean total fixation duration in milliseconds (Left) and the mean number of fixations (Right). Lower row shows last fixation behaviour collapsed across expertise: last fixation duration (Left) and its direction (Right). * $p<.05$; ** $p<.01$; *** $p<.001$.

	Non- artist		Artist	
	Prefer Means (S.D.)	Not Prefer Means (S.D.)	Prefer Means (S.D.)	Not Prefer Means (S.D.)
First saccade latency	213.88 (33.89)	206.82 (36.23)	211.95 (27.38)	214.14 (36.58)
First fixation direction	40.85 (10.90)	35.70 (9.86)	43.20 (11.61)	35.55 (8.35)
Fixation duration	1005.98 (366.94)	810.374 (358.22)	993.35 (523.14)	831.40 (671.83)
Number of fixations	3.36 (1.09)	2.81 (1.16)	3.34 (1.25)	2.76 (1.48)
Last fixation duration	318.44 (66.61)	283.83 (66.40)	287.31 (61.32)	264.28 (50.67)
Last fixation direction	46.70 (12.38)	30.10 (10.85)	50.05 (11.40)	28.70 (8.79)

Table 2.7- Drawing Choice task (Aesthetic Preference): Descriptive statistics

The previous two sections examined the behavioural results from the Free-viewing task. Here we move on to the results from the Drawing choice task. The same data analysis approach will be taken. Figure 2.11 shows gaze behaviour elicited during the Drawing Choice task when images are classified by aesthetic preference. A series of separate two-way ANOVAs were conducted, for each dependent variable. No main effects or interactions of aesthetic preference and expertise were found for first saccade latency (fig. 2.11a) all *p's*>.329. A main effect of aesthetic preference was found with participants fixating more on stimuli they aesthetically preferred for first fixation direction (fig. 2.11b) $F(1, 38)=7.872$, $MSE=104.067$, $p=0.008$, $\eta^2=0.172$, fixation duration (fig 2.11c) $F(1, 38)=21.002$, $MSE=30436.297$, $p<0.001$, $\eta^2=0.356$, number of fixations (fig 2.11d) $F(1, 38)=24.995$, $MSE=0.256$, $p<0.001$, $\eta^2=0.397$, last fixation duration (fig 2.11e) $F(1, 38)=10.381$, $MSE=1600.295$, $p=0.003$, $\eta^2=0.215$, and last fixation direction (fig 2.11f) $F(1, 38)=51.160$, $MSE=140.755$, $p<0.001$, $\eta^2=0.574$. No effect of expertise or interactions was found, all *p's*>0.376 (see Appendix 13).

We examined the relationship between aesthetic preference and proportion of fixation time in order to establish whether those stimuli that were more strongly

preferred were looked at for longer. A positive correlation was found for non-artists, $r(19)=0.138$ ($SD=0.163$), $t(19)=3.592$, $p=0.002$, $d=0.803$. Comparisons were made across the time points at which aesthetic ratings were made and differences were found. Only those who made aesthetic ratings prior to drawing preferences showed significant positive correlations: $r(9)=0.220$ ($SD=0.163$), $t(9)=3.840$, $p=0.004$, $d=1.214$. Those who made aesthetic ratings after did not: $r(9)=0.056$ ($SD=0.114$), $t(9)=1.479$, $p=0.173$, $d=0.468$. A positive correlation was found for artists regardless of the time that aesthetic ratings were made, $r(19)=0.138$ ($SD=0.184$), $t(19)=3.172$, $p=0.005$, $d=0.709$. This suggests that artists spend longer looking at images they aesthetically prefer, the more they prefer these, while non-artists only do this when aesthetically rating stimuli has been made salient to them.

2.9.5 Drawing Choice and Drawing Preference

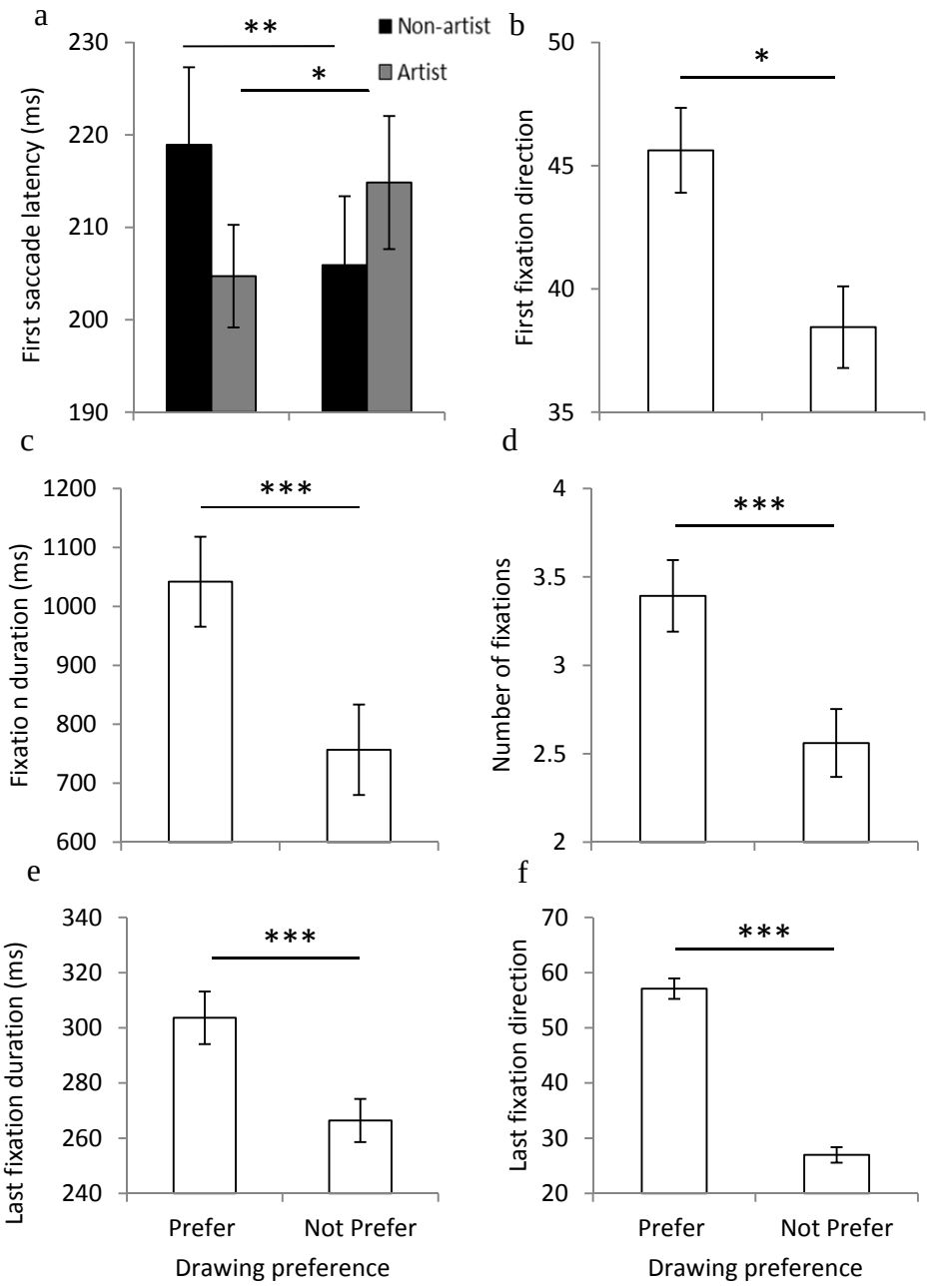

Figure 2.12- Drawing Choice task (Drawing Preference): shows gaze behaviour when image pairs are classified on the basis of drawing preference: gaze on the image that is preferred for drawing and that on the non-preferred. Organisation of figures corresponds with Figure 2.11. * p<.05; ** p<.01; *** p<.001.

	Non- artist		Artist	
	Prefer Means (S.D.)	Not Prefer Means (S.D.)	Prefer Means (S.D.)	Not Prefer Means (S.D.)
First saccade latency	218.93 (37.48)	205.91 (33.31)	204.72 (24.81)	214.85 (32.23)
First fixation direction	43.95 (12.31)	39.0 (11.81)	47.30 (9.26)	37.90 (9.20)
Fixation duration	1074.88 (423.87)	719.67 (300.05)	1008.85 (543.53)	793.59 (624.73)
Number of fixations	3.47 (1.27)	2.52 (1.05)	3.31 (1.32)	2.60 (1.39)
Last fixation duration	321.65 (62.27)	273.73 (45.15)	285.62 (53.79)	259.09 (53.54)
Last fixation direction	57.05 (14.0)	25.90 (9.95)	57.15 (9.22)	28.05 (7.88)

Table 2.8- Drawing Choice task (Drawing Preference): Descriptive statistics

Figure 2.12 shows gaze behaviour elicited during the Drawing Choice task when images are classified by drawing preference. First saccade latency behaviour was examined as a function of aesthetic preference and expertise. A two-way ANOVA showed no main effects, all *p's*>.666, but did show an interaction between expertise and drawing preference, $F(1, 38)=12.152$, $MSE=2679.466$, $p<0.001$, $\eta^2 =0.242$ which shows that artists' first saccade latency (fig 2.12a) was quicker to images preferred for drawing ($M=204.7$) than those not preferred ($M=214.8$), $F(1, 38)=4.654$, $p=0.037$, $\eta^2 =0.109$. Whereas non-artists first saccade latency was quicker to images not preferred for drawing ($M=205.9$) than those preferred ($M=218.9$), $F(1, 38)=7.687$, $p=0.009$, $\eta^2 =0.168$. Similarly, to previous sections, a series of separate two-way ANOVAs were conducted for first fixation direction, fixation duration, number of fixations, last fixation duration and direction with preference and expertise as factors. A main effect of drawing preference was found with participants fixating more on those stimuli they would prefer to draw for first fixation direction (fig 2.12b) $F(1, 38)=6.909$, $MSE=149.023$, $p=0.012$, $\eta^2 =0.154$, fixation duration (fig 2.12c) $F(1, 38)=53.844$, $MSE= 30221.218$, $p<0.001$, $\eta^2 =0.586$, number of fixations (fig 2.12d) $F(1, 38)=63.458$, $MSE=0.218$, $p<0.001$, η^2

=0.625, last fixation duration (fig 2.12e) $F(1, 38)=22.998$, $MSE=1204.925$, $p<0.01$, $\eta^2=0.377$ and last fixation direction (fig 2.12f) $F(1, 38)=130.327$, $MSE=139.268$, $p<0.001$, $\eta^2=0.774$. No effect of expertise or interactions was found, all *p's*>0.176 (see Appendix 13).

In addition, we examined the relationship between drawing preference and proportion of fixation time in order to establish whether those stimuli that were more strongly preferred for drawing were looked at for longer. A positive correlation was found for non-artists, $r(19)=0.121$ ($SD=0.162$), $t(19)=3.182$, $p=0.005$, $d=0.711$. Comparisons were made across the time points at which aesthetic ratings were made and differences were found. Only those who made aesthetic ratings prior to making drawing preferences showed significant positive correlations: $r(9)=0.193$ ($SD=0.184$), $t(9)=3.029$, $p=0.014$, $d=0.958$. Those who made aesthetic ratings after did not: $r(9)=0.050$ ($SD=0.091$), $t(9)=1.670$, $p=0.129$, $d=0.528$. A positive correlation was found for artists regardless of when aesthetic ratings were made, $r(19)=0.115$ ($SD=0.087$), $t(19)=5.683$, $p<0.001$, $d=1.27$. This suggests that artists spend longer looking at images they prefer to draw, the more they prefer to draw these, while non-artists only do this when aesthetically rating stimuli has been made salient to them.

2.10 Discussion

Aesthetic and art-making models imply relationships between the art-making process and aesthetic experience, but no direct research to examine this has been carried out. Here, we replicated the methods from Experiment 1; however, we also examined aesthetic and drawing preferences of artists as it has been suggested that the aesthetic experience of artists and non-artists differ. As in Experiment 1 we find aesthetic and drawing preferences to be inherently linked. The results provide empirical evidence in support of Mace & Ward's (2002) conclusions and current studies that indirectly show a relationship between preference and production.

To summarize the results: we found positive correlations between the aesthetic ratings and drawing preference scores participants assigned to each image. In addition, gaze when free-viewing (first fixation direction, fixation duration, fixation count) was influenced by images aesthetically preferred, and the more these were preferred the more they were fixated on. Artists' gaze was also influenced by images preferred for drawing. Again, the more these were preferred to be drawn the more they were fixated on. Similarly, gaze when making a drawing choice (first fixation direction, fixation duration, fixation count, last fixation duration, and last fixation direction) was influenced by those images aesthetically preferred and those preferred for drawing. The more these images were aesthetically preferred or preferred for drawing, the more they were fixated on, but this varied due to expertise and the time points that aesthetic ratings were made. In the next two sections, we look further into these relationships examining how preferences relate to gaze when both free-viewing and making a drawing preference.

2.10.1 Free-viewing Task Results

When participants were freely-viewing pairs of stimuli we find aesthetically preferred images to be fixated on for longer periods of time, more often and fixated first; in fact, the more a stimulus was preferred the more it was fixated on. This supports previous research that suggests gaze is influenced by preference (Shimojo, Simion, Shimojo & Scheier, 2003; Holmes & Zanker, 2012). However, when we re-categorised free-viewing trials by drawing preference then we find differences dependent on expertise. Only artists' gaze was influenced by drawing preference. They fixated for longer, made more fixations, fixated more at the earliest opportunity to the image they preferred to draw, and fixated more on the image they preferred to draw the more they desired to draw it. This may reflect previous reports of experienced artists being more deeply engaged (e.g., longer fixation durations) with the stimuli and the creative process (Nodine, Locher & Krupinski, 1993; Tinio, 2013). In contrast to this, participants were found to fixate quicker on the images less preferred for drawing regardless of expertise. When

viewing art, artists may be interested in understanding the processes required to create the artwork and may observe and analyse images as a medium that can be reproduced (Pitman & Hirzy, 2010). Artists may consider drawing preferences at this stage as they consider more about the artist. It has been suggested, in regards to paintings, that artists visualise more of the underdrawings whereas non-artists cannot visualise beyond the surface features (Chatterjee & Vartanian, 2016). This shows how the observation of art is not a passive process, particularly for an artist. Observing art results in similar experiences to both producing and appreciating art (Dewey, 1934; Tinio, 2013).

2.10.2 Drawing Choice Task Results

When a drawing preference was being made, we find similar gaze patterns compared to having no instruction which supports the suggestion that similar cognitive processes are involved in both the perception and creation of art (Martindale, 2001). Aesthetically preferred stimuli and those preferred for drawing were fixated on more, for longer, at the first opportunity, lastly before making a drawing preference and for longer during the subsequent duration of this fixation which further supports gaze to be influenced by preference and reflects choice (Holmes & Zanker, 2012; Shimojo, Simion, Shimojo & Scheier, 2003; Glaholt, Wu & Reingold, 2009). During this task stimuli were only viewed for a short period of time before participants decided to select an image they'd prefer to draw supporting that this choice is made rapidly (Groenendijk, Janssen, Rijlaarsdam & van den Bergh, 2013), in fact we find that artists first fixated quicker to their drawing preference (first saccade latency) whereas non-artists first fixated quicker to images less preferred for drawing. Differences here may be due to gaze gradually shifting towards the preferred choice (Shimojo, Simion, Shimojo & Scheier, 2003); non-artists may not consider which image they would draw at this early stage. However, more first fixations were made to images preferred and those preferred for drawing regardless of expertise. Nevertheless, artists may be more aware of choices they will make as they consider the art-

making process more and were found to fixate more on what they would prefer to draw when free-viewing stimuli.

Overall, for the Drawing Choice task we find both artists and non-artists spend more time fixating on stimuli the more strongly they aesthetically prefer them and would rather draw them, thus during this process art-making thoughts and aesthetic judgements effect gaze in a similar manner. However, positive correlations were found for artists but for non-artists' significant correlations were only found for those who made formal aesthetic judgements at the start of the study. This suggests that non-artists rely heavily on their aesthetic ratings assigned to each stimulus when making a drawing preference.

2.11 General Discussion

Similarities in cognitive processes have been suggested between the creation and perception of art (Martindale, 2001). However, research has not been conducted directly looking at the artist's aesthetic and art-making experience, although these relationships are suggested in current art-making models (Kozbelt, 2017; Mace & Ward, 2002). Here, we examine the experience of the artist prior to considering both the perceiver and artist relationships suggested in Tinio's mirror model of art. To date studies have only made indirect conclusions suggesting that there are similarities between preference and production (Taylor & Eisenman, 1964; Boyatzis & Eades, 1999), but here we gathered aesthetic and drawing preferences from both artists and non-artists to directly examine these relationships. Moreover, in order to explore the formation of aesthetic and drawing preference we recorded gaze behaviour examining the cognitive processes during consideration for creation (Drawing Choice task) and perception (Free-viewing task). We analyse eye-tracking trials on the basis of aesthetic and drawing preference to make conclusions on the relationships between aesthetic, drawing preferences and the formation of these judgements.

Positive correlations were found between aesthetic and drawing preferences regardless of expertise and in conjunction with the eye movement data it can be suggested that there are similarities between the processes involved in forming

such judgements. Experiments 1 and 2 show similar findings except the following: In Experiment 1 we found participants to fixate more and more often on images preferred for drawing when free-viewing, however this wasn't found with non-artists in Experiment 2. A reason for these results may be due to non-artists in Experiment 1 showing stronger correlations between the images aesthetically preferred and those preferred for drawing. It is also worth taking note that the stimuli in Experiment 2 were altered due to the simple-symmetrical shapes being perceived as simpler than simple-asymmetrical shapes in Experiment 1. However, in both Experiments 1 and 2 we did find non-artists to not fixate more on an image preferred for drawing the more it was preferred, although this was found for artists. The artists' total fixation to images preferred can also be viewed to be greater than the non-artists in Experiment 1. In Experiment 2, first fixations were also found to be towards images aesthetically preferred when free-viewing and towards those aesthetically preferred and preferred for drawing when making a drawing preference, with first saccade latencies being quicker to images not preferred for drawing during both tasks. Here, last fixation durations were also greater on images aesthetically preferred when making a drawing preference. Similar trends to these were found in Experiment 1, but the addition of artists and more participants in Experiment 2 may have led to these main effects being significant only in Experiment 2 due to increased statistical power.

In an attempt to allow both non-artists and artists to realistically be able to produce the stimuli, geometric shapes were used here rather than artworks. The use of abstract geometric shapes can also be suggested to be more reflective of the decisions made in the initial stages of art-making avoiding features of artworks that develop in later stages such as the addition of colour and texture. One criticism that can be made for the use of geometric shapes is that they may be considered to be relatively far removed from the common sources of inspiration upon which art is created. To address this, the approach adopted here can be developed by the use of stimuli such as photographs of real world scenes as would be used in landscape art. These can form the basis of drawing decisions.

A further criticism of the approach adopted here is the extent to which drawing preference reflects early stages of art-making. An assumption was made that drawing preference can be used as a proxy for the process of idea selection that takes place during initial art creation, however the extent to which this is the case is arguable. It is potentially more reflective of initial stages of art-making to allow both idea selection and elaboration. Within the art-making process, ideas or sketches that are chosen during the idea selection phase are not necessarily copied but can be used as a guide allowing for the artwork to evolve. Therefore, it may be more appropriate to provide participants with a task in which they are asked not to indicate which stimulus they would prefer to draw but rather which stimulus they would prefer to use as a basis from which to elaborate and develop a piece of art.

It is important to also consider other experiences that may influence the relationship between aesthetic and drawing preferences, i.e. actual drawing behaviour. Westphal-Fitch, Oh and Fitch (2013) found differences between preference and production when participants were involved with forming own symmetrical patterns using a rotation task, they suggest that active production can affect preferences. When we consider the relationship between aesthetic and drawing preference we must also consider a deeper experience of art-making. Mace and Ward (2002) explain how the multiple ways in which an idea can be created and exploring these through drawing during early stages of art-making is important, particularly prior to making a drawing choice. The drawing experience, familiarity with styles, and media may impact drawing decisions. In addition, this deeper experience with the artistic process may influence aesthetic responses (Tinio, 2013).

2.12 Conclusion

Similarities were found between aesthetic and drawing preferences and this was largely the case regardless of expertise. Gaze behaviour when free-viewing reflects behaviour when making a drawing preference as gaze appears to be directed by the images aesthetically preferred during both tasks. However, there were found

to be some differences depending on expertise. We found artists' gaze behaviour during the drawing choice task to be influenced by images they aesthetically preferred regardless of when aesthetic judgements were made, and their gaze behaviour when free-viewing was influenced by images they preferred to draw. However, non-artists gaze behaviour during the drawing choice task was only influenced by images they aesthetically preferred when aesthetic judgments were made beforehand. This suggests that non-artists use their aesthetic judgements of images to make a drawing preference, but a more fluid relationship exists for artists between images aesthetically preferred and those preferred for drawing. In regards to the art-making models, we demonstrate that during initial stages of art-making the aesthetic judgements of ideas can be important for idea selection although here we cannot conclude whether aesthetic judgements influence decisions or vice versa, but a strong relationship between the two was found in this study with further support from gaze behaviour. The artist is suggested to visualise the aesthetic experience of the perceiver whilst making art thus drawing choices may be influenced by this factor which provides support for the mirror model of art (Zeki & Nash, 1999; Tinio; 2013). However, more direct research of the artist and perceiver relationship is needed to make these conclusions as here we focus on the experiences of just the artist. Further studies are required to explore the artist in relation to the perceiver of the final product (Tinio, 2013; Vartanian, 2014).

Chapter 3: Impact of Drawing Activity on Aesthetic and Drawing Preference

3.1 Abstract

In Chapter 2, drawing preference, aesthetic preference and gaze when free-viewing and making a drawing choice were found to relate. However, drawing preferences were made without the participant engaging in any drawing behaviour. This is a potential drawback as it has been shown that for many artists sketching and drawing are a crucial part of their creative process that takes place prior to making a drawing choice. In order to mimic this active engagement with the creative processes involved in art-making (in this case drawing) and the drawing choice, we provide participants with a drawing action (stippling/stroking) to engage in whilst viewing artworks and whilst making a drawing choice. Actions made were either congruent or incongruent to the style used for the abstract geometric shapes presented. We find that the specific type of action, whether congruent or incongruent, has no impact on images preferred for drawing. We also find no congruency effect on aesthetic ratings of images or gaze when free-viewing and making a drawing preference. We did however find a trend for brushstroke stimuli being preferred for production. Interestingly, we find a secondary task effect of drawing action on general eye movement behaviour; it appears that being involved with drawing, and particularly making brushstroke actions, reduces the total number of fixations that are made when free-viewing. We conducted a similar correlational approach between aesthetic and drawing preference as in Chapter 2 and continue to find similarities between aesthetic and drawing preferences, but this is modulated by expertise and drawing activity suggesting that when artists are involved in drawing (stippling or stroking) then drawing preferences can have an impact on aesthetic responses.

3.2 Introduction

3.2.1 Initial Art-making Decisions

Studies of aesthetic experience tend to focus more on art-viewing rather than the art-making processes. Less is known of the process of sketching, artistic development, graphic representations and the cognitive mechanisms behind sketching (Goldschmidt, 1991). Mace and Ward (2002) created a model of art-making where multiple stages of the art-making process are presented ranging from idea conception to exhibiting the final piece. One stage of the art-making process that was examined in Chapter 2 is the idea selection stage. Within this stage conscious decisions are made from multiple ideas that are developed until one idea is selected to be the most significant as a final concept. However, prior to making this selection emphasis may be placed on the content of ideas, thus artists may explore these further by experimenting with the medium selected, e.g. painting on a canvas (Sapp, 1995). Mace and Ward (2002) suggest that the art-making decisions made throughout an art-making process are influenced by the artists' aesthetic experience. In Chapter 2 we support this showing the importance of aesthetic preferences when making such decisions. Past studies further show similarities between preference and production (Taylor & Eisenman, 1964; Boyatzis & Eades, 1999), but these relationships had not been directly explored.

It is suggested that the art-making experience involves initial drawing decisions where an idea is selected by the artist amongst multiple visual ideas or conceptual ones, and this often involves artists actively exploring their ideas through sketching or drawing. Drawings, which at this stage occur prior to making an artwork, are formed for two possible reasons, to develop ideas in order to create a final art piece, or to plan and organise the composition and arrangement of the visual elements of a potential final art piece (Mace & Ward, 2002). Tinio (2013) highlights the importance of sketching during the early stages of art-making, particularly when painting. It can provide a visual element of the underdrawings depicting a foundation of the artwork and an initial concept, but not all artists create sketches prior to making their artwork. They do however generate an initial idea, explore and work on this before it is further constructed into an artwork.

Groenendijk et al. (2013) found that during the art-making process participants spend the majority of time creating initial sketches and this activity tends to fall prior to the idea selection phase. Being involved in sketching can help artists identify which potential artwork is best to select for further production. In addition, Mace and Ward (2002) demonstrate that the multiple ways in which an idea can be created is important during this stage, thus these can be explored prior to making a drawing choice and highlights further importance of drawing during early stages of art-making. This suggests that being actively involved in drawing, for example exploring different techniques of drawing ideas during art-making decisions, may play a crucial role in the drawing choice.

Weisberg (1986), states that during initial art-making stages the generation of ideas tend to be based on artists' previous works. Drawing decisions may be influenced by the art style that the artist has become familiar with. Guggenheim and Whitfield (1989) directly investigated the impact of drawing production on drawing decisions. They allowed some participants to be engaged with drawing a hairdryer and others a vice. They found the drawing experience to have no effect on later drawing decisions or aesthetic judgements. Despite previous design activities to the hairdryer or vice, there was greater liking, more sketches made, more time spent sketching and more ideas created for the hairdryer. Here, it is apparent that the stimuli had an impact on drawing decisions. Regardless of previous drawing activity the participants selected to create the images they liked. However, little research has examined how art-making experiences impact art-making decisions; more recent studies have examined how art-making experiences impact aesthetic experiences.

3.2.2 Drawing Activity

Art-making is a universal behaviour that can positively affect someone's mood. Although not everyone becomes a professional artist, many are engaged in art-making activities involving doodling, sketching and photography (Dalebroux, Goldstein & Winner, 2008). Children sketch and draw more than adults, practicing drawing allows children to make decisions like professional artists, enabling them

to draw in order to please and inform themselves (Thompson, 1995). Thus, it is suggested that artists may make decisions based on their own aesthetic experience, and this can be supported by the results found in Chapter 2.

Casati and Pignocchi (2007) further suggest that the drawing style of an artist can be influenced by considering the dynamic movement of another artist from their artworks. As drawing style is dependent on the hand movement of the artist it can impact the observer's recognition and their inheritance of a similar style of drawing. For example, Taylor, Witt and Grimaldi, (2012) explain how brushstroke actions can depict the artists' original movement providing information about their behaviour, whilst stippling action is able to portray their tapping and dabbing movements. Both drawing styles can evoke motor simulations in the observers. The artist and their art-making process is important to consider as the artist can be consciously or unconsciously considering the viewers' motoric response to their artwork which influences how they produce art (Chatterjee & Vartanian, 2016).

Tinio (2013) also explains how perceivers of art can be influenced by the artist and their art-making behaviour. In addition to drawing style influencing art-making experiences, it can also impact aesthetic experiences. Gallese and Freedberg (2007) state that experience in drawing production can lead to improving the ability to understand other artists' behaviour which in turn can enhance the aesthetic appreciation of an artwork. Both the content portrayed and the actions of the artist can influence the aesthetic experience. In support of this, Leder et al. (2012) found that drawing activity had an effect on aesthetic judgements as congruent drawing actions with the artist behind the artwork observed (stippling or stroking) increased liking for paintings. Indeed McLean et al. (2015) also found a congruency effect but only when using stimuli that portrayed the actions of the artist more clearly than those used by Leder et al. They suggest that there is a need to strengthen the connection and associations between hand actions made and those perceived in the artworks for the congruency effect to be powerful. Ticini et al. (2014) found that simultaneous drawing activity may not be entirely required for this effect of congruent action on liking, but in fact a training phase and priming of the congruent action can affect aesthetic judgements. Moreover, providing

priming, with simple active words, has been found to result in participants choosing to be more active preferring to engage in a drawing or creative activity rather than resting and being inactive (Albarracín et al., 2008). This evidence suggests that an important component of the aesthetic experience is that viewers are active when attempting to understand more about the art-making process. In addition, from the artist's perspective, it was also found that when creating art (Kanji characters) that actions representing these characters were produced in the air, reasons for this may be due to processing the act of forming such characters and maybe such actions in the air also influence the physical process of drawing (Sasaki & Watanabe, 1983).

3.2.3 Gaze and The Art-making Experience

Gaze has been further found to reflect decisions, eventually shifting towards the preferred item when making a decision on preference, and enabling predictions to be made of future choices (Shimojo, Simion, Shimojo & Scheier, 2003; Glaholt, Wu & Reingold, 2009). In regards to the art-making experience, Miall and Tchalenko (2001) recorded an artist's eye movements whilst they painted. They found that when painting and producing such actions that fixation durations made were twice as long as fixation durations made when the artist was not painting. They emphasise the use of such methods to further understand artistic creation. Visualising the artist behind the artwork can influence gaze. Alvarez, Winner, Hawley-Dolan, Snapper (2015) found abstract paintings produced by an artist to be fixated on more and evoked greater pupil dilation in comparison to abstract paintings produced by children or animals when participants were considering quality, although they were not informed on who produced the art observed. Furthermore, Reid et al. (2012) found that participants fixated more on realistic images compared to the computer sketch versions of the same image.

The actual action made by the hand, whether drawing or not can influence gaze behaviour. Maycock, Liu and Klein (2010) found hand movements to match eye movements during the drawing process, particularly for artists. Eye movements have been found to follow targets more when making tapping motions than when

merely observing the targets (Mataric & Pomplun, 1998). It is suggested that vision can be influenced by hand actions but hand actions can also be influenced by perceptual processes (Tipper, 2010). Richardson, Cluff, Lyons and Balasubramaniam (2013) found that the direction of tapping movements shifted in the direction of the saccades being made. Additionally, Taylor, Witt and Grimaldi (2012) support the relationship between perception and action highlighting that the perceiver's implicit action matches movement emphasised by the artist, reaction times are faster if hand movement direction is congruent to observed art motion.

3.3 Experiment Three

To further understand the relationship between the aesthetic and art-making experience we employ a similar method to Leder et al. (2012). Here we further explore the early stages of art-making by manipulating drawing actions (congruent, incongruent and no action) to examine if this also has an impact on aesthetic and drawing preferences (as with Experiment 1 and 2). Eye movements were also recorded. Here, we use similar stimuli to Chapter 2 but in man-made rather than computer-generated form; it is notable that McLean et al. (2015) only found drawing action to influence aesthetic ratings when using particular sets of stimuli. They report that liking for pointillism and brushstroke paintings were not affected by congruent drawing actions, but liking was enhanced when using the actual productions from participants in their first study as stimuli for a different group of participants in a second study. They presented these unfamiliar drawings that portrayed actions of stippling and stroking more clearly. This led stroke drawings to receive higher aesthetic ratings when participants were stroking, and stippling drawings to receive higher aesthetic ratings when participants were stippling. As a result of this, in this experiment, we created abstract geometric shapes which were made using stippling and stroking drawing actions. They differ in symmetry which removes the potential influences of familiarity, content and colour, and allows the techniques of the artist to be clearly displayed. Using abstract images here are ideal as more attention is made to the low-level features

such as motion due to the lack of content in the artwork (Cupchik, Vartanian, Crawley & Mikulis, 2009; Nadal, 2013; McLean et al., 2015; Stojilovic & Markovic, 2014). We also examine drawing preferences of both artists and non-artists. The current stimuli indicate how the drawings were produced which may impact artists' drawing decisions to a greater extent as they consider more about the production of art (Pitman & Hirzy, 2010).

The aims of this chapter are:

1. Being active whilst viewing art has been shown to impact the aesthetic experience of the perceiver (Leder, 2012; McLean et al., 2015; Ticini, 2014). Less is known about how such drawing experiences influence an artist and their art-making experience although Guggenheim and Whitfield (1989) found drawing experience to have no impact on aesthetic or drawing preferences. We hypothesise that having a drawing experience will impact drawing preferences, such that drawing preferences will reflect congruent behaviour. Those in the "stroking" condition (in which line strokes were created by pencil) will prefer to draw stroke stimuli. Those in the "stippling" condition (in which dotted marks were created by pencil) will prefer to draw stipple stimuli. We also hypothesise that drawing experience will impact aesthetic ratings in a similar manner indicating a relationship between the aesthetic and art-making experience presented by Tinio (2013).

2. In Chapter 2 we show similarities in gaze when viewing stimuli in comparison to making a drawing preference. If drawing action impacts aesthetic preferences as previously found (Leder, 2012; McLean et al., 2015; Ticini, 2014) then we would also predict drawing action to influence gaze. Thus, we hypothesise that gaze will be directed to stimuli congruent with drawing actions both when free-viewing and when making a drawing preference. Those in the stroking condition will fixate more on stroke stimuli and those in the stippling condition will fixate more on stipple stimuli.

3.4 Method

3.4.1 Participants

A total of Eighty-one participants took part in this study; forty-eight psychology students were recruited from the University of Reading and regarded as non-artists (27 females, 21 males: ages 19-50) using a background questionnaire. Thirty-three student artists (25 females, 8 males: ages 20-49) were recruited from the Fine Art department at the University of Reading and are regarded in this study as artists using the background questionnaire, but here we also recorded what type of art they usually created and how much of art experience they had (see appendix 2). The artists' years of formal art training ranged from 5 to 7 years with a mean of 5.6 years. They had from 5 to 18 with a mean of 6.5 years of art experience. The non-artists had less than 2 years with a mean of 0.1 years of training and no years of art experience. All participants had normal or corrected-to-normal vision and each stage of the study was completed by all participants.

3.4.2 Materials

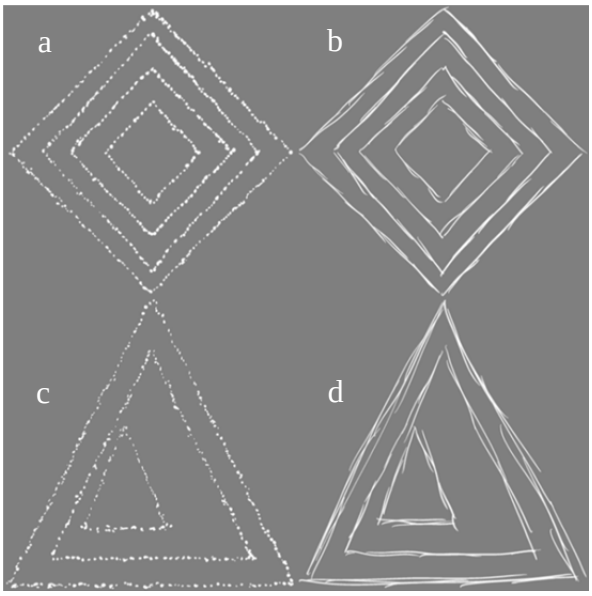

Figure 3.1- Examples of stimuli used (4 out of 8) from the four subsets: a: stipple-symmetrical (subset 1); b: stroke-symmetrical (subset 2); c: stipple-asymmetrical (subset 3); d: stroke-asymmetrical (subset 4).

The stimuli included 8 grayscale geometric shapes that had been piloted and included in Chapter 2, but here new versions were created on a Microsoft Surface computer tablet (see figure 3.1). The above stimuli were drawn using stroking and stippling action allowing for the actions of participants to match those made when creating, thus enhancing the visual associations between the images and the actions being produced (McLean et al., 2015). These images were grouped into four subsets based on their symmetry and style, with each subset containing two images (stipple-symmetrical, stroke-symmetrical, stipple-asymmetrical and stroke-asymmetrical).

Two scales were used:

- A 7-point scale was used to gather aesthetic ratings [1(very displeasing) to 7 (very pleasing)] (see Appendix 5).
- A relative preference scale was used to categorise drawing responses [1 (indicating a strong preference for the left image) to 7 (a strong preference for the right)] (see Appendix 6). Relative preference towards the two images was calculated from verbal response, numbers 1-3 indicated a preference for the left image and 5-7 for the right image, with 4 representing no preference.

The participants made these responses verbally. A verbal response was used here which have been used in past studies (Martindale, Moore & Borkum, 1990; Furman & Duke, 1988). Leder et al. (2012) recorded liking ratings using a keyboard press. Furthermore, McLean et al. (2015) requested participants to tick relevant scores on paper. These response actions may interfere with the stroking and stippling actions that participants are simultaneously making here, e.g. the rhythm and action of these may be muted whilst making judgements and the particular action to respond may interfere with the drawing action being produced. Therefore, verbal rating enables the actions to continue without a pause, and does not bias the stippling or stroking actions.

A debrief questionnaire form was also given at the end of the study to examine if participants were aware of the connection between the actions they made and the

actions portrayed in the images observed. Moreover, they were asked if they felt this relationship influenced their aesthetic ratings and drawing choice (see Appendix 8).

3.4.3 Apparatus

Stimuli were presented on a 21" colour desktop PC running Experiment builder (SR Research Ltd.). The distance between the monitor and participant was 57cm. All images were presented on a grey background and sized to 480 x 480 pixels. Stimulus width and height subtended 11.9 ° and 11.9° of visual angle. Eye movements of the right eye were recorded using an Eyelink II tracker with a sampling rate of 500Hz. A chin rest was used and participants were placed in a set position and requested not to move during the study. Calibration was maintained for each trial using a drift correct procedure between each trial that corrected fixation errors due to small movements in camera alignment (e.g. caused by head band slippage).

3.4.4 Procedure

Participants, both artists and non-artists, were assigned to one of three conditions. In the stippling condition participants were requested to tap a pencil on paper at their own pace. In the stroking condition participants were asked to draw straight lines at their own pace, for both conditions participants' hand movements could not be observed. The control group were not requested to make any drawing actions. Drawing motion was produced by all participants for all tasks; Aesthetic Rating (see section 3.4.4.1) Free-viewing (see section 3.4.4.2), Drawing Choice (see section 3.4.4.3).

3.4.4.1 Aesthetic Rating Task

The Aesthetic Rating task required participants to rate (verbally) how visually pleasing they found each image (see section 3.4.2). Participants completed this

task either before the eye-tracking tasks or at the end of the study. All images were presented for 5000ms prior to making an aesthetic judgement. Ratings were made verbally and were recorded by the experimenter.

3.4.4.2 Free-viewing task

For the Free-viewing tasks (see figure 3.2), eye movements were analysed whilst participants were presented with two images for 5000 ms. A fixation cross was displayed between each trial for 1000 ms and a drift correct was used after each trial. 32 trials were completed at random; all stipple images were presented alongside all stroke images. These pairing were shown twice allowing each image in a pair to be presented on both sides of the screen, no further information was provided for this task.

3.4.4.3 Drawing Choice task

The participants then completed the Drawing Choice task, eye movements were recorded for 5000 ms whilst participants considered which image of two they would select to draw (see figure 3.2). After images were removed they responded verbally (1 to 7) and responses were recorded by the experimenter. A relative preference scale (explained at beginning of task) was used for participants to make drawing preferences. A fixation cross was displayed between each trial for 1000 ms and a drift correct was used after each trial. 32 trials were also completed at random for the drawing choice task. These pairing were shown twice allowing each image in a pair to be presented on both sides of the screen, no further information was provided for this task.

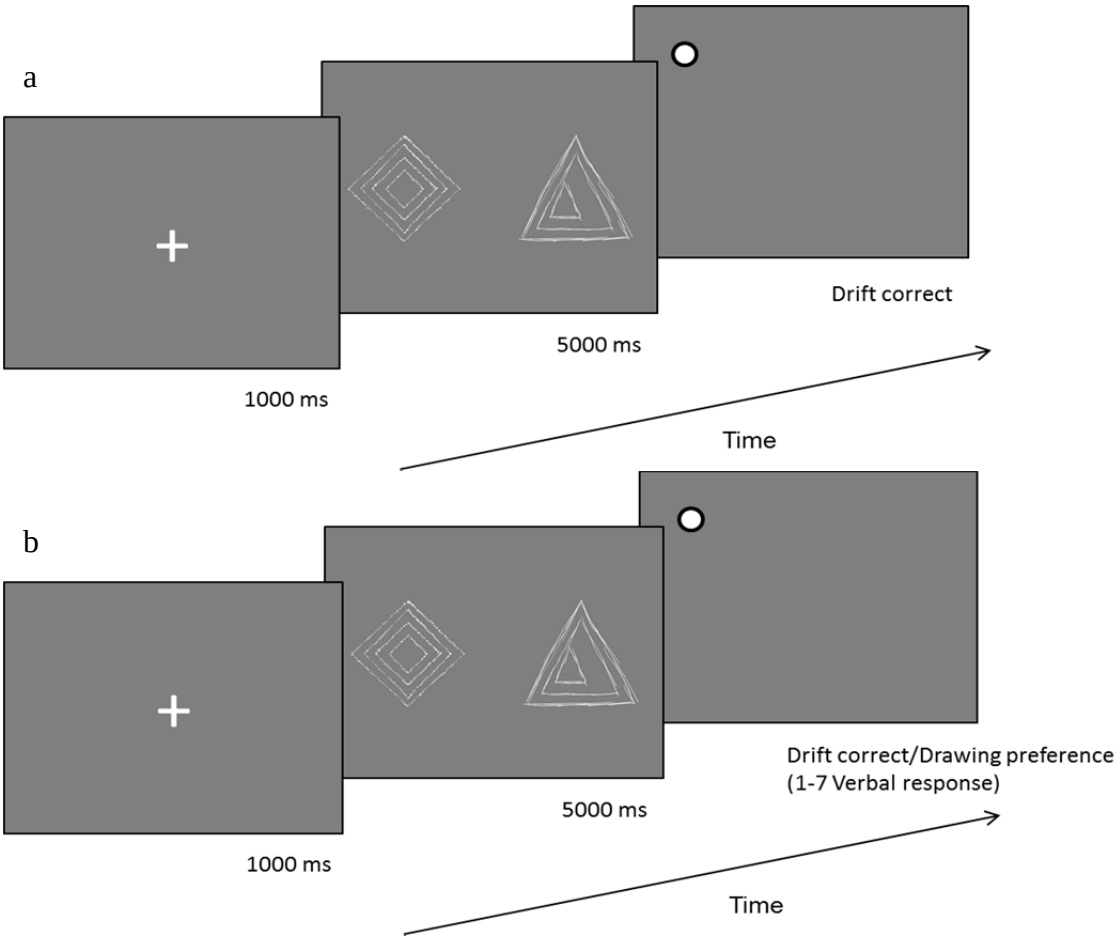

Figure 3.2- Free-view (a) and Drawing Choice (b) task trial example

3.4.5 Eye-tracking Analyses

As with Experiments 1 and 2 the following gaze metrics were used: first fixation direction (to the left or right stimulus), first saccade latency (the response time from stimuli onset to the start of the first saccadic eye movement response), total fixation duration (the total amount of time spent on each stimulus), and number of fixations (the total number of fixations on each stimulus). Fixations were classified as such if they exceeded 100 ms; if fixation along the x-axis was less than 800 pixels then this was regarded as fixation to the left image, if greater than 800 pixels, then fixation was regarded as to the right image.

3.5 Results

We first report the impact of action congruency on aesthetic and drawing preferences and present eye-tracking results when free-viewing and when making a drawing preference.

3.5.1 Effect of Congruent Action on Aesthetic Preference

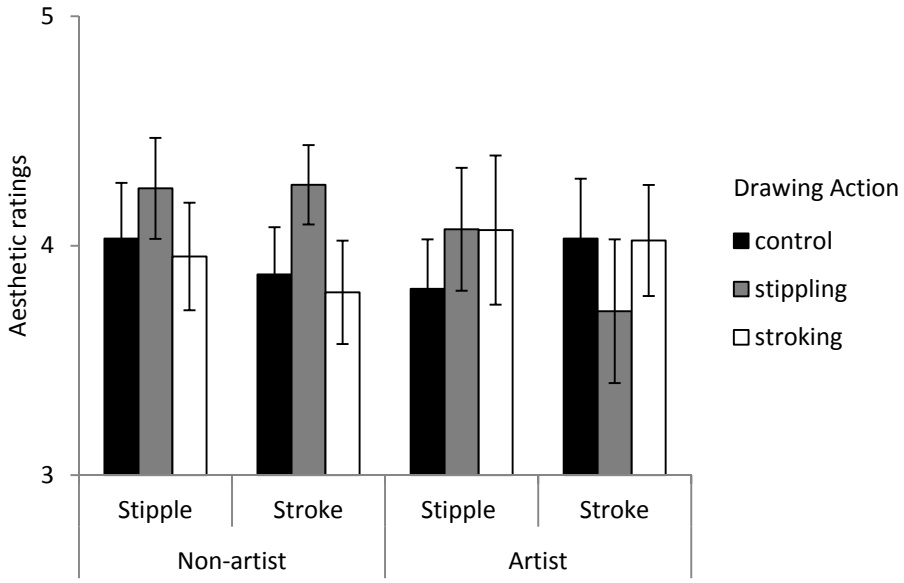

Figure 3.3- Aesthetic ratings (congruent action): shows that there is no effect of congruent action on aesthetic ratings.

	Non- artist		Artist	
	Stipple-Aesthetic rating Means (S.D)	Stroke-Aesthetic rating Means (S.D)	Stipple-Aesthetic rating Means (S.D)	Stroke-Aesthetic rating Means (S.D)
Control	4.03 (0.97)	3.88 (0.82)	3.97 (0.67)	4.16 (0.61)
Stippling	4.25 (0.88)	4.27 (0.69)	4.07 (1.00)	3.71 (1.17)
Stroking	3.95 (0.94)	3.80 (0.90)	4.07 (1.08)	4.02 (0.80)

Table 3.1- Aesthetic Ratings: Descriptive statistics

Figure 3.3 shows aesthetic ratings for image style as a function of action style and expertise. A three-way ANOVA with image style, action type and expertise as factors shows no main effects or interactions, all *p's>0*.290 (see Appendix 14).

3.5.2 Effect of Congruent action on Drawing Preference

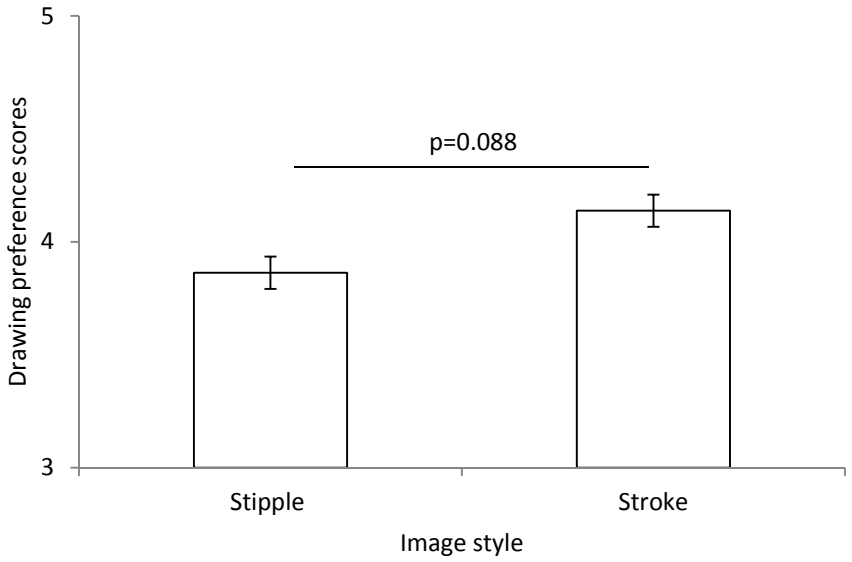

Figure 3.4 - Drawing preference scores (congruent action) collapsed across expertise and action condition: shows differences (trend) in choice of creation dependent on the style of image.

	Non- artist		Artist	
	Stipple-Drawing preference score Means (S.D)	Stroke-Drawing preference score Means (S.D)	Stipple-Drawing preference score Means (S.D)	Stroke-Drawing preference score Means (S.D)
Control	3.99 (0.32)	4.01 (0.32)	3.92 (0.70)	4.08 (0.70)
Stippling	3.90 (0.17)	4.10 (0.17)	3.61 (1.02)	4.39 (1.02)
Stroking	3.94 (0.19)	4.06 (0.19)	3.86 (1.16)	4.14 (1.16)

Table 3.2- Drawing Preference Scores Ratings: Descriptive statistics

Figure 3.4 shows drawing preference scores for image style as a function of action style and expertise. A trend shows stroke images to be preferred for drawing regardless of action and artistic expertise, $F(1, 75)=2.981$, $MSE= 0.879$, $p=0.088$, $\eta^2 =0.038$. No other main effects or interactions were found, all *p's*>0.351 (see Appendix 14).

3.5.3 Effect of Congruent Action on Free-viewing Gaze

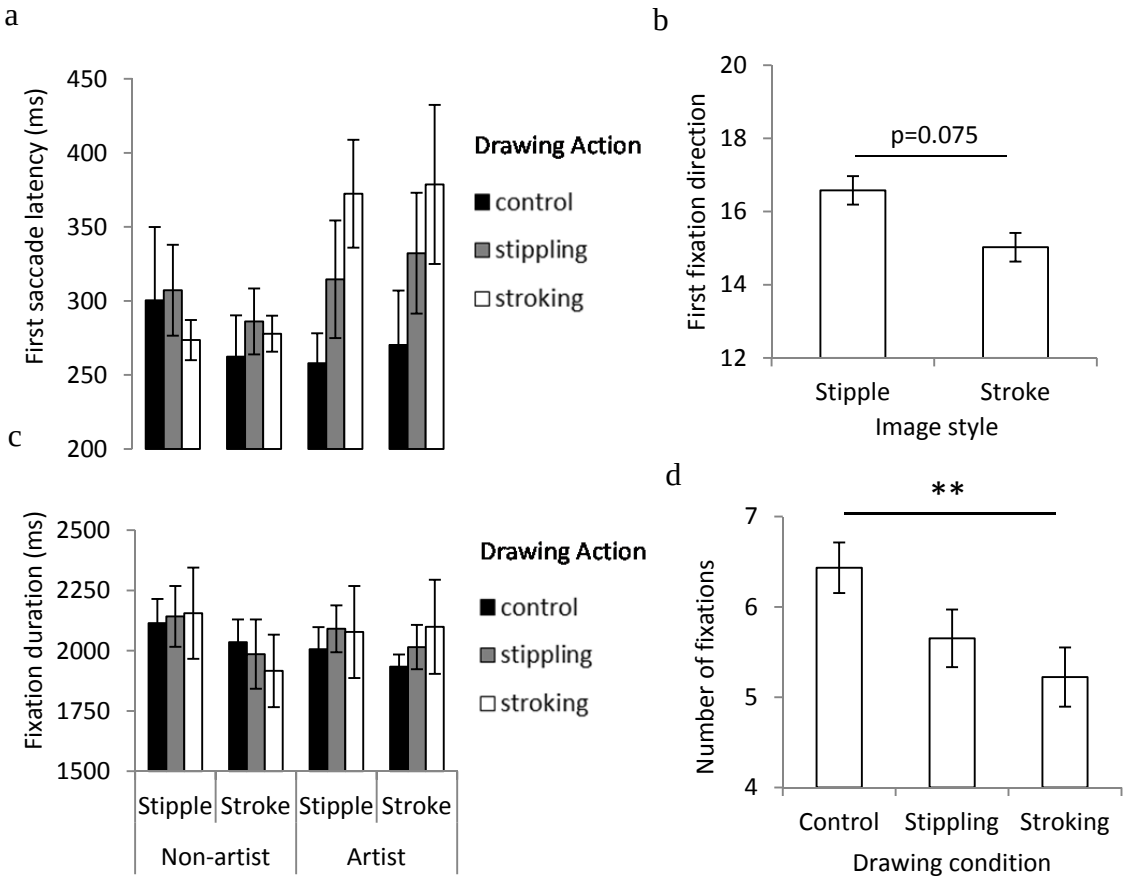

Figure 3.5- Free-viewing task (congruent action): Upper row shows first saccade response: the latency of the response in milliseconds (Left) and its direction, which is collapsed across expertise and action condition, (Right). Lower row shows overall fixation behaviour: mean total fixation duration in milliseconds (Left) and the mean number of fixations, which is collapsed across image style and expertise, (Right). * $p<.05$; ** $p<.01$; *** $p<.001$.

	Non- artist						Artist					
	Control		Stippling		Stroking		Control		Stippling		Stroking	
	Stipple Means (S.D)	Stroke Means (S.D)	Stipple Means (S.D)	Stroke Means (S.D)	Stipple Means (S.D)	Stroke Means (S.D)	Stipple Means (S.D)	Stroke Means (S.D)	Stipple Means (S.D)	Stroke Means (S.D)	Stipple Means (S.D)	Stroke Means (S.D)
First saccade latency	300.42 (198.22)	262.35 (111.74)	307.27 (122.75)	286.15 (89.16)	273.58 (54.38)	277.84 (48.61)	257.94 (57.10)	270.24 (103.97)	314.62 (148.71)	332.22 (152.66)	372.41 (120.95)	378.69 (178.14)
First fixation direction	16.19 (3.06)	15.69 (3.22)	17.13 (4.83)	14.88 (4.83)	17.81 (3.31)	14.19 (3.31)	17.0 (3.59)	14.88 (3.44)	16.29 (2.49)	14.57 (3.13)	14.64 (2.77)	16.18 (2.60)
Fixation duration	2114.47 (400.70)	2035.08 (376.59)	2142.10 (504.30)	1985.73 (574.35)	2155.41 (755.89)	1916.32 (601.68)	2058.95 (341.33)	1877.24 (177.04)	2090.71 (362.92)	2014.84 (343.61)	2077.48 (632.27)	2098.94 (647.422)
Number of fixations	6.59 (1.51)	6.53 (1.56)	5.67 (1.92)	4.95 (1.84)	5.45 (1.06)	5.39 (2.10)	6.51 (1.22)	5.85 (0.73)	6.30 (1.62)	5.78 (1.43)	5.01 (2.08)	4.86 (1.56)

Table 3.3- Free-viewing task (congruent action): Descriptive statistics

Figure 3.5 shows gaze behaviour elicited during the Free-viewing task. Overall image style, expertise and drawing conditions were not found to impact upon free-viewing gaze behaviour. A series of three-way ANOVAs were conducted for first saccade latency, first fixation direction, fixation duration and fixation count with image style, action type and expertise as factors. No main effects or interactions were found on first saccade latency (fig. 3.5a), all *p's*>0.145. For first fixation direction (fig. 3.5b) however, there was found to be a trend as first fixations tend to be directed towards stippling images, F (1, 75) = 3.251, MSE= 24.341, p=0.075, η^2=0.042. No other main effects or interactions were found, all *p's*>0.228. Fixation durations (fig. 3.5c) show no main effect of image style, expertise and action type or interactions between them, all *p's*>0.310. But there was a main effect of action type on fixation count (fig. 3.5d), F(1, 75) = 5.115, MSE= 16.688, p=0.008, η^2 =0.120, participants in the control group made more fixations (M=6.369) than those in the stroking conditions (M=5.177), p=0.006. No main effects of image style and expertise or interactions between variables were found, all *p's*>0.127 (see Appendix 14).

3.5.4 Effect of Congruent Action on Drawing Choice Gaze

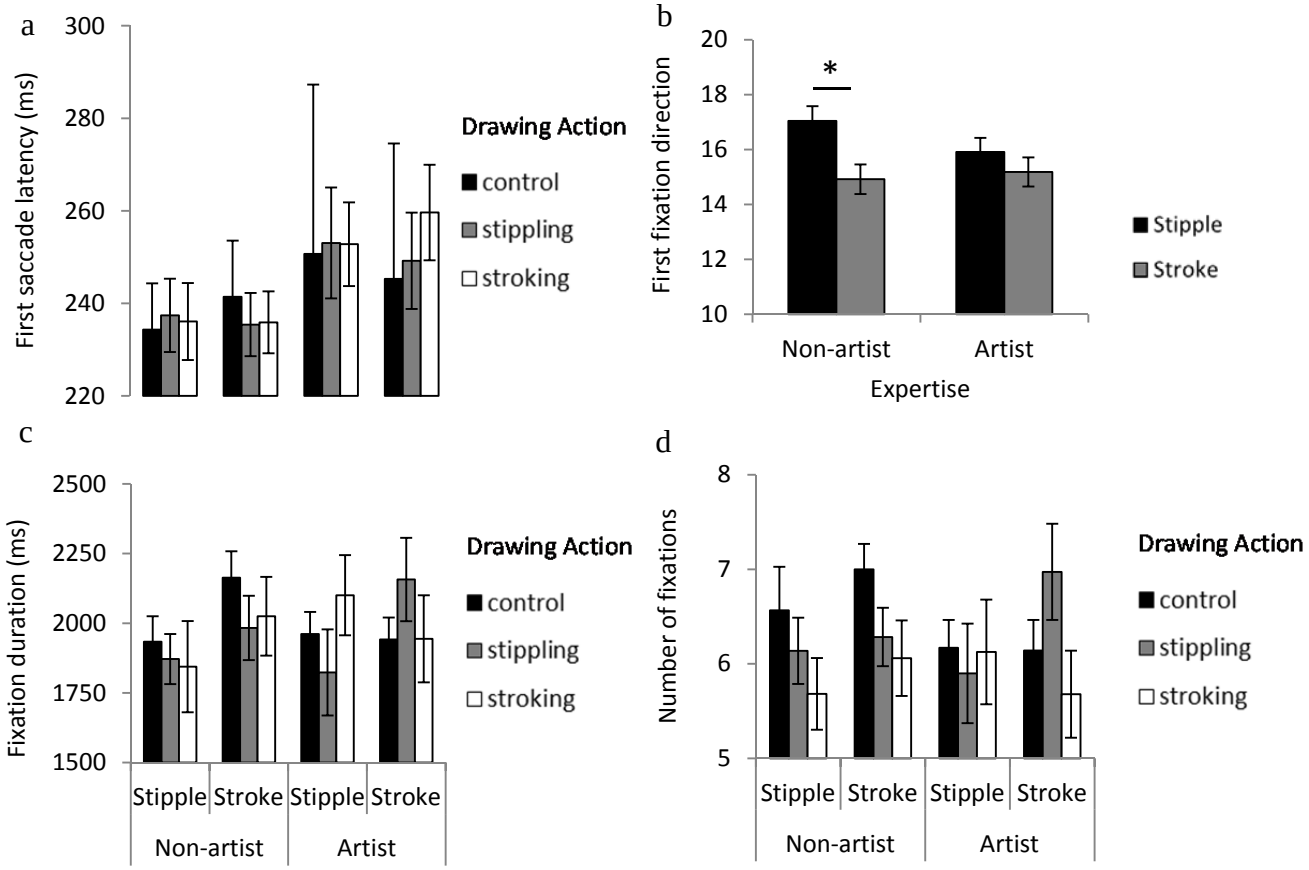

Figure 3.6- Drawing Choice task (congruent action): Upper row shows first saccade response: the latency of the response in milliseconds (Left) and its direction, which is collapsed across drawing condition, (Right). Lower row shows overall fixation behaviour: mean total fixation duration in milliseconds (Left) and the mean number of fixations (Right). * $p<.05$; ** $p<.01$; *** $p<.001$.

	Non- artist						Artist					
	Control		Stippling		Stroking		Control		Stippling		Stroking	
	Stipple Means (S.D)	Stroke Means (S.D)	Stipple Means (S.D)	Stroke Means (S.D)	Stipple Means (S.D)	Stroke Means (S.D)	Stipple Means (S.D)	Stroke Means (S.D)	Stipple Means (S.D)	Stroke Means (S.D)	Stipple Means (S.D)	Stroke Means (S.D)
First saccade latency	234.32 (40.1)	241.42 (48.59)	237.41 (31.7)	235.41 (27.28)	236.07 (33.32)	235.89 (26.79)	250.68 (103.51)	245.30 (82.72)	253.05 (44.84)	249.18 (38.94)	252.78 (29.99)	259.63 (34.24)
First fixation direction	16.75 (2.72)	15.25 (2.72)	17.25 (4.17)	14.75 (4.17)	16.88 (3.54)	15.13 (3.54)	15.25 (3.28)	16.75 (3.28)	12.64 (3.61)	14.36 (2.34)	14.45 (1.63)	13.64 (1.57)
Fixation duration	1933.84 (365.87)	2163.66 (377.90)	1871.57 (359.23)	1982.99 (461.72)	1844.30 (654.51)	2024.84 (564.95)	1961.14 (224.19)	1941.89 (222.66)	1823.63 (577.53)	2156.93 (559.35)	2100.41 (476.91)	1943.86 (518.11)
Number of fixations	6.56 (1.84)	7.0 (1.07)	6.14 (1.41)	6.28 (1.24)	5.68 (1.52)	6.06 (1.60)	6.17 (0.83)	6.14 (0.92)	5.90 (1.97)	6.97 (1.90)	6.13 (1.84)	5.68 (1.53)

Table 3.4- Drawing Choice task (congruent action): Descriptive statistics

Figure 3.6 shows gaze behaviour elicited during the Drawing Choice task. Overall image style, expertise and drawing conditions were not found to impact upon gaze behaviour. Four separate three-way ANOVA's examining first saccade latency (fig. 3.6a), fixation duration (fig. 3.6c), fixation count (fig. 3.6d) with image style, action type and expertise were conducted. No main effects or interactions were found, all *p's*>0.092. For first fixation direction (fig. 3.6b), a trend was found for an interaction between image style and expertise, $F(1, 75)=3.556$, $MSE= 69.875$, $p=0.063$, $\eta^2 =0.072$. 45. Pairwise comparisons show that non-artists made more first fixations to stipple images ($M=16.958$) compared to stroke images ($M=15.042$), $p=0.037$(see Appendix 14).

3.5.5 Aesthetic and Drawing Relationships

We found that congruent drawing action had no influence on the styles of drawings being selected for creation. Here, we further examine correlations between aesthetic and drawing preference for all drawing conditions. To examine the hypothesised relationship between aesthetic ratings and drawing preference scores, separate correlations between these were conducted for each participant and their correlation coefficients were Z prime transformed and subject to a one-sample t-test. This was carried out separately for both artists and non-artists to examine whether these correlations significantly differed from zero. Positive correlations between aesthetic ratings and drawing preference scores were found for non-artists regardless of action type, Non-artists: $r=0.523$ ($SD=0.382$), $t(15)=4.205$, $p<0.001$, $d=1.051$ (Control); $r=0.46$ ($SD=0.331$), $t(15)=5.186$, $p<0.001$, $d=1.296$ (Stippling); $r=0.457$ ($SD=0.467$), $t(15)=3.637$, $p=0.002$, $d=0.909$ (Stroking). Comparisons were made across the time points at which aesthetic ratings were made and no differences were found.

Positive correlations between aesthetic ratings and drawing preference scores were found for artists regardless of action type, Artists: $r=0.386$ ($SD=0.425$), $t(7)=2.165$, $p=0.067$, $d=0.765$ (Control); $r=0.439$ ($SD=0.390$), $t(13)=3.531$, $p=0.004$, $d=0.944$ (Stippling); $r=0.374$ ($SD=0.422$), $t(10)=2.787$, $p=0.019$, $d=0.840$ (Stroking). However, comparisons were made across the time points at which

aesthetic ratings were made and differences were found for those in the stippling and stroking condition. Artists only show a relationship here if aesthetic ratings were collected after the eye-tracking tasks; r=0.701 *(SD*=0.257), t(5)=4.335, p=0.007, d=1.77 (Stippling); r=0.704 *(SD*=0.152), t(5)=6.510, p<0.001, d=2.658 (Stroking). Those who made aesthetic ratings at the start of the study did not show significant positive correlations here; r=0.243 (*SD*=0.357), t(7)=1.586, p=0.157, d=0.561 (Stippling); r=-0.024 (*SD*=0.273), t(4)=-.174, p=0.870, d=-0.077 (Stroking).

3.5.6 Awareness and Participant's Responses to Effect of Congruent Action

A binomial test was run on the debrief responses examining participants' awareness of the relationship between their simultaneous action and the motion that could be perceived in the images. The proportion of non-artists that were unaware of the relation between their actions and the actions of the artist .84 was significantly higher than expected, p<0.001. The same proportion .84 did not believe this relationship affected their responses, p<0.001. A binomial test was also run for artists, the proportion of artists that were unaware of the relation between their actions and the actions of the artist .68 was not significantly higher or lower than expected, p<0.108. A chi square was conducted on how this relationship affected responses as no effect, positive effect and negative effects were reported. Nevertheless, overall artists did not feel that this impacted response, X^2 (2, N=25) =14.480, p<0.001.

3.5.7 Additional Findings: Gaze a Useful Measure of Preference

In Chapter 2 the results can be portrayed to support gaze as a useful measure of preference. We reanalysed free-viewing trials according to Chapter 2 to examine if aesthetic and drawing preference continues to impact gaze when engaged with drawing (see tables 3.5 & 3.6).

	Non- artist						Artist					
	Control		Stippling		Stroking		Control		Stippling		Stroking	
	Prefer Means (S.D)	Not Prefer Means (S.D)	Prefer Means (S.D)	Not Prefer Means (S.D)	Prefer Means (S.D)	Not Prefer Means (S.D)	Prefer Means (S.D)	Not Prefer Means (S.D)	Prefer Means (S.D)	Not Prefer Means (S.D)	Prefer Means (S.D)	Not Prefer Means (S.D)
First saccade latency	281.67 (173.23)	266.81 (92.36)	315.29 (125.84)	296.86 (119.46)	280.84 (55.48)	278.73 (56.80)	262.55 (69.73)	273.63 (63.13)	343.34 (166.31)	273.14 (793.66)	424.45 (180.04)	347.23 (124.36)
First fixation direction	14.19 (3.12)	13.31 (2.24)	13.94 (2.72)	12.19 (2.40)	10.75 (6.17)	15.50 (4.35)	11.25 (2.92)	14.625 (4.14)	11.79 (3.47)	13.00 (3.76)	13.09 (3.21)	12.18 (3.03)
Fixation duration	2259.17 (283.76)	1891.87 (255.88)	2376.30 (422.34)	1771.23 (447.29)	2291.08 (644.71)	1780.11 (543.98)	2025.16 (209.32)	1932.81 (244.75)	2057.11 (275.81)	2046.86 (282.11)	2248.45 (228.82)	1924.38 (227.65)
Number of fixations	6.51 (1.02)	6.55 (1.50)	5.47 (1.58)	5.27 (1.44)	5.41 (1.31)	5.46 (1.30)	6.29 (0.96)	6.08 (0.78)	6.17 (1.72)	6.09 (1.23)	5.11 (1.37)	4.70 (1.60)

Table 3.5- Free-viewing task (Aesthetic preference): Descriptive statistics

3.5.7.1 Aesthetic Preference

A main effect of aesthetic preference on first saccade latency shows that latencies to preferred images were slower than to those that were less preferred, $F(1, 75) = 5.965$, $MSE=31054.603$, $p=0.017$, $\eta^2=0.074$. There was no main effect of expertise or action type and no interactions between variables, all *p's*>0.149. There was no main effect of aesthetic preference, expertise or action type and no interactions on first fixation direction, all *p's*>0.113.

A main effect of aesthetic preference was found as more time was spent fixating images that were aesthetically preferred, $F(1, 75) = 13.826$, $MSE= 3841511.695$, $p<0.001$, $\eta^2=0.156$, but there were no main effects of expertise or action type, all *p's*>0.329. There was however an interaction between aesthetic preference and expertise $F(1, 75) =4.232$, $MSE=1175767.309$, $p=0.043$, $\eta^2=0.053$. Only non-artists fixated more on images aesthetically preferred ($M=2308.852$) than less preferred ($M=1814.4$), $p<0.001$. There was a main effect of action type on number of fixations, $F(1, 75) =5.100$, $MSE= 16.623$, $p=0.008$, $\eta^2=0.120$. Participants in the control condition made more fixations ($M=6.358$) than those in the stroking condition ($M=5.169$), $p=0.006$. There was no main effect of aesthetic preference or expertise and no interactions, all *p's*>0.131.

	Non- artist						Artist					
	Control		Stippling		Stroking		Control		Stippling		Stroking	
	Prefer Means (S.D)	Not Prefer Means (S.D)	Prefer Means (S.D)	Not Prefer Means (S.D)	Prefer Means (S.D)	Not Prefer Means (S.D)	Prefer Means (S.D)	Not Prefer Means (S.D)	Prefer Means (S.D)	Not Prefer Means (S.D)	Prefer Means (S.D)	Not Prefer Means (S.D)
First saccade latency	275.69 (133.78)	283.62 (177.62)	292.07 (97.74)	289.44 (96.76)	276.80 (46.35)	280.02 (62.39)	245.85 (49.65)	291.06 (105.86)	377.60 (239.04)	270.16 (99.43)	405.80 (147.70)	348.17 (152.13)
First fixation direction	14.13 (3.40)	12.00 (3.01)	15.00 (5.32)	13.31 (3.84)	12.88 (2.66)	13.50 (3.58)	11.63 (3.58)	12.25 (2.82)	12.71 (3.79)	13.21 (3.58)	15.27 (3.17)	12.27 (2.45)
Fixation duration	2180.77 (357.52)	1973.09 (358.21)	2311.41 (510.30)	1821.36 (530.20)	2261.45 (508.26)	1817.47 (416.59)	1999.31 (223.40)	1953.70 (140.53)	2191.11 (351.21)	1922.18 (388.66)	2448.81 (560.68)	1723.82 (522.04)
Number of fixations	6.89 (1.43)	6.25 (1.19)	5.79 (2.07)	4.82 (1.63)	5.81 (1.29)	4.94 (1.42)	6.35 (0.89)	6.19 (0.73)	6.21 (1.65)	5.83 (1.54)	5.57 (1.83)	4.26 (1.69)

Table 3.6- Free-viewing task (Drawing preference): Descriptive statistics

3.5.7.2 Drawing Preference

This data was further reanalysed according to drawing preference. Two separate three-way ANOVA's examining first saccade latency and first fixation direction with drawing preference, action type and expertise were conducted. No main effects or interactions were found, all *p's*>0.076.

A similar analysis was conducted examining fixation duration and number of fixations. There was a main effect of drawing preference on fixation duration as more time was spent fixating on images that were preferred for drawing, $F(1, 75) = 14.053$, $MSE = 5009921.725$, $p<0.001$, $\eta^2=0.158$. There was no main effect of expertise or action type and no interactions, all *p's*>0.185. There was a main effect of drawing preference on number of fixations as more fixations were made to drawing preference, $F(1, 75) = 14.100$, $MSE=19.778$, $p<0.001$, $\eta^2=0.158$. There was also a main effect of action type, $F(1, 75) = 5.906$, $MSE= 19.182$, $p=0.004$, $\eta^2=0.136$. Participants in the control condition made more fixations ($M=6.420$) than those in the stroking condition ($M=5.144$), $p=0.003$. There was no main effect of expertise and no interactions between preference, expertise and action type, all *p's*>0.356 (see appendix 15).

3.6 Discussion

We did not find an impact of drawing activity, which can often be important in early stages of art-making, on drawing choices (Mace & Ward, 2002; Tinio, 2013). We found that the drawing choices of artists were not influenced by their current drawing experience (action); in fact, we found a trend for stroke images being preferred for creation regardless of drawing activity. This supports Guggenheim and Whitfield (1989) who found drawing experience with an object (hairdryer or vice) to have no impact on drawing decisions or drawing production but a general liking for hairdryers was found. Although, drawing preferences would be expected to be more greatly influenced when action is prompted through drawing and specifically when action made is congruent to what is observed (Albarracín et al.,

2008). Sketching has been suggested to serve as an aid for initial design of artworks; here we find that the activity of drawing, not creating specific elements, but action alone does not influence what is preferred for drawing. We also did not find aesthetic judgements to be influenced by simultaneous actions although this has been found in past research (Leder et al., 2012; Ticini et al., 2014; McLean et al., 2015). Therefore, we do not provide support for the mirror model of art which suggests that the aesthetic experience is influenced by the art-making process of the artist.

To summarize the results, we found a trend for brushstroke images to be preferred for drawing. Gaze when free-viewing shows an effect of image style with a trend for participants to make more first fixations to stippling images. More fixations were also made with participants in the control group compared to those involved with making stroking actions. Gaze when making this drawing choice shows non-artists' first fixations were directed more to stipple images. Overall as found in Experiments 1 and 2 we continue to find similarities between images aesthetically preferred and those preferred for drawing. However, significant correlations for artists in the drawing conditions (stippling/stroking) were only found for those who made aesthetic judgements after the drawing preference task.

We find no effect of congruent actions on aesthetic, drawing preference scores, or gaze when free-viewing and when making a drawing preference. Debrief questions revealed that artists may be aware of the different actions performed to make the stimuli and how they matched own actions, but non-artists were not aware of this. Regardless, both artists and non-artists did not feel that making simultaneous congruent or incongruent actions influenced their aesthetic ratings and drawing preference scores. This was found to be an important factor in Mclean et al's. (2015) study as participants that felt the link between their action and the actions of the artist influence their aesthetic ratings, were found to have stronger congruency effects.

The results reported here can be compared to previous studies. Our main findings are contrary to those reported by Leder et al. (2012). They found an effect of congruent action using artworks. Brushstroke paintings were liked more when

participants were simultaneously producing congruent stroking actions, and pointillism paintings were liked more when participants were simultaneously producing congruent stippling actions. Following this we expected images preferred for drawing, and particularly those aesthetically preferred, to be influenced by the actions being simultaneously produced, but our results show no effect. We did however show a trend in greater preferences for creating brushstroke images. A similar aesthetic preference for brushstroke images was reported by McLean et al. (2015). They also found no effect of congruency. An effect of image type was found in Leder et al's results, but unfortunately, they did not clarify the direction of this effect.

McLean et al. (2015) conclude that greater awareness of activity is required for liking to be influenced by congruent actions. When they used a new set of stimuli (productions from participants in their experiment one), then an effect of congruency was found. A further experiment in which participants were made more aware of the action and art production relationship also led to an effect of congruency, but only for those making stippling actions. They conclude that greater awareness of the association between their action and the stimuli is important for a congruency effect to be found. This provides a potential explanation why no effect of congruency was found in our study. A further comparison can be made to Woltin and Guinote (2015) in which a partial replication of Leder et al. (2012) was carried out. They also found no effect of congruency overall, but both painting styles were preferred whilst participants made stroking actions. Unfortunately, they did not report the main of effect of art style, so it is unclear whether or not brushstroke paintings were preferred. Overall, research shows that brushstroke paintings are generally preferred over pointillism paintings and there is no consistent effect of congruency unless participants are made more aware of the actions performed to create the stimuli.

In addition to the results presented above, we also examined gaze. When participants were free-viewing, we find first fixations to be more towards stipple forms, regardless of expertise. In addition, a general effect of actual drawing behaviour appears to impact gaze when free-viewing. More fixations were found to be made by participants in the control group compared to those making

stroking actions when participants were freely-viewing drawings. Simultaneous drawing activity reduces the number of fixations made, particularly when engaged in making stroking actions. This seems to mirror the findings of Miall and Tchalenko (2001) who report that during painting an artist's fixation durations were twice as long as to when they were not painting, consequently our participants are producing fewer fixations. Similarly, when we examine gaze during the Drawing Choice task we find further impact of drawing activity. Non-artists' first fixations were found to be directed more to stipple images when making a drawing choice despite a trend for selecting to draw stroke images.

We continue to find positive correlations for both artists and non-artists between aesthetic and drawing preference, even when producing drawing actions themselves. However, significant correlations for artists in the drawing conditions (stippling and stroking) were only found for those who made aesthetic judgements after the drawing preference task. This difference was not found when making no action, nor was it found in Chapter 2 when no actions were made. When engaged in drawing it is apparent that the experience of artists is altered, an aesthetic-creative relationship found when making no actions is only found when artists make drawing choices prior to evaluating stimuli. Therefore, artists drawing experiences appear to impact on their aesthetic experiences. This can be due to experience in the creative process (combination of drawing action and decisions) enhancing understanding of the artists' process affecting the aesthetic experience (Gallese & Freedberg, 2007). Similarly, when artists were involved with a drawing action, gaze whilst free-viewing was only towards images they'd prefer to draw, which suggests that when artists are engaged with drawing then drawing preferences are considered more than aesthetic preferences. For non-artists however, images aesthetically preferred relate to images preferred for drawing regardless of drawing activity experience and when ratings are made, and they continue to fixate both on aesthetic and drawing preferences.

No effect of congruency on art-making decisions was found, thus being more involved with a specific art-making experience (making drawing actions) does not influence decisions, although sketching and drawing prior to making initial art-making decisions is considered to be important. However, for artists, being

involved in a drawing activity had an impact on their drawing-aesthetic preference relationship. Tinio's (2013) model suggests that a perceiver of art is influenced by considering the art-making processes of the artist. When providing a greater experience of art-making (making stippling or stroking actions) we do not find this to influence aesthetic experiences when our participants were observing and aesthetically rating stimuli, we therefore do not replicate results found by making congruent drawing actions (Leder et al., 2012; Ticini et al., 2014; McLean et al., 2015). A reason for not finding an effect here, particularly in regards to the aesthetic experience, may be due to the use of geometric drawings. It is notable that Leder et al. (2012), McLean et al. (2015), Woltin and Guinote (2015) used paintings that had been created for exhibition, although McLean et al. (2015) only found a congruency effect using novel drawings in stroke and stipple forms, the inclusion of art that has been made for exhibition is ideal, particularly to understand the perspective of the perceiver of a final product. Chatterjee (2011) explains how the visual properties of art can attract viewer's perception more than simple objects, thus artworks can have a greater effect on the perceiver and their consequential responses. When we consider displaying a final product of art and Tinio's mirror model of art, it is apparent that the actions of the artist, which include the specific techniques and diverse styles of the artist as used in this chapter, are also emphasised during later stages of art-making to impact the perceivers early and on-going aesthetic experiences. In Chapter 4 we explore these questions further.

3.7 Conclusion

We do not find an impact of drawing activity, which can often be important in the formation of aesthetic judgements and drawing choices. Mace and Ward (2002) state that the multiple ways in which an idea can be created is important during initial stages of art-making thus are explored prior to making a drawing choice; however, we find no effect of congruent action on drawing or aesthetic preferences. Regardless of making congruent or incongruent actions participants tend to select to draw stroke drawings and we find this to influence gaze as those

making incongruent actions to strokes (those stippling) fixate more on stroke images prior to making a drawing choice. We continue to find similarities between images aesthetically preferred and those preferred for drawing, but this is modulated by expertise and drawing activity as artists in the stippling and stroking conditions who made aesthetic judgements prior to drawing preferences did not aesthetically prefer images the more they wanted to draw them. Thus, it can be suggested that the drawing experience influences the artists' overall aesthetic experience as aesthetic preferences begin to match drawing preferences after drawing decisions are made.

We however conclude that drawing activity has little direct impact on drawing choices as only a trend is found for preferring to create brushstrokes images. Having a drawing experience also has little impact when observing drawings and making aesthetic judgements which supports Guggenheim and Whitfield's (1989) study. We do not provide support for the mirror model of art and our results do not replicate findings from past studies that suggest a relationship between artistic actions and the aesthetic experience. It may be the case that use of art (used in previous research) rather than geometric stimuli (used here) may be ideal to explore this further as we consider the aesthetic experience of a perceiver of art.

Chapter 4: Impact of Drawing Activity and Training on Aesthetic Preference

4.1 Abstract

Here, we adopt two approaches, one where simultaneous drawing action is completed by the participant as in Chapter 3 and another using training and priming of drawing behaviour to further examine the relationships between art-making and aesthetic experience. Here, we consider the aesthetic experience of a perceiver of the final product of art, thus we incorporate artworks (pointillism and brushstroke paintings) as stimuli. When considering the perceiver of a final art piece, it has been suggested that their aesthetic experience, which involves early perceptual responses through to forming aesthetic judgements, can be influenced by the art-making process of the artist (Tinio, 2013). Some studies have demonstrated that the actions of the artist can influence liking of artworks when observers simultaneously create or familiarise themselves with congruent and incongruent actions (Leder et al., 2012; Ticini et al., 2014; McLean et al., 2015). However, such studies do not relate findings back to the relationship between the artist and perceiver. Furthermore, there are adjustments that can be made to improve current study designs. In Experiment 3 we found no effect of congruency on aesthetic preferences and in Experiment 4 we continue to find no influence on aesthetic ratings and gaze behaviour, but brushstroke style artworks are preferred and fixated on for longer. In Experiment 5 the enhancement of visuo-motor associations by including a training phase and priming participants, showed an effect of congruency as drawing actions influenced gaze, participants fixated more on stipple images when presented with a stipple prime and fixated more on stroke images when presented with a stroke prime. The results support current models of aesthetic experience as the low-level features (artist technique) influence aesthetic responses and particularly gaze but only when the link between the action and art production is made explicit. Specifically regarding Tinio's (2013) model, we show that gaze behaviour (a measure of the formation of aesthetic judgements) is influenced by congruent actions when greater training and information of artistic action is provided. Thus, earlier stages of the aesthetic experience can relate to later stages of art-making as depicted in the model.

4.2 Introduction

There has been a great deal of research that examines what features of stimuli and artworks affect the aesthetic experience, and what aspects appear to play an important role in it being deemed aesthetically pleasing. When we consider art as an object that can be aesthetically evaluated, there seems to be a difference in art that distinguishes it from other objects. It has been argued that in order to better understand the aesthetic experience of art; research must consider the artist behind the artwork, their motivations, decisions and actions (Tinio, 2013). The link between the artists' experience while producing art to the aesthetic experience of the perceiver has been made explicit in Tinio's Mirror Model. More knowledge of the interactions between production and perception as portrayed in the mirror model of art are crucial for greater understanding of the aesthetic experience of the viewer, and current methods can be used to examine these relationships (Schabmann et al., 2015; Vartanian, 2014).

The conclusion that perceivers evaluate the artist as part of their aesthetic experience is suggested from evidence showing that the identity of the artist is important to them. Perceivers of art can distinguish between those artworks that are computer generated and those that are man-made. This has been found to impact the aesthetic experience with man-made art rated to be more attractive (Chamberlain, Mullin & Wagemans, 2015). In addition, Reid et al. (2012) found participants to fixate more on realistic images compared to the computer sketch versions of the same image. Alvarez, Winner, Hawley-Dolan, Snapper (2015) also found abstract paintings produced by an artist to be fixated on more and regarded to be of higher quality compared to those produced by children or animals. Further studies show original versions of art to be aesthetically preferred to computer versions of art as participants perceive more movement in real artworks in comparison to modified computerised versions and higher aesthetic ratings are given to these artworks. It is suggested that the dynamics of the artworks and the actions of the artist (i.e. brushstrokes), impact upon the perceivers' response (Umilta et al., 2012; Sbriscia-Fioretti et al., 2013). The visual properties of art can attract viewer's perception more than simple objects, and artworks can have a greater effect on the perceiver and their consequential responses (Chatterjee,

2011). This further demonstrates the importance of using artworks to understand in greater depth the impact of the artist on the perceiver.

4.2.1 Drawing Activity and Training

In the mirror model of art, the first stages of the aesthetic experience can be particularly examined in relation to the latter stages of art-making. Here, the audience's initial perception and experience of the artwork relates to the artist's final modifications of the artwork. As the perceiver's experience develops they follow the artist's work from its final stages in production through to the initial idea (Tinio, 2013). Some studies have examined the perceiver's aesthetic experience in relation to the artist and their actions, but further investigation is required. Leder et al. (2012) conducted a study where they examined how creating simultaneous actions (stippling or stroking) whilst observing artworks influenced aesthetic judgements, particularly if these actions were similar or different to the original actions of the artist. They found that congruent actions with the artist positively impacted the perceiver's liking of art. However, replications of this study have failed to find an impact of congruent action on the perceiver's experience; in contrast results show a general impact of artistic behaviour with brushstroke paintings being preferred regardless of action (McLean et al., 2015; Woltin & Guinote, 2015; Experiment 3). However, an impact of congruent action on aesthetic rating was found when people with certain characteristics were examined, when participants were introduced with new stimuli clearly showing artistic action and when participants were informed about the existing relationships between the actions portrayed in the art and those being simultaneously made. It is apparent that simultaneous actions alone may not be sufficient to examine the relationships between artist and perceiver and results from Chapter 3 supports this, thus providing a more obvious link through explicitly informing participants of the link between their action and the artwork may be important. However, as this has obvious drawbacks of demand characteristics, an alternative method can be provided through training.

Therefore, in this chapter we further extend the work presented in Chapter 3 in two ways. Firstly, by using artworks that were obviously created with brushstrokes and created using dots of paint (pointillism) rather than geometric shapes, thereby emphasizing the method of their creation and including artworks that had been made for exhibition. Secondly, a training phase was introduced to provide a greater experience of artistic actions. In this training phase participants created stippling and stroking actions and no action when presented with a photograph representing a congruent hand grip (see Leder et al, 2012 and Ticini et al, 2014 for similar methods). A priming phase was also included where a hand photograph was presented before observing pointillism paintings. Ticini (2014) found perceivers to rate these pointillism paintings higher on a liking scale when presented with the stippling hand prime. It has been suggested that training may be important for the aesthetic experience of different art styles. Naïve viewers who attended lectures about art style (abstract) and gained knowledge about these methods were found to have higher aesthetic ratings for abstract paintings than those who received a lecture on Renaissance art or no lecture at all (Stojilovic & Markovic, 2014). Kirsch, Drommelschmidt and Cross (2013) also found that obtaining training rather than only observing dance sequences influenced how much perceivers enjoyed theses sequences. Greater enjoyment for dance sequences was found at the end of the study for those who received physical training. Physical training of the eye has also been found to impact aesthetic preferences. Topolinski (2010) found that increased motor fluency through ocular-muscle training impacted aesthetic judgements of movements. They found that congruent trials where dot movements matched eye movements were liked more.

4.3 Experiment Four

It is suggested that the perceiver's aesthetic experience can be influenced by the artist's art-making process. However, results in Chapter 3 show no effect of congruency. Here, we aim to further test these claims by testing both artists and non-artists as perceivers of art as oppose to geometric shapes.

1. We examine if diverse actions influence the perceivers' experience when they simultaneously are acting in a congruent or incongruent manner (actions of stippling or stroking) using both subjective aesthetic ratings and eye-tracking methods. Leder et al (2012) demonstrate that liking for artworks are greater if the perceiver is producing congruent actions. Here, we include similar artworks and actions. Thus, we hypothesise that aesthetic judgement for congruent artworks will be higher than those for incongruent artworks and those in the control group who do not make any simultaneous actions.

2. As with previous experiments eye movements were recorded as a proxy for the on-going aesthetic experience and to examine the formation of the aesthetic judgement. When we consider the perceiver, it is suggested that the low-level features of artworks including the styles and techniques of the artist have an impact on perceptual processes which can be detected in gaze behaviour. We hypothesis that gaze (first fixation, first saccade latency, fixation duration and fixation count) will be influenced by congruent stimuli. Thus, greater fixation will be towards congruent artworks compared to incongruent artworks. As we introduce existing artworks into this study we also take note of participants' familiarity of artworks and how this may impact aesthetic ratings and gaze.

4.4 Method

4.4.1 Participants

A total of seventy-two participants took part in this study; forty-eight psychology students were recruited from the University of Reading and regarded as non-artists (27 females, 21 males: ages 18-26) using the same background questionnaire as used in Experiment 3. Twenty-four student artists (21 females, 3 males: ages 20-49) were recruited from the Fine Art department at the University of Reading and were regarded in this study as artists using the same background questionnaire (see appendix 2). Years of formal art training for the artists ranged from 5 to 9 years with a mean of 5.4 years of training and art experience. The non-artists had less than 2 years with a mean of 0.15 years of training and art experience. All participants had normal or corrected-to-normal vision and each stage of the study was completed by all participants.

4.4.2 Materials

Figure 4.1- Experimental stimuli: Twelve paintings are displayed that were used in this experiment which differed in terms of style, 6 were brushstrokes paintings and 6 pointillism paintings.

The twelve paintings used as stimuli in the experiment are shown in Figure 4.1 and these differed in terms of image style: six were brushstrokes paintings and six were pointillism paintings. The images were similar to those used by Leder et al. (2012) and McLean et al. (2015) (see Appendix 9 for more information).

A 7-point scale was used to gather aesthetic ratings [1(very displeasing) to 7 (very pleasing)] (see Appendix 5). At the end of the study participants were asked to rate how familiar they were with each painting [1 (very unfamiliar) to 7 (very familiar)] (see Appendix 7). A debrief questionnaire form was also given to examine if participants were aware of the connection between the actions they made and the actions portrayed in the images. Moreover, they were asked if they felt this relationship influenced their aesthetic ratings (see Appendix 8).

Table 4.1 presents the trials that were completed by participants portraying all twelve images and all possible combinations. It is important to note that the order of these trials was kept consistent for all participants.

Trial	Image 1	Style	Image 2	Style
1	A view of Sluis in the morning sun	*Stipple*	Coals towboats	*Stroke*
2	Trees by a canal	*Stipple*	View on Arles	*Stroke*
3	On the cliffs of Pourville	*Stroke*	Honfleur	*Stipple*
4	Olive grove	*Stroke*	Bessin harbor entrance	*Stipple*
5	Port-en-Bessin, cranes and breakthrough	*Stipple*	The sea at Saintes Maries	*Stroke*
6	The sea at Pourville	*Stroke*	Meadows at the creek	*Stipple*
7	The sea at Saintes Maries	*Stroke*	A view of Sluis in the morning sun	*Stipple*
8	Honfleur	*Stipple*	The sea at Pourville	*Stroke*
9	Bessin harbor entrance	*Stipple*	On the cliffs of Pourville	*Stroke*
10	Meadows at the creek	*Stipple*	The sea at Saintes Maries	*Stroke*
11	Coals towboats	*Stroke*	Trees by a canal	*Stipple*

12	View on Arles	*Stroke*	Port-en-Bessin, cranes and breakthrough	*Stipple*
13	Honfleur	*Stipple*	Olive grove	*Stroke*
14	Meadows at the creek	*Stipple*	View on Arles	*Stroke*
15	Bessin harbor entrance	*Stipple*	Coals towboats	*Stroke*
16	On the cliffs of Pourville	*Stroke*	A view of Sluis in the morning sun	*Stipple*
17	Olive grove	*Stroke*	Trees by a canal	*Stipple*
18	The sea at Saintes Maries	*Stroke*	Bessin harbor entrance	*Stipple*
19	View on Arles	*Stroke*	Honfleur	*Stipple*
20	Trees by a canal	*Stipple*	On the cliffs of Pourville	*Stroke*
21	Port-en-Bessin, cranes and breakthrough	*Stipple*	Olive grove	*Stroke*
22	A view of Sluis in the morning sun	*Stipple*	The sea at Pourville	*Stroke*
23	Coals towboats	*Stroke*	Meadows at the creek	*Stipple*
24	The sea at Pourville	*Stroke*	Port-en-Bessin, cranes and breakthrough	*Stipple*

Table 4.1- Image pairings

4.4.3 Apparatus

Stimuli were presented on a 21" colour desktop PC that had a refresh rate of 75Hz running Experiment builder (SR Research Ltd.). The distance between the monitor and participant was 57cm. All images were presented on a grey background and sized to 567 x 425 pixels. Stimulus width and height subtended 14° and 10.5° of visual angle. Eye movements of the right eye were recorded using an Eye link II tracker with a sampling rate of 500Hz. A chin rest was used and participants were placed in a set position and requested not to move during the study. A standard 9-point grid was used to calibrate eye movements before each task.

4.4.4 Procedure

Participants were assigned to one of three action conditions. In the stippling condition participants were requested to tap a pencil on paper at their own pace. In the stroking condition participants were asked to draw straight lines at their own pace, for both conditions participants' hand movements could not be observed. The control group were not requested to make any actions. Thus, there were 3 independent variables: Image Style (Brushstroke and Pointillism); Action type (Control; Stipple; Stroke) and Expertise (Non-artist; Artist).

4.4.4.1 Aesthetic Rating Task

Participants rated how visually pleasing the stimuli were (see section4.4.2). Participants completed this either before the free-viewing eye-tracking task or at the end of the study. All images were presented for 5000ms prior to making an aesthetic judgement. Ratings were made verbally and were recorded by the experimenter.

4.4.4.2 Free-viewing Task

Eye movements were recorded whilst participants were presented with two images for 5000 ms (see figure 4.2). A fixation cross was displayed between each trial for 1000 ms and a drift correct was used after each trial. 24 trials were completed and the order of these trials were kept consistent (see table 4.1).

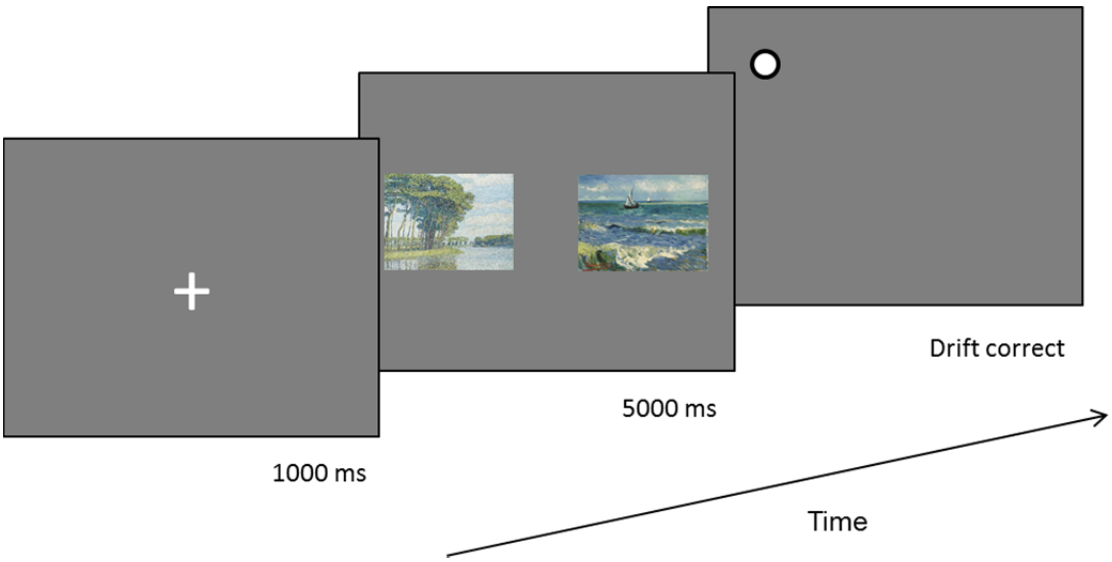

Figure 4.2- Eye-tracking trial example

4.4.5 Eye-Tracking Analyses

As with previous Experiments in this thesis, gaze metrics were recorded and we report first fixation direction (to the left or right stimulus), first saccade latency (the response time from stimuli onset to the start of the first saccadic eye movement response), total fixation duration (the total amount of time spent on each stimulus), and number of fixations (the total number of fixations on each stimulus). Fixations were classified as such if they exceeded 100 ms, if fixation along the x-axis was less than 800 pixels then this was regarded as fixation to the left image, if greater than 800 pixels then fixation was to the right image. Free-viewing trials were categorised based on fixation metrics towards stipple or stroke images to understand if gaze was influenced by image style and congruent action. The effects of familiarity on aesthetic ratings are then displayed.

4.5. Results

We first present results examining the influence of congruent action on aesthetic ratings and then present how this impacts gaze (first saccade latency, first fixation, fixation duration and fixation count). Finally, we present results depicting participants familiarity with the artworks used in this study.

4.5.1 Effect of Congruent Action on Aesthetic Preference

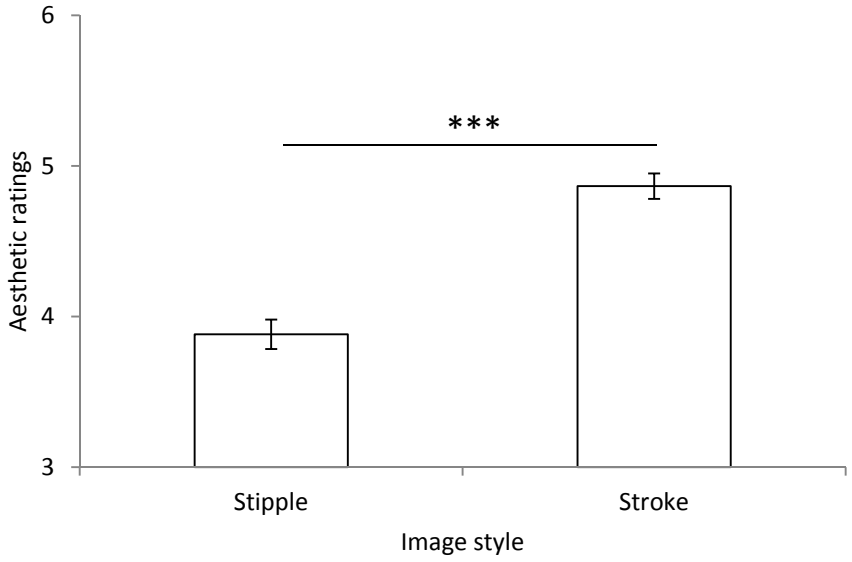

Figure 4.3- Aesthetic ratings (congruent action) collapsed across expertise and drawing condition: shows differences in aesthetic ratings dependent on the style of artwork. * $p<.05$; ** $p<.01$; *** $p<.001$.

	Non- artist		Artist	
	Stipple-Aesthetic rating Means (S.D)	Stroke-Aesthetic rating Means (S.D)	Stipple-Aesthetic rating Means (S.D)	Stroke-Aesthetic rating Means (S.D)
Control	3.96 (0.64)	4.92 (0.48)	3.76 (0.80)	4.63 (0.75)
Stippling	3.67 (0.84)	5.23 (0.63)	4.16 (0.87)	5.08 (0.66)
Stroking	3.81 (0.94)	5.06 (0.42)	3.83 (0.89)	4.58 (0.87)

Table 4.2- Aesthetic Ratings: Descriptive statistics

Figure 4.3 shows aesthetic ratings for the paintings (stroke & stipple) as a factor of expertise, image style and action type. A three-way ANOVA was conducted and a main effect of image style was found as participants aesthetically preferred brushstroke paintings to pointillism paintings, $F(1,66)= 93.835$, $MSE= .377$, $p<0.001$, $\eta^2=0.587$. There was no main effect of expertise and no main effect of action condition but a trend was found for an interaction between image style and expertise, $F(1,66)= 3.558$, $MSE= 1.343$, $p=0.064$, $\eta^2=0.051$. Pairwise comparisons show a trend with artists assigning higher aesthetic ratings ($M=5.069$) to brushstroke paintings compared to non-artists ($M=4.64$), $p=0.084$ (see Appendix 16).

4.5.2 Effect of Congruent Action on Gaze

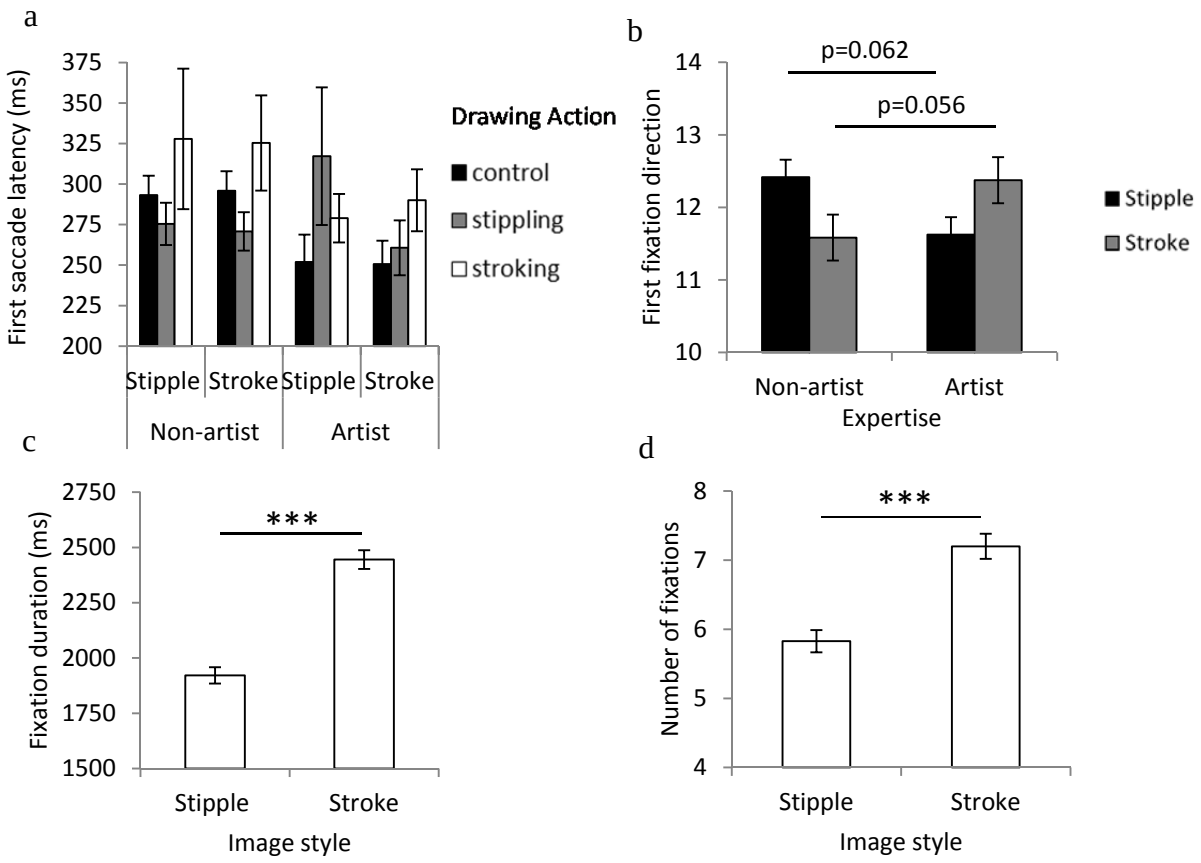

Figure 4.4- Gaze (congruent action) Upper row shows first saccade response: the latency of the response in milliseconds (Left) and its direction, which is collapsed across drawing condition, (Right). Lower row shows overall fixation behaviour collapsed across condition and expertise: mean total fixation duration in milliseconds (Left) and the mean number of fixations (Right). * $p<.05$; ** $p<.01$; *** $p<.001$.

	Non- artist						Artist					
	Control		Stippling		Stroking		Control		Stippling		Stroking	
	Stipple Means (S.D)	Stroke Means (S.D)	Stipple Means (S.D)	Stroke Means (S.D)	Stipple Means (S.D)	Stroke Means (S.D)	Stipple Means (S.D)	Stroke Means (S.D)	Stipple Means (S.D)	Stroke Means (S.D)	Stipple Means (S.D)	Stroke Means (S.D)
First saccade latency	293.17 (47.85)	295.87 (48.24)	275.39 (52.17)	270.78 (47.34)	327.88 (173.61)	325.37 (117.65)	250.97 (44.68)	249.13 (38.91)	317.24 (120.11)	260.68 (47.83)	278.95 (42.36)	290.02 (54.04)
First fixation direction	12.94 (1.24)	11.06 (1.24)	12.06 (2.05)	11.94 (2.05)	12.25 (1.57)	11.75 (1.57)	11.25 (1.98)	12.75 (1.98)	11.5 (1.93)	12.5 (1.93)	12.13 (0.99)	11.88 (0.99)
Fixation duration	1858.64 (373.0)	2464.88 (407.46)	1947.39 (365.56)	2501.33 (393.93)	1916.07 (314.28)	2445.22 (422.23)	1931.87 (160.19)	2347.74 (211.70)	1991.38 (295.77)	2386.63 (243.88)	1931.23 (259.07)	2435.48 (356.82)
Number of fixations	5.68 (1.04)	7.49 (1.78)	6.05 (1.69)	7.34 (1.33)	5.47 (1.16)	6.88 (1.58)	6.71 (0.97)	7.85 (1.05)	5.74 (2.01)	7.13 (2.12)	5.63 (1.05)	6.38 (0.97)

Table 4.3- Gaze (congruent action): Descriptive statistics

Figure 4.4 shows gaze behaviour elicited when viewing paintings. Overall image style was found to impact upon free-viewing gaze behaviour with participants more likely to fixate for longer and make a greater number of fixations to brushstroke paintings.

A series of three-way ANOVAs were conducted for first saccade latency, first fixation direction, fixation duration and fixation count with image style, action type and expertise as factors. No main effects or interactions on first saccade latency were found, all *p's*>0.180. The same analysis examining first fixation direction (fig 4.4b) also showed no main effect of style, action type or expertise, but a trend for an interaction was found between image style and expertise, $F(1, 66) = 3.865$, $MSE = 20.056$, $p=0.05$, $\eta^2=0.055$. Pairwise comparisons reveal a trend that artists make more first fixations ($M=12.375$) than non-artists ($M=11.583$) to brushstroke paintings, $p=0.056$, with a trend for non-artists to make more first fixations ($M=12.417$) to pointillism paintings than artists ($M=11.625$), $p=0.062$.

For fixation duration (fig 4.4c) and number of fixations (fig 4.4d) a main effect of image style was found with participants fixating for longer and making more fixations to brushstroke compared pointillism paintings, $F(1, 66) = 40.467$, $MSE = 198311.685$, $p<0.001$, $\eta^2=0.380$, $F(1, 66) = 41.203$, $MSE = 1.308$, $p<0.001$, $\eta^2=0.384$, respectively. There was also a trend of the action type on the number of fixations made, $F(1, 66) = 2.629$, $MSE = 7.714$, $p<0.080$, $\eta^2=0.074$. Participants in the control condition were found to make more fixations ($M=6.935$) compared to those in the stroking condition ($M=6.087$), p=0.076. There was no main effect of expertise or interactions on fixation durations and number of fixations, all *p's*>0.310. It is worth noting that no interactions were found between action condition and image style which shows there is no effect of congruency (see Appendix 16).

4.5.3 Familiarity

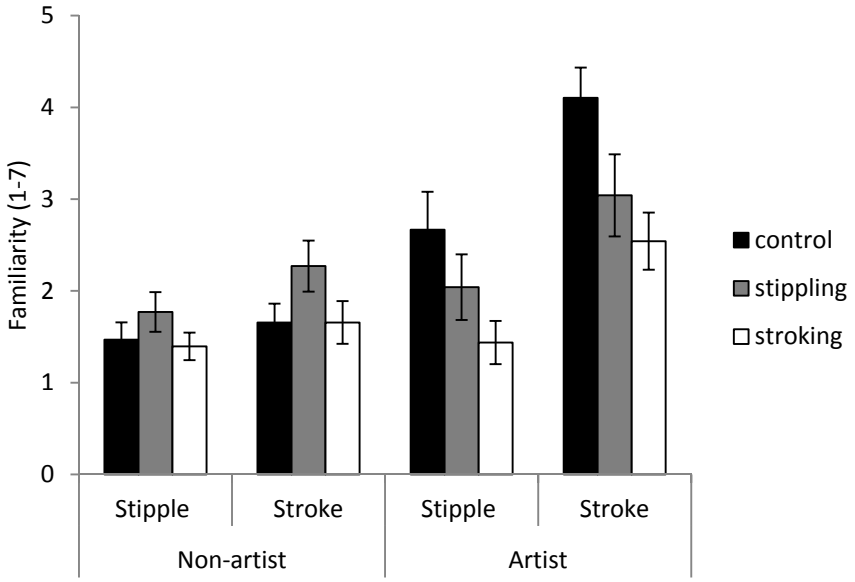

Figure 4.5- Familiarity collapsed across condition and expertise: shows differences in familiarity ratings dependent on the style of artwork, expertise of participants and drawing action completed.

	Non- artist		Artist	
	Stipple familiarity rating Means (S.D)	Stroke familiarity rating Means (S.D)	Stipple familiarity rating Means (S.D)	Stroke familiarity rating Means (S.D)
Control	1.47 (0.75)	1.66 (0.82)	2.67 (1.17)	4.10 (0.93)
Stippling	1.77 (0.87)	2.27 (1.11)	2.04 (1.01)	3.04 (1.27)
Stroking	1.40 (0.60)	1.86 (0.99)	1.44 (0.67)	2.54 (0.88)

Table 4.4- Familiarity ratings: Descriptive statistics

Figure 4.5 shows artists and non-artists familiarity ratings for brushstroke and pointillism paintings. A three-way ANOVA was conducted, a main effect of image style was found as participants were more familiar with brushstroke paintings than pointillism paintings, $F(1,66)= 68.693$, $MSE= .261$, $p<0.001$, $\eta^2=0.510$. There was also a main effect of expertise on familiarity, artists were more familiar with all artworks ($M=2.639$) compared to non-artists ($M=1.703$), $F(1, 66) = 20.101$, $MSE= 28.021$, $p<0.001$, $\eta^2=0.233$. An interaction was found between expertise and condition, $F(1, 66) = 4.523$, $MSE= 6.305$, $p=0.014$, $\eta^2=0.113$. Pairwise comparisons

reveal that artists in the control condition were more familiar with artworks than those in the stroking condition, p=0.004. No other main effects or interactions were found, all $p's$>0.244.

4.5.4 Awareness and Participants' Responses to Effect of Congruent Action

A binomial test was run on the debrief responses examining non-artists' awareness of the relationship between their simultaneous action and the motion that could be perceived in the images. The proportion of non-artists that were unaware of the relation between their actions and the actions of the artist .88 was significantly higher than expected, p<0.001. A chi square was conducted on how this relationship affected responses as no effect, positive effect and negative effects were reported. Nevertheless, overall non-artists did not feel that this impacted response, X^2 (2, N=32) =52.563, p<0.001.

A similar binomial test for awareness of relationship was run with artists. The proportion of artists that were unaware of the relation between their actions and the actions of the artist .69 was not significantly higher or lower than expected, p<0.210. A chi square was conducted on how this relationship affected responses of artists. Overall, artists did not feel that this impacted response, X^2 (2, N=16) =9.875, p=0.007.

4.5.5 Additional Findings: Gaze a Useful Measure of Preference

In addition to the results presented here we reanalysed trials in accordance to Chapter 2 to examine if aesthetic preference continues to impact gaze when viewing artworks and when engaged in drawing (see table 4.5).

	Non- artist						Artist					
	Control		Stippling		Stroking		Control		Stippling		Stroking	
	Prefer Means (S.D)	Not Prefer Means (S.D)	Prefer Means (S.D)	Not Prefer Means (S.D)	Prefer Means (S.D)	Not Prefer Means (S.D)	Prefer Means (S.D)	Not Prefer Means (S.D)	Prefer Means (S.D)	Not Prefer Means (S.D)	Prefer Means (S.D)	Not Prefer Means (S.D)
First saccade latency	294.58 (62.27)	293.25 (41.18)	274.78 (49.15)	270.83 (54.40)	323.48 (166.43)	326.78 (121.21)	245.39 (37.81)	247.44 (43.87)	261.47 (47.74)	318.02 (119.32)	300.09 (61.87)	257.73 (20.64)
First fixation direction	9.19 (2.07)	11.38 (1.86)	10.31 (1.89)	9.94 (1.84)	10.25 (2.49)	9.69 (2.68)	10.13 (2.30)	9.25 (2.19)	11.88 (2.59)	9.63 (1.41)	11.00 (0.93)	10.88 (1.89)
Fixation duration	2479.92 (471.67)	1841.34 (379.21)	2524.71 (347.84)	1929.89 (364.10)	2493.51 (441.72)	1870.41 (312.45)	2455.77 (302.60)	1822.18 (277.06)	2556.36 (336.51)	1833.30 (413.04)	2411.77 (344.90)	1953.94 (320.00)
Number of fixations	7.46 (2.05)	5.75 (1.01)	7.40 (1.49)	5.92 (1.69)	6.86 (1.40)	5.50 (1.23)	8.22 (1.32)	6.27 (1.12)	7.46 (2.31)	5.41 (1.88)	6.41 (0.98)	5.62 (0.93)

Table 4.5- Gaze (Aesthetic preference): Descriptive statistics

A three-way ANOVA examining first saccade latency with aesthetic preference, action type and expertise as factors showed no main effects, *p's*>0.207. An interaction was found between aesthetic preference, action type and expertise, $F(1, 66)= 4.228$, MSE= 7527.955, $p=0.019$, $\eta^2=0.114$. Artists in the stippling condition show quicker first saccade latencies to aesthetically preferred images ($M=261.5$) compared to less preferred (M=318.0), p=0.009. However, artists in the stroking condition show quicker first saccade latencies to images not preferred compared ($M=300.1$) to those aesthetically preferred ($M=257.7$), $p=0.049$. The same analysis examining first fixation direction with aesthetic preference, action type and expertise as factors showed no main effects or interactions, all *p's*>0.077.

Using the same analysis for fixation duration and number of fixations, a main effect of preference was found as participant's fixated for longer and made more fixations to images preferred, $F(1,66)= 50.951$, $MSE= 11978811.50$, $p<0.001$, $\eta^2=0.436$, $F(1,66)= 47.910$, $MSE= 77.648$, $p<0.001$, $\eta^2=0.421$, respectively. There was no main effect of expertise, action type or any interactions, all *p's*>0.093 (see appendix 17).

4.6. Discussion

Tinio's (2013) mirror model of art suggests that the initial reactions during the aesthetic experience of the perceiver are influenced by the artist and their latter art-making process. In these later art-making and early aesthetic experience stages both artist and perceiver are concerned about low-level features of the artwork. To investigate this claim we adopted a study design used by Leder et al. (2012). They found that when perceivers made stippling motions whilst viewing art created with different actions then pointillism paintings were preferred and when perceivers made stroking actions then brushstroke paintings were preferred. Contrary to this, and in line with the results of Experiment 3, we find no effect of congruent action between artist and perceiver on the perceiver's aesthetic judgements. We also extend this research by examining gaze to incongruent or congruent images and again we find no effect of congruency here. The results do

provide some support for the mirror model of art and other models of aesthetic experience as we find that image style has an impact on gaze with the brushstroke paintings being looked at more often and for longer. Moreover, artists made more first fixations to brushstroke paintings than non-artists, and non-artists made more first fixations to pointillism paintings than artists. Therefore, perceptual properties are shown to impact aesthetic experiences and early explorations. However, is important to consider that brushstrokes were also aesthetically preferred, thus participants may be fixating on what is aesthetically preferred regardless of image style. When trials were reanalysed according to aesthetic preference, both artists and non-artists were found to fixate more (longer and more often) on images aesthetically preferred.

To summarize, the results show brushstroke paintings to be aesthetically preferred, a trend is found with artists assigning higher aesthetic ratings to brushstroke paintings than non-artists, but both artists and non-artists prefer brushstroke to pointillism paintings. In addition, participants fixated more and more often on brushstroke paintings. A trend similar to Chapter 3 was found here as those in the stroking condition generally made fewer fixations than those in the control condition. First fixation direction analysis shows artists to make more first fixations than non-artists towards brushstroke paintings, but non-artists make more first fixations than artists to pointillism paintings. These results are further discussed here.

Gaze can be influenced by early bottom-up perceptual processing and it is apparent here as brushstroke paintings are fixated on more and more often. First fixations here are found to be influenced by expertise; artists fixated on brushstroke paintings first more often than non-artists, whereas non-artists fixated first on pointillism paintings more often than artists. Initial aesthetic reactions can be captured in early eye movements and we suggest here that artists' aesthetic judgements are made quickly as they have been shown to match aesthetic judgements made after lengthier viewing times (Locher et al., 2007; Willis & Todorov, 2006). Comparable findings to these were found by McLean et al. (2015) who presented similar artworks along with similar methods and showed that brushstroke paintings were aesthetically preferred regardless of congruent or

incongruent action. Analogous to these Reid et al. (2012) found that participants generally spent more time fixating on the realistic images compared to the computer sketch versions although the same content was displayed in both. This suggests that when forming aesthetic judgements, low-level features such as artistic techniques are considered, maybe more so than the content of the artwork. Locher (2006) explains how during early stages of the aesthetic experience, the low-level features; the pictorial elements, the style and form of artworks have an influence on the perceivers experience. Here, we further show that the act of making brushstrokes reduces fixation count in comparison to making no actions. These results are in line with Miall and Tchalenko (2001) who found that painting activity led fixation duration to be twice as long as to when the artist was not painting. Long fixation durations are a consequence of fewer fixations. While the impact of congruency is not found here, the familiarity of artworks may be having an effect on these results as brushstroke paintings are regarded to be more familiar than pointillism paintings by all participants (McLean et al., 2015). We also found artists to be more familiar with all paintings presented which is not surprising.

Here, we find that coupling the actions of an artist with the actions of a viewer, whether congruent or incongruent, does not impact the aesthetic experience whether examining overall aesthetic preferences or gaze patterns. Contrary to this, Ticini et al. (2014) did find an effect of congruency when priming participants with hand actions. Similar to Leder et al. (2012), when presented with stippling hand actions, ratings for pointillism paintings were higher than when presented with stroking and no hand actions. Taylor, Witt and Grimaldi (2012) also reported support for this relationship between perception and action highlighting that if the perceiver's implicit action matched the movements emphasised by the artist in the artwork, reaction times were faster. The results from such studies have been interpreted in terms of the mirror neuron hypothesis which claims that a mirror neuron system in the brain is activated both when an action is performed by a person and when the same action viewed is being performed by another individual (Rizzolatti & Craighero, 2004). An alternative explanation and one that fits with our findings relating preference, gaze behaviour and familiarity is processing

fluency. Leder (2013) links the results of congruent action influencing liking to the processing fluency where the ease to process artworks is enhanced once making simultaneous actions. This then leads to a positive influence on aesthetic judgements. However, it appears in our results that aesthetic judgements are not affected by the congruency between artistic action and the simultaneous action executed by the perceiver. Processing fluency can however be used to explain our results as brushstroke paintings were considered to be more familiar thus can be easier to process leading to greater aesthetic preferences, consequently eye movements were towards brushstroke paintings where more fixation and longer fixation was made with artists also fixating these styles first.

Debrief questions revealed that non-artists were not aware of the different actions performed in making the stimuli and how they were congruent or incongruent to their own actions. Greater awareness of this relationship may be required for the expected congruency effects (McLean et al., 2015). However, some artists were aware of this and in Chapter 3 similar results were found. Despite this, we continue to find that participants do not feel that undergoing simultaneous behaviour influences aesthetic responses. It may be the case that the efforts to enhance association between art production techniques and perceivers' action are simply not strong enough to engage the mechanisms or systems involved in changing behaviour (e.g., the mirror neuron system or perhaps the fluency with which participants' experience art and their familiarity with techniques).

One way to examine this without introducing demand characteristics while still enhancing the association between art production techniques and actions is through a pre-training phase. A paradigm employed by Ticini et al. (2014) involved a training phase and priming in which the artistic actions were associated to photographs involving hand shapes depicting brushes being held that would produce those movements (e.g., pointillism associated with a brush held between the thumb and forefinger for precision grip to induce a stippling motion, brushstrokes associated with coarser force grip). They found that when viewers were primed with these action photographs then aesthetic appreciation was elevated for the congruent image style. This may act through enhanced visuo-visual associations rather than only visuo-motor associations allowing perceivers

to visualise the way actions are produced by the artist, consequently influencing their aesthetic experiences. Park et al. (2015) suggest that viewers may simulate the movement of the painter once they are more aware of the artist and how they create the art. Albarracin et al. (2008) suggest that priming both perception and action can lead to increases of perceiving, imitating and adopting the behaviour of others, thus they promote further investigation of this. Experiment 5 adopts similar training and priming procedures to the Ticini et al. (2014) study examining aesthetic judgements to artworks and viewers' eye movement responses.

4.7 Experiment Five

In Experiment 4 we found no effect of congruency on both aesthetic ratings and gaze and we found differences in this effect dependent on the expertise of participants in both Experiment 3 and 4. Therefore we only recruited non-artists in this current study. Previous research has suggested that the link between actions of the perceiver and those involved in producing the artwork can affect the aesthetic experience of the viewer, but we have not found a relationship here. One way to enhance this link may be to include a pre-training phase. Therefore, to further understand the relationship between artist and perceiver we adopt the method from Ticini et al. (2014). A training phase is completed where participants learn drawing actions (stippling & stroking) associated with different hand posture images and are primed with these images prior to observing artworks. We again gather both aesthetic ratings and use eye movements to understand further understand the formation of judgements.

1. We hypothesise that when a priming hand posture is presented that is congruent to the actions involved in producing the artwork observed then aesthetic ratings will be greater than when participants are presented with an incongruent or no action hand prime.

2. Furthermore, we also hypothesise that when a congruent priming hand posture is presented then gaze (first saccade latency, first fixation, fixation duration and fixation count) will be influenced and be directed towards the congruent artwork

more so than the incongruent artwork. No difference will be found when no action hand grips are presented.

4.8 Method

4.8.1 Participants

Thirty participants took part in this study (ages 18-42; 27 females, 3 males). Here, we only recruited non-artists after failing to find any differences in congruency effects due to expertise in the previous two studies. Using the background questionnaire, all participants had less than 2 years with a mean of 0.13 years of art training and art experience (see appendix 2). All participants had normal or corrected-to-normal vision and each stage of the study was completed by all participants.

4.8.2 Apparatus and Materials

All apparatus and materials used are as Experiment 4. Artworks used are shown in figure 4.1& appendix 9.

Table 4.6 presents the trials that were completed by participants portraying all twelve images and all possible combinations. It is important to note that the order of these trials was kept consistent for all participants.

Trial	Hand prime	Image1	Style	Image 2	Style
1	Stipple	A view of Sluis in the morning sun	*Stipple*	Coals towboats	*Stroke*
2	Stroke	Trees by a canal	*Stipple*	View on Arles	*Stroke*
3	Stroke	On the cliffs of Pourville	*Stroke*	Honfleur	*Stipple*
4	No action	Olive grove	*Stroke*	Bessin harbor entrance	*Stipple*
5	Stroke	Port-en-Bessin, cranes and breakthrough	*Stipple*	The sea at Saintes Maries	*Stroke*

6	Stipple	The sea at Pourville	*Stroke*	Meadows at the creek	*Stipple*
7	No action	The sea at Saintes Maries	*Stroke*	A view of Sluis in the morning sun	*Stipple*
8	Stipple	Honfleur	*Stipple*	The sea at Pourville	*Stroke*
9	Stroke	Bessin harbor entrance	*Stipple*	On the cliffs of Pourville	*Stroke*
10	Stroke	Meadows at the creek	*Stipple*	The sea at Saintes Maries	*Stroke*
11	No action	Coals towboats	*Stroke*	Trees by a canal	*Stipple*
12	Stipple	View on Arles	*Stroke*	Port-en-Bessin, cranes and breakthrough	*Stipple*
13	No action	Honfleur	*Stipple*	Olive grove	*Stroke*
14	No action	Meadows at the creek	*Stipple*	View on Arles	*Stroke*
15	Stipple	Bessin harbor entrance	*Stipple*	Coals towboats	*Stroke*
16	Stipple	On the cliffs of Pourville	*Stroke*	A view of Sluis in the morning sun	*Stipple*
17	Stipple	Olive grove	*Stroke*	Trees by a canal	*Stipple*
18	Stipple	The sea at Saintes Maries	*Stroke*	Bessin harbor entrance	*Stipple*
19	No action	View on Arles	*Stroke*	Honfleur	*Stipple*
20	No action	Trees by a canal	*Stipple*	On the cliffs of Pourville	*Stroke*
21	Stroke	Port-en-Bessin, cranes and breakthrough	*Stipple*	Olive grove	*Stroke*
22	Stroke	A view of Sluis in the morning sun	*Stipple*	The sea at Pourville	*Stroke*
23	Stroke	Coals towboats	*Stroke*	Meadows at the creek	*Stipple*
24	No action	The sea at Pourville	*Stroke*	Port-en-Bessin, cranes and breakthrough	*Stipple*

Table 4.6- Image pairing and hand primes

4.8.3 Procedure

4.8.3.1 Training Phase

In a training phase participants were shown three hands that represented three different actions, stippling, stroking and no action. We used the same photographs employed by Ticini et al. (2014) (See figure 4.6). The participants adopted the hand shape shown and produced the actions represented 6 times for 10 seconds prior to completing the eye-tracking and pleasingness rating tasks (see explicit instructions below). They held no implement while doing this, simply moving their hand in response to the photograph shown. They were explicitly told to produce the painting movement represented and their own hands were visible throughout the training phase thereby allowing links to be formed between the motor output and the photograph.

Training instructions:

- Stroking action: Perform actions of drawing lines of approximately 10cm using the stroking grip.
- Stippling action: Perform actions of making dots by tapping at your own pace using the stippling grip.
- No action: Place hand palm down on the table

Stippling Stroking No action

Figure 4.6- Example of hand posture images (images adopted from Ticini et al., 2014)

4.8.3.2 Aesthetic Rating Task

Participants rated how visually pleasing the 12 paintings were, each painting was rated three times (after observing all hand images). All images were presented for 5000ms before an aesthetic judgement was made. Prior to this, participants were presented with a hand image for 1000 ms. This task was completed either before the eye-tracking task or at the end of study using a 7-point scale (1: very displeasing to 7: very pleasing) (see Appendix 5). Ratings were made verbally and were recorded by the experimenter.

4.8.3.3 Eye-tracking Task

Participants completed 24 trials in which they viewed two artworks for 5000 ms (see figure 4.7). Prior to each trial a hand prime image (8 trials for each hand action type) was presented in a randomised order for 1000 ms. A fixation cross was displayed between each trial for 1000 ms and a drift correct was used after each trial. The order of all 24 trials was kept consistent using an originally randomised hand prime order where all images were presented at least once with one of the three hand primes (see table 4.5).

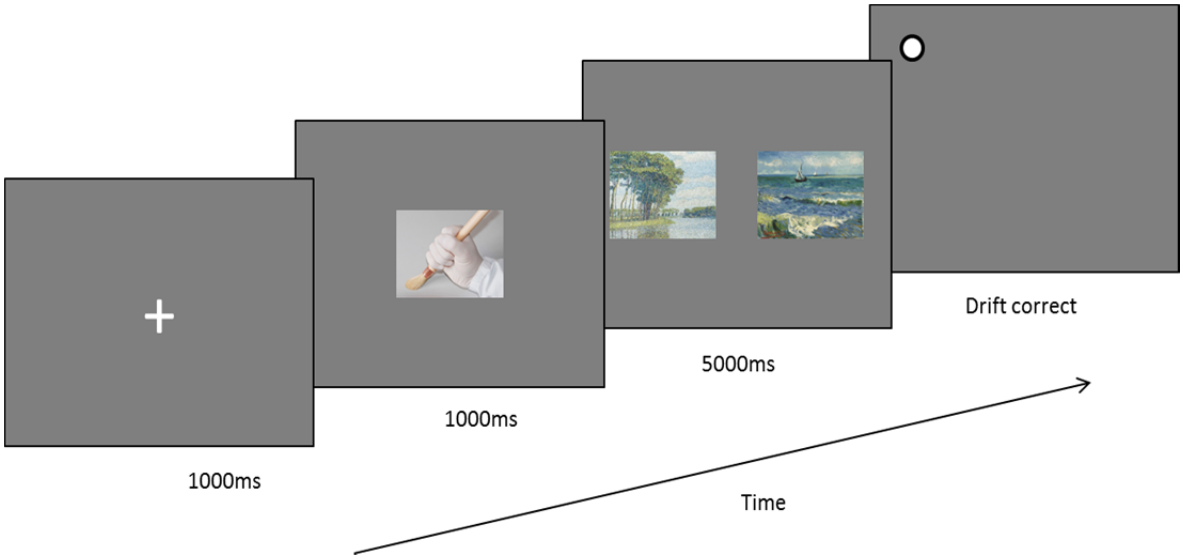

Figure 4.7- Eye- tracking trial example

4.8.4 Eye-tracking Analyses

Eye-tracking analyses were the same as Experiments 1-4. We report first saccade latency, first fixation direction, fixation duration and number of fixations.

4.9 Results

Presented below are results found in accordance to the study conducted examining the impact of congruent action of aesthetic preferences and gaze. We first present how congruent action influence aesthetic ratings and then present how this impacts gaze (first saccade latency, first fixation, fixation duration and fixation count). A summary table of these results are then provided.

4.9.1 Effect of Congruent Action on Aesthetic Preference

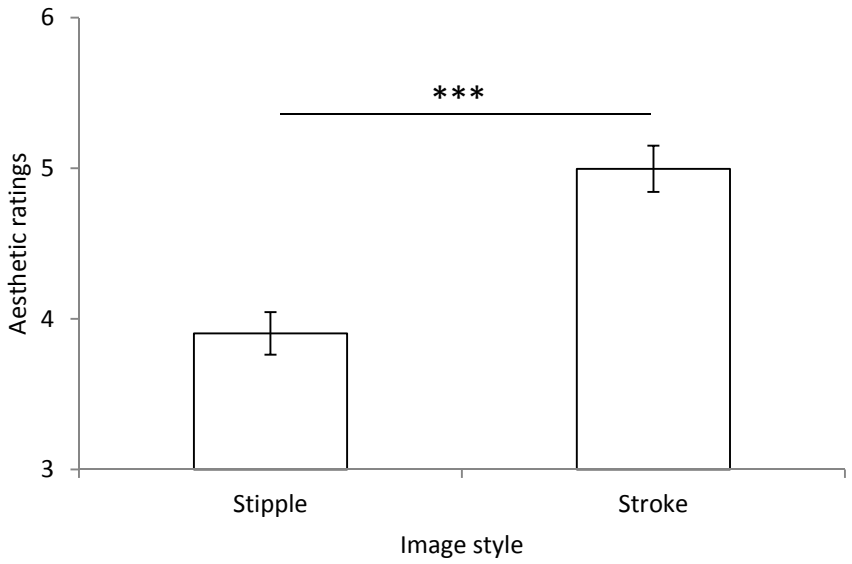

Figure 4.8- Aesthetic ratings (congruent action) which is collapsed across hand action: shows difference in aesthetic ratings dependent on the style of artwork. * p<.05; ** p<.01; *** p<.001.

	Stipple- Aesthetic rating Means (S.D)	Stroke- Aesthetic rating Means (S.D)
No action prime	3.89 (0.81)	4.93 (0.86)
Stippling prime	3.94 (0.73)	4.98 (0.73)
Stroking prime	3.88 (0.80)	5.08 (0.87)

Table 4.7- Aesthetic ratings: Descriptive statistics

Figure 4.8 shows aesthetic ratings as a function of image style and hand image prime. A two-way ANOVA with image style and hand prime showed only a main effect of image style on aesthetic ratings as brushstroke paintings were aesthetically preferred to pointillism paintings, $F(1, 29) = 35.787$, $MSE=1.501$, $p<0.001$, $\eta^2=0.552$, all other p's>0.130 (see Appendix 18).

4.9.2 *Effect of Congruent Action on Gaze*

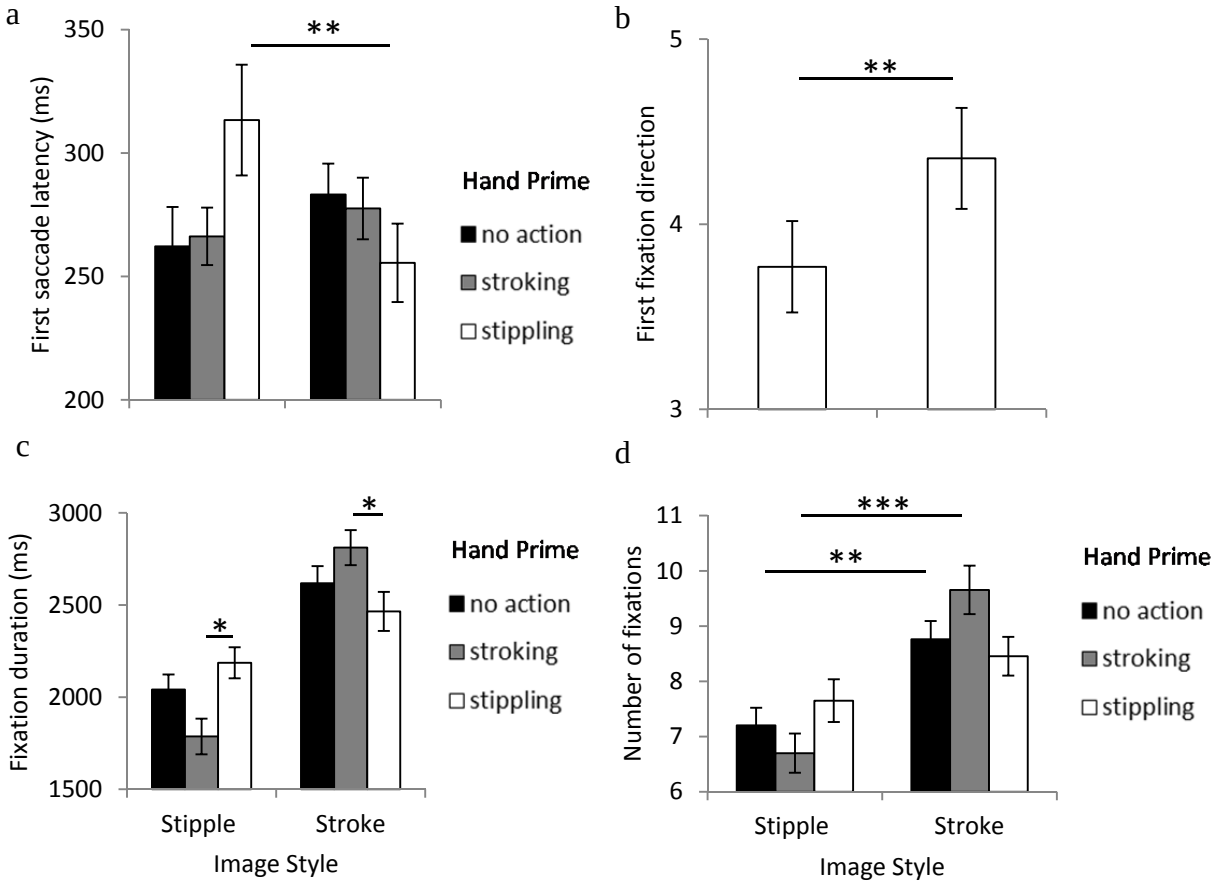

Figure 4.9- Gaze (congruent action) Upper row shows first saccade response: the latency of the response in milliseconds (Left) and its direction, which is collapsed across hand prime type, (Right). Lower row shows overall fixation behaviour: mean total fixation duration in milliseconds (Left) and the mean number of fixations (Right). * $p<.05$; ** $p<.01$; *** $p<.001$.

	No action prime		Stippling prime		Stroking prime	
	Stipple Means (S.D)	Stroke Means (S.D)	Stipple Means (S.D)	Stroke Means (S.D)	Stipple Means (S.D)	Stroke Means (S.D)
First saccade latency	262.21 (85.88)	283.23 (68.51)	313.35 (122.89)	255.54 (86.93)	266.23 (61.52)	277.56 (68.41)
First fixation direction	3.90 (1.40)	4.10 (1.40)	3.67 (1.49)	4.33 (1.49)	3.37 (1.59)	4.63 (1.59)
Fixation duration	2041.05 (447.86)	2617.92 (511.06)	2186.23 (462.04)	2465.28 (579.71)	1786.57 (530.91)	2811.32 (522.32)
Number of fixations	7.20 (1.73)	8.76 (1.80)	7.65 (2.12)	8.45 (1.91)	6.70 (1.94)	9.65 (2.41)

Table 4.8- Gaze (congruent action): Descriptive statistics

Figure 4.9 shows gaze behaviour elicited when viewing paintings. Overall image style and drawing condition were found to impact upon free-viewing gaze behaviour. A greater amount of time, more fixations and initial fixation was made towards brushstroke paintings. However, fixation duration was also influenced by congruent action.

A series of two-way ANOVA's were carried out examining gaze behaviour with image style and action hand prime as factors. First saccade latency (fig 4.9a) showed no main effects but did show an interaction between image style and hand prime, $F(2, 58) = 7.472$, $MSE = 3710.153$, $p<0.001$, $\eta^2 = 0.205$. Pairwise comparisons showed this was driven by quicker first saccade latencies to brushstroke paintings ($M=255.536$) compared to pointillism paintings when preceded by a stipple prime ($M=313.347$), $p=0.006$, all other *p's*>0.384. First fixation direction (fig 4.9b) showed a main effect of image style with more first fixations being made to brushstroke paintings, $F(1, 29) = 8.398$, $MSE=22.756$, $p=0.007$, $\eta^2=0.225$, all other *p's*>0.453.

Fixation duration (fig 4.9c) also showed a main effect of image style as brushstroke paintings were fixated on more, $F(1, 29) = 30.506$, $MSE = 579715.130$, $p<0.001$, $\eta^2 = 0.513$, and an interaction between this and hand prime, $F(2, 58) = 4.962$, $MSE=$

425933.224, p=0.01, η^2=0.146. Participants fixated more on pointillism paintings when preceded by the stipple prime (M=2186.233) compared to the stroke prime (M=1786.567), p=0.05 and fixated more on brushstroke paintings when the stroke prime was presented (M=2811.317) compared to the stipple prime (M=2465.283), p=0.022. This shows a congruent effect of the primes on time spent looking at associated artworks.

Number of fixations (fig 4.9d) showed a similar pattern to fixation duration with a main effect of image style on the number of fixations as brushstroke paintings were fixated on more, $F(1, 29) = 30.843$, MSE=4.582, p<0.001, η^2=0.515, and an interaction between this and hand prime, $F(2, 58) = 3.821$, MSE= 4.672, p=0.028, η^2=0.116, all other p's>.223. Here, an effect of congruency was found but in a different manner, participants did not make more fixations to brushstroke paintings (M=8.454) compared to pointillism paintings when presented with the stipple prime (M=7.650), p=0.181, but did so when presented with a no action or stroke prime, p=0.002; p<0.001, respectively. Thus, participants fixated more on brushstrokes, which were preferred, but less so when primed with an incongruent action (see Appendix 18).

4.9.3 Additional Findings: Gaze a Useful Measure of Preference

In addition to the results presented here we reanalysed trials in accordance to Chapter 2 to examine if aesthetic preference continues to impact gaze when trained in drawing actions and primed prior to observing artworks (see table 4.9).

	No action prime		Stippling prime		Stroking prime	
	Prefer Means (S.D)	Not Prefer Means (S.D)	Prefer Means (S.D)	Not Prefer Means (S.D)	Prefer Means (S.D)	Not Prefer Means (S.D)
First saccade latency	278.99 (62.13)	261.61 (108.07)	283.35 (104.95)	294.46 (99.79)	278.66 (68.28)	270.85 (78.20)
First fixation direction	3.50 (1.370	3.36 (1.31)	3.21 (1.42)	3.18 (1.54)	3.46 (1.48)	3.04 (1.00)
Fixation duration	2691.40 (507.26)	1995.58 (564.54)	2550.37 (571.96)	2107.05 (508.15)	2767.70 (602.82)	1848.62 (657.77)
Number of fixations	9.07 (2.20)	6.82 (1.79)	8.77 (2.03)	7.29 (1.91)	9.39 (2.78)	6.79 (2.03)

Table 4.9- Gaze (Aesthetic preference): Descriptive statistics

A series of two-way ANOVA's were carried out examining gaze behaviour. There was no main effect of preference or hand prime and no interaction between them for first saccade latency and first fixation direction, all *p's*>0.295. There was a main effect of preference on fixation duration and number of fixations with more time being spent fixating images and more fixations made to those aesthetically preferred, $F(1, 75) = 23.142$, $MSE = 21181328.24$, $p<0.001$, $\eta^2 = 0.444$, $F(1, 75) = 23.503$, $MSE = 201.242$, $p<0.001$, $\eta^2 = 0.448$, respectively. No effects of hand image and no interactions were found, all *p's*>0.159 (see appendix 19).

4.10 Discussion

Aesthetic ratings and gaze continue to be influenced by image style. Brushstroke paintings were aesthetically preferred to pointillism paintings and more time, more fixations and first fixations were made towards the brushstroke paintings. In fact, despite a pre-training phase being carried out and being primed with different hand actions, participants fixated (longer and more often) on images they aesthetically preferred. We did not find an effect of congruency with aesthetic ratings as found by Ticini et al. (2014), although they only examined the impact of

congruency on aesthetic judgements of pointillism paintings and not brushstroke paintings. However, we did find an effect of congruency on gaze behaviour with both brushstroke and pointillism paintings: more time was spent fixating on pointillism paintings when presented with a stipple prime compared to a stroke prime, and more time spent fixating brushstroke paintings when shown a stroke prime compared to when shown a stipple prime. The results suggest that the actions of the artist influence aesthetic experiences providing support for the mirror model of art.

To summarize the results, we find brushstroke paintings to be aesthetically preferred to pointillism paintings. When presented with a stipple prime, first saccade latencies were found to be quicker towards the brushstroke paintings than pointillism paintings. In addition, first fixations were directed towards brushstrokes, regardless of the hand prime. Brushstroke paintings were also fixated on for longer and more often. However, interactions with the hand primes for both fixation duration and number of fixations shows an effect of congruency that wasn't found in Experiment 4. Regarding fixation duration, when a stroke prime was presented participants fixated more on brushstroke paintings and when a stipple prime was presented participants fixated more on pointillism paintings. Regarding fixation count, more fixations were generally made to brushstroke paintings, but an interaction with the hand prime showed that when a stipple prime was presented fewer fixations were made to the brushstroke paintings.

The enhancement of visuo-motor and visuo-visual associations between the actions of the artist and actions trained and primed influence the response of the perceiver. We do find an effect of congruency here that supports past studies (Ticini et al., 2014; Leder et al., 2012). This is only found in the impact on gaze, although gaze is useful for understanding the formation of aesthetic judgements (Locher, 2006; 2007). We found more time to be fixated on artworks that were made in a congruent fashion to the hand primes presented to the participants. Less fixations were also made to brushstroke paintings when presented with an incongruent hand prime (stippling hand), despite the brushstroke paintings being preferred and fixated on more in general. In contrast, we found an effect of

incongruence regarding first saccade latency as participants fixated quickly to brushstroke paintings when presented with a stipple prime, this may be due to a general preference for brushstroke paintings and making more first fixations to these. The congruency effect found in this study can be explained by the processing fluency theory as implicit knowledge of the hand action that is required to produce the paintings may influence gaze. The enhanced associations between art style and hand postures could enable ease of processing the stimuli consequently influencing gaze. On the other hand, these results can also be explained by the mirror neuron hypothesis. The actions that were observed in the artworks evoked the mirror neuron system, thus gaze was influenced and was directed towards congruent artworks. Nevertheless, this is difficult to conclude as the effect may not be apparent without both training and priming.

The training process and priming that leads to a congruency effect is supported by Freyd (1983) who demonstrated that knowledge of the drawing method has an impact on the recognition of images. Physical training can affect the aesthetic experience, and engaging with the activity rather than just observing the behaviour can have a great impact on experiences. Kirsch et al. (2013) found that actual physical training rather than mere exposure of dance moves increased liking of dance sequences after training. In fact, direct muscular training of the eye has been found to impact aesthetic preferences as movements previously trained (unknowingly) were found to be aesthetically preferred. Congruent trials where dot movements matched eye movements were liked more. This supports the impact of processing motor fluency as trained movements were more fluent (Topolinski, 2010; Woltin & Guinote, 2015). Therefore, greater motor fluency through training impacts aesthetic responses and provides an explanation for the results found in Experiment 5. The training phase alone however may not lead to the effect found in our study, but the priming of hand actions may be of great importance and has been found to impact perception, imitation and adoption of others behaviour (Albarracin et al., 2008). In Experiment 4 where training and priming was not included but instead participants made simultaneous congruent or incongruent actions, we would expect but didn't find an effect of congruency, thus the importance of priming suggests that processing fluency and the visual

information provided is important for the effect of congruency where the hand postures associated with the art style influences gaze.

4.11 General Discussion

It has been suggested that while viewing art from the early perceptual responses through to forming aesthetic judgements, perceivers can be influenced by the art-making process of the artist (Tinio, 2013). Some recent studies have demonstrated that the actions of the artist can influence aesthetic judgements when observers simultaneously create or familiarise themselves with congruent and incongruent actions. However, such studies do not analyse the initial and on-going aesthetic responses to art that are suggested to relate to the later processes of the artist, i.e. during later stages of art-making the artist emphasises the low-level features of their work which can include their style, techniques and textures incorporated. These features can impact on eye movements and reactions to paintings which in turn influence aesthetic judgments (Lee, Tang & Tsai, 2005; Wallraven, Cunningham, Rigau, Feixas & Sbert, 2009).

In Experiment 4 we found simultaneous actions (stippling/stroking) to not influence aesthetic ratings and gaze behaviour, but brushstroke paintings were preferred, fixated on for longer and also regarded to be more familiar. In particular, artists were found to fixate first to brushstroke paintings more so than non-artists, with non-artists fixating first to pointillism paintings supporting that these properties impact initial responses and experiences. This does provide some support for the mirror model of art and other models of the aesthetic experience as it is clear that low-level features in art and perceptual properties can influence exploration and aesthetic judgements. However, it is important to consider the impact that aesthetic preference was found to have on gaze. In Experiment 5, the inclusion of a training phase allowing participants to be familiar with two distinctive drawing actions (along with a third no action condition) and priming participants led to a congruency effect being found between artist and perceiver. We continue to find brushstroke paintings to be preferred and fixated on longer; here first fixation is also directed towards brushstroke paintings. However, the

presentation of a hand prime influenced gaze such that the artworks that were congruent to the hand prime were fixated on more. This effect was not found for overall aesthetic ratings but only from gaze behaviour suggesting that the processes involved in the formation of artworks are more affected by the actions of artist once visuo-motor and visuo-visual associations are enhanced. This provides some support for the mirror model of art as the results can be interpreted as evidence that the latter stages of art-making are suggested to impact the initial aesthetic experiences of the perceiver.

This interpretation can be extended more broadly as reflecting a relationship between art and embodiment. Freedberg and Gallese (2007) suggest that the observation of art and embodiment, even in a static form influences the aesthetic experience. The way in which art is produced and the actions of the artist impact the aesthetic experience of the perceiver due to activation of embodied mechanisms. The visible marks from creation and imagining the actions and directions of the artist's movement activates areas in the perceiver's brain that leads to feeling a similar experience to the artist (Piechowski-Jozwiak et al., 2017). Proverbio, Riva and Zani (2009) used static photographs and found greater activation of mirror neurons when participants were presented with images that implied dynamic human motion compared to those that depicted less dynamic action. In relation to mirror neurons, it is suggested that the actions observed activate perceptions of the behaviour required. Sbriscia-Fioretti et al., (2013) found participants to perceive more movements in real artworks in comparison to modified computerised versions. In addition, higher aesthetic ratings were given to these artworks. The researchers suggest that the dynamics of the artworks, where the brushstrokes made by the artist can be perceived, affected these results. Umilta, Berchio, Sestito, Freedberg and Gallese (2012) also found the motor system to be involved with observation of artworks. When observing original artworks cortical motor activation was evoked in the brain, but there was no activation apparent when participants observed the same artwork when it was generated by a computer and resulting aesthetic ratings were higher for the original artworks. However, these images were also perceived to portray more movement and be more dynamic. Liew, Han and Aziz-Zadeh (2010) actually found

that the familiarity of gestures included in their task modulated the effect of the mirror neuron system. Therefore, while it has been suggested that the mirror neuron system is responsible, it may simply reflect the participant's knowledge of how the art was produced.

Another possible explanation of congruency effects is that this is more simply due to fluency, i.e. an ease of processing (Leder, 2013). Increasing the ease of processing with use of hand primes provides greater support for the impact of artistic action as implicit knowledge of the hand action that is required to produce the paintings may influence liking (Ticini et al., 2014). When participants were observing artworks, Mclean et al. (2015) only found an effect of congruency on aesthetic ratings when participants were made explicitly aware of the connection between their actions and the actions displayed in the artworks. Our results support a relationship between artistic action and aesthetic experience but only when visuo- motor and visuo-visual associations are enhanced. This provides support for the mirror model of art and could be interpreted in terms of a mirror neuron system explanation or a fluency explanation.

4.12 Conclusion

Overall it is apparent that brushstroke paintings are preferred and fixated on more; however, we find an effect of congruency to impact gaze when the perceiver is trained and primed with action styles. These results provide support for the mirror model of art and may be due to processing fluency. The ease of processing can influence the relationship between artist and perceiver as we find that a familiar style of art is preferred and fixated on more, training and priming of congruent action further positively effects gaze. However, explanations of these results may also be supported by the mirror neuron hypothesis. These studies however have only investigated actions of the artist in relation to stippling and stroking form, but there are other actions that can be examined, furthermore other low-level features such as brushstroke thickness, the type of painting material, the texture and colours used that are emphasised during the later stages of art-making need to be addressed. This is required in order to empirically test whether the

artist and their behaviour has an impact on the aesthetic experience of the perceiver as suggested in the mirror model of art. In addition to this, more research is also required to consider how the art-making experience of the artist is influenced by visualising their perceivers.

Chapter 5: General Discussion

5.1 Introduction

This thesis has investigated the relationships between the creation and perception of art. Previous research has identified 3-4 phases involved in art creation. Initial stages of art-making involve exploring ideas before selecting an idea to further develop. Intermediate stages of art-making involve expanding and modifying the current artwork. Final stages of art-making involve making enhancements to the artwork demonstrating that it is near to completion (Sapp, 1995; Mace & Ward, 2002; Tinio, 2013). Similar phases are involved in the aesthetic experience; initial aesthetic responses, when art is first observed, are influenced by bottom up processing of the low-level features. The intermediate stages of the aesthetic experience can be both automatic and deliberate where the content and artistic style of the artwork becomes important. The later stages of the aesthetic experience lead to an aesthetic judgement being formed. This stage involves deliberate evaluation of the artworks where experience of art and knowledge becomes important (Locher et al., 2007; Chatterjee, 2011; Leder et al., 2004; Tinio 2013). Tinio (2013) suggested a "Mirror Model of Art" in which the aesthetic experience of an art viewer and the art-making processes undertaken by the artist mirror each other temporally. The artist's initial ideas and concepts develop until the completed artwork is finished, and the perceiver's aesthetic experience develops from initial responses to the completed artwork through time to an experience which also reflects the artist's initial ideas and concepts. This research has examined different stages of art-making progressing from early initial decisions to artistic actions, the effect of expertise, and both aesthetic ratings and eye-tracking measures are used throughout capturing the process of forming aesthetic judgements. This thesis examines the perspective of an artist and how aesthetic and art-making experiences relate to each other and whether the art-making experience influences art-making choices. The perspective of the perceiver is also considered examining whether the aesthetic experience is directly influenced by the art-making process.

Specifically, Experiment 1 and 2 examined the link between the aesthetic experience and the initial stages of art-making that take place when an art-making decision is made. Experiment 3 examined aesthetic experiences and art-making decisions made during initial stages of art-making when actions involved in the art-making process are enacted. Experiment 4 and 5 then moved from decisions made when personally creating to examining the relationship between aesthetic experiences and the art-making processes involved in artworks created by others. Overall, there was found to be some supporting evidence for links between the aesthetic experience and the art-making processes involved in the stages of art creation. There was strong evidence for a link between aesthetic experience and the initial stages of art making involved in personal artistic decisions (shown through preferences and gaze behaviour - Experiments 1 and 2), but little evidence for an influence of the actions involved in the process of creation on aesthetic experiences or decisions (Experiments 3 and 4). However, there was some evidence for the aesthetic experiences of perceivers to reflect the processes involved in art-making by others when the actions of the perceiver and that involved in the creation of the artwork was more explicitly linked (Experiment 5). Throughout Experiments 1 to 5 differences in the aesthetic experiences of artists and non-artists was examined and some differences which are later discussed in more detail were found between artists and non-artists

The following sections outline the findings from each chapter in more detail in the context of wider literature drawing conclusions; this is followed by portraying the implications of these studies. Finally, the limitations are considered prior to providing future areas of research that must be conducted to further understand the aesthetic and artistic experience.

5.2 Review of Experimental Chapters

5.2.1 Chapter Two

The thesis begins with an investigation into the initial art-making stage; here the artist has multiple options and ideas that they can select for production (Sapp, 1995; Mace & Ward, 2002; Tinio, 2013). However, no previous studies have directly examined what influences the choices made during this process (Kozbelt, 2017). We examined how drawing preference relates to aesthetic preference, further exploring the processes of forming these decisions using eye-tracking techniques. Chapter 2 reported two experiments examining the relationship between a participants aesthetic experience and the initial stages of art creation, in this case the initial art-making stages of deciding what to create i.e., the choice of what to draw. It was found that those shapes that were aesthetically preferred would also be preferred for drawing. Furthermore, gaze behaviour was influenced by aesthetically preferred shapes and those preferred for drawing, both when free-viewing and when making a drawing choice. However, differences were apparent due to expertise with artists more heavily considering the images they preferred to draw when free-viewing. This supports research that suggests that greater expertise leads to greater consideration of the artist's creative process and further indicates similar cognitive processes involved in both the creation and perception of art. We can conclude that the aesthetic experience may inform art-making decisions providing empirical support for Mace and Ward's (2002) model, but a direction between aesthetic preferences influencing drawing preference or vice versa is not confirmed. In addition, the artist is suggested to visualise the aesthetic experience of the perceiver whilst making art thus drawing choices may be influenced by this factor which provides support for the mirror model of art (Zeki & Nash, 1999; Tinio; 2013). However, more direct research of the artist and perceiver relationship is needed to make these conclusions.

5.2.2 Chapter Three

Current models of art-making (Mace & Ward, 2002; Tinio, 2013) use interviews to unpack the art-making experiences of the artist. However, there is limited empirical research that particularly examines the art-making decisions of the artist. In Chapter 2 we found similarities between images aesthetically preferred and those preferred for drawing and in how such preferences influence gaze, however art-making models also indicate the importance of sketching and drawing prior to making initial art-making decisions (Mace & Ward, 2002; Tinio, 2013). Here we further explore the early stages of art-making by manipulating drawing actions (congruent, incongruent and no action) to examine if this also has an impact on drawing preferences. This can provide understanding of initial art-making decisions as presented by Mace and Ward (2002) who state that the multiple ways in which an idea can be created are important during initial stages of art-making. We also examined how manipulation with drawing actions impacts aesthetic preferences and gaze when forming aesthetic responses, this relates to the interactions presented in Tinio's (2013) model. Specifically, we examined if aesthetic experiences can be influenced by the artistic actions of the artist as low-level features of art are considered to impact early and on-going aesthetic experiences.

To date few studies have examined how artistic actions influence art-making decisions and processes, although some studies have shown that engaging with stippling and stroking actions can influence aesthetic judgements of brushstroke and pointillism paintings (Leder et al., 2012; McLean et al., 2015). After adopting similar methods and allowing participants to make congruent and incongruent actions to the images presented, we did not find drawing choice or aesthetic rating to be affected by congruent drawing activity. Guggenheim and Whitfield (1989) also found no effect of drawing practice on drawing decisions or aesthetic ratings when they provided participants with a drawing experience, but they found one type of image to be preferred for production. Similarly, we found a trend showing one type of image (brushstroke drawings) to be preferred for production. We continue to find similarities between images aesthetically preferred and those preferred for drawing, but this was modulated by expertise and drawing activity

as artists in the stippling and stroking conditions who made aesthetic judgements prior to drawing preferences did not aesthetically prefer images the more they wanted to draw them. Thus, drawing choices were required to be made for this relationship to occur suggesting that artists engaged in drawing may use drawing preferences to form aesthetic judgements. For artists, being involved in a drawing activity has an impact on their drawing-aesthetic preference relationship which supports the importance of sketching prior to making a drawing choice and how art-making experiences in turn impact aesthetic experiences (Mace & Ward, 2002; Tinio, 2013). However, we do not find direct effects of congruency here on both drawing and aesthetic preferences thus we do not provide support for Tinio's mirror model of art to suggest that the aesthetic experience is influenced by the actions of another artist. A reason for this may be due to the use of geometric shapes, which are useful to understand drawing preferences, but Chatterjee (2011) explains how the visual properties of art can attract viewer's perception more than simple objects. Therefore, artworks can have a greater effect on the perceiver and their consequential responses, particularly when considering the actions of the artist. The stages presented in Tinio's mirror model of art indicate that art-making processes of the artist (i.e. artistic action) influences the perceivers aesthetic experience, therefore it is important to include artworks that shows the product in its final form where the actions of the artist are visible. Using artworks made for exhibition portrays artists' actions that were obviously created with brushstrokes and dots of paint (pointillism).

5.2.3 Chapter Four

In Chapter 4 we analyse the perspective of the perceiver and how the actions of the artist impact their experience further examining the relationships between the creation and perception of artworks. Specifically, the studies within Chapter 4 examine how the aesthetic experience of the perceiver (early and on-going responses) is influenced by engagement with the artistic actions of other artists. Here, the formation of aesthetic judgements was analysed using gaze. Such responses are suggested to be influenced by the later stages of the artists' art-

making process. The actions of the artist are considered, both stroking and stippling actions are tested and used as a form of action that is used during the art-making process and particularly emphasised later in order to be a low-level feature that influences early observation (Tinio, 2013; Taylor, Witt & Grimaldi, 2012). In Experiment 4, a similar method to Experiment 3 was conducted here but participants were presented with artworks (paintings). No impact of congruent action was found here as in Experiment 3. Rather the results show an impact of artistic style only, with overall brushstroke paintings being preferred and fixated on more. The mirror model of art, amongst other models of aesthetic experience, can be supported by such results as low-level features emphasised by the artist in later stages of art-making (stroking and stippling actions) are recognised by the perceiver and fixation is affected by the image style, artists first fixations were also greater to brushstroke paintings than non-artists. However, a general preference for brushstroke paintings could have led to greater fixation here. In addition, the factor of familiarity, which shows brushstroke paintings to be more familiar, may have reduced the expected congruency effect of the artist on the perceiver, although in Experiment 3 familiarity would not have impacted this and no congruency effect was found. The familiarity of brushstroke paintings may have led to an ease of processing resulting in these paintings being aesthetically preferred and consequently fixated on more. Studies do demonstrate the importance of training on the aesthetic experience and suggest the need to strengthen the visual and motoric links by allowing participants to view their own hand actions, the hand actions of the artists (hand posture prime) and the link between these and the artwork which led to Experiment 5 being carried out (Freyd, 1983; Stojilovic & Markovic, 2014; Kirsch et al., 2013).

In Experiment 5 we altered the method used in Experiment 4 by attempting to enhance the visual-motor associations by providing greater associations with the actions of the artist. A training phase and method of priming similar to Ticini et al. (2014) was incorporated. The actions of stroking and stippling were learned by all participants and were associated with a hand grip image that demonstrated how the action was completed. The participants completed similar tasks to Experiment 4 but were primed with a hand grip prior to viewing or making aesthetic

judgements. The artistic style was again found to be influential as brushstroke paintings were preferred and fixated on more. However, an effect of congruency was found. When participants were primed with a stippling prime they spent more time fixating on pointillism paintings than when primed with the stroke prime, and spent more time fixating on brushstroke paintings when primed with the stroke prime compared to the stipple prime. The mirror model of art is supported further here as a relationship between artist and perceiver is found, although it is apparent that an increase in enhancing visuo-motor and visuo-visual associations was necessary.

5.3 Implications

5.3.1 Testing the Mirror Model of Art

The mirror model of art suggests a relationship between artist and perceiver where there are links made between the different stages of art-making with the different stages of the aesthetic experience. One of the advantages of this model is its testability, yet little research has been conducted analysing the different stages of art-making and aesthetic experience relationships (Tinio & Smith, 2014). Studies are required to test the model using tools that can relate to both aesthetics and creativity. Research involving liking and preference scales is useful, but there is a need to adopt more behavioural, physiological and neurological methodologies that provide an insight into the processes that take place throughout the aesthetic and art-making experience and not just at the point of aesthetic judgement (Tinio, 2013). Eye-tracking measures, drawing decisions, drawing activity and aesthetic ratings were incorporated in the studies presented here. As this model considers both the artist and perceiver to understand the full experience, then it is important to examine both perspectives. Research that examines different parts of the model is vital for understanding the conversation between artist and perceiver and links between the creation and perception of art (Vartanian, 2014).

In the chapters of this thesis we have specifically addressed different stages of aesthetic and art-making experiences and considered some of the interactions between these as presented in the mirror model of art. In Chapter 2 we examine

the perspective of the artist by investigating their initial art-making decisions; the relationships between their aesthetic and drawing preferences. However, we further extend these results considering the cognitive processes forming such preferences by analysing eye movement behaviour. We find images aesthetically preferred to impact gaze both when free-viewing and making drawing preferences which supports that there are similar cognitive processes involved in the creation and perception of art. It is important to understand how the artists' own experience directs art-making decisions. Although this relationship of the artist themselves is not explicit in the mirror model of art, it is part of the initialisation stage depicted in the model. This relationship between an artists' aesthetic and art-making experience is suggested in Mace and Ward's (2002) model which was the foundation of Tinio's model. In addition, this research may be of support to the mirror model suggesting that the aesthetic experience of the artist, that appears to be important during art-making, may be dictated by artists visualising their perceiver and their perceiver's potential experience (Zeki &Nash, 1999; Tinio, 2013). However, more research is required here to specifically examine how the artist considers their perceiver. In contrast, further research must also address how the early stages of art-making are imagined by the perceiver.

In Chapter 3 we again examine artists and their initial art-making decisions, however here we manipulated drawing actions that the participants were simultaneously creating when making both aesthetic and drawing preferences. The results do not provide support for the initialisation stages of art-making which suggest that past drawing experiences can impact drawing decisions as we find no effect of congruent action on drawing choice. However, we do provide some support that being involved in drawing prior to making a drawing choice is important, particularly for artists. Regarding the artists involved in making drawing actions, the relationships between aesthetic and drawing preference that were found in Chapter 2, were only found here for those who made drawing preferences prior to aesthetic judgements. This shows that engaging in creative activities (drawing action and decisions) influence artists' aesthetic judgements although no direct impact of congruency on aesthetic judgements was found. The impact of congruent action on aesthetic judgement has been found in recent

studies and can be suggested to provide support for the mirror model of art as it considers both the artist behind the stimuli and the perceivers' aesthetic response. However, the results in Chapter 3 do not support this; potential reasons for the lack of effect here were addressed in Chapter 4.

In Chapter 4 we introduced artworks of others to examine the later stages of art-making considering the techniques of the artist and their actions that are emphasised here and are expressed to impact the perceiver's initial reactions and on-going aesthetic experience. We support the mirror model of art as we show that the actions of the artist can impact the perceiver's aesthetic response, particularly gaze which provides information on initial reactions and on-going processes. In Experiment 4 we find brushstroke paintings to be fixated on more regardless of congruency, with artists fixating on these first more than non-artists and non-artists fixating more on pointillism paintings first. This demonstrates that low-level features such as artistic action are considered early on and are important for the perceiver; although we must also consider that brushstroke paintings were aesthetically preferred and found to be more familiar thus this can also be influencing gaze. In Experiment 5, after enhancing visuo-motor and visuo-visual associations by training and priming participants, we then find the specific actions of the artist to have an impact on the perceiver's aesthetic response to the congruent art style. Presentation of a congruent action of the artist influenced gaze such that they fixated more on congruent artworks. We therefore support the mirror model of art showing the formation of aesthetic responses to be influenced by the artistic behaviour produced by the artist, although it is apparent that more explicit links between the participants and artists action was needed through both training and priming of action. Overall, this research adds to existing literature and particularly examines stages and concepts within the mirror model of art considering both aesthetic and art-making processes providing further understanding on the relationship between the creation and perception of art.

5.3.2 Impact of Expertise on Aesthetic and Art-making Experiences

A major aim of this thesis was to explore differences in aesthetic and art-making experiences due to expertise. Throughout the chapters presented in this thesis we have conducted studies including both artists and non-artists and we find some differences between the two groups of participants in each chapter. Here, we provide an overview of the differences we find and present support for research and models that indicate the importance of expertise.

In Experiment 2, differences were apparent due to expertise with artists more heavily considering the images they preferred to draw when free-viewing. They fixated more, made more fixations, fixated more at the earliest opportunity to the image they preferred to draw, and fixated more on the image they preferred to draw the more they desired to draw it. This may reflect previous reports of experienced artists being more deeply engaged (e.g., longer fixation durations) with the stimuli and the creative process (Nodine, Locher & Krupinski, 1993; Tinio, 2013). In addition, when making a drawing decision the artists were found to fixate quicker to their drawing preferences demonstrating that artists are more aware of their preference and results show that they are already considering these during the previous stage when freely-viewing stimuli. Non-artists gaze was also influenced by task order, during the drawing task they fixated more on preferences the more they preferred the images only when aesthetic judgements had been made beforehand. This supports research that suggests that greater expertise leads to greater consideration of the artist's creative process, further indicates similar cognitive processes involved in both the creation and perception of art and highlights a greater fluidity between these processes for artists (Pitman & Hirzy, 2010; Martindale, 2001, Tinio, 2013).

In Chapter 3 we find the relationship between images aesthetically preferred and those preferred for drawing to be modulated by expertise and being engaged with drawing. Non-artists showed positive relationships here between aesthetic and drawing preference regardless of the condition they were in and the time at which aesthetic judgements were made. Positive relationships were found for artists in the control group, but these were only found for those in the stippling and stroking

conditions if aesthetic judgements were made after drawing decisions. Thus, when artists were engaged in drawing and making drawing choices prior to evaluating stimuli, then a greater aesthetic-creative relationship was found. In addition to this, when artists were involved with a drawing action, gaze whilst free-viewing was only towards images they'd prefer to draw, which suggests that when artists are engaged with drawing then drawing preferences are considered more than aesthetic preferences. Therefore, artists' drawing experiences appear to impact on their aesthetic experiences (Mace & Ward, 2002; Gallese & Freedberg, 2007); however, no direct impact of drawing action was found here. First fixations were found to differ due to expertise when presented with geometric stimuli differing in style and creating stippling or stroking actions. Non-artists were found to make first fixations to stipple images despite a trend found for a preference to draw stroke images. Therefore, low level features can impact early explorations supporting previous research (Wallraven et al., 2009; Chatterjee, 2011; Tinio, 2013). The reason for low-level features having a particular impact on gaze is discussed below.

In Experiment 4 first fixations were again found to be influenced by expertise and image style; artists fixated first on brushstroke paintings more so than non-artists, whereas non-artists fixated first on pointillism paintings more so than artists although there was a general preference for brushstroke paintings. Thus, again low-level features impact initial exploration despite preferences, this is particularly apparent with non-artists. This supports results from Chapter 3 and research that shows low-level features have a greater impact on early responses to art (Tinio, 2013). In addition, this supports that non-artists initial gaze is impacted more so by abstract elements and individual features regardless of liking, whereas artists consider the artwork on a whole. Non-artists may not be able to visualise beyond the surface features of artworks like artists (Pihko, et al., 2011; Chatterjee & Vartanian, 2016).

Overall, we find that artistic expertise modulates the relationships between aesthetic, art-making experiences and gaze. Artists appear to be considering more of the art-making process when merely viewing stimuli which impacts their process and the speed of process to make a drawing choice. This initial response

through first fixation continues to differ due to expertise when engaged in drawing, with artists fixating first to styles of art they prefer (brushstrokes) and non-artists fixating on less preferred styles (pointillism). These results provide further support for a consideration of the perceptual properties in art; however, the impact of congruency and action on aesthetic and art-making experiences is not impacted by expertise. In fact, artists' aesthetic judgements can be influenced by their art-making experiences (drawing and making a drawing preference) regardless of producing specific drawing actions.

5.3.3 Artistic Experiences during Art Observation

There are also practical implications from the research presented in this thesis, across the studies there appears to be an influence of being involved with a drawing experience (activity and decision), and particularly having training in drawing on the aesthetic experience. This highlights the potential of implementing new divergent methods into the art observation experience. Pitman and Hirzy (2010) explain the need to allow visitors of museums to engage in creativity and experience art more dynamically where the artist's creative process can also be presented to perceivers. The act of drawing and sketching whilst in an art gallery/museum could be promoted as this can add to the aesthetic experience. Mere observation, although it may enable consideration of the drawing process, particularly for artists, is not enough for perceivers to fully engage with the motivations and art-making processes of the artist. Tinio, Smith, and Potts (2010) found that visitors in an art museum reported expecting, needing, and actively seeking information about artists and the context in which their works were created.

Tinio (2013) discusses how using the mirror model of art to better structure the function of a museum can lead to more dynamic experiences. Observers can be provided with more information about the artwork but also a deeper level of experience with the process of creation. Specker, Tinio and van Elk (2017) further examined the aesthetic experience when presenting information about an artwork to observers. They conclude that the mirror model of art presents a good

representation of an experience within a museum, but some modifications to the model can be made.

Physically engaging with art and creating artworks whilst exploring others can add to the full aesthetic experience. Kirsch et al. (2013) showed that physical training and practice had a greater impact on appreciation and enjoyment of dance in comparison to only observing the dance routines. From the research in this thesis we see that engaging with drawing techniques and making drawing choices can have an impact on the aesthetic experience. A framework that involves engaging with art where perceivers can be heavily involved with the artists' art-making process and create their own art, changes perceptions of a museum and the function of art galleries with this approach having potential to extend into art and aesthetics education.

5.3.4 Eye-tracking as a Measure of Preference

There remains to be inconsistent research regarding the use of eye-tracking as a measure of preference, particularly when free-viewing images within the field of empirical aesthetics. Holmes and Zanker (2012) found gaze to be directed towards the images aesthetically preferred and further suggested that this could also be found when free-viewing. Leder et al. (2010) incorporated free-viewing tasks into their study and found attractiveness to direct fixation with fixation duration and first fixations being greater towards more attractive faces. In contrast, Isham and Geng (2013) did not find gaze (fixation duration and last fixation) to be influenced by aesthetic value when free-viewing and Amir et al. (2011) found differences between the types of shapes fixated on and those liked from other participants subjective responses. The experiments conducted in this thesis have used free-viewing eye-tracking techniques as a measure of preference and to further understand the aesthetic experience with visual art (Locher, 2006). Further evidence is provided below from the results of these experiments to support the use of eye-tracking.

Throughout this thesis there has been a strong link between gaze and image preference. Free-viewing eye-tracking tasks where participants were given no

formal instruction were used in all five studies. The results from Experiments 1 and 2 can be used to present eye-tracking methods as a useful measure of preference as images aesthetically preferred were fixated on more and longer, and the more they were preferred the longer they were fixated on. Similar results were found for artists' drawing preferences. In addition to this, the results from Experiments 3, 4 and 5 were re-analysed in accordance to Experiments 1 and 2 to explore whether images preferred influenced gaze when drawing/undergoing training and when presented with artworks. Experiment 3 showed that when participants were involved with a drawing action, gaze whilst free-viewing continued to be influenced by images aesthetically preferred and those preferred for drawing. However, only the non-artists were found to fixate longer on images aesthetically preferred, with both non-artists and artists fixating more and longer on images they'd prefer to draw, which suggests that when artists are engaged with drawing then drawing preferences are considered more than aesthetic preferences. In Experiment 4 we presented artworks and found participants to fixate more (longer and more often) on images aesthetically preferred, artists also made more first fixations to these. Differences were found here to Experiment 3 which suggests that when actions are no longer presented in geometric shapes but from other artists' work, then both artists and non-artists continue to fixate on aesthetic preferences. Despite a pre-training phase being carried out and participants being primed with different hand actions in Experiment 5, participants fixated (longer and more often) on images they aesthetically preferred. Therefore, the studies conducted here provides further support for eye-tracking as a useful measure of preference for both geometric shapes (computer-generated, man-made in stipple and stroke form) and artworks (brushstrokes and pointillism).

5.3.5 Williams Model: Integration of aesthetic and art-making experience

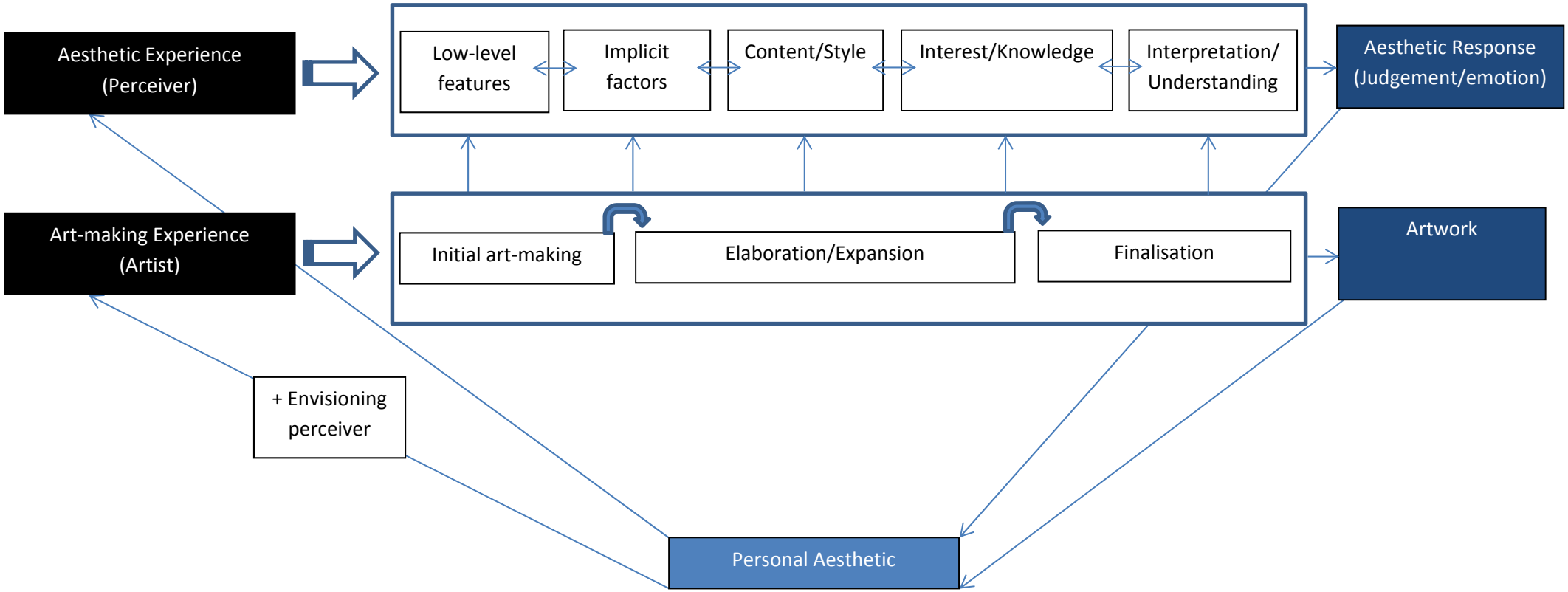

Figure 5.1-Williams model (elaboration of Tinio's Mirror Model of Art)

In figure 5.1 a model is presented that aims to extend the mirror model of art by considering the more complex understanding of the aesthetic and art-making experience using current literature and the studies from this thesis. The stages of an aesthetic experience are presented. These are based on previous models of the aesthetic experience to artworks proposed by Leder et al. (2004; 2014), Locher et al. (2010) and Chatterjee (2011). These models show how an aesthetic experience develops from the perceptual low-level features of an artwork to an aesthetic response. Implicit factors such as fluency and familiarity will have an impact on this experience. The perceivers consider the styles and content within the artwork. More deliberate processing takes place where the individuals taste, interest and knowledge of art become important leading the perceiver to form interpretations in an attempt to understand the artwork. The artwork is finally evaluated leading to an overall aesthetic response (judgement and/or emotion). It is important to note that stages of the aesthetic experience can be revisited prior to forming judgements and that this is not necessarily a linear process.

In addition to the processing stages involved in the viewers developing aesthetic experience, figure 5.1 also shows the stages involved in the art-making process. These are based on those outlined in Sapp (1995), Mace and Ward (2002) and Tinio (2013). The art-making experience begins with forming potential ideas to create, and then selecting one or more of these ideas to elaborate on. After working with this/these idea(s), an artwork emerges. It is important to note that the development of the artwork is an iterative process and prior stages can be revisited at any time. Ideas can be developed but then dropped and earlier ones selected instead. Once the artwork has sufficiently developed it is then finalised and prepared for exhibition.

The personal aesthetic of the perceiver and the artist has been shown to influence both the aesthetic and art-making experience (Kay, 1999; Mace & Ward, 2002). This is shown in figure 5.1. The perceiver's personal aesthetic will modulate their progression through the stages underlying a final aesthetic response (judgement and/or emotion), which in-turn modifies (or may not) their personal aesthetic. Likewise, the artist's personal aesthetic will impact on the stages involved in the

creation of an artwork which again modifies (or may not) the artists' personal aesthetic (Mace & Ward, 2002; Tinio, 2013).

Figure 5.1 depicts how the perceivers' aesthetic experience can be influenced by different stages of the artists' art-making experience. Unlike previous suggestions in which stages of the aesthetic experience are deliberately limited to stages of the art-making process in a mirrored fashion, such that early stages of the aesthetic experience are linked to later stages of the art-making process for example (Tinio, 2013), here we highlight how stages of art-making may inform the perceiver during any stage of the aesthetic experience. This is supported by the research within this thesis. Brushstroke and pointillism paintings were found to impact on the eye-movements of perceivers; this may be due to the final touches applied to the artwork impacting on the early aesthetic experiences of the perceiver as would be suggested by the mirror model of art. However, these results were found to differ depending on prior knowledge of artist's techniques, which may suggest that early aesthetic experiences can be influenced by a greater understanding the early stages of the art-making process. Furthermore, aesthetic preferences were found to be for a specific style (brushstroke paintings), but the style of art (for example the application of heavy brushstrokes to a piece) can be established and emphasised during any stage of the art-making process, not only during the final stage. More widely, other low-level perceptual features of an artwork (e.g. symmetry) that would be processed early during an aesthetic experience can be created during any of the stages of the art-making process (Tinio & Leder, 2009; Tinio, 2013). This supports the suggestion that there is a greater fluidity between the relationship of the creation and perception of art.

5.3.6 Conclusion

Art is experienced daily by millions in various ways; empirical aesthetic research aims to gain further understanding on what aspects of art are appreciated, why we find art pleasing?, what influences the perceivers experience and the working process of the artist? However, previous research fails to examine these questions in relationship to the interaction between the artist and the perceiver. Here we

present potential implications of the thesis studies demonstrating that integrating the artist and perceiver in experiments gives understanding on how the artist is considered by the perceiver and the perceiver considered by the artist. This provides a foundation for an area of research that incorporates more creative tasks into the observation of art and more self-reflecting methods into the creation of art. We provide greater support for differences between expertise, particularly regarding gaze, and rigorous testing of eye-tracking methods demonstrates its use as another measure of preference. Overall, we present a model that considers the relationships between the aesthetic and artistic experience in more depth.

5.4 Considerations and Limitations

In regards to the methods of our study, there are some factors that may need to be considered and other aspects that may be viewed as limitations. In this section we present these, provide reasons behind the methods used and explanations of how these issues were avoided or are not a concern.

5.4.1 Visual Complexity

Complexity was included in this research as a collative variable in Experiments 1 and 2; it is useful to manipulate complexity when examining aesthetic and artistic experiences. However, it may be argued that the complexity of images viewed could influence gaze due to saliency. More complex images may be more salient. In Holmes and Zanker's (2012) study they did not explicitly account for the impact of saliency in their design despite presenting a large number of different images. They stated that longer durations (5000 ms) would avoid saliency influencing gaze. Djamasbi, Siegel and Tullis (2014) highlighted that during free-viewing the main images of a website influenced fixation and preference. The researchers concluded that the longer the main image was fixated on, the higher the aesthetic appeal. Again, saliency was not considered here although size, complexity, colour and content of images could influence this. Henderson, Brockmole, Castelhano and Mack (2007) suggest that when actively viewing images, i.e. when performing a

task, then gaze is not influenced by visual saliency, but cognitive and more meaningful factors concerning the task at hand direct gaze. Similar results were found by Underwood and Foulsham (2006), but they find that when participants were free-viewing then salient objects of scenes did influence fixation, however only initial fixation was effected here. Previous research suggests that saliency, while contributory, is only an important factor for initial viewing behaviour. When images are presented for longer periods of time and/or when people are engaged with a task, then more cognitive factors are important. However, to avoid issues here and as we employ a free-viewing task, we considered the luminance of the geometric shapes created and presented in Experiments 1, 2 and 3, which is one factor from our stimuli that may affect saliency. We calculated luminance using a luminance photometer and all images were confirmed to be within +/-5% of the overall mean (Kun, Palinko & Razumenić, 2012).

5.4.2 Presentation Durations

The free-viewing task used throughout this thesis provided participants with 5000 ms of time to view the two images displayed. It may be suggested that it would be better to give more time to participants in order to develop aesthetic preferences. Maughan, Gutnikov and Stevens (2007) found positive correlations between gaze and aesthetic evaluations when displaying images for 5000 ms, however only one image was presented here in each scene. Wallraven, Cunningham, Rigau, Feixas and Sbert (2009) used 6000 ms presentation times and concluded that this was enough time to process low and higher-level information enabling participants to form judgements of complexity and aesthetic appeal, whereas, Leder et al. (2010) presented scenes to participants when free-viewing for 10000 ms. However, 5000 ms was the greatest duration used by Holmes and Zanker (2012), participants were presented with up to eight images and were requested to look for the image they preferred. They also conclude that it would be possible to calculate aesthetic preference using similar methods but allowing participants to free-view stimuli. Amir et al. (2011) conducted a study where two images were presented, here only 2000 ms presentation durations were used to calculate preference. In contrast,

Isham and Geng (2013) gave participants unlimited time to make a choice (choice task) and decide they were ready to make aesthetic ratings (free-viewing task). The mean time to end each trial across both tasks was approximately 3500 ms, which fits well with that work in which time constraints are imposed and suggests that aesthetic preferences can be generally ascertained with 5000 ms of viewing. Positive correlations between short and longer presentation times have also been found. Short presentation times of 100 ms and the resulting pleasingness ratings of stimuli (art and faces) have been found to positively correlate with ratings made when viewing stimuli for an unlimited time, again showing that aesthetic preferences are formed in a very short period of time (Locher et al., 2007; Willis & Todorov, 2006). Therefore, viewing time may not be an essential factor to consider and presentation durations of 5000 ms can be regarded as suitable and acceptable to use to understand aesthetic preferences.

5.4.3 Laboratory Settings

The factors discussed above raise the issue of conducting creative and perceptual experiences in a laboratory setting. Mace and Ward (2002) argue that real-life studies provide more information to researchers than laboratory studies as participants can interact with the environment. This can be particularly important for an artist regarding their motivation and efforts. Furthermore, Brieber, Nadal, Leder and Rosenberg (2014) found both aesthetic ratings and time spent viewing art to be greater for art when displayed in a museum than shown in a laboratory, thus context can be important for the aesthetic experience. However, Mace and Ward (2002) do suggest that the combination of laboratory studies in conjunction with real-life studies of artists is ideal. If wanting to explore artists and non-artists' creative processes then a laboratory setting is required as such experiences may not occur as often in real-life. In addition, current aesthetic and art-making models demonstrate the need for empirically examining the theoretical conclusions implied (Tinio, 2013; Vartanian, 2014). In regards to art-making, laboratory studies allow understanding of both the mechanical and cognitive principles associated with drawing (van Sommers, 1984). In regards to aesthetic experiences,

laboratory studies are now more advanced allowing for multiple methods to be used to understand aesthetic responses and the formation of judgements, for example using eye-tracking techniques. It is also possible to use such methods simultaneously providing a greater understanding of the aesthetic experience (Leder & Nadal, 2014).

5.4.4 Art Students as Artists

Here, professional artists did not take part but art students were classified as artists. We do this according to past research that uses "artists". It may be argued that art students are not artists, however those who took part in our study had at least five years of formal art training and were involved in making art on a regular basis which has been used as criteria for an "expert artist" in accordance to Glazek (2010; 2012). Our definition also fits with other studies where participants have been classed as artists/experts/trained, if received training for several years (Calabrese & Marucci, 2006), received graduate level art training (Nodine, Locher & Kuprinski, 1993), had more than one year of drawing experience (Perdreau & Cavanagh, 2013), are art students (in this case it was art history) (Pihko et al., 2011), have extensive experience in drawing (Kozbelt et al., 2010) or are graduate or upper-level undergraduate art students who produced artworks independently alongside class assignments (Kristjanson, Antes & Kristjanson, 1989).

It is however important to note that despite all artists being fine art students, not all considered themselves to be drawers or painters. Although they may engage with doing these activities for their course they were artists with varied styles who created different forms of art on a regular basis. Art students in general have been found to verbalise and acknowledge their lack of skill particularly in drawing, with some desiring to improve their drawing ability (McManus et al., 2010). In addition, it was difficult to attain the large number of artists that was desired to match the number of non-artists due to our criteria. Therefore, future studies could also examine professional artists as well as art students, but older participants must then be considered as non-artists, particularly if making conclusions on eye movement behaviour.

5.5 Possible Future Directions

Here, we present areas that are required to be further examined in order to gain a greater understanding on the aesthetic and artistic experience. Suggestions are made in relation to the mirror model of art where the relationships between artist and perceiver can be further studied. Reasons behind such relationships then need to be answered, thus further exploration into the mirror neuron and fluency hypotheses is useful. From the thesis, we find an impact of action on gaze, but little research explores these eye and hand relationships particularly whilst drawing and when the hand is not in view. Finally, we highlight how such research can have greater implications by further examining patient's experience.

5.5.1 Art-making and Aesthetic Experiences

Mace and Ward's (2002) model and the mirror model of art (Tinio, 2013) depict relationships between art-making and aesthetic experiences. However, there is a lack of empirical research investigating these relationships. Here, we have addressed questions revolving around initial art-making decisions and actions of the artist but there are many areas of the models that need to be addressed. Chapter 2 and 3 shows the importance of the artists' aesthetic experience when creating artworks and Chapter 4 shows the importance of the creation process on the aesthetic experience of the perceiver, but more is required to examine these aesthetic and art-making processes.

We have conducted some studies into the initial art-making stages showing that relationships exist between what is aesthetically preferred and preferred for drawing. Further studies are required to consider the artist and whether their initial thoughts and processes are influenced by potential perceiver's response. In order to achieve this, in-depth studies with artists involving interviews, questionnaires, and observing their initial art-making practices are ideal. Studies have also investigated how artist's motivations and knowledge of these can influence the aesthetic experience of the perceiver. The display, type of title or the inclusion of written information about the artwork and artist have been shown to have an impact on the aesthetic experience of the perceiver (Millis, 2001; Temme,

1992; Kirk, 2009). Tinio, Smith, and Potts (2010) also found that visitors in an art museum reported expecting, needing, and actively seeking information about artists and the context in which their works were created. To understand how information that relates to the initial art-making stage impacts aesthetic experiences, then studies are required that manipulate perceiver's access to such information about the artwork, artist (professional/ novice/ computer/ child/ animal), title and motivations.

The development of the artwork is then proposed to relate to the on-going aesthetic experience. Here, the introduction of content to the emerging artwork, and refining of characteristics is suggested to influence the observer's aesthetic experience. On the other hand, the artist may consider their perceivers, as the style and overall composition are modified, the expertise and knowledge of the perceiver may be important for the desired aesthetic response (Tinio, 2013). To test the impact of art development on the perceiver, participants can be presented with a more detailed view of these stages, for example by showing a video clip of an artist at work, using actual or carefully manufactured intermediary stimuli or by allowing perceivers to be involved with art-making themselves. Experiencing a more detailed view of art-making may influence the perceiver. Guggenheim and Whitfield (1989) however did not find such an experience to influence aesthetic experiences when they allowed participants to receive a greater experience engaging with drawing. Furthermore, no effects of familiarity with drawing were found in Zizak and Reber's (2004) study until stimuli were copied using calligraphy where the stimuli were apparently more distinct; therefore, drawing behaviour that portrays action more clearly can impact familiarity. However, Chapter 3 explored how experience with artistic actions influenced drawing decisions and no effect of congruent action was found. In addition, we can conduct experimental studies to understand how the artist's development of art changes dependent on them considering different perceivers (artists/non-artists/children). To fully understand whether artists do consider their audience when making art we can conduct an in-depth study with an artist. Here, the art developing stage can be observed, moreover gaze whilst creating art can be

recorded and a documentary on the artists' thoughts and decisions will provide further insight.

The final stages of art-making relate to preparing the artwork for display. Here, the techniques of the artist, texture, colours and styles are emphasised and it is suggested that the artist considers the perceiver during this stage of art-making; in contrast, the perceiver is influenced by these low-level features during initial exploration (Tinio, 2013). A few studies have been conducted that demonstrate how congruent actions with the artist produce higher liking scores for those images when actions are made simultaneously (Leder et al, 2012; McLean et al, 2015). In Experiments 3, 4 and 5 we did not find this to be the case, but did find gaze to be influenced by congruent action when associations between own actions and actions of the artist were enhanced. There are more low-level features that need to be tested including the thickness of brushstrokes applied, the type of painting material, the texture and colours used. Saunderson, Cruickshank and McSorley (2013) did not find an impact on gaze due to the material in which a painting was presented (original, photographic or computer monitor), however self-reports did suggest that the viewer may consider these differing image formats. To understand whether the artist is considering the perceiver during later stages of art-making an in-depth study with artists is required, here gaze can be recorded whilst artists make finishing touches to artworks and interviews conducted whilst artists prepare their artworks to be displayed, for example at an art show.

When conducting further research into the aesthetic and art-making experiences it may also be ideal to consider other factors that form the aesthetic experience rather than pleasingness and aesthetic preference alone. Studies examining the aesthetic experience can also consider experiences and emotions such as sadness, fear, interest and surprise (Vessel, Starr & Rubin, 2013; Chatterjee & Vartanian, 2016).

5.5.2 Mirror Neuron Explanation

In recent years' art has begun to be studied in more detail with research examining the neurological basis of aesthetic and artistic experience (Piechowski-Jozwiak et al., 2017). Current neuro-aesthetic research links aesthetic preferences to areas associated to reward in the brain such as orbito-frontal and medial-prefrontal cortex, ventral striatum, anterior cingulate, and insula. In addition, brain areas such as MT are also found to be activated during observation particularly due to the movement that can be perceived. The mirror neuron hypothesis provides further explanation for this (Chatterjee, 2011; Chatterjee & Vartanian, 2014). However, more research is required here, particularly regarding the mirror neuron and fluency hypotheses to consider more of the overall aesthetic experience rather than aesthetic judgements alone and exploring differences dependent on expertise. The results from Leder et al. (2012) and Ticini et al. (2014), which show an impact of artistic actions on the aesthetic experience, can be explained by the mirror neuron hypothesis as a mirror neuron is activated both when an action is performed by the person and when the same action is performed by another individual, but the influence of familiarity and processing fluency of artistic actions impacting aesthetic response is also considered (Ticini et a., 2014).

It is unclear how the brain understands observed actions and can be argued from two perspectives, the mirror neuron system is a specialised system for understanding action, and this may explain how we observe and understand other's actions, but a general perceptual familiarity that is used to understand other objects and interactions may suffice to explain responses. Brain responses have been found to be impacted by both previous visual familiarity and previous motor experience of performing an action, but clear mirror system activation was found when effect of visual familiarity was controlled for. These results do not extend to static artworks where the actions of the artist are less apparent as here dance movements were examined, thus more research is required here (Calvo-merino, Grèzes, Glaser, Passingham, Haggard, 2006).

The observation of art and embodiment, even in a static form is able to influence the aesthetic experience. It is suggested that the way in which art is produced and

the actions of the artist impact the aesthetic experience of the perceiver due to activation of embodied mechanisms (Freedberg & Gallese, 2007; Knoblich & Prinz, 2001). Recent studies have introduced neuroimaging techniques in order to explore brain activation during aesthetic experiences. However, more is required particularly examining art-making experiences (Chatterjee & Vartanian, 2016). Umilta et al. (2012) state that the role of the mirror neuron system in relation to the aesthetic experience requires more investigation, but their research did find the motor system to be involved with observation of artworks. However, in this study the aesthetic ratings could be affected by the participants' knowledge of how the art was produced rather than the impact of the mirror neuron system. Liew, Han and Aziz-Zadeh (2010) found that observing familiar gestures are associated with increased sensory-motor related processing but unfamiliar gestures are more associated with visual processing. Thus, the familiarity of gestures perceived may modulate the mirror neuron system; the activity within these regions may be dependent on the task and stimuli. Research into the actions of the artist in relation to the perceiver and manipulations in tasks can help understand the impact of the mirror neurons system in relation to familiarity and processing fluency particularly using fMRI methods.

5.5.3 Hand and Eye Movement Relationships

When drawing, top-down processes are important as decision-making, familiarity and knowledge can all impact this process and the outcomes. Furthermore, bottom-up processing is important as visual information guides drawing behaviour (Ostrofsky, Nehl & Mannion, 2017). Another dimension that should be examined is this relationship between visual information and drawing behaviour, the relationship between hand and eye movements, particularly when no visual feedback is given. It is apparent that during mundane activities the hand follows eye movements (Land & Hayhoe, 2001). Richardson, Cluff, Lyons and Balasubramaniam (2013) found that the direction of tapping movements actually shifted in the direction of the saccades being made. However, eye movements may be influenced by hand actions; Costantini, Amborsini and Sinigaglia (2012) suggest

that gaze behaviour is influenced by action, and congruent action that is readily recruited influences eye movements. Regarding looking at a target this is affected if movements are incompatible. Incompatible actions between the actor being observed and the participants affected gaze and the ability to observe hand actions. Therefore, vision can be influenced by hand actions but hand actions can also be influenced by perceptual processes (Tipper, 2010).

In regards to drawing, a deeper investigation of the relationship between eye and hand movements during artistic drawing is required, particularly of artists (Choi & DiPaola, 2015). Taylor, Witt and Grimaldi (2012) support a relationship between perception and action highlighting that the perceiver's implicit action matches movement emphasised by the artist, reaction times are faster if hand movement direction is congruent to observed art motion. Specifically, regarding eye movements, Maycock, Liu and Klein (2010) found hand movements to match eye movements during the drawing process, particularly for artists. The research presented in this thesis further shows drawing action, even when hidden, to have an impact on gaze; fewer fixations were found to be made in Experiments 3 and 4 when participants were simultaneously making brushstroke actions. Similarly, Miall and Tchalenko (2001) found that when artists were creating art then their eye movements were affected due to the mere action of painting. Here, they found that painting influenced gaze as fixation durations were twice as long as to those made when not painting. Longer fixation duration would result in fewer fixations; thus, this is supported from Experiments 3 and 4. In contrast, McCormick, Causer and Holmes (2013) found more fixations to be made when physical hand movements were made in comparison to observation or imagination of such movement. More research is required here to understand the relationships between action and gaze, particularly when drawing and when hand movements are hidden.

5.5.4 Art-making and Aesthetic Experiences: Clinical Implications

Many people are engaged in aesthetic and art-making experiences despite artistic training, age and health problems. Research has investigated aesthetic and art-making experiences, particularly considering artistic expertise. However, a lack of research has examined these experiences across ages and illnesses (Halpern & O'Connor, 2013). It has been suggested that those, particularly children and students with physical and visual disabilities require greater access to art-making experiences (Coleman & Cramer, 2015). Art therapy has been used with impaired children and older adults and the interaction with art has been found to aid development. Engagement with art for example has been particularly found to assist those with autism encouraging interaction with others (Malchiodi, 2011; Lusebrink, 2004).

Art-making experiences have also been extended into clinical studies to further understand differences due to mental health and illness using results to further develop treatments. Santosa et al. (2007) concluded that bipolar patients and art students were more creative than healthy control non-artists. However, they state that further research is required to understand what impacts this difference and how this affects treatment. When considering engaging in art and being creative, then there are some diseases that lead to hand actions, artistic abilities and recognition, which are specifically associated to the creation and appreciation of art, to deteriorate. In regards to Alzheimer's disease, painting skills were in fact found to improve whilst many other skills deteriorated. Miller and Johansson (2016) found Alzheimer's patients to be able to paint both when given instruction and no instructions, in fact they painted for longer and were more expressive using greater proportions of the canvas when they were given no instruction. Furthermore, the actual style and content of patient's paintings were surprisingly consistent across sessions despite the patients having poor memory ability. Rankin et al (2007) found art productions made by Alzheimer's patients to be more similar in style to healthy controls than those with frontotemporal and semantic dementia, further stating that Alzheimer's patients had greater art-making abilities.

In addition to examining art-making experiences, few studies explore the aesthetic experiences of patients. Some recent research has found that those who suffer with Alzheimer's hold stable aesthetic preferences overtime despite having poor memory, even for those images that are being judged in terms of pleasingness (Halpern, 2008; Graham et al., 2013, Silveri et al., 2015). Halpern and O'Connor (2013) show further support for stable aesthetic preferences with frontotemporal dementia patients. This demonstrates that art and the aesthetic experience is not heavily affected by such illness, thus it is useful to provide patients with these experiences which also have the potential to aid their well-being. The current studies that support the stability of aesthetic preferences in Alzheimer's patients however report difficulties with the tasks administered. Graham et al. (2013) state how participants found difficulties concentrating with the tasks and they were not sure whether to judge images based on aesthetic preference or other factors. Miller and Johansson (2016) found that giving participants no instruction led to greater artistic expression, not needing to cognitively process instructions may have allowed for this relaxed state and freedom to paint.

When exploring aesthetic judgements from patients, issues have been highlighted particularly due to the methods used to gather responses. In this thesis, eye-tracking and use of a free-viewing task has been found to reflect aesthetic preference, thus an experiment can be designed that allows patients aesthetic preferences to be recorded without the need of instructions and difficult tasks. However, it is important to consider the type of eye-tracking device required; Vidal, Turner, Bulling and Gellersen (2012) provide an overview of useful eye-tracking devices for studying those with mental health issues, including Alzheimer's patients. They explain how eye-tracking techniques are a useful measure for monitoring the progress of Alzheimer's disease but also indicate how the disease impairs eye movements, thus this is something to consider when designing an eye-tracking study. Mosimann, Felblinger, Ballinari, Hess and Müri (2004) found that when Alzheimer's patients were viewing a clock they made fewer fixations and slower first fixations to areas of interest compared to healthy controls. This can be an important factor if Alzheimer's patients are to engage with aesthetic and art-making eye-tracking tasks. Despite this, Mapstone, Rösler, Hays,

Gitelman and Weintraub (2001) did not find any differences in gaze between older healthy adults and Alzheimers patients. Although younger adults were found to be less affected by distractions, both older adults and Alzheimers patients equally fixated away from a central region of interest. In an eye-tracking study, short presentations of stimuli and no specific instruction can be used to reduce difficulties in concentrating, processing information and understanding what decisions are required to be made. Further techniques can be employed that can provide easy and reliable ways to understand if and how aesthetic preferences remain stable in Alzheimer's and other patients leading to more research using such experiences alongside art-making methods to aid well-being.

5.6 Conclusion

This thesis studies different stages of art-making progressing from early initial decisions to diverse actions, both aesthetic ratings and eye-tracking measures are used throughout capturing the process of forming an aesthetic judgement and overall aesthetic preferences. The results from Chapter 2 show both artists and non-artists desire to create images the more pleasing they find them, similar cognitive processes were found during observation and making drawing preferences suggesting that relationships exist between the creation and perception of art. Similar findings were found in Chapter 3 when drawing actions were also carried out by participants, but the strength of these relationships varied for artists when engaged in drawing. Nevertheless, no effect of action was found to impact drawing preferences and aesthetic preferences which was predicted due to previous research. The results from Chapter 4 further support a relationship between the creation and perception of art. The processes of forming an aesthetic judgement were found to be influenced by the artist's art-making process when observing artworks; however, an effect of congruent action on aesthetic preference was only found when using training and priming methods which may enhance visuo-motor and visuo-visual associations between the hand actions of the participants, the hand prime images and the artworks being viewed. Overall, we have examined the relationships between aesthetic preferences, drawing preferences and drawing experience. We conclude that aspects of

perception, production and enjoyment are integrated and that interactions exist between the artist and the perceiver during the creation and perception of art (Dewey, 1934; Tinio, 2013).

This research has theoretical and practical implications. Tinio (2013) identified the need for research to analyse both the creative and aesthetic processes, this research has empirically investigated these relationships in greater depth, although more is required to fully understand the aesthetic and art-making interactions. In conjunction with the main aims of this thesis, this research has highlighted differences due to expertise and the usefulness of eye-tracking. This thesis provides support for existing art-making and aesthetic models, allowing conclusions to be made on the artist, perceiver and artistic-aesthetic experiences. It is important to examine both aesthetic and creative processes considering the artist and perceiver. This research begins to examine part of the framework of the mirror model of art, but more research is required investigating both perceiver and artist perspectives using both aesthetic and creative tasks in order to fully understand the conversation and relationships which build the overall aesthetic experience.

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Appendices

Appendices Section A- Materials

Appendix 1- Example of Information Sheet

Title of Study: Drawing and the aesthetic experience

Information Sheet

Supervisor:	Email:	Phone:
Dr Eugene Mcsorley	**e.mcsorley@reading.ac.uk**	5552
Dr Rachel McCloy	**r.a.mccloy@reading.ac.uk**	6027
Experimenters:		
Louis Williams	**l.j.williams@pgr.reading.ac.uk**	8522

We would be grateful to you if you could assist us by participating in our study.

Your participation will take approximately 30 minutes where you will be required to complete different visual tasks. You will spend time viewing pairs of images whilst drawing. The second task then involves you making a decision on which image of two presented you would prefer to draw. You will have multiple trials to complete and will respond (1-7) using the provided answer sheet, (1) for strong preference of left image and (7) for strong preference of right image. You will also be requested before or after the experiments to rate how pleasing you find each image, 1(very displeasing) to 7 (very pleasing). Throughout this experiment your eye movements will be tracked and at the end of the experiment you will be requested to complete a simple questionnaire about the study.

Your data will be kept confidential and securely stored, with only an anonymous number identifying it. Information linking that number to your name will be stored securely and separately from the data you provide us. All information collected for the project will be destroyed after a period of 5 years from the completion of the research project. Taking part in this study is completely voluntary; you may withdraw at any time without having to give any reason. Please feel free to ask any questions that you may have about this study at any point.

This application has been reviewed by the University Research Ethics Committee and has been given a favourable ethical opinion for conduct

Thank you for your help.

Appendix 2- Example of Consent Form

Participant……

Age……

Gender- M/F

Years of formal art training……

Years of experience……

Title of Study: Drawing and the aesthetic experience

Consent form

I, …… agree to participate in this study being conducted by Louis Williams and Dr Eugene McSorley at The University of Reading. I have seen and read a copy of the Participants Information Sheet and have been given the opportunity to ask questions about the study and these have been answered to my satisfaction. I understand that all personal information will remain confidential to the Investigator and arrangements for the storage and eventual disposal of any identifiable material have been made clear to me. I understand that participation in this study is voluntary and that I can withdraw at any time without having to give an explanation.

I am happy to proceed with my participation.

Signature ----------

Name (in capitals) ----------

Date ----------

Appendix 3- Example of Debrief Form

University of Reading

School of Psychology and Clinical Language Sciences
Whiteknights
Reading
RG6 6AL

Title of study: Drawing and the aesthetic experience

Debrief Sheet

Supervisor:	Email:	Phone:
Dr Eugene McSorley	**e.mcsorley@reading.ac.uk**	5552
Dr Rachel McCloy	**r.a.mccloy@reading.ac.uk**	6027
Experimenters:		
Louis Williams	**l.j.williams@pgr.reading.ac.uk**	8522

Purpose of the study

The purpose of this study is to understand if drawing activity influences aesthetic and drawing preference. It also examines whether drawing activity influences gaze patterns when free-viewing and when an instruction is provided. Stroking and stippling drawing activities were used to create congruent and incongruent visual and motion links. Furthermore, both expert and novice artists will be tested. This research aims to support the influence of the drawing process on liking and add to existing research by analysing the influence of drawing activity on gaze patterns.

1. Name one independent variable used in the experiments?

2. Why was an eye tracking device required?

Thank you for your help.

Appendix 4- Complexity and Symmetry Scale

Participant……

Is a line of symmetry present in the figure?

Circle Yes or No on the provided sheet for all 8 compositions

1. Yes No	**5. Yes No**
2. Yes No	**6. Yes No**
3. Yes No	**7. Yes No**
4. Yes No	**8. Yes No**

Rate the complexity of the figure if attempting to draw it freehand only?

Rate complexity on the 7-point scale provided by ticking the appropriate box

Very simple Very complex

	1	2	3	4	5	6	7
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							

Appendix 5-Example of Pleasingness Rating Scale

Participant……

How pleasing is the image?
Rate pleasingness on the 7-point scale provided by ticking the appropriate box

Trial	Very displeasing 1	2	3	4	5	6	Very pleasing 7
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							

Appendix 6- Example of Drawing Preference Scale

Strong preference for left — No preference — Strong preference for right

Trial	1	2	3	4	5	6	7
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							
32							

Appendix 7- Example of Familiarity Questionnaire

Participant……

Familiarity- How familiar are you with the artwork?

Trial	1	2	3	4	5	6	7
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							

Appendix 8- Example of Debrief Questions (Ex3 & Ex4)

I was aware of the link between images and drawing motion

1- Strongly disagree
2- Disagree
3- Neutral
4- Agree
5- Strongly agree

My awareness of the similarities in drawing motion affected my ratings

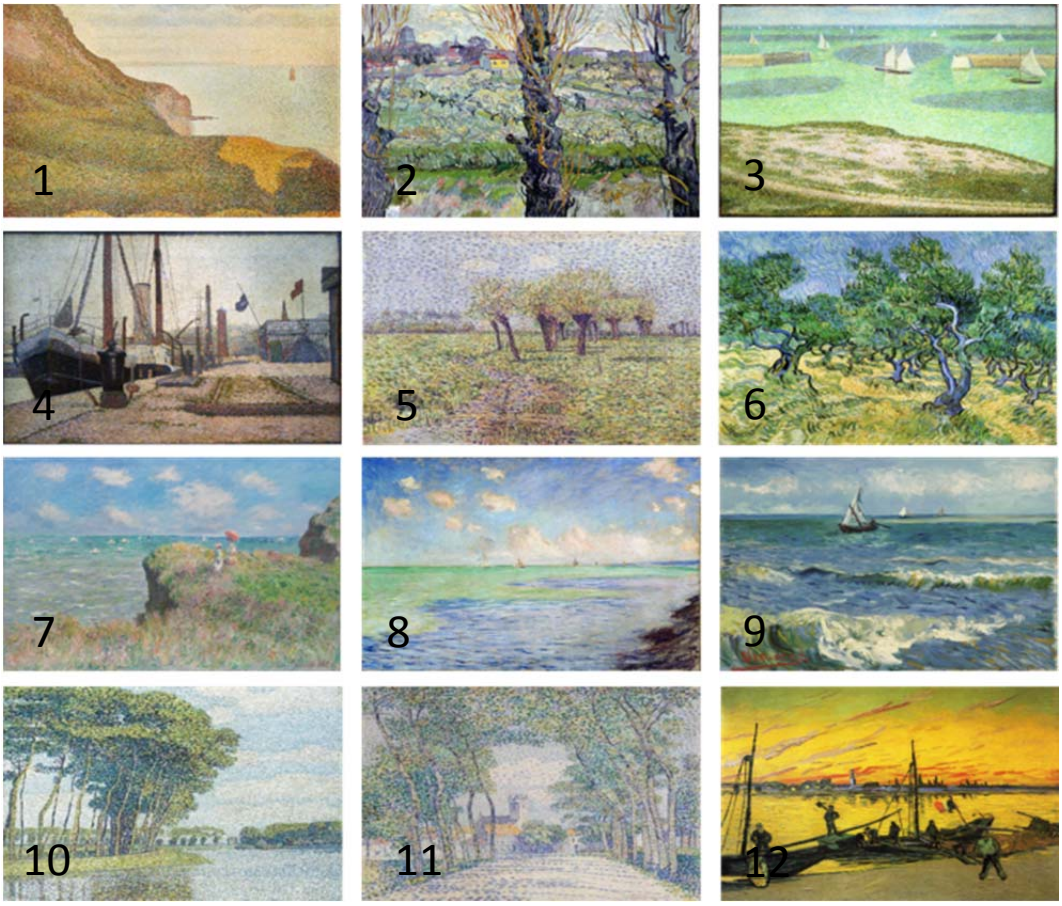
1- Strongly disagree
2- Disagree
3- Neutral
4- Agree
5- Strongly agree

<u>For artists</u>

What type of artist are you and what types of art do you create?

……
……
……
……
……

Appendix 9- Artwork Information (Ex4 & Ex5)



1. Seurat, Georges (1859-1891). Port-en-Bessin, cranes and breakthrough
2. van Gogh, Vincent (1889). View on Arles
3. Seurat, Georges (1859-1891). Bessin harbor entrance
4. Seurat, Georges (1886). La Maria, Honfleur
5. Baum, Paul (1859-1932). Meadows at the creek
6. van Gogh, Vincent (1989). Olive grove
7. Monet, Claude (1840-1926). On the cliffs of Pourville
8. Monet, Claude (1882). The sea at Pourville
9. van Gogh, Vincent (1888). The sea at Saintes Maries
10. Baum, Paul (1904).Trees by a canal
11. Baum, Paul (1859-1932). A view of Sluis in the morning sun
12. van Gogh, Vincent (1888). Coals towboats

Appendices Section B- Results Summary Tables

Appendix 10- Free-viewing t-test summary table (Ex1)

	Fixation metric	*t*	*p*
Free-viewing (Aesthetic preference)	First saccade latency	1.923	.064
	First fixation direction	.581	.566
	Fixation duration	3.984***	<.001
	Fixation count	4.027***	<.001
Free-viewing (Drawing preference)	First saccade latency	1.560	.13
	First fixation direction	-.517	.61
	Fixation duration	2.091*	.045
	Fixation count	2.049*	.05

Note. * p<.05; ** p<.01; *** p<.001

Appendix 11- Drawing Choice task t-test summary table (Ex1)

	Fixation metric	*t*	*p*
Drawing Choice task (Aesthetic preference)	First saccade latency	-.493	.63
	First fixation direction	.693	.49
	Fixation duration	4.212***	<.001
	Fixation count	4.320***	<.001
	Last fixation duration	1.011	.32
	Last fixation direction	5.008***	<.001
Drawing Choice task (Drawing preference)	First saccade latency	.100	.92
	First fixation direction	1.544	.13
	Fixation duration	8.980***	<.001
	Fixation count	10.376***	<.001
	Last fixation duration	2.844**	.008
	Last fixation direction	10.880***	<.001

Note. * p<.05; ** p<.01; *** p<.001

Appendix 12- Free-viewing ANOVA summary table (Ex2)

	Fixation metric	Preference		Expertise		Preference x Expertise	
		F	*p*	*F*	*p*	*F*	*p*
Free-viewing (Aesthetic preference)	First saccade latency	.115	.74	.048	.83	.082	.78
	First fixation direction	7.097*	.011	.147	.70	.337	.57
	Fixation duration	17.1***	<.001	.096	.76	.887	.352
	Fixation count	12.7***	<.001	.082	.78	2.331	.14
Free-viewing (Drawing preference)	First saccade latency	4.592*	.039	.130	.72	.819	.37
	First fixation direction	<.001	1.0	2.821	.10	3.536	.068
	Fixation duration	17.8***	<.001	.005	.94	8.69***	<.001
	Fixation count	12.7***	<.001	.108	.74	11.4**	.002

Note. * p<.05; ** p<.01; *** p<.001

Appendix 13- Drawing Choice task ANOVA summary table (Ex2)

	Fixation metric	Preference		Expertise		Preference x Expertise	
		F	*p*	*F*	*p*	*F*	*p*
Drawing Choice task (Aesthetic preference)	First saccade latency	.271	.61	.079	.78	.979	.33
	First fixation direction	7.872**	.008	.228	.64	.300	.59
	Fixation duration	21.0***	<.001	.001	.98	.186	.67
	Fixation count	24.99***	<.001	<.001	.93	.005	.94
	Last fixation duration	10.381**	.003	2.145	.15	.418	.52
	Last fixation direction	51.16***	<.001	.19	.66	.801	.38
Drawing Choice task (Drawing preference)	First saccade latency	.189	.67	.075	.79	12.2***	<.001
	First fixation direction	6.909*	.012	.309	.58	.664	.42
	Fixation duration	53.84***	<.001	<.001	.98	3.241	.08
	Fixation count	63.46***	<.001	.011	.92	1.321	.26
	Last fixation duration	22.99***	<.001	2.771	.104	1.9	.176
	Last fixation direction	130.3***	<.001	.309	.582	.151	.70

Note. * p<.05; ** p<.01; *** p<.001

Appendix 14- Congruent Action ANOVA summary table (Ex3)

	DV	Image style		Expertise		Action type		Image style x Expertise		Image style x Action type		Expertise x Action type		Image style x Expertise x Action type	
		F	*p*	*F*	*p*	*F*	*p*	*F*	*p*	*F*	*p*	*F*	*p*	*F*	*p*
Congruent action	Aesthetic	.398	.530	.032	.858	.198	.821	.10	.920	.156	.856	1.258	.290	.629	.536
	Drawing	2.981	.088	-	-	-	-	.880	.351	.656	.522	-	-	.241	.786
Congruent action (Free-viewing)	First saccade latency	.092	.762	1.837	.179	1.245	.294	2.174	.145	.242	.786	1.540	.221	.490	.614
	First fixation direction	3.251	.075	-	-	-	-	.721	.399	.135	.874	-	-	1.508	.228
	Fixation duration	1.046	.31	.845	.361	1.088	.342	.118	.732	.003	.997	-	-	.190	.827
	Fixation count	2.386	.127	.027	.87	5.1**	.008	.109	.742	.445	.643	1.932	.152	.23	.788
Congruent action (Drawing Choice)	First saccade latency	.016	.899	.2.364	.128	.037	.964	.135	.715	.335	.717	.084	.920	.668	.516

First fixation direction	.603	.44	-	-	-	-	3.556	.063	.269	.765	-	-	.482	.619
Fixation duration	1.142	.289	.338	.563	.603	.55	.329	.568	.365	.695	-	-	.740	.481
Fixation count	.865	.355	.316	.576	2.466	.092	.045	.832	.503	.607	1.287	.282	1.010	.369

Note. * $p<.05$; ** $p<.01$; *** $p<.001$

Appendix 15- Free-viewing ANOVA summary table (Ex3)

	DV	Preference		Expertise		Action type		Preference x Expertise		Preference x Action type		Expertise x Action type		Preference x Expertise x Action type	
		F	*p*	*F*	*p*	*F*	*p*	*F*	*p*	*F*	*p*	*F*	*p*	*F*	*p*
Free-viewing (Aesthetic preference)	First saccade latency	5.965*	.017	1.918	.170	1.952	.149	2.061	.155	1.216	.302	2.184	.120	1.546	.220
	First fixation direction	1.760	.189	-	-	-	-	.126	.723	.874	.422	-	-	4.56*	.014
	Fixation duration	13.8***	<.001	.964	.329	.939	.396	4.23*	.043	.383	.683	-	-	.580	.563
	Fixation count	1.394	.241	.013	.909	5.1**	.008	.741	.392	.051	.950	2.086	.131	.616	.543
Free-viewing (Drawing preference)	First saccade latency	1.670	.20	2.356	.129	1.311	.276	2.222	.140	2.672	.076	1.407	.251	.616	.543
	First fixation direction	1.495	.225	-	-	-	-	.100	.725	.071	.931	-	-	2.200	.118

Fixation duration	14.1***	<.001	.777	.381	.894	.413	.031	.961	1.725	.185	-	-	.698	.501
Fixation count	14.1***	<.001	.003	.957	5.9**	.004	.308	.580	1.048	.356	1.728	.185	.746	.478

Note. * p<.05; ** p<.01; *** p<.001

Appendix 16- Congruent Action ANOVA summary table (Ex4)

	DV	Image style		Expertise		Action type		Image style x Expertise		Image style x Action type		Expertise x Action type		Image style x Expertise x Action type	
		F	*p*	*F*	*p*	*F*	*p*	*F*	*p*	*F*	*p*	*F*	*p*	*F*	*p*
Congruent action	Aesthetic	93.8***	<.001	.397	.531	.804	.452	3.558	.064	.842	.435	.728	.487	.561	.573
Congruent action	First saccade latency	1.077	.303	1.411	.239	1.007	.371	.739	.393	1.762	.180	.989	.377	1.381	.259
	First fixation direction	.011	.918	-	-	-	-	3.87*	.05	.372	.691	-	-	1.336	.270
	Fixation duration	40.5***	<.001	.245	.623	.773	.466	.627	.431	.028	.972	-	-	.104	.902
	Fixation count	41.2***	<.001	.083	.774	2.629	.080	1.046	.310	.336	.716	1.013	.369	.406	.668

Note. * p<.05; ** p<.01; *** p<.001

Appendix 17- Free-viewing ANOVA summary table (Ex4)

	DV	Preference		Expertise		Action type		Preference x Expertise		Preference x Action type		Expertise x Action type		Preference x Expertise x Action type	
		F	*p*	*F*	*p*	*F*	*p*	*F*	*p*	*F*	*p*	*F*	*p*	*F*	*p*
Aesthetic preference	First saccade latency	.101	.751	1.625	.207	.865	.426	.166	.685	3.17*	.049	1.122	.332	4.23*	.019
	First fixation direction	.638	.427	1.090	.30	0.927	.401	3.231	.077	1.855	.164	-	-	1.516	.227
	Fixation duration	51.0***	<.001	.230	.633	.917	.405	.007	.935	.179	.836	-	-	.245	.783
	Fixation count	47.9***	<.001	.074	.787	2.463	.093	.030	.864	1.128	.330	.839	.437	.570	.568

Note. * $p<.05$; ** $p<.01$; *** $p<.001$

Appendix 18- Congruent Action ANOVA summary table (Ex5)

	DV	Image style		Hand image		Image style x Hand image	
		F	*p*	*F*	*p*	*F*	*p*
Congruent action	Aesthetic	35.79***	<.001	.927	.402	1.131	.330
Congruent action	First saccade latency	.782	.38	.437	.65	7.47***	<.001
	First fixation direction	8.398**	.007	-	-	.802	.453
	Fixation duration	30.51***	<.001	1.956	.151	4.96**	.01
	Fixation count	30.84***	<.001	1.538	.223	3.821*	.028

Note. * p<.05; ** p<.01; *** p<.001

Appendix 19- Free-viewing ANOVA summary table (Ex5)

	DV	Preference		Hand image		Preference x Hand image	
		F	*p*	*F*	*p*	*F*	*p*
Aesthetic preference	First saccade latency	.163	.689	.817	.447	.568	.570
	First fixation direction	.469	.499	1.218	.304	.219	.804
	Fixation duration	23.14***	<.001	1.725	.187	1.901	.159
	Fixation count	23.5***	<.001	.634	.534	1.234	.299

Note. * p<.05; ** p<.01; *** p<.001