Doctoral Thesis

Is a group of individuals reporting psychotic-like experiences less susceptible to visual illusions than a non-clinical group?

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Abstract

Background

A "basic cognitive disruption" leading to impairment in top-down and bottom-up processing is thought to underlie a number of anomalous experiences reported by individuals with psychosis. Visual illusion paradigms may be useful in exploring this potential disruption. The primary aim was to explore whether a group of young people having psychotic-like experiences were less susceptible to visual illusions than a group of healthy controls. This study also examined the relationship between frequency of psychotic-like experiences and illusion susceptibility and the role of appraisals and emotions because they are considered an important mechanism underlying anomalies in perception.

Method

A quantitative cross-sectional design was used to compare visual illusion susceptibility scores from a clinical group of young people reporting psychotic-like experiences with a non-clinical comparison group from a student population. Relationships between illusion susceptibility; the frequency of psychotic-like experiences; appraisals and emotional responses to psychotic-like experiences were explored within the clinical group only. Twenty-five clinical participants and 53 non-clinical participants completed a visual illusions task (measuring illusion susceptibility) and measures examining psychotic-like symptoms and mental-health symptomology. The clinical group only completed measures examining frequency, appraisals and emotional responses to psychotic-like experiences.

Results

The research found the clinical group were significantly more susceptible to visual illusions than the non-clinical group. When depression, anxiety and stress scores were controlled for, no significant difference was found between the groups for illusion susceptibility. Susceptibility scores were not related to frequency of psychotic-experiences; appraisals or emotional responses to anomalous experiences.

Discussion

The finding that a clinical group were more susceptible to visual illusions than a non-clinical group does not fit with Hemsley's (2005) cognitive model. However, perceptual processing differences were observed between a clinical and non-clinical group. Theoretical and clinical implications for these findings are considered.

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1. Introduction

1.1 Overview

This study aims to explore how individuals with psychotic-like experiences perceive the world around them in comparison to healthy controls. In doing so it aims to consider whether disruptions in visual processing may underlie unusual experiences using a visual illusion paradigm. The study also aims to explore the role of appraisals and emotions which may contribute to symptom development and maintenance.

Previous research hypothesises a "basic cognitive disruption" occurring in the neural circuits as a potential mechanism underlying psychotic experiences (Hemsley, 2005). The disruption is thought to arise as the result of a combination of factors (genetic and environmental) all of which operate through a "final common pathway" (Hemsley, 2005). The outcome is hypothesised to be a mismatch in the coordination of two mechanisms (bottom-up and top-down processing) which are required to provide a coherent internal representation of the external world. Specific psychotic experiences implicated by this disruption include hallucinatory phenomena; feelings the world has altered and the formation of delusional beliefs. Visual illusion paradigms may be useful in exploring this potential disruption because they illustrate the visual system's ability to integrate top-down and bottom-up processing in perception. (Notredame, Pins, Deneve, & Jadri, 2014).

The introduction to this thesis begins with a definition of psychosis, including the main symptoms and epidemiology of psychotic-like experiences in the general population. An overview of the aetiology of psychotic symptoms is discussed, focusing on the role of the "basic cognitive disruption" and individual appraisals and emotional responses. Various

theories of visual perception which may inform understanding of the development of psychotic-like experiences are then considered, including the visual binding hypothesis and the role of top-down modulation in perception. These models are discussed in the context of psychosis literature to explore how they fit with Hemsley's (2005) cognitive model of psychosis. The rationale for using a visual illusion paradigm to examine visual processing is discussed in more detail and studies exploring visual illusion susceptibility in psychosis populations are considered. The clinical implications for this study are discussed, including the potential to provide a normalising explanation for psychotic experiences and the development of future training packages to help individuals to use context to interpret their perceptual experiences. Finally the rationale for the current research is summarized and the research hypothesis and research questions are presented.

1.2 Psychosis

1.2.1 Definition and epidemiology.

Psychosis has been broadly conceptualised as a disturbance in thought, emotion or behaviour which can affect an individual's ability to make sense of reality (National Institute for health and Clinical Excellence, 2014). The Adult Psychiatric Morbidity Study (2007) estimated the prevalence of a psychotic disorder within the general population at 0.5% and it is widely acknowledged that symptoms at a clinical level can lead to significant impairment in an individual's daily functioning and quality of life (Fowler et al., 2009; Stafford, Jackson, Mayo-Wilson, Morrison, & Kendall, 2013).

There are a large number of symptoms which can be experienced as part of a psychotic episode and the types and severity of these symptoms vary hugely from one

individual to another. Some symptoms experienced by individuals with a diagnosis of psychosis may be present within other psychological disorders such as anxiety and depression and for this reason they cannot always be completely separated. However, symptoms thought of as common to psychosis include: altered perceptual experiences, such as seeing, hearing, smelling or feeling things that others cannot (also described as sensory hallucinations); and the formation of beliefs which are different from reality, such as the belief your food is being poisoned or the government is conspiring against you (also known as delusional beliefs). Traditionally these symptoms (hallucinations and delusions) have been described as positive symptoms of psychosis. Other symptoms, characterised by an absence of feeling and/or behaviour include apathy, anhedonia, avolition and social withdrawal. Historically these types of symptoms have been described as negative symptoms of psychosis (The British Psychological Society (BPS), 2014).

1.2.2 Aetiology of psychosis.

The stress vulnerability model can be helpful in understanding the development of psychotic experiences (Neuchterlein & Dawson, 1984). According to the model, some individuals have a predisposing vulnerability as a result of biopsychosocial and environmental origin. This may include the influence of genetics, childhood trauma or neglect; social isolation and specific types of communication within the family unit (e.g. family hostility, contradictory and/or ambiguous communication) (Read, Morrison, & Ross, 2005; de Sousa, Varese, Sellwood, & Bentall, 2013). A survey of 4000 adults from the general population found that a history of childhood abuse led to a 10 fold increase in the risk of developing psychosis (Janssen et al., 2004). A meta-analysis exploring the impact of childhood trauma (including sexual, physical and/or emotional abuse, neglect, death of a

parent and bullying) on the development of psychotic symptoms reported that the number of individuals transitioning to psychosis would be reduced by 33 percent if these risk factors were removed (Varese et al., 2012). A meta-analysis by Sousa et al. 2013 found a large effect size for the prevalence of communication characterised as vague and contradictory in parents whose children had developed psychosis.

Although the development of a predisposing vulnerability in response to earlier adverse events does not necessitate an individual developing psychotic-like experiences it does put them at increased risk, particularly if they are faced with subsequent adversities or memories of a previous trauma. Empirical data has shown that individuals with a predisposing vulnerability to developing psychotic symptoms experienced greater undesirable emotional reactions in response to later stress in comparison to a control group (Morrison, 2001; Palmier-Claus, Dunn & Lewis, 2012). The stress vulnerability model coupled with empirical findings has led many to conceptualise psychosis as a natural reaction to adverse life events (BPS, 2014).

1.2.3 Psychotic-like experiences on a continuum.

Whilst psychosis in itself does not represent a discrete diagnostic category, its symptoms are recognised in two prominent diagnostic manuals, the International Classification of Diseases, 10th Revision (ICD-10) and the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-5). Within these manuals psychosis is documented under a range of disorders including schizophrenia, schizotypal disorders, delusional disorders and schizoaffective disorders.

Recently, psychotic symptoms have been found common outside of psychotic disorders. Empirical research has found psychotic symptoms are experienced by a large number of healthy individuals, leading to an increasing research interest in this area (Kelleher & Cannon, 2011). The National Comorbidity Study surveyed households regarding their experience of psychotic symptoms (Kessler, Chiu, Demler, & Walters, 2005). The results showed that 9.1% of respondents endorsed items which indicated they experienced psychotic symptoms. However the majority of these symptoms were present below the clinical threshold. Only 16.1% of these respondents were deemed to reach diagnostic criteria for a psychotic disorder. These findings have been replicated in numerous studies. A meta-analysis by Van Os, Lynscott, Myin-Germeys, Dellespaul and Krabbendam (2009) reported prevalence rates of psychotic-like experiences between 5-8% in the general population. The BPS (2014) understanding psychosis and schizophrenia document states that 10% of the general population will hear voices at least once throughout their lifetime and one third of the population will hold suspicious or paranoid beliefs (e.g. needing to be on your guard from others; believing there is a conspiracy against you) (Garety et al., 2005). An adolescent survey of psychotic experiences revealed 21% of the group had experienced hallucinations (Yoshizumi, Murase, Honjo, Kaneko, & Murakami, 2004), suggesting a high presence of psychotic experiences in young adulthood within the general population. Psychotic-like experiences have also been reported in healthy individuals placed in sensory and sleep deprived environments (Daniel, Lovatt, & Mason, 2014). Again, these findings suggest psychotic-like symptoms are common outside of psychotic disorders.

Healthy individuals having psychotic experiences are recognised as being at increased risk of transitioning to psychosis (Kelleher & Cannon, 2010). However the presence of psychotic-like symptoms does not precede transition to a psychotic disorder in the majority of

cases. A longitudinal study with 7076 participants from the general population experiencing recent onset sub-clinical psychotic symptoms found only 8% of participants presented with symptoms at a clinical level at two year follow up (Hanssen, Bak, Bijl, Vollebergh, & Os, 2005). A study measuring transition rates amongst a group of individuals who were deemed at high risk of transitioning to psychosis also reported only 8% of participants meeting a diagnosable psychiatric disorder at two year follow up (Morrison et al., 2012). Given these findings, the view of psychotic symptoms as purely dichotomous, suggesting either the presence or absence of a clinical disorder has been largely nullified (Van Os et al., 2009). A more accurate view describes psychotic-like symptoms as existing on a continuum of severity, with psychotic disorders at one end and non-clinical psychotic-like experiences at the other end (Johns & Van Os, 2001; BPS, 2014).

Although psychotic symptoms do not necessarily indicate pathology, much can be learned about factors underpinning psychotic illness from individuals who are reporting non-clinical psychotic-like experiences. Research has found that patients and healthy individuals who have psychotic experiences share many of the same risk factors (e.g. social and environmental risk factors), suggesting a high construct validity between psychotic symptoms experienced at a clinical level and those experienced outside of a clinical disorder (Kelleher & Cannon, 2010).

1.3 Development of psychotic-like experiences

A number of cognitive models have been helpful in exploring potential mechanisms underlying the development of psychotic-like experiences. The cognitive model of psychosis postulates that a “basic cognitive disruption” influences the development of psychotic-like experiences through a “final common pathway”. In psychological terms, this is a disruption

in the co-ordination of bottom-up and top-down processing which is thought to underlie psychotic experiences including a sense the world has altered, feelings of salience and hallucinatory phenomena. Cognitive models for positive symptoms of psychosis also implicate appraisals, emotional responses and metacognitive beliefs as key factors underlying the development and maintenance of psychotic-like experiences (Hemsley, 2005; Morrison, 2001). These ideas will be discussed in the following section.

1.3.1 Hemsley's (2005) cognitive model and the development of psychotic-like experiences.

One mechanism thought to underlie anomalous perceptual experiences (e.g. hallucinatory phenomena) is a "basic cognitive disruption". Hemsley's (2005) cognitive model postulates that this occurs in response to a triggering event of biopsychosocial origin, leading to disruptions in an individual's neural circuitry. These factors can disrupt the neural pathways at different locations and at multiple points along the visual channels. Subsequent psychotic-like experiences are thought to develop based on where and at what point the disruption has occurred, resulting in large individual variation. As yet it is not known exactly which type of unusual experiences occur based on the location of the disruption.

It is noteworthy that the model does not implicate a "basic cognitive disruption" as the cause of psychotic experiences. Rather, it is the contribution of a range of earlier factors (e.g. childhood trauma or neglect; social isolation) which make an individual more vulnerable to a "basic cognitive disruption" being activated by subsequent life stressors.

The cognitive disruption impairs the integration of incoming sensory information (known as "bottom-up" processing) with relevant contextual information from memory stores

in the brain (known as "top-down" processing). The memory stores implicated in this model refer to memories which can be used to guide perception as opposed to general memories of past events. Importantly, it is the integration of these two processes (bottom-up and top-down) which enable a person to form a coherent picture and make sense of their environment (see Figure 1).

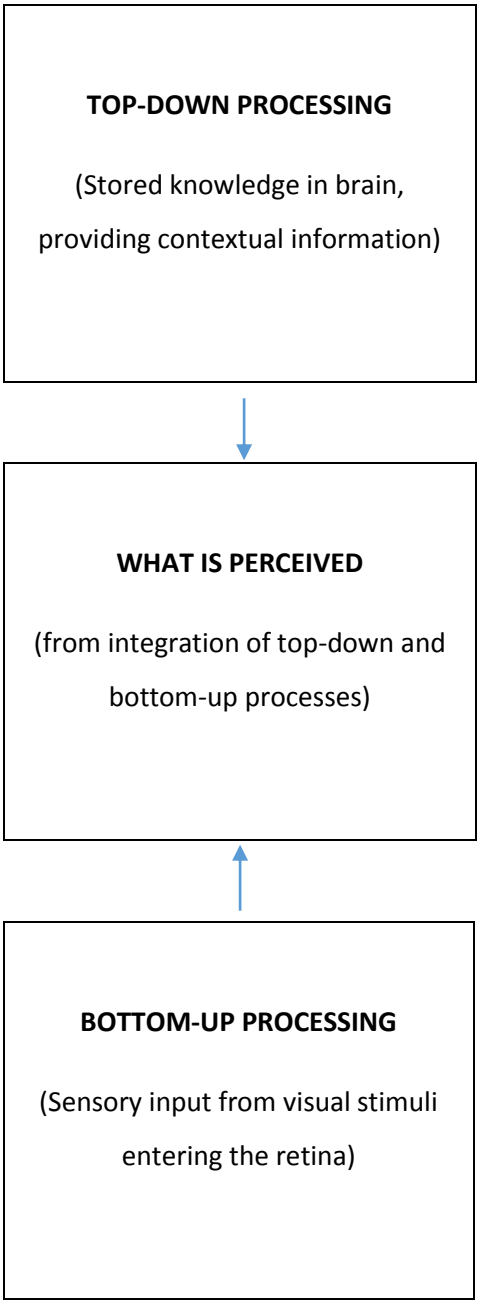

Figure 1. *A diagrammatic representation of the visual processing system, based on Hemsley's cognitive model (2005)*

To illustrate this, a healthy individual standing in a park would begin processing the incoming sensory information in front of them (e.g. trees, grass and park benches). Initially this information would enter the retina and travel along neural pathways (bottom-up processing). This sensory information is subsequently integrated with relevant prior memory

stores based on expectations about the world (top-down processing), providing the person with contextual information to make sense of their environment (e.g. they are in a park). Individuals who have experienced a "basic cognitive disruption" will have a breakdown in the ability to integrate these two processes successfully. Without an organizing framework to integrate relevant stores of prior knowledge with new incoming sensory information, individuals are vulnerable to perceptual anomalies. Clinically this impairment means incoming sensory stimuli are processed without any or with limited context in which to make sense of the perceptual information, potentially leading to a fragmented, incoherent image of the external world, with a sense that something is unusual or different.

Empirical evidence has supported Hemsley's (2005) model. A review exploring perceptual organization in individuals with a diagnosis of schizophrenia between 1975 - 2004 identified 33 studies, 28 of which reported impairments in the integration of relevant top-down information as a key finding, adding further weight to the cognitive model (Uhlhaas & Silverstein, 2005). Subjective accounts of unusual experience also fit with this model and describe the impact of "loosening of context" on visual experiences: "Objects seemed altered from the usual. They did not stand together in an overall context and I saw them as meaningless details" (Matussek, 1952). Thoughts and feelings that the world is altered or meaningless are common psychotic-like experiences.

A further consequence of a reduction in contextual integration is that attention is focused on the wealth of individual details in the environment, rather than the 'bigger picture'. As stored knowledge helps us to differentiate relevant from irrelevant stimuli, a reduced ability to access and/or utilise this information in people with psychosis may result in an over-reliance on sensory information. Clinically this could lead to information usually

outside of consciousness intruding into one's awareness, or give rise to stimuli which appear less embedded within the environment standing out from their usual context (Uhlhaas & Mishara, 2007). Objects which appear decontextualized are more likely to be noticed by an individual, potentially appearing hyper significant and leading to a feeling of salience. As such, individuals with psychosis may have a very different perceptual experience of the world, resulting in anomalous perceptual experiences. Subsequent appraisals of these experiences are likely to be an important factor in determining how these experiences are interpreted, (i.e. as benign phenomena or distressing intrusions), and thus whether the individual experiencing them transitions to psychosis. These ideas will be discussed in more detail below.

1.3.2 Appraisals of psychotic-like experiences occurring as a consequence of a "basic cognitive disruption".

Individual appraisals and emotional responses to psychotic-like experiences are thought to be an important mechanism underlying the outcome of perceptual changes occurring as a consequence of a "basic cognitive disruption". These include appraisals and emotional responses to the anomalous experiences discussed (e.g. a sense that the world is different or altered in some way, hallucinatory phenomena, feelings of salience) but they may also impact on other psychotic symptoms, such as delusion formation.

According to the cognitive model of psychosis, perceptual changes trigger a sense making process, aimed at providing meaning to unusual experiences (Garety et al., 2001). Initial perceptual changes are seen as uncharacteristic (i.e. they are noticeably different from an individual's everyday experience) and subsequent appraisals influence the future experience of symptoms. The meanings attributed to perceptual experiences are strongly

influenced by prior life events (Garety et al., 2001; Beck, 1976). Early adverse experiences encourage the formation of negative schematic representations of the self, others and the world (e.g. someone who experienced childhood abuse from a caregiver may develop the belief that they are helpless; others as threatening and the world as dangerous). Prior adverse experiences also make an individual more likely to appraise current ambiguous experiences within a negative context (e.g. the sense that the world has altered in some way may lead to the conclusion that the individual is in danger because others are plotting against them). These appraisals have a subsequent impact on individual emotional and behavioural responses (e.g. believing others are plotting against you may increase anxious feelings and hyper-vigilance towards confirmatory evidence) all of which serve to maintain psychotic experiences (Garety, Kuipers, Fowler, Freeman, & Bebbington, 2001; Hemsley, 2005).

The role of appraisals in psychotic symptom development and maintenance has been supported empirically. Fowler et al., (2006) reported that strong negative schematic beliefs were traits of individuals with chronic psychosis. Smith et al. (2006) found that individuals with greater negative schematic beliefs about themselves and others reported delusions of greater severity and felt more distressed by them. Kilcommons and Morrison (2005) found that early adverse experiences (e.g. trauma) resulted in greater negative appraisals which were associated with psychotic experiences. Hanssen et al. (2005) found that emotional appraisals of psychotic-like experiences significantly affected clinical outcome and anxiety has been postulated a central emotion in development of persecutory delusions (Freeman, Garety, Kuipers, Fowler, & Bebbington, 2002). Again, empirical findings support the cognitive model, suggesting individuals who have experienced earlier adverse events are more likely to engage in biased cognitive processing, appraising anomalous perceptual experiences occurring as a result of a “basic cognitive disruption” (e.g. hallucinatory

phenomena, feelings the world has altered) and accompanying affective responses (e.g. increased anxiety) within a negative framework, potentially leading to delusion formation (e.g. persecutory delusions) (Garety et al., 2001; Brett et al., 2007).

In addition to the formation of persecutory delusions, individual appraisals may underlie the development of delusions of reference. These are beliefs that items or events have a special meaning for the individual. For example, an irrelevant stimulus, usually outside of conscious awareness which has intruded into one's perception (as a result of the "basic cognitive disruption" outlined above) may lead to the appraisal "this object must have a specific meaning to me". Healthy individuals also engage in this reasoning process to understand and interpret perceptual information but they are more able to draw on context to influence their interpretation and disregard irrelevant stimuli. When context is not used, it is hypothesised that an individual is more likely to make inappropriate inferences about causal relationships (Hemsley, 2005; Einhort & Hogarth, 1986). This is also particularly pertinent given research suggesting individuals at risk of psychotic phenomena have a "dopamine supersensitivity" which may cause biases in perception and cognition (e.g. hypervigilance toward irrelevant objects, jumping to conclusions) (van der Gaag et al., 2012). This means individuals with psychosis are potentially at increased risk of appraising ambiguous perceptual information with limited evidence and within a negative framework. These appraisals are thought to underlie the development and maintenance of perceptual aberrations (Garety et al., 2001).

Appraisals implicated in the metacognitive model of psychosis also fit with Garety's (2001) model of psychosis, influencing the outcome of perceptual experiences occurring as a consequence of a "basic cognitive disruption" (Hemsley, 2005). Metacognition is commonly

described as the process of thinking about thoughts (Wells, 1999). Morrison et al. (2001) has conceptualised metacognitive beliefs within a psychosis framework with common maladaptive metacognitive beliefs including perceiving psychotic-like experience as threatening, anxiety-provoking, outside of an individual's control or being externally caused. These beliefs are hypothesised to result in emotional and behavioural changes which serve to maintain subsequent psychotic phenomena (Morrison et al., 2001). For example, an individual sensing that the world appears altered as a result of a "basic cognitive disruption" could draw the conclusion that their symptoms are threatening and outside of their control. Again, interpretations of symptoms may have subsequent behavioural and emotional consequences (e.g. sleep deprivation due to increased anxiety) leading to maintenance of the psychotic-like experiences. If the same individual appraises their symptom being internally caused (due to the result of sleep deprivation) they may be more likely engage in different behavioural and emotional consequences (the individual gets more sleep and experiences low levels of anxiety) potentially reducing the likelihood of future perceptual aberrations.

Empirical evidence also supports an association between maladaptive metacognitions and psychotic symptoms. Baker and Morrison (1998) found that a group of participants experiencing hallucinatory phenomena endorsed significantly greater maladaptive metacognitive beliefs on a questionnaire in comparison to a control group of participants. Goldstone, Farhall, Thomas and Ong (2013) investigated self-reported metacognitions within a psychosis group and non-clinical group, finding dysfunctional metacognitive beliefs were a predictive factor in hallucination and delusion proneness.

Recently there have been a number of studies exploring the role of maladaptive metacognitive beliefs in individuals experiencing psychotic-like experiences outside of a

clinical disorder, finding significant association between maladaptive metacognitive beliefs and the experience of hallucination and delusions (e.g. Barbato et al., 2013; Barkus et al., 2010; Brett, Johns, Peters, & McGuire, 2008; Morrison et al., 2006; Morrison, French & Wells, 2007a; Palmier-Claus, Dunn, Taylor, Morrison, & Lewis, 2013; Welsh, Cartwright-Hatton, Wells, Snow, & Tiffin, 2014).

Empirical findings therefore suggest individual appraisals of perceptual experiences occurring as the result of a "basic cognitive disruption" influence the development and maintenance of psychotic-like symptoms experienced as part of a psychotic disorder and those experienced outside of a clinical diagnosis. Appraisals which have been found to be particularly pertinent in the development and/or maintenance of psychotic symptoms include perceiving the experience as threatening, anxiety-provoking, outside of individual control and externally caused (Morrison et al., 2001). Thus, although a basic cognitive disruption may underlie perceptual anomalies, metacognition and appraisals will determine how intrusive and distressing these perceptual anomalies are to the individual.

1.4 Visual perception

1.4.1 Visual perception overview and definition.

Within any given environment there is a multitude of objects and items available to the visual processing system (Kastner & Ugerleider, 2001). Due to its limited processing capacity the visual system must prioritise which information is processed, enabling individuals to guide their attention efficiently and navigate their environment. This is well conceptualised in Wolfe and Horowitz's (2004) description of driving into a town:

"As you drive into the centre of town cars and pedestrians approach from several directions. The wind blows a newspaper into the gutter and a pigeon does something unexpected on your windshield. This would be a demanding and stressful situation but you would probably make it to the other side of town without mishap."

The ability to filter out irrelevant information is important in maintaining a cohesive visual environment and preventing information usually outside of consciousness intruding into awareness. In order to selectively focus attentional resources to appropriate stimuli information processing systems rely on the successful coordination of bottom-up and top-down information. As discussed, bottom-up processing includes the sensory information which enters the retina and is stimulus-driven (e.g. objects present in an individual's visual field). Top-down processing is based on prior memory stores based on expectations and/or information about the world (e.g. of having encountered similar stimuli before) and provides context to the stimulus driven information (Poirel et al., 2010). The processing of these information sources is carried out by an organising framework which operates to integrate bottom-up sensory information with existing top-down knowledge. Again, successful coordination leads to a coherent internal representation of relevant external information and in doing so allows the individual to make sense of their visual environment

General models of visual perception can be helpful in understanding this process. Gestalt theorists (e.g. Muller-Lyer, Ebbinghaus) have long proposed the importance of top-down processing for coherent visual perception. According to Gestalt theory, the visual system groups stimuli on the basis of principles such as depth, proximity and size. These are commonly considered top-down processes because they rely on previous memory stores and allow the visual system to make sense of incoming stimulus driven information (Wagemans

et al., 2012). Additionally, Navon's theory of visual perception recognises the importance of processing global and local elements in guiding perceptual awareness. The author postulates the importance of top-down processing in allowing a scene to be "decomposed" in order to make sense of the local (or stimulus driven) elements (Navon, 1977). Importantly, general models of visual processing support the notion of bottom-up and top-down integration in driving coherent visual perception.

The ability to disregard redundant information is also central for guiding information processing and in enabling us to respond adaptively to our environment (Katsuki & Ungerleider, 2001). Again, the successful coordination between bottom-up and top-down processes are important in enabling this process to occur. This perceptual organisation establishes our moment-by-moment awareness of our visual world (Connor, Egeth & Yantis, 2004). However, visual processing is a complex system and it is perhaps unsurprising that the mechanisms involved are vulnerable to disruptions (Frith & Dolan, 1997). It is possible that such disruptions may result in anomalies of perception. This will now be considered in more detail.

1.4.2 Psychosis and visual perception models.

Various theories have been put forward in relation to disruptions in visual perception channels and the development of psychotic-like experiences, including the visual binding hypothesis and theories considering the role of top-down modulation in perception These models also fit with Hemsley's (2005) cognitive model of psychosis and will be discussed below.

1.4.2.1 Visual binding hypothesis.

Visual binding refers to an individual's ability to integrate incoming bottom-up signals with appropriate neural structures within the brain and to perceive constituent parts of an object as a whole (Silverstein et al., 2009). It has been postulated that individuals with psychosis may have a visual binding deficit resulting in reduced contextual integration and a tendency towards detail-oriented processing. This theory is supported by a study using a contour task (see Figure 2), demonstrating an individual's ability to draw on Gestalt grouping principles such as closeness and proximity to perceive an image of a shape during a brief 300ms display.

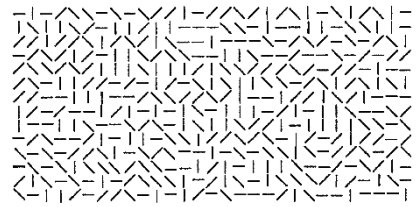

Figure 2

Example of the contour task used in Parnas et al. (2002)

The authors found reduced performance in this contextual integration task in individuals with schizophrenia (Parnas et al., 2001). These findings have been further supported by functional Magnetic Resonance Imaging (fMRI) studies examining visual activity during completion of the contour task. Silverstein et al. (2009) found reduced abilities to bind information in a group of individuals with schizophrenia compared with a control group. In practice, processing detail at the expense of seeing the "bigger picture" could result in individuals with psychosis perceiving the world in a fragmented way, potentially increasing the likelihood for perceptual aberrations.

1.4.2.2 Top-down modulation.

As well as perceiving incoming visual stimuli differently, it has been hypothesised that people with psychosis may experience less top-down influence on their perception. Previous research suggests that people with psychosis may be less able to use and integrate this stored visual knowledge to guide their perception, resulting in an over-reliance on incoming sensory signals with no organising framework to put this information into context (Notredame et al., 2014). In a voice recognition experiment, Ilankovic et al. (2011) presented participants with either a picture of themselves or a stranger followed by a pre-recorded tape of their own voice or another's voice. Researchers presented participants with 'valid' trials (where the picture matched the voice on the recorder) or 'invalid' trials (where the picture did not match the recorded voice). Participants had to decide whether the voice was their own or that of another person. The results showed a positive relationship between severity of delusions and errors on the invalid trials. This supports the theory that people with psychotic symptoms are more reliant on incoming sensory signals (e.g. the primed picture) and are less able to integrate top-down modulating processes (e.g. memory stores of the sound of their voice) to interpret their environment.

Gold, Fuller, Robinson, Braun, & Luck (2007) explored top-down modulation using a visual search task in which participants were asked to find a target amongst distractor items. In some trials only a few distractor items closely matched the target, making the target more apparent. This also meant the visual system could rely on stimulus driven processing to detect the target. In others trials half the distractors matched the target item, meaning the visual system was more reliant on top-down modulation to disregard the distracters and guide perception of the target. The authors reported that individuals with psychotic symptoms were

significantly slower in comparison to controls in detecting targets in trials relying more heavily on top-down modulation. Top-down factors also play an important role in the decision making process regarding the integration of sensory information with relevant memory stores. A reduced influence of top-down modulation may result in individuals with psychosis processing information with little or no context, leading to an environment which appears abstract or meaningless, potentially resulting in perceptual anomalies.

Findings from brain studies have supported these theories. Dima et al., (2009) used fMRI during a cognitive task and found an increase in bottom-up processing and a reduction in top-down processing in individuals with a diagnosis of schizophrenia in comparison to a control group. Again, this may give rise to more detail-oriented processing or a reduced ability to use stored material to differentiate relevant from irrelevant stimuli. Importantly, the reduced influence of top-down modulation may be relevant to a wider understanding of the development of perceptual anomalies (Uhlhaas & Silverstein, 2005).

1.4.2.3 How visual perception models fit with Hemsley's (2005) cognitive model of psychosis.

As discussed above Hemsley's (2005) cognitive model of psychosis, postulates a "basic cognitive disruption" occurring in response to a triggering event in individuals with a predisposing vulnerability. The "basic cognitive disruption" leads to a disturbance at various points in the neural circuitry and is hypothesised as a potential mechanism underlying the development of psychotic-like experiences. Theories regarding visual binding and/or top-down modulation fit with this model in providing a greater understanding of the perceptual processes which may underlie the "basic cognitive disturbance". Visual binding and top down modulation models hypothesise difficulties in the integration of bottom-up and top-

down information and a decreased influence of top-down processes, leading to a reduction in the ability to coherently process visual information. Clinically this may culminate in an overreliance on sensory information with a greater focus on small details in the environment which have little or no context. This could lead to the appearance of hallucinatory phenomena, a sense that the world is altered or different in some way and feelings of salience. Subsequent appraisals designed to provide meaning to these idiosyncratic visual experiences may also result in delusion formation.

Finding out more about perceptual processes in psychosis could inform our understanding of psychotic symptoms. One way of doing so is to use visual illusion paradigms. These will now be considered in more detail.

1.5 Visual illusions

Visual illusions were first discovered at the end of the 19th Century by a number of physiologists including Ebbinghaus, Muller-Lyer and Poggendorf. They are achieved when an image is perceived differently from its true external form. Thus, in a similar way to hallucinatory phenomena, visual illusions give rise to perceptual experiences which do not reflect reality (Notredame et al., 2014).

Visual illusions transpire when incoming sensory information enters the retina and activates stored memories from prior experience (e.g. knowledge of grouping principles), resulting in perception which differs significantly from actual incoming signals (Dima et al., 2009). As such they demonstrate the ability of the perceptual system to successfully integrate bottom-up and top-down processes. Visual illusion paradigms have been found useful in

providing information about mechanisms underlying perception in individuals experiencing psychotic-like phenomena (Notredame et al., 2014).

Existing research suggests that individuals with psychosis may be less susceptible to visual illusions than non-clinical samples (e.g. Dima et al., 2009; Kantrowitz, Butler, Schecter, Silipo, & Javitt, 2009; Mittal, Gupta, Keane, & Silverstein, 2015; Silverstein et al., 2013; Uhlhaas, Phillips, Mitchell, & Silverstein, 2006). A lack of susceptibility to illusions may indicate an over-reliance on bottom-up processing, or a lack of top-down modulation. This is because the illusion is being perceived as its true image (which is based on incoming sensory information) and suggests prior memory stores (as a result of top-down processes) are not implicated because if they were these processes would lead to the perception of an image which was different from its reality (i.e. the illusion).

A lack of susceptibility to visual illusions may also lead to a superior performance on tasks, (e.g. individuals with psychosis are not "deceived" by the context) perceiving the individual parts more accurately and therefore psychotic symptoms cannot be attributed to a generalised cognitive deficit as previously thought (Heinrichs & Zakzanis, 1998; Notredame et al., 2014; Yang et al., 2013). Studies examining visual illusions in individuals with psychosis will now be discussed in more detail.

1.5.2 Visual illusion perception in psychosis populations.

There has been increasing interest in the use of visual illusions paradigms within psychosis populations (e.g. Dima et al., 2009; Kantrowitz et al., 2009; Mittal et al., 2015; Silverstein et al., 2013; Uhlhaas et al., 2006). Uhlhass et al. (2006) found that individuals with schizophrenia were less susceptible to the Ebbinghaus illusion than healthy controls. In

this illusion (see Figure 3), the two inner circles in both images are physically the same size but they are perceived as being different, with the inner circle on the right being perceived as larger than the inner circle on the left. The illusion transpires when an individual's prior memory stores (in this case for depth cues) are activated in response to the incoming stimuli from the illusion. Based on prior knowledge of these grouping principles the larger surrounding outer circles influence the perceived size of the inner circle, with the outer circles being viewed in the forefront, reducing the perceived size of the inner circle and giving it a smaller appearance than its actual size (Rose & Bressan, 2002). When smaller circles surround a larger inner circle, the outer circles appear in background (again due to prior memories for depth), amplifying the size of the inner circle and it is perceived larger than its actual size (Silverstein et al., 2013). The Ebbinghaus illusion is therefore hypothesised to assess the visual system's ability to integrate top-down information with incoming sensory input. Ulhass et al. (2006) found individuals with a diagnosis of schizophrenia were more accurate at perceiving the true size of the inner circles. Reduced susceptibility would therefore suggest disturbances to the integration of incoming stimuli with prior knowledge for depth cues (potentially as the result of a "basic cognitive disruption" as discussed above).

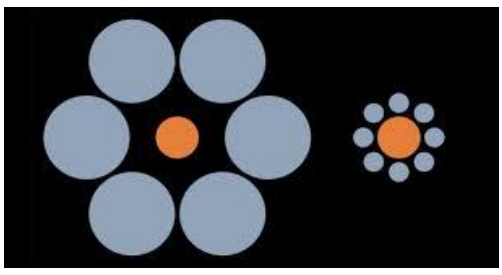

Figure 3. *Example of the Ebbinghaus Illusion*

Silverstein et al. (2013) used the same illusion amongst three groups: a group of individuals with first episode psychosis, a group of inpatients with a diagnosis of

schizophrenia, and a healthy control group. The results showed that the schizophrenia group had significantly lower susceptibility to the illusion in comparison to the first episode psychosis group and the healthy control group. There was a trend level different between the first episode group and control group, with the first-episode group being less susceptible to the visual illusion. This suggests the schizophrenia group and first episode group experienced less cognitive coordination of top-down and bottom-up processes, potentially as a result of a "basic cognitive disruption". Interestingly the researchers found that these effects diminished when participants were tested at discharge from inpatient treatment, suggesting that potential disruptions to the visual system are not inherent to the individual and are amenable to repair following symptom reduction. Mittal et al. (2015) investigated susceptibility to the Ebbinghaus illusion in a group of participants deemed as high risk of developing psychosis and a control group. The research found superior performance for the clinical group on the basis they were less deceived by the visual illusion in comparison to a control group, suggesting that disruptions in visual integrative mechanism may be present outside of a psychotic disorder.

Kantrowitz et al. (2009) explored illusion susceptibility between a group of individuals with a diagnosis of schizophrenia and a control group using the Muller-Lyer and Poggendorf illusions. In the Muller-Lyer illusion, (see Figure 4), two horizontal lines are presented with an arrowhead at either end. On the top line both arrowheads point inwardly and on the bottom line both arrowheads point outwardly. Due to the orientation of the arrowheads, the image appears larger when they point inwards and smaller when they point outwards. Again, this is due to the integration of incoming stimuli with prior memory stores which lead to the top line being perceived as closer, giving rise to a line appearing longer in length compared with its actual size. The opposite is true of the bottom line, with the

integration of bottom-up and top-down processes leading to the perception that the line is further away, resulting in a shorter perception of line length compared with its actual size (Howe & Purves, 2004). Again, it is the successful coordination of sensory information with prior memory stores which gives rise to this visual illusion.

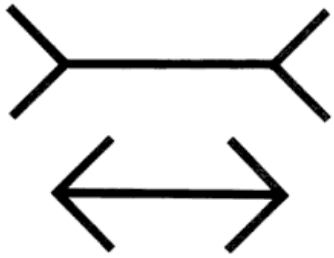

Figure 4. *Example of the Muller-Lyer Illusion*

In the Poggendorf illusion, (see Figure 5), a straight line set at a 45 degree angle is concealed by an intervening rectangle. Once more, the integration of top-down and bottom-up processes gives rise to an image which does not reflect its reality. In this case the line is misinterpreted as being offset whilst the true image is linear (Ciszewski, Wichowicz & Zuk, 2015). No differences were found amongst groups for the Poggendorf illusion and the clinical group were found to be more susceptible to the Muller-Lyer illusion in comparison to the control group, suggesting that psychosis populations may not be less susceptible to all visual illusions. Although mixed in their findings, a growing body of research suggests that psychosis populations may experience some difficulties with integrative processes within the visual system.

Again, results from visual illusion paradigms supports Hemsley's (2005) cognitive model of psychosis and theories of visual perception, suggesting that individuals with psychosis are less able to bind visual elements into a contextual whole, being more inclined to greater piecemeal processing to inform their perceptual experiences. Clinically this could

have real life impacts, potentially leading to the manifestation of an incoherent visual environment and the development of psychotic-like symptoms (Kantrowitz et al., 2009).

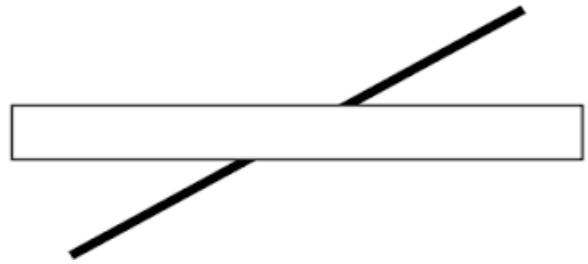

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Figure 5. *Example of the Poggendorf Illusion*

Other studies have used an ecologically based illusion known as the hollow mask (see Figure 6), comprised of an image of a face which is concave and two dimensional. Studies have found that control groups perceive the shape as a normal three dimensional (convex) image of a face instead of the true concave image (Dima et al., 2009). Again this illustrates the visual systems' ability to coherently coordinate bottom-up processes with prior top-down representations. In this case, prior knowledge of faces as three dimensional constructs are integrated with bottom-up signals entering the retina, generating an inaccurate perception of the face being three dimensional. However, individuals experiencing psychotic symptoms are less susceptible to this illusion and thus more likely to depict the mask as its actual two dimensional image.

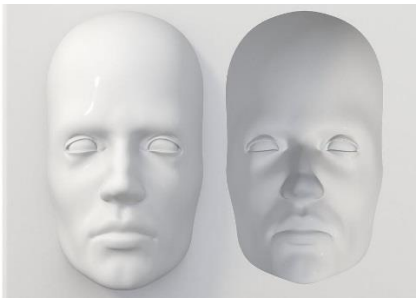


Figure 6. *Example of the hollow mask illusion. The mask on the left is convex and the mask on the right is concave*

The researchers also measured connectivity in the brain using fMRI whilst the participants were looking at the hollow mask. They found an increase in bottom-up connectivity and a decrease in top-down processing in the clinical group and a strengthening of top-down processing in the control group (Dima et al., 2009). The ability to contextually integrate all the features of a face is important in emotion recognition. Clinically, a reduced ability to recognize emotional expressions could lead individuals to inappropriately interpret facial expressions and the intentions of others (Silverstein & Keane, 2011).

Taking these studies together, the empirical evidence supports Hemsley's (2005) cognitive model of psychosis. Superior performance in visual illusion paradigms illustrates the reduced influence of contextual integration on incoming stimuli and greater tendency for piecemeal processing in psychosis populations. Reduced integration is thought to be a consequence of a "basic cognitive disruption" which may lead to altered perceptual experiences.

However, it is noteworthy that the majority of existing studies examining visual illusions in psychosis populations have taken place in samples of individuals with chronic schizophrenia and it is difficult to ascertain whether any differences in susceptibility to illusions are an underlying mechanism of psychotic symptoms or a result of the disease process. In addition, most existing studies have examined visual illusions in isolation or in small numbers (less than three), rather than a group of illusions. Due to the limitations of current research it would be beneficial to examine perception to a set of visual illusions (this study uses a battery of 13) in a group of people with psychotic-like experiences (e.g. hearing or seeing things other people cannot) but who do not have a diagnosis of psychosis. This is the aim of the current study.

1.6 Clinical implications for current research

Research suggests that a "basic cognitive disruption" leads to difficulties with contextual integration and the development of subsequent psychotic-like experiences. Understanding more about the mechanisms underlying the development of psychotic-like experiences will be useful clinically. For example, it is important to understand why people with psychosis or those with psychotic-like symptoms experience perceptual anomalies in order to provide an explanation for these experiences, thus potentially reducing the likelihood of further progression of these symptoms (e.g. delusion formation). Kingdon and Turkingdon (1991) used a cognitive behavioural therapy approach with a strong "destigmatising rationale" to provide a clear reason for the development of psychotic symptoms. They found positive outcomes from this approach, participants required little or no medication and had minimal hospital admissions.

Providing benign explanations of anomalous experiences may be particularly pertinent within a group of individuals with psychotic-like experiences given research suggesting individuals at risk of psychotic phenomena have a "dopamine supersensitivity" which may cause biases in perception and cognition, increasing the likelihood of perceptual aberrations (van der Gaag et al., 2012). Cognitive therapy approaches for individuals with at-risk mental states focus on normalising unusual experiences in order to reduce the likelihood of delusion formation. Freeman et al. (2002) propose that people with anomalous experiences may not develop full blown psychotic symptoms if they adopt a more normalising explanation for their experiences (e.g. "I thought [this] had a significant meaning to me but it was probably because I was stressed").

Moreover, cognitive behavioural therapy (CBT) is most effective in treating psychosis when anomalous experiences are re-appraised as being self-generated (Fowler, Garety & Kuipers, 1995). Having an explanation for anomalous experiences as the result of a different perceptual style may therefore support individuals to not go down a route in which they could develop delusional appraisals to explain their unusual experiences, potentially resulting in the development of psychosis. There have also been some encouraging findings for the psychological treatment of help seeking individuals with psychotic symptoms who have not transitioned to psychosis. Preti and Cellar (2010) reviewed five randomised control trials using CBT and found that transition rates to psychosis in the treatment groups were 11% and 31.6% in the control group. One randomized control trial conducted a three year follow up. They found that cognitive therapy significantly reduced the chance of antipsychotic medication prescription and the likelihood of transition to psychosis (Morrison, French & Wells, 2007b).

These findings are promising in showing the effectiveness of psychological intervention to reframe anomalous experiences, both in the treatment of psychotic symptoms and in reducing the development of psychosis. If individuals with psychotic-like experiences do indeed have contextual processing difficulties, this alternative explanation for unusual experiences could be incorporated within a CBT intervention, providing an understanding of why these experiences occur. It may also be possible to develop training packages to encourage individuals to use context to interpret their perceptual experiences.

Research exploring appraisals of perceptual changes in individuals with psychotic-like experiences may also elucidate specific beliefs playing a role in development and maintenance of psychotic symptoms. Greater knowledge regarding these factors could also

serve to enhance the specificity of early clinical interventions, targeting the particular beliefs implicated.

However, we first need to understand more about perceptual processes in individuals with psychotic-like experiences (e.g. hearing or seeing things that other people cannot) and ascertain whether these processes do indeed underlie perceptual aberrations. This study therefore aims to investigate whether a group of individuals with psychotic-like experiences are less susceptible to the effects of visual illusions in comparison to a healthy control group.

1.7 Summary and rationale for current research

This study aims to explore how individuals with psychotic-like experiences perceive the world around them in comparison to healthy controls. In doing so the research aims to explore particular mechanisms which may underlie anomalous experiences. The particular mechanism which this study aims to focus on is whether disruptions in visual processing may underlie psychotic symptoms.

The rationale for this idea comes from the cognitive model of psychosis which hypothesizes that there is a "basic cognitive disruption" underlying anomalous experiences (Garety et al., 2001). The nature of this cognitive disruption is still under debate, but there is a suggestion that disturbances to the integration of top-down and bottom-up perceptual processing may be responsible (Hemsley, 2005).

Disruptions in the visual system are believed to be a potential mechanism underlying psychotic symptoms because they can lead to: 1) 'reduced contextual integration' (when an individual is less able to use context and/or prior memory stores to guide and inform what they are seeing) and 2) a tendency towards 'detail-oriented processing' (when an individual has greater propensity toward processing the finer details of their environment).

Disruptions of this nature may mean that an individual's visual processing system becomes over-reliant on incoming sensory signals with no 'organising framework' (Notredame et al., 2014). For example, a reduced ability to use stored material may make it more difficult for the visual system to differentiate relevant from irrelevant stimuli, resulting in information usually outside of consciousness intruding into awareness. In addition to this, processing the finer details of the environment at the expense of seeing the "bigger picture" could also result in individuals with psychosis perceiving the world in a fragmented way. Ultimately these disruptions can result in people having a very different perceptual experience of the world. Specific psychotic experiences which could develop from a disruption in this pathway include hallucinatory phenomena, a sense that the world has altered, and feelings of salience. An attempt to understand and explain these unusual experiences may result in the potential development of delusional beliefs.

One method which appears to be particularly helpful in informing our understanding of how the visual system is operating is the use of visual illusion paradigms. This is because visual illusions demonstrate the ability of the visual system to integrate constituent parts into a meaningful whole (Notredame et al., 2014). They also illustrate the use of context in perception. Individuals with psychosis have been found to have reduced susceptibility to some visual illusions, supporting the notion of difficulties with contextual integration.

However, many previous studies using visual illusion methodologies have taken place in samples of individuals with chronic schizophrenia and it is therefore difficult to ascertain whether susceptibility to illusions are an underlying mechanism of psychotic symptom or a result of the disease process. In addition, most existing studies have examined visual illusions in isolation or in small numbers (less than three), rather than a group of illusions. In order to address these gaps in the research this study aims to recruit individuals who are experiencing

psychotic-like symptoms (e.g. seeing or hearing things that other people cannot) but have not transitioned to psychosis and examine visual illusion susceptibility using a large set of 13 illusions.

This study will also examine the role of appraisals and emotional responses because they are considered an important mechanism underlying the outcome of perceptual changes occurring as a consequence of a "basic cognitive disruption". The rationale for this idea comes from cognitive models of psychosis which hypothesises that perceptual changes trigger a sense making process, aimed at providing meaning to psychotic experiences. Initial perpetual changes are seen as uncharacteristic and subsequent appraisals influence the future experience of symptoms. The meanings attributed to perceptual experiences are strongly influenced by prior life events (Garety et al., 2001; Morrison et al., 2001; Beck, 1976). Individuals who have experienced earlier adverse events (commonly found in psychosis populations) are more likely to engage in biased cognitive processing when appraising perceptual experiences occurring as a result of a "basic cognitive disruption" (e.g. hallucinatory phenomena, feelings the world has altered), potentially leading to delusion formation (Garety et al., 2001).

Research has supported this theory, showing early adverse experiences results in greater negative appraisals which are associated with psychotic experiences (Kilcommons & Morrison, 2005). Appraisals which may be particularly pertinent in the maintenance of psychotic symptoms include perceiving the experience as threatening, anxiety-provoking, outside of individual control and externally caused (Morrison et al., 2001). These will be explored as part of this study.

1.8 Research hypothesis and questions

Research hypothesis

A clinical group of individuals with psychotic-like experiences will be significantly less susceptible to visual illusions (and therefore more accurate at a size matching task) than a non-clinical comparison group.

Research questions

1. Is there a relationship between the frequency of current and/or lifetime anomalous experiences and susceptibility to visual illusions in a clinical group of individuals reporting psychotic-like experiences?

2. Is there a relationship between appraisals and/or emotional responses of anomalous experiences and susceptibility to visual illusions in a clinical group of individuals reporting psychotic-like experiences?

2. Method

This chapter outlines the methodology for this study. This includes: the study design, participant information, the measures, the procedure, ethical considerations, and the plan of analysis. It is noteworthy that this study recruited clinical participants only. The recruitment of the non-clinical participants was conducted by a psychology undergraduate as part of a separate study. The Chief Investigator for this study has permission from the Chief Investigator of the non-clinical study (Dr Irene Sperandio) to use the non-clinical data for the within-subjects analysis conducted as part of this research. For reader clarity the methodology for the non-clinical group has also been outlined in this chapter. This includes: the inclusion and exclusion criteria; the measures and the procedure.

2.1 Design

The study employed a quantitative cross-sectional design which involved both between-group and within-group comparisons.

To address the research hypothesis, the study compared visual illusion susceptibility scores from a clinical group of young people reporting psychotic-like experiences who were accessing secondary mental health services with a non-clinical comparison group from a student population at the University of East Anglia (UEA). To address the research questions the study examined the relationships between the frequency of psychotic-like experiences at two time points (current and lifetime); appraisals of psychotic-like experiences; emotional responses to psychotic-like experiences and susceptibility to visual illusions within the clinical group.

The data for the clinical group were collected from a visual illusions task; self-report questionnaires and a semi-structured interview. The data for the non-clinical group were gathered from a visual illusions task and self-report questionnaires. The design also involved the collection of covariates (e.g. measurement of depression, anxiety and stress) from both groups to control for potential confounding variables. The measures used in the clinical and non-clinical will be discussed in more detail below.

2.2 Participants

2.2.1 Clinical Group.

This study recruited a clinical group of 25 individuals from Youth Mental Health Teams in the Norfolk and Suffolk NHS Foundation Trust (NSFT). The Youth Mental Health Teams provide support in the community for individuals aged between 14 – 25 years. These are multidisciplinary teams which aim to provide person-centred approaches to young people experiencing mental health difficulties.

2.2.1.1 Clinical group inclusion criteria.

The following inclusion criteria were applied for the clinical group at the beginning of the study:

- Aged between 16 and 25 years
- Accessing secondary mental health services for young people
- A score of six or greater with regards to psychotic-like experiences (e.g. seeing or hearing things other people cannot), irrespective of symptom duration, measured using the Prodromal Questionnaire (PQ).

These criteria were chosen to clearly distinguish the clinical group from the non-clinical group, allowing valid comparisons to be made between the two groups. Previous studies exploring visual illusion susceptibility have taken place in samples of individuals with chronic schizophrenia. This has made it difficult to ascertain whether any differences in susceptibility to illusions are an underlying mechanism of psychotic symptoms, or a result of the disease process (e.g. Dima et al., 2011). These criteria aimed to help to address the limitations of current research by ensuring that participants were experiencing subclinical levels of psychotic symptoms, as measured by the PQ.

2.2.1.2 Clinical group exclusion criteria.

The following exclusion criteria were employed to the clinical group at the beginning of the study:

- Current or historical experience of a psychotic episode
- Severe learning disability or a diagnosis of Autistic Spectrum Disorder
- Visual impairment which could not be corrected by visual aids
- Insufficient proficiency in the English language, preventing completion of self-reports

The criteria were chosen to ensure that current psychotic-like experiences were not being experienced in the context of a current episode of psychosis or following a previous psychotic episode which could confound the findings of the research.

To ensure that valid conclusions could be drawn from the planned statistical analysis the exclusion criteria were also designed to ensure participants could accurately see the visual illusions programme, understand the self-report questionnaires and semi-structured interview

questions. The inclusion and exclusion criteria were assessed through liaising with mental health clinicians and scores on the PQ screening measure.

2.2.1.3 Non-clinical group.

As discussed above, the non-clinical data collection also formed part of a separate study investigating the effects of psychotic-like experience severity on visual illusion susceptibility in a student population. A total of 74 participants were recruited into the non-clinical group. Participants scoring above the 75th percentile on the Schizotypal Personality Questionnaire, (the screening measure for the non-clinical group) were removed from the study (n = 20) because higher scores are indicative of greater schizotypal traits. One participant was removed because they had a family history of psychosis, leaving a total of 53 participants in the non-clinical group.

2.2.1.4 Non-clinical group inclusion criteria.

The following inclusion criteria were applied to the non-clinical group:

- Undergraduate students attending the UEA
- Aged between 18 and 25 years

The criteria were chosen to ensure recruitment for the non-clinical group was from a general student population.

2.2.1.5 Non-clinical group exclusion criteria.

The following exclusion criteria were applied to the clinical group:

- Visual impairment which could not be corrected by visual aids

- High scores on the SPQ (participants scoring above 75th percentile were removed)
- Family history of psychosis
- High scores on the DASS (boxplots were used to check for outliers)

These criteria were chosen to ensure a clear distinction could be made between the clinical and non-clinical group.

2.2.2 Sample size.

To make sure that the planned analysis had sufficient statistical power to make valid interpretations of the research hypothesis and questions sample size calculations were conducted.

The calculation for the between-groups analysis was based on Cohens d power table (Kazdin, 2003). Effect sizes for between-group differences in illusion susceptibility vary within the literature. Previous studies comparing sensitivity to visual illusions between a group of participants with a diagnosis of schizophrenia and a control group found effect sizes as large as 1.2. Whilst comparisons in visual illusion susceptibility between a group experiencing a first episode of psychosis with a control group found only moderate effect sizes of 0.4 (Silverstein et al., 2013).

This study originally planned to use a large effect size of 0.6 at $p < .05$ and a standard power of 0.8. A large effect size was chosen as, to be clinically useful, the researchers would want illusion susceptibility to clearly differentiate between the non-clinical and clinical group. Based on this calculation, 45 participants were required in each group. Despite substantial effort, 25 participants were recruited in the clinical group. In order for the study to

have appropriate power, a large effect size of 0.8 at $p < .05$ and standard power of 0.8 would be needed. If a significant result is found, an ANCOVA was planned to control for potential confounding factors (e.g. mood and anxiety). A sample size of 25 will provide 75% power to detect a large effect size of $\eta^2 = .15$ (Clark-Carter, 2010).

For the within-subjects correlational analysis a sample size of 45 was also originally used. This is because a sample size of 45 will provide 79% power to detect a moderate effect size of 0.4 (Clark-Carter, 2010). The sample size of 25 recruited in this study will provide 73% power to detect a moderate effect size of 0.5.

2.2.3 Sample characteristics

A summary of the demographic data for the clinical and non-clinical is provided in Table 1. Scores from the depression anxiety and stress scale (DASS) have been included in this table for both groups to illustrate a clear distinction between the clinical and non-clinical group (with the clinical group scoring higher across all subscales in comparison to the non-clinical group, indicating greater mental health symptomology).

Table 1

Demographic Data for the clinical group (n = 25) and non-clinical group (n = 53)

Variable	Group		*n* (%)	*M* (*SD*)	Range
PQ	Clinical			11.88 (2.85)	6 - 15
SPQ	Non-clinical			3.66 (2.52)	0 - 7
Gender	Clinical	Male	20		
		Female	80		
	Non-clinical	Male	84.9		
		Female	15.1		
Age (in years)	Clinical			20.44 (2.96)	16 - 25
	Non-clinical			19.79 (0.93)	18 - 22
Family history of psychosis	Clinical	Yes	16		
		No	84		
Handedness	Clinical	Right	88		
		Left	12		
	Non-clinical	Right	84.9		
		Left	15.1		

Depression subscale (from DASS)	Clinical	28.28 (9.36)	11 – 42
	Non-clinical	6.11 (7.71)	0 - 40
Anxiety subscale (from DASS)	Clinical	25.48 (6.56)	16 – 40
	Non-clinical	4.19 (5.41)	0 – 29
Stress subscale (from DASS)	Clinical	30.60 (7.75)	13 – 40
	Non-clinical	9.53 (8.41)	0 - 33

Normative data from a non-clinical sample reports a mean score of 14.31 for the depression sub-scale; 10.73 for the anxiety subscale and a mean score of 18.64 for the stress subscale (Brown, Chorpita, Korotitsch, & Barlow, 1997). Table 1 shows that the non-clinical group in this study scored lower across all three subscales, suggesting that the mood scores are reflective of a non-clinical sample.

Percentages for DASS scores within the severity ratings (found in the DASS manual for the normative data) for the clinical and non-clinical sample in this study can be found in Table 2.

Table 2

Sample Percentages for DASS Severity Ratings for Clinical Group (n = 25) and Non-Clinical Group (n = 53)

Severity rating	Percentile	Group	Depression subscale (%)	Anxiety subscale (%)	Stress subscale (%)
Normal	0-78	Clinical	0	0	8
		Non-clinical	83.02	83.02	81
Mild	78-87	Clinical	8	0	4
		Non-clinical	7.55	9.43	5.66
Moderate	87-95	Clinical	12	0	8
		Non-clinical	5.66	3.77	3.77
Severe	95-98	Clinical	24	16	32
		Non-clinical	1.89	1.89	9.43
Extremely Severe	98-100	Clinical	56	84	48
		Non-clinical	1.89	1.89	0

The table shows that none of the clinical sample was in the normal range for depression, over three quarters of the non-clinical sample was in the normal range. Approximately one fifth of the clinical sample was in the mild – moderate range for depression, where as only 13% of the non-clinical sample were in this range. Three quarters of the clinical sample experienced severe – extremely severe levels of depressive symptoms, in comparison to less than 4% of the non-clinical sample.

None of the clinical sample experienced anxiety within the normal – moderate range, with the whole sample experiencing anxiety as severe – extremely severe levels. In contrast, over three quarters of the non-clinical sample experienced anxiety within the normal range, with less than 4% experiencing anxiety in the severe – extremely severe range.

One fifth of the clinical sample experienced stress within the normal – moderate range, compared with almost 90% in the non-clinical sample. In the clinical sample 80% experienced stress at severe – extremely severe levels, whilst less than 10% of the non-clincal

group experienced severe – extremely severe stress.This highlights the severity of mental health problems (i.e. high levels of depression, anxiety and stress) in the clinical group in comparison to the non-clinical group.

2.3 Measures

The measures used in this study included: 1) the Prodromal Questionnaire (PQ; used as a screening tool); 2) the Visual Illusions Task (used as the primary outcome measure); 3) the DASS (used to control for potentially confounding mood variables); 4) the Demographic Questionnaire (used to control for potentially confounding demographic variables); 5) the Appraisal of Anomalous Experience Interview (AANEX; used for an in depth assessment of psychotic-like experiences). The non-clinical group also completed these measures with the exception of the PQ and the AANEX. To measure psychotic-like experiences the non-clinical group completed the SPQ-B because it assesses schizotypal traits commonly found in non-clinical populations. These measures will be discussed in more detail below. Copies of all the measures are included in the Appendices C-G. .

2.3.1 Screening measures.

The screening measures for the clinical and non-clinical group will be outlined below:

2.3.1.1 Clinical group screening measure.

The Prodromal Questionnaire (PQ-16; Ising et al., 2012)

Participants from the clinical group completed the PQ-16. The PQ-16 is a 16-item self-report measure, assessing the presence of attenuated psychotic symptoms on a two-point scale (True or False). Questions include: “I have seen things that other people apparently

can't see." If a participant endorses 'True' they rate their level of distress on a four point scale (No, Mild, Moderate or Severe). A cut-off score of six for symptom items was used in this study because it is indicative of subclinical levels of psychosis (Loewy, Pearson, Vinogradov, Bearden, & Cannon, 2011). The score which was used referred to items endorsed on the True/False scale only (e.g. if a participant endorsed true for an item they would score one point) irrespective of level of distress. Participants suitability for the study was therefore based on the presence of psychotic like experiences and not distress.

Participants scoring below six were not eligible for the clinical group. The PQ-16 exhibits good psychometric properties. Total scores on the measure were significantly correlated with the Comprehensive Assessment of At-Risk Mental State (CAARMS) diagnosis and Cronbach's alpha for total score on the 16 item measure was .774 (Ising et al., 2012). It is also a practical screening measure, taking 5 minutes to administer.

2.3.1.2 Non-clinical group screening measure.

Schizotypal Personality Questionnaire – Brief Version (Raine & Benishay, 1995)

Participants from the non-clinical group completed the SPQ-B. This measure was chosen because it assesses schizotypal traits commonly found in the general population. It is noteworthy that the SPQ-B was also considered an appropriate screening measure in this group because it is a non-clinical self-report scale which assesses schizotypal traits (a criterion in the measurement of psychotic-like experiences). Normative data for a non-clinical sample reports a mean total score of 9.6 for the SPQ-B (Axelrod, Grilo, Sanislow & McGlashan, 2001). Participants from the non-clinical group who scored above the 75th percentile (this included scores above 9) were excluded from the final data analysis to ensure

a valid distinction was made between the clinical and non-clinical groups (i.e. that individuals with high schizotypy scores were not included in the non-clinical group).

2.3.2. Primary outcome measure

2.3.2.1 Visual Illusions Task.

The visual illusions task is a computer-based program, presented in Flash (as used in Chouinard & Noulty, 2013). Participants were presented with 13 different visual illusions tapping into different neural mechanisms (see Table 3 for a list of all illusions included in the task). Each illusion was presented four times for a total of 52 trials on a computer screen. The illusions were presented in a random order generated by the program and participants were instructed to perform a size-matching task, adjusting the length of a comparison stimulus 'A' to match the size of a second standard stimulus 'B' (see Figure 1). For each visual illusion the comparison stimulus was counterbalanced, appearing twice in the position of stimulus 'A' and twice as stimulus 'B'. The comparison stimulus was presented either 20% larger or 20% smaller than the target stimulus.

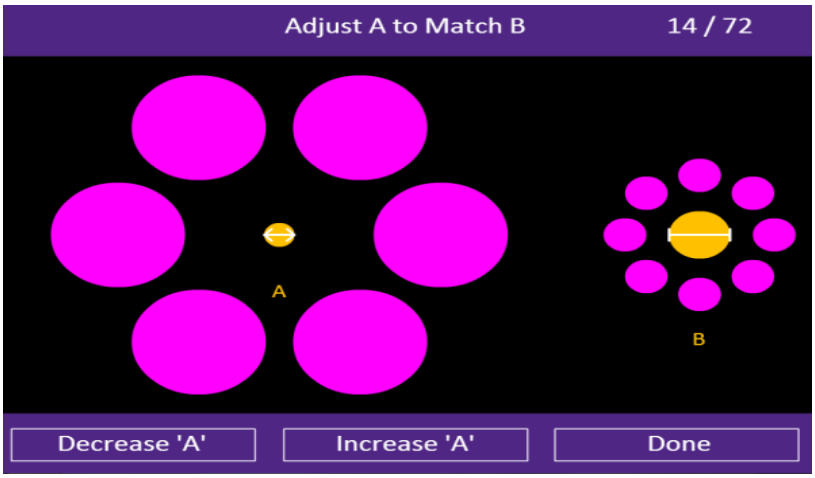


Figure 7. *Example of a trial in the visual illusions task*

Participants adjusted the comparison stimulus by pressing the left hand button on a mouse to make the stimulus bigger and the right hand button to make it smaller. Each press of the mouse decreased or increased the size of the comparison stimulus by two pixels. Participants were also instructed to judge the size of comparison stimulus without using any other approaches (e.g. measuring the length with their finger). At the beginning of each trial, instructions were presented at the top of the screen. Three buttons were presented to participants at the bottom of the screen: "Increase", "Decrease", and "Done". Once participants had adjusted the comparison stimulus so that they perceived it to be the same size as the standard stimulus they were asked to press "Done" to indicate they had finished. Participants had as much time as they required to complete the task. On average the task took approximately 25 minutes to complete. A susceptibility index was calculated on completion of the programme for each visual illusion for each participant:

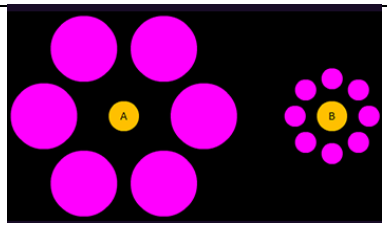
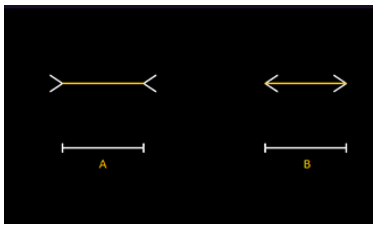
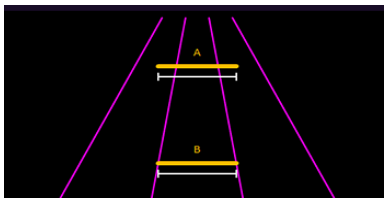
[(Perceived Size in Configuration A – Perceived Size in Configuration B)/ (Perceived Size in Configuration A + Perceived Size in Configuration B)].

An 'overall susceptibility' score was generated by summing the susceptibility scores for individual visual illusions and calculating the mean for each participant. This calculation is based on previous studies using the same method (e.g. Chouinard, Noulty, Sperandio, & Landry, 2013). The susceptibility index provides a score regarding the magnitude of the difference between the size of the comparison stimulus and the standard stimulus once the participant has finished their adjustments. The susceptibility score therefore relates to how closely the participant has size-matched the comparison stimulus with the target stimulus, measured in pixels. The susceptibility score ranges from 0 – 1, with lower scores being indicative of lower susceptibility to visual illusions (e.g. a score of 0 would mean that the

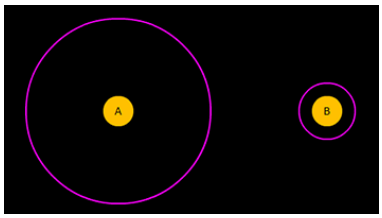
comparison stimulus was accurately matched to the same size as the target stimulus). Individuals who are less susceptible to illusions will be more accurate in size matching the two stimuli. Visual illusion tasks using the same method of adjustment have been widely used in visual psychophysics (e.g. Chouinard et al., 2013). Both clinical and non-clinical groups completed the visual illusions task.

Table 3

The 13 Illusions included in the Visual Illusion Task

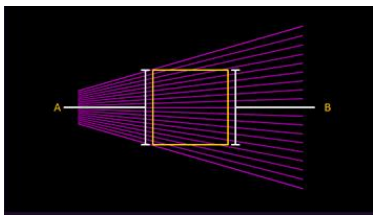
Visual Illusion	Diagram	Description
Ebbinghaus		In the Ebbinghaus illusion, the two inner circles in both images are physically the same size. Contextual cues from the outer circles lead to the inner circle on the right being perceived as larger than the inner circle on the left.
Muller-Lyer		In the Muller-Lyer illusion, two identically sized horizontal lines are presented with an arrowhead at either end. On the top line both arrowheads point inwardly and on the bottom line both arrowheads point outwardly. Due to the orientation of the arrowheads, the image appears larger when they point inwards and smaller when they point outwards.
Ponzo		In the Ponzo illusion, the top and bottom line are identical in size. The converging lines give the appearance of depth and the top line appears longer in length than the bottom line.

Delbeouf



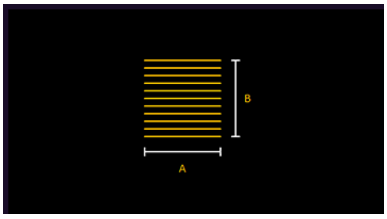
In the Delbeouf illusion, the two inner circles are the same size. Due to contextual cues from the surrounding circle the inner circle on the right appears bigger than the inner circle on the left.

Ehrenstein



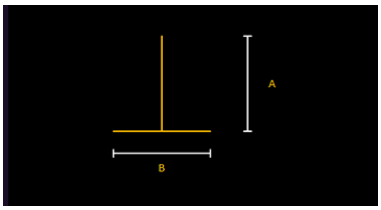
In the Ehrenstein illusion lines A and B, on the left and right hand side of the yellow square are indentifical in size. Due to contextual cues from the converging lines, line A appears longer in length than line B.

Helmholtz-Square



In the Helmholtz-Square illusion the horizontal and vertical length of the square (comprised of vertical lines) is identical in size. Due to the orientation of the lines, the length of line B appears greater than line A.

Horizontal-Vertical

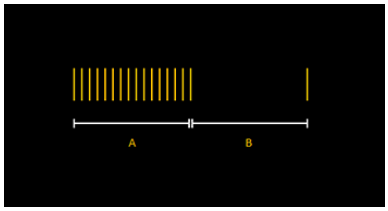


In the Horizontal-Vertical illusion both lines are identical in length. Based on prior knowledge of horizontal and vertical objects, the vertical line is perceived as longer in length than the horizontal line.

Jastrow

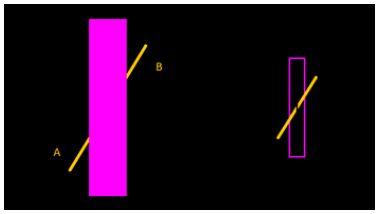
In the Jastrow illusion the two figures are identical. Due to their orientation, the lower figure is perceived as bigger than the upper figure

Oppel-Kundt



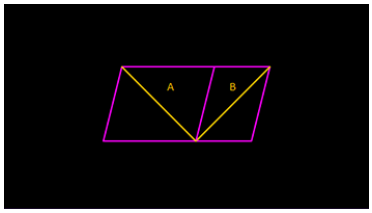
In the Oppel-Kundt illusion the distance represented by line A is equal to the distance represented by line B. When the distance is filled with vertical lines (image A) the length appears longer than the empty space (image B).

Poggendorf



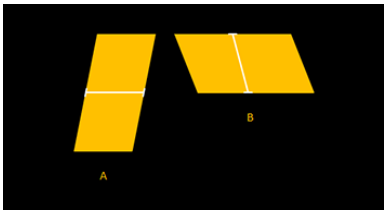
In the Poggendorf illusion, a straight line set at a 45 degree angle is concealed by an intervening rectangle. The line is misinterpreted as being offset whilst the true image is linear

Sanders



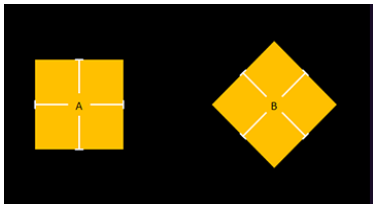
In the Sanders illusion, the two diagonal lines are equal in length. Based on depth cues from the surrounding from the purple lines, line A is perceived as longer than line B.

Shepard



In the Shepard illusion, the mid sections (indicated by the white lines) are identical for both parallelograms. Due to the orientation of the shapes line B appears longer in length than line A.

Square-Diamond



In the Square-Diamond illusion, both squares are identical in size. When the square is in a diamond position (image B) it appears larger than its standard position (image A).

2.3.3. Secondary outcome measures.

2.3.3.1 The Depression and Anxiety Scale (DASS, Lovibond & Lovibond, 1995).

This is a 42-item self-report scale measuring the severity of current anxiety, depression and stress/tension. Each subscale contains 14 items. Participants indicated the extent to which each statement had applied to them over the last week on a four point scale, ranging from 0 "did not apply to me at all" to 3 "applied to me very much, or most of the time", giving a total score which ranged between 0 – 126. A total score of 27 or above is indicative of symptoms within a clinical range (Crawford & Henry, 2003) (Lovibond & Lovibond, 1995).

This measure exhibits good psychometric properties: internal consistencies for depression (a = 0.96); anxiety (a= 0.89) and stress (a= 0.93) (Brown, Chorpita, Korotitsch, & Barlow, 1996). The measure takes 10-20 minutes to complete. The DASS has been included in this study as a control variable because extremes in affective state may have an impact on an individual's levels of concentration and engagement with the research task and therefore may account for between-group differences. Both clinical and non-clinical groups completed this measure. High scores on the DASS in the non-clinical group were checked prior to analysis and outliers were removed as detailed in the results section.

2.3.3.2 Appraisals of Anomalous Experiences Interview (AANEX; Brett et al., 2007).

The AANEX is a semi-structured interview which measures the presence of psychotic-like experiences and individual appraisals of these experiences. The AANEX was used in addition to the PQ-16 because it provides more in-depth information about the nature of psychotic-like experiences, which are of particular interest in this study. Scores on the

AANEX were used to explore whether visual illusion susceptibility was specifically related to the frequency of psychotic-like experience, appraisals and/or emotional responses to these experiences, as outlined in the research questions above.

The 'anomalous perception' subscale was administered to explore individual perceptual psychotic-like experiences for 12 items. Questions included 'have you had the experience of the world seeming altered in a strange way, so that it didn't seem as real and familiar as usual?' These items were measured over time to give two ratings:

1) A 'current' rating which was based on the frequency of psychotic-like experiences over the past month, rated as either 1 "absent", 2 "unclear" or 3 "present". A total state score of 24 could be obtained on this section of the AANEX, with higher scores indicating greater frequency of current psychotic like experiences.

2) A 'lifetime' rating was measured because psychotic-like experiences have been found to be variable over time. The items were scores based on the frequency of psychotic-like experience across the lifespan, rated as either 1 "absent", 2 "uncertain", 3 "mild", 4 "moderate", 5 "severe". A total lifetime rating of 60 could be obtained for this section of the AANEX, with higher scores indicating higher frequency of psychotic-like experiences across the lifespan.

Frequency of psychotic-like experiences was explored because if a "basic cognitive disruption" does indeed underlie anomalous experiences, the intensity at which an individual experiences these symptoms may be related to the level of disruption between the integration of bottom-up and top-down processes. As discussed above, visual illusion paradigms are

useful because they provide an experimental method of investigating the co-ordination of bottom-up and top-down processes.

Appraisals and emotional responses to psychotic-like experiences were also measured because previous research has reported that these may contribute to the development and maintenance of psychotic-like experiences (Brett et al., 2007; Morrison, 2001; Well & Matthews, 1996; Freeman et al., 2002). Based on this research the following appraisals were measured:

- 'Valence' of psychotic-like experience. This item was rated on a five point scale ranging from 1 (strongly negative) to 5 (strongly positive). Questions included: "how do you feel when [this] happens?"

- 'Perceived controllability' was measured on a five point scale from 1 (none) to 5 (total) (e.g. "when you first experienced [this], how much control did you have over the experience?").

- 'Externality' was measured on a five point scale, ranging from 1 (internal) to 5 (external) (e.g. "did you think [this] was caused by changes in you, or something outside of you?").

The following 'emotional' responses were also rated:

- 'Self-rated anxiety' was rated on a five point scale ranging from 1 to 5. Questions included: "can you tell me how anxious you felt? Say from 1 to 5, if 1 is 'not at all' and 5 is 'as anxious as you've even been?"

- 'Self-rated excitement' was rated on a five point scale ranging from 1 (not at all) to 5 (as excited as ever been). Questions included: "can you tell me how excited you felt?"

Responses to the 'appraisal' items were summed to provide a score ranging from 3-15, reverse scoring relevant items, with higher scores being indicative of more negative appraisals (i.e. appraisals which have been found to significantly greater within clinical populations having psychotic-like experiences (Brett et al., 2007). 'Emotional' responses were also summed, reverse scoring relevant items to provide a score ranging from 2-10, with higher scores being indicative of more negative emotional responses to psychotic-like experiences (i.e. emotional responses which have been reported to be significantly greater for clinical populations experiencing psychotic-like experiences (Brett et al., 2007)). This version of the AANEX took approximately 30 minutes to administer and exhibits good construct validity. The measure exhibits good interrater reliability, "65% of items had at least substantial agreement; 35% had almost perfect agreement" (Brett et al., 2007). This measure was completed by the clinical group only.

The Chief Investigator had prior experience administering semi-structured interviews in secondary mental health teams within a research context. In order to ensure good standards of inter-rater reliability the interviews were audio recorded, providing the participant gave their consent, and rated independently by the Chief Investigator and the Field Supervisor (Clinical Psychologist based within a secondary mental health team). The Field Supervisor was experienced in conducting research, including the scoring of semi-structured measures within this population. Inter-rater reliability was 94%, suggesting high levels of concordance for this measure.

2.3.3.3 Demographic Information.

In order to control for the impact of potential confounding variables on group differences, demographic data were collected from both groups. The following information

was included for both the non-clinical and clinical group: gender, years of education; right or left handedness and family history of mental health diagnoses.. In line with previous studies (e.g. Chouinard et al., 2013) hand dominance was collected because right handed individuals have a more obvious brain dominance compared to left handed people which may have implications on how they perceive the visual illusions (e.g. effects between the groups may be greater for individuals who are right handed). This measure was completed by the clinical and non-clinical group.

2.4 Procedure

2.4.1 Clinical group participation.

Recruitment of participants was carried out through liaising with managers in local youth mental health teams. Initially the researcher contacted team managers in secondary mental health teams via email to arrange a time to present the study to team members and provided them with clinician information sheets and posters which outlined the inclusion and exclusion criteria (see Appendices H and I).

Relevant clinical staff in the mental health teams were asked to identify and inform the researcher of potential participants who may be suitable for the project based on the inclusion and exclusion criteria listed on the clinician information sheets. In all cases the clinicians gained verbal consent from potential participants to be contacted by the researcher.

2.4.2 Contact with individuals in the clinical group.

If and only when verbal consent had been sought the researcher telephoned the potential participants to explain the study further and answer any questions. If they were still interested in participating in the research a meeting was arranged and a confirmation letter

was sent in the post. Potential participants also had the option of contacting the researcher either via telephone or email which was supplied by clinical staff or could be found on the study posters (located with secondary mental health team reception areas) and information sheets (given to clinicians if they wanted to pass them on to potential participants). After initial contact with potential participants, the researcher sent them a written information sheet if they had not already been given one by a mental health clinician so that they could receive this information 48 hours prior to meeting, giving participants enough time to read the information (see Appendix J). Depending on participant preference, the researcher conducted the study at the participant's home address or in a room located at the service they usually received care. If the researcher conducted home visits, lone worker policies for the service and UEA were followed at all times.

Consent to be contacted was recorded on an electronic database. This included participant name and contact number. If the participant did not consent to participate in the study or they were not suitable for the study all of these details were subsequently destroyed.

In the secondary mental health teams, 59 individuals were identified by mental health professionals using the inclusion and exclusion as being potentially eligible for the study. Of these 52 were approached by clinicians and given information about the research; 38 gave verbal consent to be contacted by the researcher and 26 took part in the study (1 of which was subsequently deemed ineligible), allowing the researchers to recruit 48% of all potential participants. A flow chart detailing these recruitment numbers and reasons for participant exclusion at the different stages is illustrated in Figure 7.

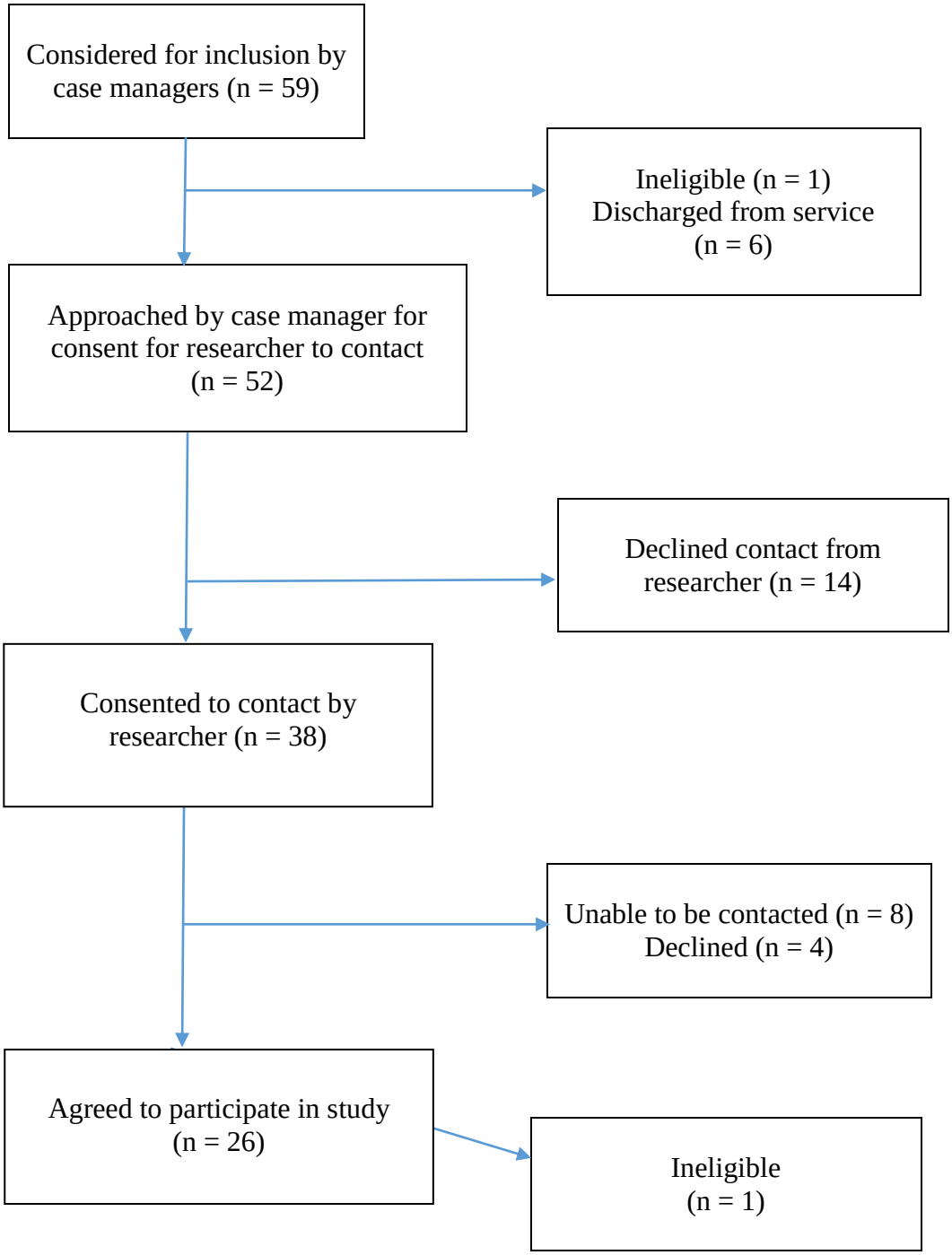


Figure 7. *Flow chart of participant inclusion and exclusion*

2.4.3 Clinical group research session procedure.

Once participants had given informed consent (see Appendix K) they completed the PQ screening measure to ensure they were suitable for the project. Providing they were eligible for the study, participants either completed the rest of the study in one session or two sessions, depending on participant preference. Participants completed the visual illusions task followed by the DASS, AANEX and demographic questionnaire. This order was chosen to reduce the impact of fatigue and to lower the potential impact of mood induction on performance on the primary measure (the visual illusions task). Participants were offered a break after completing the visual illusions task.

At the end of the study, all participants were paid £5 to compensate for their time. This was paid in cash and participants signed a form to document that they had received the money. All participants were provided with a receipt, they signed two copies, one of which the researcher kept for their records (see Appendix L). Participants were asked if they wished to receive a summary of the research findings which was recorded on an electronic database (see Appendix M for a summary of findings for research participants) and were provided with a full debrief (see Appendix N).

2.4.4. Non-clinical group participation and research session procedure.

Recruitment of the non-clinical group was carried out through poster advertisements displayed on the UEA site. Participants signed up to the study online and were sent an email with a participant information sheet attached. The email also instructed them to complete the study questionnaires online at least 24 hours prior to the study session commenced. The reason for this was to reduce the impact of fatigue and to lower the potential impact of mood

induction on performance on the primary measure (the visual illusions task). A link to the study questionnaires was provided in the email.

The visual illusions task was completed in a laboratory room at the UEA at the time booked by participants via the online system. Informed consent was collected prior to the visual illusions task. If a participant completed the questionnaires online but did not attend the session in the laboratory their questionnaires were subsequently destroyed and their answers were not used. Participants in the non-clinical group were offered compensation for their time either via course credits or payment if the maximum number of credits had been reached. All data were stored securely on the UEA site.

2.5 Ethical Considerations

2.5.1 Ethical approval.

Prior to the recruitment of the clinical participants, ethical approval was obtained from the Norfolk and Suffolk NHS Foundation Trust Research and Development department and the Wales REC (see Appendix O). The non-clinical study received approval from the UEA ethics committee. At the end of the study a report was sent to the ethics committee summarizing the study findings (see Appendix P).

2.5.2 Informed consent.

Initially potential participants were approached by a mental health professional and given a brief overview of the study. The professional approached potential participants either face to face or by telephone. The professional explained that the potential participant may be eligible for the study and provided verbal information about the study. If the participant was interested, they were asked to give verbal consent that they were willing for the researcher to

contact them. If the potential participants gave their verbal consent the researcher contacted them to arrange an initial meeting to answer any questions they had about the study. As discussed, the researcher sent a participant information sheet in the post so that they received it 48 hours prior to the initial meeting and the collection of consent. This allowed participants time to consider whether they would like to take part in the study. If participants did not receive the participant information sheet 48 hours prior to the first meeting, consent was not taken until after this time period and an additional meeting was arranged. It was made clear to participants that there was no obligation for them to take part in the study; they may withdraw at any point and it would not have any impact on the care they were currently receiving or would receive in the future.

In the initial meeting the information sheet was reviewed and potential participants were given the opportunity to ask any questions. If potential participants were happy to participate in the study written consent was taken prior to administration of any measures. Thus, no data was collected from participants prior to the researcher collecting written consent.

2.5.3 Confidentiality and data storage.

All information pertaining to the study was confidential within the research team. Once consent had been gained, each participant was assigned a numerical study number to ensure their data remained anonymous, which was stored on a password-protected electronic database. Personal details such as names, addresses and contact numbers were also stored on a password protected database or phone and deleted when no longer needed or at the end of the study. If electronic data was transferred it was done so on an encrypted memory stick and met the NHS standards of data transfer. Passcodes were used on NHS, home, university and

laptop computers to ensure confidentiality at all times. Only anonymised data were stored on these computers.

An audio recorder was used to record interview-based measures (AANEX), providing participants had given their consent. These recordings were transferred immediately onto a computer after the session, transporting the audio recorder to the computer securely. Any recorded data sent via email was encrypted. Participant names were not used on recordings and were removed from the audio recorder once they had been transferred to the computer. The research supervisor rating these recordings for concordance purposes and deleted the recordings from their computer once they were no longer required. The computer used in this study was stored on either NHS or University premises.

Paper materials relating to the study were stored in a locked filing cabinet (e.g. questionnaires) at the UEA. The consent forms were stored in a locked cabinet at the UEA, separate to the remaining research materials (e.g. measures) to maximise participant anonymity. After data collection the researcher took the measures to the locked cabinet, transporting them securely.

2.5.4 Potential risks and benefits for participants and researcher.

There were no risks identified for participants taking part in the study. All the measures were standardized and had been previously administered within similar populations.

As part of the study participants were asked questions regarding their appraisals of their psychotic-like experiences (e.g. when you first experienced [this] how much control did you feel you had over the experience?) As it can be anxiety provoking to talk about difficult

experiences, participants were fully informed of this before consenting into the study. They were also told that they could speak to the researcher or their care team and had a right to withdraw at any point. In the event that the researcher had any cause for concern (e.g. due to participant distress or transition to psychosis) the protocol was that the session would be stopped immediately and the researcher would take the necessary action (e.g. speaking with the participants case manager or the on-call duty worker). All participants were provided with a debrief at the end of the study.

The potential benefits for participants taking part included contributing to research which hopes to find out more about how people process visual information and potentially allow a greater understanding to where difficulties may occur. This could help to inform psychological interventions for unusual experiences in the future. Participants also received £5 as a token of gratitude for taking part.

A potential risk to the researcher included visiting participants who wished to be seen at home. In this instance the researcher adhered to the UEA and service policies regarding lone working at all times. This involved informing their research supervisor or a member of the care team what time the appointment started and at what time it was expected to end and the address of the meeting (it is noteworthy that professional adhered to the confidentiality guidelines if they were provided with a participant address). The researcher informed the professional once the appointment has finished. This policy was used for all appointments where the participant was seen outside of the service. Research assessments were only conducted during working hours (8am - 6pm, Monday - Friday).

2.6 Plan of analysis

Data analysis was conducted using the Statistical Package for Social Sciences (SPSS) Version 23. The data from the three measures used in this study (DASS, AANEX, demographic questionnaire) and the susceptibility index from the visual illusions task were entered into SPSS for each participant. The data were checked to ensure they had been accurately inputted and cleaned. All relevant assumptions were checked prior to analysis of the data as outlined in the results section (Pallant, 2007).

2.6.1 Hypothesis one:

A clinical group of individuals reporting psychotic-like experiences will be significantly less susceptible to visual illusions in a size matching task in comparison to a non-clinical comparison group.

Independent samples t-tests were used to examine the hypothesis. This test was used to explore whether susceptibility to the visual illusions (using the susceptibility index score) differed significantly between the clinical and non-clinical groups.

In the event of a significant difference between the groups, a one-way analysis of covariance (ANCOVA) was planned to look at whether this difference remained significant after controlling for potential confounding variables (e.g. mood) measured by the DASS.

2.6.2 Research Questions:

Research question one: is there a relationship between the frequency of current and/or lifetime psychotic-like experiences and susceptibility to the visual illusions task in a clinical group of individuals reporting psychotic-like experiences?

Research question two: is there a relationship between appraisals or emotional responses to psychotic-like experiences and susceptibility to visual illusions in a clinical group of individuals reporting psychotic-like experiences?

Pearson product-moment correlations were planned to explore the research questions. Four correlations were planned to look at the strength of the relationship between: 'current' and 'lifetime' scores 'appraisal' and 'emotional' response scores on the ANNEX with the susceptibility index score for the clinical group.

If a significant relationship was found, partial correlations were planned to explore whether this relationship remained after controlling for the effects of potential confounding variables (e.g. mood) which were measured by the DASS.

3. Results

3.1 Overview of the Results Section

This section will outline the results from the statistical analyses conducted on the data collected from research participants. Initially the process used to screen the data (e.g. check for missing data and outliers) will be outlined followed by the procedures used to test assumptions. These processes were carried out before the data was analysed to minimise threats to validity.

This section also considers the primary hypothesis for the study followed by the two research questions. The method used to analyse the data as well as the outcomes will be described. At the end of this section the findings are summarised.

3.2 Data Screening and Assumption Testing

Before the data were analysed, they were screened to check for missing data and to ensure data input was accurate. The main variables of interest to this study (visual illusion susceptibility, frequency of 'current' and 'lifetime' anomalous experiences and symptom 'appraisals' and 'emotional' responses) and the control variables (depression, anxiety and stress scores) were screened and examined to see whether the assumptions for statistical analysis were met.

3.2.1 Missing data.

Every effort was taken to avoid missing data during the collection process by asking all the interview questions, encouraging participants to complete all the questionnaire items and checking these within the data collection sessions when possible.

During data input it was found that one participant had missed one item on the DASS questionnaire, accounting for only 1.3% of all cases and 2.4% of items on the individual questionnaire. Given that the missing data accounted for less than 5% of the overall measure, this item was replaced with a mean score based on the rest of the items endorsed on the questionnaire (Tabachnick & Fidell, 2007).

3.2.2 Outliers.

Boxplots and scatterplots were used to examine outliers prior to data analysis. No outliers were found for the variables measured in the clinical group. Between one and three outliers were identified in the non-clinical group for two variables (susceptibility scores and scores on the DASS). Outliers are usually found when a participant has been included from outside the population of interest therefore the extreme result may not be reflective of the population or it could be that the population of interest is diverse (David Clark-Carter, 2010). It was believed that diversity in the population was most likely. The analysis was run with and without these cases. No changes were found for significance and the effect size remained the same so the results have been reported with the full data set.

A small number of total trials (5.9%) on the visual illusion programme were accidently skipped by participants. This meant that the participants were not able to size match the comparison stimuli with the target stimuli because due to the design of the program, trials could not be repeated once the participant has pressed the ‘done’ tab to indicate the trial had been completed. The scores from these trials were subsequently removed from the dataset.

Participants in the non-clinical group were screened for a family history of psychosis because research has shown there may be a genetic link involved in the development of

psychotic-like symptoms (Greenwood et al., 2007). One participant was removed from the data analysis for this reason.

3.2.3 Assumption testing.

Histograms were used to check the normality of data distribution. Initial inspection revealed that the depression, anxiety and stress scores (collected from the DASS) were not normally distributed in either group. The clinical group were negatively skewed (suggesting participants experienced higher levels of depression, anxiety and stress) and scores in the non-clinical group were positively skewed (suggesting lower levels of depression, anxiety and stress). As discussed above, differences in the DASS scores between groups would be expected and suggests a clear distinction between the clinical and non-clinical group.

Shapiro-Wilk tests were used to further inspect the data statistically to ensure that assumptions for normality were met prior to analyses. The scores showed that three variables were not normally distributed: frequency of 'lifetime' anomalous experiences $p < .05$; 'appraisals' of psychotic-like experiences, $p < .05$ and 'emotional' responses, $p < .05$. In order to meet normality assumptions square root transformations were applied to each of these variables which corrected the skewness for severity of 'lifetime' anomalous experiences but did not improve skewness for the 'appraisals' and 'emotional' responses to psychotic-like experiences. Data analyses carried out with these variables were therefore non-parametric and formed part of the secondary analysis.

Levene's test for homogeneity of variance was carried out for t-tests and the appropriate statistic was reported based on whether equal variances were assumed. All statistics reported from the t-tests are two-tailed

For the correlation analysis, scatterplots were conducted to check for linearity and homoscedasticity and no problems were found.

3.3 Descriptive Data for Study Variables

3.3.1 Primary and secondary outcome variables.

Descriptive statistics for the primary and secondary outcome variables in the study are presented in Table 4.

Table 4

Descriptive Data for Study Variables

	Group	N	*M*	*SD*	Range
Susceptibility Scores	Clinical	25	0.15	0.03	0.10 – 0.20
	Non-Clinical	53	0.12	0.03	0.05 – 0.20
Current Anomalous Experiences	Clinical	25	25.52	5.55	16.00 – 36.00
Lifetime Anomalous Experiences	Clinical	25	30.80	7.97	17.00 – 51.00
Appraisals of Psychotic -Like Experiences	Clinical	25	20.58	1.30	5.00 – 9.00
Emotional Response of Psychotic-Like Experiences	Clinical	25	2.66	0.75	2.00 – 4.00

3.4 Differences between the clinical and non-clinical group

Statistical tests were conducted to explore whether there were differences between the clinical and non-clinical for potentially confounding variables including: gender, handedness and age.

Chi squared tests (with Yates Continuity Correction) indicated no significant differences for gender between groups, X^2 (1, n = 25), p = .85 or handedness between the clinical and non-clinical group, X^2 (1, n = 25), p = .88. An independent samples t-test found no differences in age between the clinical and non-clinical group, t (76) = 1.07, p = .30.

Independent samples t-tests exploring differences between the groups for DASS scores found the clinical group had significantly greater depression scores than the non-clinical group, t (76) = 11.05, p < .001, d = 2.59 (two-tailed), indicative of a large effect size. The clinical group also had significantly greater anxiety scores than the non-clinical group, t (76) = 15.13, p < .001, d = .87 (two-tailed), indicative of a medium effect size and significantly greater stress scores than the non-clinical group, t (76) = 10.58, p < .001 (two-tailed), d = .79, indicative of a medium effect size. Again, this illustrates a clear distinction between the clinical and non-clinical group in terms of mental health symptomology as would be expected.

3.5 Hypothesis Testing

3.5.1 Hypothesis one.

An independent samples t-test was used to explore the hypothesis that a group of young people having psychotic-like experiences would be less susceptible to visual illusions than a non-clinical group. Opposite to the prediction, the t-test found that the clinical group

(*M* = 0.15, *SD* = 0.03) were significantly more susceptible to visual illusions than the non-clinical group (*M* = 0.12, SD = 0.03), *t* (76) = 3.76 *p* > .0001, *d* = .94 (two-tailed), indicating a large effect size.

Due to the significant finding, an ANCOVA was conducted, controlling for depression, anxiety and stress scores. The ANCOVA found no significant difference between groups on susceptibility scores, F (1, 75) = .22, *p* = .64 after controlling for DASS scores. The effect size was small (eta squared = .003) suggesting these results should be interpreted tentatively.

3.6 Research Question Testing

3.6.1 Question one.

A Pearson's correlation was conducted to explore whether there was a relationship between the frequency of current anomalous experiences and susceptibility scores in the clinical group. The correlation was not significant , *r* = .240, *n* = 25, *p* = .248.

A Pearson's correlation was conducted to explore whether there was a relationship between the frequency of the transformed lifetime anomalous experience scores and susceptibility scores in the clinical group. The correlation was not significant, *r* = .349, *n* = 25, *p* = .087. This result is at trend level significance, suggesting that greater frequency of lifetime anomalous experiences led to greater perceptual errors on the visual illusions task (i.e. increased susceptibility). Due to the finding of a trend level of significance, a Pearson's Correlation was conducted to explore whether there was a relationship between DASS scores and illusion susceptibility scores. This is due to depression, anxiety and/or stress having been identified as potential confounding factors. No significant relationships were found for the

depression and anxiety subscales and illusion susceptibility. A significant relationship was found for scores on the stress scale and illusion susceptibility, $r = .439$, $n = 25$, $p = .028$, showing that higher scores on the stress scale were related to higher scores on the susceptibility index. This means that the greater stress a participant reported the more susceptible to illusions they were. A partial correlation was conducted between lifetime anomalous experiences and illusion susceptibility, controlling for scores on the stress scale. The partial correlation was not significant, $r = .116$, $n = 22$, $p = .591$.

A Spearman rho correlation was conducted to explore whether there was a relationship between appraisals of anomalous experiences and susceptibility scores in the clinical group. This non-parametric test was chosen because the data for appraisals of anomalous experiences was not normally distributed, violating assumptions for a Pearson's correlation. The correlation was not significant, $r = -.087$, $n = 25$, $p = .68$.

A Spearman rho correlation was conducted to explore whether there was a relationship between emotional responses to anomalous experiences and susceptibility scores in the clinical group. Again, this non-parametric test was chosen because the data for emotional responses to anomalous experiences was not normally distributed, violating assumptions for a Pearson's correlation. The correlation was not significant, $r = .115$, $n = 25$, $p = .58$.

3.7 Summary of Results Section

The research found that the clinical group were significantly more susceptible to visual illusions than the non-clinical group. The effect size for this result was large, suggesting that valid interpretations could be made. However, when depression, anxiety and

stress scores from the DASS were controlled for, no significant difference was found between the groups for illusion susceptibility.

No relationship was found between susceptibility scores in the clinical group and frequency of 'current' or 'lifetime' anomalous experiences. No relationship was found between susceptibility scores in the clinical group and 'appraisals' or 'emotional' responses to psychotic-like experiences.

The implications for these results will be considered below.

4. Discussion

4.1 Overview of the Discussion

This section will first re-outline the aims and rationale of the current study. The research findings will be summarised, including the primary hypothesis and the two research questions. The findings of the current study will be compared to the results of previous research, and the theoretical and clinical implications of the results will be considered. The strengths and limitations of the current study will be discussed, followed by suggestions for future areas of research.

4.2 Aims of the Research

The primary aim of the current study was to explore whether young people having psychotic-like experiences were less susceptible to visual illusions than a healthy control group. The rationale for this aim will be briefly summarised below.

Adverse life events are believed to trigger a "basic cognitive disruption" in individuals with a pre-disposing vulnerability which impedes the integration of visual information at various points along the neural circuity (Hemsley, 2005). The two mechanisms implicated in this disruption are bottom-up and top-down processes, the successful co-ordination of which are required to provide a coherent visual representation of an individual's environment.

The "basic cognitive disruption" is thought to underlie a number of anomalous experiences reported by individuals with psychosis including: feelings the world has altered; feelings of salience and hallucinatory phenomena. Although much is known about the types of anomalous experiences reported by individuals with psychosis, less is known about the

mechanisms which may underlie them. Visual illusion paradigms are useful in exploring the impact of a "basic cognitive disruption" because they illustrate the visual systems ability to integrate top-down and bottom-up processing in perception. (Notredame, Pins, Deneve, & Jadri, 2014).

Prior research has found psychosis and at-risk populations are less susceptible to visual illusions than non-clinical groups, providing empirical support for this theory. Visual illusions paradigms have been useful clinically, suggesting psychosis populations process visual information with reduced contextual integration and/or an overreliance on sensory information with no organising framework, leading to a potentially incoherent, fragmented image of the world (e.g. Dima et al., 2009; Kantrowitz et al., 2009; Mittal et al., 2015; Silverstein et al., 2013; Uhlhaas et al., 2006).

This has led to increasing interest in this area. However the majority of research to date has been conducted in populations who have a clinical diagnosis of psychosis or a long-standing diagnosis of schizophrenia, suggesting differences in visual processing may be part of the disease process or specific to clinical populations. For this reason the current study aimed to explore whether a group of young people, accessing mental health services, and having psychotic-like experiences outside of a clinical diagnosis were less susceptible to visual illusions than a group of healthy controls. This aim of this study was also borne out of clinical implications for these investigations, including the potential to provide a normalising explanation for psychotic-like experiences.

Secondary aims of this study involved investigating whether there was a relationship between the frequency of current and/or lifetime psychotic-like experiences and illusion susceptibility within the clinical group. Frequency of psychotic-like experiences was

explored because if a "basic cognitive disruption" does indeed underlie anomalous experiences the frequency at which an individual has these experiences may be related to the level of disruption between the integration of bottom-up and top-down processes. As discussed above, visual illusion paradigms are useful because they provide an experimental method of investigating the co-ordination of these processes.

Appraisals and emotional responses to psychotic-like experiences were also explored to see whether there was a relationship with susceptibility scores in the clinical group. The rationale for this was based on the cognitive model of psychosis which implicates individual appraisals and emotional responses to psychotic-like experiences as an important mechanism underlying the development and maintenance of psychotic phenomena (Garety et al., 2001; Morrison, 2001). This is relevant to the current study given that a "basic cognitive disruption" (which is of particular interest to this research) is believed to underlie psychotic-like experiences. Subsequent appraisals and emotional responses may therefore influence the development of the psychotic-like experiences implicated (e.g. a sense that the world is different or altered in some way, hallucinatory phenomena, feelings of salience) but they may also impact on other psychotic symptoms, such as delusion formation. For these reasons exploring the relationship between appraisal and/or emotional responses and the processing of visual information (as measured the visual illusion task) was an aim of this study.

4.3 Summary of Research Findings

4.3.1 Hypothesis one.

It was hypothesised that a group of young people having psychotic-like experiences would be less susceptible to a size-matching visual illusion task than a healthy control group.

Contrary to this hypothesis, the clinical group were significantly more susceptible to visual illusions than the non-clinical group. This result became non-significant after controlling for depression, anxiety and stress scores. The theoretical and clinical implications for these findings will be discussed in the following sections.

4.3.2 Research question one.

The first research question explored whether there was a relationship between the frequency of psychotic-like experiences (including current experiences and those experienced over an individual's lifetime) and illusion susceptibility in the clinical group. No significant relationships were found for either time points, suggesting the frequency of psychotic-like experiences was not related to the perception of visual illusions within the clinical group.

4.3.3 Research question two.

The second research question investigated whether there was a relationship between appraisals and/or emotional response to psychotic-like experiences and illusion susceptibility. No significant relationships were found, suggesting appraisals and emotional responses were not related to the perception of visual illusions within the clinical group. Again, the theoretical and clinical implications for these findings will be discussed in the following sections.

4.4 Links with Past Research and Theory

The primary results from the current study are not consistent with previous findings in psychosis populations and the results were different from those expected given the research hypothesis. However, the results are in part consistent with some previous findings (which

will be discussed below) and provide novel information for a clinical group who is not believed to have been previously studied using a visual paradigm comprising of 13 illusions.

This section will first consider the results from the primary hypothesis for this study in relation to previous findings and provide possible explanations to the unexpected findings. The secondary analysis which did not find any significant results will then be considered and reasons for the non-significant findings will be outlined.

4.4.1 Findings from the Primary Hypothesis.

4.4.1.1 Visual illusion susceptibility in clinical and non-clinical groups.

The finding that there were no significant differences in illusion susceptibility between a clinical group having psychotic-like experiences and a non-clinical group, after controlling for depression, anxiety and stress scores is not consistent with previous research finding psychosis populations exhibit superior performances in visual illusions paradigms in comparison to non-clinical groups (i.e. they are less susceptible to visual illusions) (e.g. Dima et al., 2009; Kantrowitz et al., 2009; Mittal et al., 2015; Silverstein et al., 2013; Uhlhaas et al., 2006).

The strength of the effect size for this study cannot be directly compared with similar populations because it is believed that a clinical group having psychotic-like experiences outside of a clinical or at-risk diagnosis have not been studied previously using a visual illusion paradigm. The effect size for group differences in illusion susceptibility before controlling for mood was above the standard cut off for a large effect size suggesting these findings were interpretable based on the power calculation detailed in the method section

(Cohen, 1992). When controlling for depression, anxiety and stress scores the effect size was found to be small, suggesting the results should be interpreted tentatively.

The scores from the mood measure (the DASS) suggest that the clinical group were experiencing additional mental health problems including anxiety and low mood. The finding that there was a significant difference for illusion susceptibility between the clinical and non-clinical group and that this effect became non-significant when controlling for mood scores therefore suggests individuals with high levels of anxiety, low mood and stress are more susceptible to visual illusions. Previous research has found that emotional states affect visual perception (Zahra & Clore, 2011). Individuals experiencing low mood perceive the steepness of a slope as significantly greater than those experiencing a positive mood. Estimates of the gradient of a hill were also greater during a fear induced task in which participants stood on a skateboard at the top of the hill (held in place by chocking the wheels) in comparison to a control task (standing on a stable box), implicating emotion as a potential factor influencing how the external world is perceived (Stefanucci, Proffitt, Clore & Parekh, 2008). In a semantic priming study participants were briefly shown a priming word (representing either a bad or good meaning) and then asked to evaluate a second word (e.g. pressing a button to indicate whether it was a good or bad word) (Storbeck and Clore, 2008). One group were played music chosen to evoke positive affect whilst a second group were played music designed to evoke a sad state. Prior research has found that individuals are quicker to respond to words following a brief display of a similar word (the prime) (Klauer & Musch, 2003). Storbeck and Clore (2008) found this did not happen for the group who experienced a sad mood. Again, these results fit with the findings of this study, implicating that emotional states may lead to differences in how visual information is processed.

Another explanation for the findings could be that previous research investigating illusion susceptibility has done so with individuals experiencing chronic psychosis. Silverstein et al., (2009) explored illusion susceptibility amongst a group of inpatients with a diagnosis of schizophrenia and a healthy control group found. The study found that differences in illusion susceptibility diminished (i.e. the clinical group no longer exhibited lower susceptibility to visual illusions) when participants were tested at discharge from inpatient treatment (Silverstein et al., 2009). These findings suggest that potential disruptions to the visual system may be amenable to repair following treatment, leading to successful integration of bottom-up and top-down processing. They also suggest that disruptions as a result of a "basic cognitive disruption" may be a feature of chronic psychosis which would explain why the clinical group did not demonstrate lower susceptibility in comparison to the non-clinical group in this study.

It is noteworthy that the findings do not contradict all prior research exploring illusion susceptibility in psychosis populations. Kantrowitz et al. (2009) found a clinical group with a diagnosis of schizophrenia demonstrated increased susceptibility to the Muller-Lyer illusion in comparison with a healthy control group. It has been hypothesised that this could be due to differences in the very early stages of visual processing (relating to the perception of contrast; Kantrowitz et al., 2009) as opposed to difficulties with the integration of top-down and bottom-up processes (implicated by Hemley's 2005 cognitive model). Specifically, mechanisms which enable boundaries between two different contrasts to be differentiated (e.g. the Muller-Lyer image from its background) have been found to be dysfunctional in psychosis populations (Kantrowitz et al., 2009). The Muller-Lyer is one illusion believed to become more apparent (i.e. the true image is more readily seen as its actual figure) at full contrast (as displayed in Kantrowitz et al., 2009). The ability to distinguish contrasts would

therefore be particularly advantageous for this visual illusion, potentially explaining why a non-clinical comparison group were less susceptible to the Muller-Lyer illusion compared to a clinical group. This study therefore provides some support for the notion that differences occurring in the very early stages of processing (relating to contrast perception) may underlie an increased susceptibility to illusions (e.g. Kantrowitz et al., 2009; Yang et al., 2013). However, this does not account for an overall increased susceptibility to the 13 visual illusions. Connected to this, there is an argument that additional studies may be subject to a "file drawer effect", biasing published studies to those finding significant effects which fit with prior research (Yang et al., 2013).

4.4.1.2 Methodology of the visual illusion paradigm.

4.4.1.2.1 Size matching tasks versus forced choice responses.

Although the above explanations may go some way in explaining the findings of the current study they do not fully explain why a clinical group having psychotic experiences coupled with high levels of anxiety, depression and stress were significantly more susceptible to visual illusions than the non-clinical group.

One reason for this may be due to the methodology used in the visual illusion task in comparison with previous studies. This study chose a size-matching task in which participants altered the size of a comparison stimulus to match a target stimulus. The majority of previously published studies have used a forced choice design in which participants have to indicate which of two stimuli is larger or smaller or whether two stimuli are the same size or different (e.g. Dima et al., 2009; Kantrowitz et al., 2009; Silverstein et al., 2013; Uhlhaas et al., 2006, Yang et al., 2013). Forced choice responses are dependent on subjective

thresholds for whether the comparison stimulus meets the requirements and the response given is therefore subject to individual variation. For example one individual which has a 'low threshold' criteria when asked "are these two stimuli the same or different?" may see two images which appear almost matched and give a response to indicate they are the same. Another individual with a 'high threshold' criteria asked the same question for the same stimuli may also see stimuli which are closely matched in size. However due to their subjectively high threshold they may give a response to indicate the images are different (Skottun & Skoyles, 2013). The use of a size-matching task in this study may have therefore reduced potential confounding factors of a forced choice task, which has been used in the majority of published studies exploring visual illusion paradigms in psychosis populations, and contributed to differences in visual susceptibility findings in comparison to previous literature.

4.4.1.2.2 The use of a battery of illusions versus individual illusions.

The majority of previous studies exploring illusion susceptibility within psychosis population have done so with less than three visual illusions (e.g. Dima et al., 2009; Silverstein et al., 2013; Uhlhaas et al., 2006, Yang et al., 2013) whereas the current study used a battery of 13 different visual illusions. The susceptibility score used to compare the two groups was based on data from all 13 visual illusions. The illusions were also looked at individually and the clinical group were either significantly more susceptible or there was no significant difference between either group across all 13 visual illusions. A wider variety of visual illusions may have enabled a more comprehensive comparison of visual processing mechanisms between a clinical and non-clinical group. Moreover seven of the visual illusions included in this battery have not been tested within published psychosis populations

previously (e.g. Debleouf, Ehrenstein, Helmholtz-Square, Horizontal-Vertical, Jastrow, Shepard and Square-Diamond), potentially explaining the contrary findings reported in this study.

4.4.2.1 Anti-psychotic medication as a confounding variable.

This study initially aimed to explore illusions susceptibility in a group having psychotic-like experiences who weren't taking anti-psychotic medication. Due to low participant uptake as a result of this exclusion criteria a substantial amendment was approved which allowed for the recruitment of the clinical sample. For this reason the majority of the clinical sample comprises of individuals who were taking anti-psychotic medication which may pose a potential confounding factor for the results of this study.

There are mixed findings with respect anti-psychotic medication usage and its impact on visual illusion susceptibility. Differences in perceptual grouping tasks have been found in psychosis populations who have been taking antipsychotic medication (as well as those who haven't), suggesting antipsychotic medication may not significantly impact on visual processing tasks such as the visual illusion paradigm presented in this study (e.g. Frith, Stevens, Johnstone &, Owens 1983; Silverstein et al., 2009). Other studies exploring the impact of anti-psychotic medication in psychosis populations have found differences in illusion susceptibility based on medication dosage. One study found that the group taking the highest anti-psychotic dosages made greater "perceptual errors", indicating that these individuals were more susceptible to visual illusions (Diržius, Liutkevičius, Žukauskaite, Leskauskas & Bulatov, 2013). These findings highlight anti-psychotic medication as a potential confounding variable, providing a possible explanation for the current findings and highlighting that any conclusions should be tentative.

4.4.2.2 The impact of specific psychotic-like experiences.

This study investigated illusion susceptibility in a clinical group having low-level unusual experiences. The psychotic-like experiences explored in this study were not specifically related to those implicated by a "basic cognitive disruption" (e.g. feelings the world is altered, feelings of salience, hallucinatory phenomena) because the study wanted to explore whether general experiences of psychotic-like symptoms impacted on illusion susceptibility.

A previous study comparing illusion susceptibility in a clinical group with a diagnosis of schizophrenia and a non-clinical control group found reduced susceptibility in the clinical group only when considering a subset of the population. The study found that individuals experiencing thought disorder and disorganisation exhibited reduced susceptibility to visual illusions in comparison to a control group (Yang et al., 2013). These findings suggest specific unusual experiences could lead to differences in illusion susceptibility between clinical and non-clinical groups where as other do not. The wide range of psychotic-like experiences included in this study may account for reduced susceptibility not being found in the clinical group, however this does not account for the increased susceptibility.

4.4.3 Findings from the research questions.

4.4.3.1 Research question one.

The finding that the frequency of current or lifetime psychotic-like experiences were not related to illusion susceptibility is a novel area of research. Therefore these findings cannot be compared to previous studies. However, the reasons for these findings can be speculated. One explanation could be that the clinical population studied did not have a

diagnosis of psychosis and were not measured as being at-risk of transitioning to psychosis suggesting that a disruption in the co-ordination of bottom-up and top-down processes as a result of a "basic cognitive disruption" was not triggered and is a feature of chronic psychosis. Again, previous research has found that differences in illusion susceptibility remitted once participants were discharged from an inpatient unit (Silverstein et al., 2009), suggesting that visual processing difficulties resolve when psychotic symptoms have reduced. Individuals in this study were having very low-level psychotic-like experiences which may not have met a threshold required to significantly disrupt bottom-up and top-down processes as reported in previous studies.

Another rationale for these findings could be that the clinical group comprised of individuals having a wide range of psychotic-like experiences. The PQ questionnaire used to screen participants for the clinical group included questions relating to unusual perceptual experiences but also included questions such as "I feel uninterested in the things I used to enjoy" or "I feel extremely anxious when meeting people for the first time" (Loewy et al., 2005). As discussed above, it is possible that individuals having psychotic-like experiences specifically implicated by a "basic cognitive disruption" (e.g. feeling the world is altered, feelings of salience, hallucinatory phenomena) may be less susceptible to visual illusions which was not captured within the clinical group in this study. Equally this may also mean that individuals who are highly anxious and depressed are more susceptible to visual illusions. A significant correlation was found between stress scores and visual illusions, suggesting higher levels of stress were related to increased susceptibility to visual illusions.

4.4.3.2 Research question two.

The findings that appraisals and emotional responses were not related to illusion susceptibility is also a novel area of research. As above, these results cannot be directly compared to previous studies but the reason for these findings will be considered.

One explanation for these findings could be that appraisals are not necessarily related to the frequency and/or severity of psychotic-like experiences but are based on individual interpretation. According to the cognitive model of psychosis, perceptual changes trigger a sense making process, aimed at providing meaning to unusual experiences (Garety et al. 2001). Initial perceptual changes are seen as uncharacteristic to everyday visual experiences and subsequent appraisals influence the future experience of symptoms. Appraisals and emotional responses to current situations are heavily based on prior life events. This means that two individuals experiencing psychotic-like experiences of similar frequency or intensity could interpret and respond to these experiences in very different ways. For example, an individual having lived through severe early life adversities may likely appraise subsequent perceptual changes occurring as a result of a "basic cognitive disruption" within a negative framework (e.g. being outside of their control), and experience feelings of distress (e.g. increased anxiety) (Kilcommons & Morrison, 2005; Hanssen et al., 2005; Freeman, Garety, Kuipers, Fowler, & Bebbington, 2002). Vulnerable individuals are also more likely to experience a "dopamine sensitivity" making them more susceptible to "jump to conclusions" on the basis of limited (often negatively framed) evidence (van der Gaag et al., 2012). Another individual experiencing similar psychotic symptoms with different life experiences may appraise similar intensity of symptoms in a more positive framework (e.g. due to sleep deprivation).

The clinical group in this study scored highly on appraisals and emotional responses, both of which were indicative of a more negative response to the psychotic-like experiences. However the psychotic-like symptoms experienced by the clinical group were measured as being very low-level in terms of their presence and frequency. Previous research has shown psychotic-like experiences exist on a continuum, ranging from psychotic disorders at one end and non-clinical psychotic-like experiences at the other end (Johns & Van Os, 2001; BPS, 2014). The symptoms experienced by the clinical group in this study were outside of a clinical diagnosis. One reason no relationship was found for appraisals and susceptibility scores could be that low-level psychotic-like experiences had not arisen as a result of a "basic cognitive disruption" and regardless of individual symptom appraisal and/or emotional response they did not reach a threshold to trigger integration difficulties between bottom-up and top-down processes. On the other hand high levels of anxiety and low mood may underlie perceptual changes which increase susceptibility to visual illusions.

4.4.4 Theoretical and research implications of the findings.

The majority of previous research exploring visual illusion susceptibility to understand mechanisms which may underlie unusual perceptual experiences occurring as a consequence of a "basic cognitive disruption" have done so with populations with: a clinical diagnosis of psychosis; a longstanding diagnosis of schizophrenia or with a group measured at-risk of transitioning to psychosis (Dima et al., 2009; Kantrowitz et al., 2009; Silverstein et al., 2013; Uhlhaas et al., 2006, Yang et al., 2013). The current study investigated a visual illusion paradigm within a previously unstudied population who were having psychotic-like experiences outside of a clinical diagnosis and provides potentially novel information regarding the mechanisms underlying psychotic-like experiences.

As outlined in the introduction, the cognitive model of psychosis postulates a "basic cognitive disruption" as a potential mechanism underlying unusual perceptual experiences (Hemsley, 2001). This disruption is thought to interrupt integrative visual processes which would usually enable coherent images to be formed. As a result, individuals experience greater piecemeal processing with a reduced influence of prior knowledge to provide context to make sense of their environment. With no or limited context (e.g. knowledge of depth cues) psychosis populations have been found to see visual illusions as their true external image, rather than the illusion they aim to create (e.g. Dima et al., 2009; Kantrowitz et al., 2009; Silverstein et al., 2013; Uhlhaas et al., 2006, Yang et al., 2013).

The findings of this study are therefore not consistent with the cognitive model of psychosis or previous literature in this area because the clinical group were significantly more susceptible to visual illusions than the non-clinical group, suggesting they made greater perceptual errors. Given that this research was conducted with a novel population and a novel method of measuring illusion susceptibility, the findings from this study do not necessarily refute the cognitive model of psychosis or findings from published studies (e.g. Hemsley, 2005; Dima et al., 2009; Uhlhaas et al., 2006). However, they do suggest that low-level psychotic-like experiences outside of a clinical diagnosis (regardless of 'current' or 'lifetime' frequency) may not be influenced by difficulties in the co-ordination of bottom-up and top-down processing as a result of a "basic cognitive disruption". It could be speculated that psychotic-like experiences outside of an at-risk or clinical diagnosis do not meet a threshold required to trigger a "basic cognitive disruption" in visual processing channels, and that such a disruption may underlie more severe psychotic experiences.

However, the finding that the clinical group are more susceptible to illusions in this study suggests a difference in perception between clinical and non-clinical individuals. This difference could be responsible for unusual experiences which, if appraised in a distressing way, could lead to psychosis, as proposed in Garety et al's (2001) cognitive model of psychosis.

The finding that appraisals and emotional responses to psychotic-like symptoms are not related to illusion susceptibility fits with the cognitive model of positive symptoms of psychosis (Garety et al., 2001). As discussed above, this theory postulates that appraisals and emotional responses to psychotic-like experiences influence the development and maintenance of future symptoms. Individual interpretations of these experiences are subject to individual variation, based on prior life events which influence schematic representations of the self, others and the world (Fowler et al., 2006; Beck, 1976). A relationship between appraisals and/or emotion responses to psychotic-like experiences and susceptibility scores would not necessarily follow on this basis because one person experiencing a feeling that the world has altered may appraise this more negatively than another person having a similar psychotic-experience.

This study also found that the clinical group exhibited high levels of negative appraisals and emotional responses (e.g. appraising their symptoms in a negative valence, experiencing high levels of anxiety). These results fit with previous research which has found these types of responses to be higher in clinical populations accessing mental health support (Brett et al., 2007). Although these scores could not be directly compared to a relevant control group (e.g. participants having psychotic-like experiences outside of secondary mental health services) they suggest that individuals in clinical settings experience appraisals

and emotional responses which are associated with may put them at increased vulnerability to the development and maintenance of psychotic-like experiences (e.g. Garety et al., 2001; Hanssen et al. 2005; Morrison et al., 2001).

It is also noteworthy that the findings of this study fit with a continuum approach for psychotic symptoms (BPS, 2014). Although this was not a direct aim of the study, recruitment of clinical participants was carried out in a general secondary mental health service and participants were not considered to have a diagnosis or be at-risk of developing psychosis. This adds further evidence to the view that psychotic-like symptoms are part of a spectrum, ranging from experiences within the general population to those present within clinical disorders (Johns & Van Os, 2001).

4.5 Clinical Implications

The finding that a clinical group were more susceptible to visual illusions than a non-clinical group suggests a difference in perception between these individuals. Although the exact mechanisms require further investigation, providing an explanation for these experiences being the result of differences in the way visual information is being processed may potentially reducing the likelihood of further progression of these symptoms (e.g. delusion formation). Kingdon and Turkingdon (1991) used a cognitive behavioural therapy approach with a strong "destigmatising rationale" to provide a clear reason for the development of psychotic symptoms. They found positive outcomes from this approach, including reduced anxiety, increased feelings of hope and reduced hospital admission. The results of this study suggest that high levels of anxiety may be a factor influencing differences in perception which could underlie psychotic-like experiences. Treatment

interventions which reduce negative emotional states may therefore reduce these perceptual differences which could lead to the development of psychosis.

Providing explanations of psychotic-like experiences may also be particularly pertinent within a group of individuals with psychotic-like experiences given research suggesting individuals at risk of psychotic phenomena have a "dopamine supersensitivity" which may cause biases in perception and cognition, increasing the likelihood of perceptual aberrations (van der Gaag et al., 2012). It may also reduce high levels of emotional distress (e.g. anxiety and low mood) as found in this study which may be contributing to differences in visual perception and giving rise to anomalous experiences (Zadra & Clore, 2011). Cognitive therapy approaches for individuals with at-risk mental states focus on normalising unusual experiences in order to reduce the likelihood of delusion formation. Freeman et al. (2002) propose that people with anomalous experiences may not develop full blown psychotic symptoms if they adopt a more normalising explanation for their experiences (e.g. "I thought [this] had a significant meaning to me but it was probably because I was stressed").

Moreover, cognitive behavioural therapy (CBT) is most effective in treating psychosis when anomalous experiences are re-appraised as being self-generated (Fowler, Garety & Kuipers, 1995). Having an explanation for anomalous experiences as the result of a different perceptual style may therefore support individuals to not go down a route in which they could develop delusional appraisals to explain their unusual experiences, potentially resulting in the development of psychosis. There have also been some encouraging findings for the psychological treatment of help seeking individuals with psychotic symptoms who have not transitioned to psychosis. Preti and Cellar (2010) reviewed five randomised control trials

using CBT and found that transition rates to psychosis in the treatment groups were 11% and 31.6% in the control group. One randomized control trial conducted a three year follow up. They found that cognitive therapy significantly reduced the chance of antipsychotic medication prescription and the likelihood of transition to psychosis (Morrison, French & Wells, 2007b).

Given the complexity of the clinical picture, in terms of the potential for a "basic cognitive disruption" and affective states (e.g. high levels of anxiety and depression) to underlie differences in visual perception, use of an tailored psychological formulation developed collaboratively with the client, acknowledging a range of experiences is likely to be beneficial for improving psychological understanding and outcomes for individuals having psychotic-like experiences (Johnstone & Dallos, 2014).

4.6 Strengths and Limitations of the Research

4.6.1 Limitations of the study.

4.6.1.1 Sample size.

The original minimum number of clinical participants required to achieve sufficient statistical power was calculated as 45 and this study achieved 25 participants. This was not a limitation for the primary hypothesis because a large effect was found. A smaller sample size may have been a limitation for the secondary research questions which were non-significant.

This was despite substantial efforts to recruit participants through various strategies including: maintaining regular contact with team managers, psychologists and case managers; frequent promotion of the study through attendance at team meetings; expansion of inclusion criteria with regards to age; removal of the exclusion criteria with regards anti-psychotic

medication usage; extension of the time frame to recruit and expanding recruitment to additional services within the NSFT.

The PQ screening measure for this study was initially planned to be used routinely within the secondary mental health service where the recruitment was taking place and administered by staff members to all clients. However, this was not introduced during the time frame allocated to recruit into this study. This was due to organisational changes outside of researcher control. This may have made the identification of participants for the study considerably more difficult because the PQ measured low-level unusual experiences (of particular interest to this study) which may not have been asked as part of the existing routine assessment questions.

An additional challenge was the organisational changes the service was experiencing at the time of recruitment, which led to alterations in team structures, including staff members relocating to different teams, and new staff entering the mental health teams. Understandably this may have led to reluctance to commit to research activities during what was already a very busy time.

It may also have been that the symptoms of interest (psychotic-like experiences) contributed to difficulties in some clients engaging in additional research activity (e.g. due to experience feeling of anxiety in relation to their experiences).

Although a small sample size represents a limitation for the study, the recruitment of 25 participants to the clinical sample does still allow statistical comparisons to be considered. Again, this was not a limitation for the primary hypothesis because a large effect was found.

A small sample size may represent a limitation for the secondary research questions which were found to be non-significant.

4.6.1.2 Number of appraisal and emotional items measured.

The appraisals and emotional responses to psychotic-like experiences investigated in this study were chosen because previous research has found these contribute to psychotic symptom development and maintenance (Garety et al., 2001). Due to the time constraints for this study a small number of appraisals and emotional responses, totalling five items were chosen to be investigated. Given the small number of items, the range of scores for appraisals and emotional responses to psychotic-like symptoms were relatively small. The data for these variables were not normally distributed and were not corrected by square root transformations. This violated parametric assumptions for Pearson correlations meaning that the non-parametric alternative (Spearmans Rho) was used to analyse the data. Non-parametric test lack power, particularly with small sample sizes meaning that any interpretations of the data are tentative (Whitley & Ball, 2002). As discussed in the method section, the AANEX measure (from which the items were chosen) has a flexible format which enables researchers to measure items of most interest to the study. If this study was designed again a greater number of appraisals and emotional responses from the AANEX would be measured because the small number of items measured in this study represents a weakness of the research. A greater number of items would increase the likelihood that the data would be normally distributed which would allowing parametric tests to be used with the potential to provide clinically relevant information about a wider range of appraisals and emotions in the clinical group.

4.6.2 Strengths of the study.

4.6.2.1 Use of a novel clinical population.

A strength of the current research is recruitment of a clinical sample which has not previously been investigated in published studies. As discussed above, the majority of previous research exploring illusion susceptibility in psychosis populations has been carried out with individuals with a diagnosis of psychosis or schizophrenia or people measured at-risk of developing psychosis. It is hoped that this research has contributed to an under-researched area, providing novel insights into mechanisms underlying psychotic-like experiences within a clinical population.

4.6.2.2 Use of a range of suitable measures and control variables.

A further strength of this study was the range of methods used to measure different variables. This study included self-report questionnaires and an experimental computer task to explore whether there were any differences between a clinical group having psychotic-like experiences and a non-clinical comparison group with regards their susceptibility to illusions. The combination of these tasks is likely to reduce the chance that participants would develop beliefs about the aims of the study and potentially modify their answers accordingly, increasing the construct validity of the findings (Kazdin, 2010).

This study also used a battery of 13 visual illusions whereas the majority of previous studies have explored illusion susceptibility with between one and three visual illusions (e.g. Dima et al., 2009; Kantrowitz et al., 2009; Silverstein et al., 2013; Uhlhaas et al., 2006, Yang et al., 2013). Greater variation in the types and variations of visual illusions may allow for a

more comprehensive assessment of general susceptibility to visual illusions between a clinical and non-clinical population, which has not been captured by previous research.

Appropriately measuring control variables is a strength of this study. Although a number of studies have measured illusion susceptibility in psychosis populations they have not controlled for potential confounding variables such as depression, anxiety and stress, as measured by the DASS in this study (e.g. Dima et al., 2009; Kantrowitz et al., 2009; Silverstein et al., 2013). These symptoms are important to consider because they are highly prevalent in psychosis populations. A meta-analysis of 1683 individuals measured at-risk of transitioning to psychosis found comorbid diagnoses of anxiety disorders were 15% and diagnoses of depressive disorders were found for 41% of the group (Fusar-Poli, Nelson, Valmaggia, Yung, & McGuire, 2014). These symptoms may also influence engagement with the research process. For example feelings of low mood may affect motivation to engage with the research tasks, whilst feelings of anxiety and/or stress could influence the ability to attend to the research materials. The measurement of appropriate confounding variables in this study meant they could be controlled for in the analysis if relevant, increasing the reliability and validity of the study findings. In addition, careful attention was made to include measures which were valid for the population being studied and relevant to the main variables of interest.

4.7 Future Direction for Research

A number of areas could be considered for future research. First, replication of the methodology of this study, including a size-matching task exploring illusion susceptibility. This would increase the validity of the findings that forced-choice designs may not capture (Skottun & Skoyles, 2013). As discussed above, the majority of previous research

investigating illusion susceptibility have done so with forced-choice designs which may impact on the generalisability of these findings. This study explored illusions susceptibility with a novel population. Future research would benefit from replicating this study with a similar population (i.e. a clinical group having psychotic-like experiences outside of a clinical diagnosis) which would increase the reliability of these findings. Future research might also consider a greater sample size. This would also increase the reliability and validity of the findings for the research questions and allow for exploration of illusion susceptibility amongst sub-groups on the basis of different psychotic-like symptoms. Previous research has found reduced susceptibility in a clinical group only when considering a subset of the population who were experiencing thought disorder and disorganisation (Yang et al., 2013). Future studies may benefit from additional measures to give an in depth assessment of the types of psychotic-symptoms being experienced. Additional research would also benefit from measuring affective states (e.g. anxiety and depression) to elucidate whether emotions may be underlying anomalies of perception.

Although this study attempted to recruit participants who were not taking anti-psychotic medication, low participant uptake led to this being removed as an exclusion criteria. Future research exploring illusion susceptibility in a psychosis population who are not taking anti-psychotic medication would remove this potential confounding factor.

Longitudinal research exploring illusion susceptibility within a population of young people having psychotic-like experiences with a comparison group may also merit future investigation. The consent forms used in this study asked if participants would be happy to be contacted in 12 month's time. The majority of participants consented to being contacted (24 out of 25) suggesting longitudinal research with the same population could be conducted to

explore whether there were any differences in illusion susceptibility in the clinical group at a later time point. Longitudinal research in general could be useful in exploring whether susceptibility to illusions changes over time and whether this was related to the severity of psychotic-like experiences to explore. This may increase understanding of the potential mechanisms underlying a "basic cognitive disruption" and whether they are indeed a feature of chronic psychosis. Previous research has already found that reduced susceptibility to illusions diminished in a clinical group when participants were tested before charge from an inpatient hospital, suggesting there may be a relationship between symptom severity and illusion susceptibility (Silverstein et al. 2013).

4.8 Conclusion

The research adds to psychosis literature exploring visual illusion susceptibility with a novel population (a clinical group reporting psychotic-experiences outside of a clinical diagnosis) using a large set of 13 visual illusions.

The study aimed to explore how individuals with psychotic-like experiences perceive the world around them in comparison to healthy controls. In doing so the research hoped to explore particular mechanisms which may underlie anomalous experiences. The particular mechanism which this study aims to focus on is whether disruptions in visual processing may underlie psychotic symptoms.

The finding that a clinical group were more susceptible to visual illusions than a non-clinical group suggested that psychotic-like experiences outside of a clinical diagnosis did not occur as a result of the "basic cognitive disruption" as implicated by Hemsley's (2005) cognitive model.

However, differences in perceptual processing were observed between the groups and a number of explanations, based on previous research, were presented to understand the findings. These include potential deficits in the early stages of visual processing (e.g. contrast perception) which may lead to increased susceptibility to illusions (Kantrowitz et al., 2009). Previous studies have found that individuals with a diagnosis of schizophrenia to be more susceptible to illusions (Silverstein et al., 2013). Another explanation may be that psychotic-like experiences occurring as a result of a "basic cognitive dysfunction" may be a feature chronic psychosis. Equally the results may mean that individuals who are highly anxious and depressed are more susceptible to visual illusions. Previous literature has found emotional arousal affects perception of the environment (Zadra & Clore, 2011).

Methodological issues were also reviewed in order to understand the findings of the study. The majority of previously published studies within psychosis populations have used a forced choice design. The use of a size-matching task in this study may have increased the validity of findings and accounted for the observed differences in illusion susceptibility in comparison with existing literature (Skottun & Skoyles, 2013). Previous studies exploring illusion susceptibility within psychosis populations have also done so with less than three visual illusions (e.g. Dima et al., 2009; Silverstein et al., 2013; Uhlhaas et al., 2006, Yang et al., 2013) whereas the current study used a battery of 13 different visual illusions. A wider variety of visual illusions may have enabled a more comprehensive comparison of visual processing mechanisms between a clinical and non-clinical group.

Previous studies exploring the impact of anti-psychotic medication in psychosis populations have found differences in illusion susceptibility based on medication dosage (Diržius, Liutkevičius, Žukauskaite, Leskauskas & Bulatov, 2013). These findings highlight

anti-psychotic medication as a potential confounding variable, providing a possible explanation for the current findings.

The finding that a clinical group processes visual information differently to a non-clinical group is useful clinically. Having an explanation for anomalous experiences as the result of a different perceptual style may support individuals to not go down a route in which they could develop of psychosis. Previous research has found that normalising explanations have positive outcomes for psychotic experiences, including reduced hospital admissions (Kingdon and Turkingdon, 1991).

Future research will benefit from exploring visual illusion susceptibility using a size-matching task with a variety of visual illusions. In depth assessment measures for mental health symptomology and a larger sample size may further understanding of the relationship between psychotic-like experiences and/or emotions and visual processing.

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6. Appendices

Appendix A: Ethical Approval for Substantial Amendment from Wales REC

Ymchwil Iechyd a Gofal Cymru
Health and Care Research Wales

Gwasanaeth Moeseg Ymchwil

Research Ethics Service

Ariennir gan Lywodraeth Cymru
Funded by Welsh Government

Wales REC 4
G1/G2 Croesnewydd Hall
Croesnewydd Road
Wrexham Technology Park

Telephone : 01978 726377
E-mail : tracy.biggs@wales.nhs.uk
Website : www.hra.nhs.uk

04 December 2015

Miss Emily Drake
University of East Anglia
Norwich Research Park
Norwich
NR47TJ

Dear Miss Drake

Study title: **Is a group of individuals reporting psychotic-like experiences less susceptible to visual illusions than a non-clinical group?**
REC reference: **15/WA/0167**
Protocol number: **N/A**
Amendment number: **1**
Amendment date: **14 October 2015**
IRAS project ID: **161513**

The above amendment was reviewed at the meeting of the Sub-Committee held on 04 November 2015.

Ethical opinion

The members of the Committee taking part in the review gave a favourable ethical opinion of the amendment on the basis described in the notice of amendment form and supporting documentation.

The Committee noted the revision to the inclusion and exclusion criteria together with the amendments to the protocol and supporting documentation in relation thereto.

Approved documents

The documents reviewed and approved at the meeting were:

Document	*Version*	*Date*
Notice of Substantial Amendment (non-CTIMP) [161513/869709/13/180/46770]	1	14 October 2015
Participant consent form [Parent/Guardian]	1	15 October 2015
Participant information sheet (PIS) [Clinicians]	2	15 October 2015
Participant information sheet (PIS) [Parent/Guardian]	1	15 October 2015
Research protocol or project proposal	2	15 October 2015

Membership of the Committee

The members of the Committee who took part in the review are listed on the attached sheet.

R & D approval

All investigators and research collaborators in the NHS should notify the R&D office for the relevant NHS care organisation of this amendment and check whether it affects R&D approval of the research.

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

We are pleased to welcome researchers and R & D staff at our NRES committee members' training days – see details at http://www.hra.nhs.uk/hra-training/

15/WA/0167: Please quote this number on all correspondence

Yours sincerely

T.a. Biggs.

Dr Kath Clarke
Chair

E-mail: tracy.biggs@wales.nhs.uk

Enclosures: *List of names and professions of members who took part in the review*

Copy to: *Dr Bonnie Teague, NHS*
Mrs Sue Steel

Wales REC 4

Attendance at Sub-Committee of the REC meeting on 04 November 2015

Committee Members:

Name	*Profession*	*Present*	*Notes*
Dr Kath Clarke Chair	Senior Investigations Manager	Yes	
Mr Philip Richards	Associate Specialist - Surgery	Yes	

Also in attendance:

Name	*Position (or reason for attending)*
Mrs Tracy Biggs	Research Ethics Committee Manager

Appendix B: Ethical Approval from NSFT Research and Development

Research and Development The Knowledge Centre
Hellesdon Hospital Drayton High Road
Norwich
NR6 5BE
Telephone 01603 421255
E mail: RDofficemailbox@nsft.nhs.uk

Miss Emily Drake
Trainee Clinical Psychologist
University of East Anglia
Norwich Research Park
Norwich
NR4 7TJ

Dear Miss Drake,

7th January 2015

Re: RD #15 161513 Is a group of individuals reporting psychotic-like experiences less susceptible to visual illusions than a non-clinical group?

Further to the initial study approval letter, dated 1st July 2015, a substantial amendment has been received for research governance review and approval.

I am pleased to inform you that the amendment has been approved, and so may proceed. This approval is valid in the following organisation:

- **Norfolk and Suffolk NHS Foundation Trust**

The final list of amendment documents reviewed and approved are as follows:

Documents	Version	Date
Consent Form	1	Oct-15
Protocol	2	Oct-15
Information Sheet: Participants	1	Oct-15
Information Sheet: Clinicians	2	Oct-15

Your research governance approval is valid providing you comply with the conditions set out below:

1. You notify the Research and Development Office should you deviate

or make changes to the approved documents.

2. You alert the Research and Development Office by contacting me, if significant developments occur as the study progresses, whether in relations to the safety of individuals or to scientific direction.

3. You complete and return the standard annual self-report study monitoring form when requested to do so at the end of each financial year. Failure to do this will result in the suspension of research governance approval.

4. You comply fully with the Department of Health Research Governance Framework, and in particular that you ensure that you are aware of and fully discharge your responsibilities in respect to Data Protection, Health and Safety, financial probity, ethics and scientific quality. You should refer in particular to Sections 3.5 and 3.6 of the Research Governance Framework.

5. You ensure that all information regarding patients or staff remains secure and strictly confidential at all times. You ensure that you understand and comply with the requirements of the NHS Confidentiality Code of Practice, Data Protection Act and Human Rights Act.

6. Unauthorised disclosure of information is an offence and such disclosures may lead to prosecution.

7.

8. If you require any further confirmation, please contact me at

the above address.

Yours sincerely,

Dr Bonnie Teague

(Research Manager)

Chair: Gary Page
Chief Executive: Michael Scott
Trust Headquarters: Hellesdon Hospital,
Drayton High Road, Norwich, NR6 5BE
Tel: 01603 421421 Fax: 01603 421440 www.nsft.nhs.uk

Appendix C: Prodromal Questionnaire

			If true how much distress did you experience?			
	True	False	No	Mild	Moderate	Severe
1. I feel uninterested in the things I used to enjoy						
2. I often seem to live through events exactly as they happened before (déjà vu)						
3. I sometimes smell or taste things that others can't smell or taste						
4. I often hear unusual sounds like banging, clicking, hissing, clapping or ringing in my ears						
5. I have been confused at times whether something I experienced was real or imaginary						
6. When I look at a person, or look at myself in the mirror, I have seen the face change right before my eyes						
7. I get extremely anxious when meeting people for the first time						
8. I have seen things that other people apparently can't see						
9. My thoughts are sometimes so strong that I can almost hear them						
10. I sometimes see special meanings in advertisements, shop windows, or in the ways things are arranged around me						

11. Sometimes I have felt that I'm not in control of my own ideas or thoughts						
12. Sometimes I feel distracted by distant sounds that I am not normally aware of						
13. I have heard things other people can't hear like voices of people whispering or talking						
14. I often feel that others have it in for me						
15. I have the sense that some person or force is around me, even though I could not see anyone						
16. I feel that parts of my body have changed in some way, or parts of my body are working differently from before						

Appendix D: Schizotypal Personality Questionnaire – Brief Version

Participant No. _____

SPQ-B Questionnaire

Please read these instructions carefully.

For each Question you must circle a response of either Yes *or* No*.*

We would ask you to circle the answers that most closely match your experience and avoid missing any questions out.

We would appreciate it if you could be as honest as possible when giving your answers.

1. People sometimes find me aloof and distant. **Yes / No**

2. Have you ever had the sense that some person or force is around you, even though you cannot see anyone? **Yes / No**

3. People sometimes comment on my unusual mannerisms and habits. **Yes / No**

4. Are you sometimes sure that other people can tell what you are thinking? **Yes / No**

5. Have you ever noticed a common event or object that seemed to be a special sign for you? **Yes / No**

6. Some people think that I am a very bizarre person. **Yes / No**

7. I feel I have to be on my guard even with friends. **Yes / No**

8. Some people find me a bit vague and elusive during a conversation. **Yes / No**

Participant No. _____

9. Do you often pick up hidden threats or put-downs from what people say or do? **Yes / No**

10. When shopping, do you get the feeling that other people are taking notice of you? **Yes / No**

11. I feel very uncomfortable in social situations involving unfamiliar people. **Yes / No**

12. Have you had experiences with astrology, seeing the future, UFOs, ESP, or a sixth sense? **Yes / No**

13. I sometimes use words in unusual ways. **Yes / No**

14. Have you found that it is best not to let other people know too much about you? **Yes / No**

15. I tend to keep in the background on social occasions. **Yes / No**

16. Do you ever suddenly feel distracted by distant sounds that you are not normally aware of **Yes / No**

17. Do you often have to keep an eye out to stop people from taking advantage of you? **Yes / No**

18. Do you feel that you are unable to get "close" to people? **Yes / No**

19. I am an odd, unusual person. **Yes / No**

Participant No. _____

20. I find it hard to communicate clearly what I want to say to people. **Yes / No**

21. I feel very uneasy talking to people I do not know well. **Yes / No**

22. I tend to keep my feelings to myself. **Yes / No**

Appendix E: Appraisal of Anomalous Experiences Interview

Participant ID:
Date:

AANEX – Visual Perception Study

Part 1: Perceptions

I've got a list of experiences that sometimes people have, and I'd like to ask you if you've ever experienced any of them.

1) Depersonalisation:

a) *Have you had the experience of feeling alienated or at a distance from yourself, so that your actions and movements seem impersonal and automatic or it feels as though you are listening to yourself speaking when you talk?*

If yes:

Q. *Have you had this experience more than once, or was it an isolated event?*
Q *Do you still experience this (from time to time)?*
Q *How long has the experience lasted for? (Minimum and maximum duration)*
Q *Did this experience occur in the context of an 'altered state'?*

CURRENT (presence within last month)

1	2	3
Absent	Unclear	Present

LIFETIME (frequency)

1	2	3	4	5
Absent	Uncertain	Mild	Moderate	Severe

2) Derealisation:

a) Have you had the experience of the world seeming altered in a strange way, so that it didn't seem as real and familiar as usual, but perhaps looked flat or artificial?

b) Have you had the experience of the world seeming different or new, so that it seemed less solid, and more perfect or 'glowing' somehow?

If yes:

Q. *Have you had this experience more than once, or was it an isolated event?*
Q *Do you still experience this (from time to time)?*
Q *How long has the experience lasted for? (Minimum and maximum duration)*
Q *Did this experience occur in the context of an 'altered state'?*

CURRENT (presence within last month)

1	2	3
Absent	Unclear	Present

LIFETIME (frequency)

1	2	3	4	5
Absent	Uncertain	Mild	Moderate	Severe

2) **Visual anomalies (global):**

a) Have you had the experience of alterations in your vision, so that for example colours look different, you are more sensitive to light, things seem to move when you look at them, or people's faces look strange?

If yes:

Q. *Have you had this experience more than once, or was it an isolated event?*
Q *Do you still experience this (from time to time)?*
Q *How long has the experience lasted for? (Minimum and maximum duration)*
Q *Did this experience occur in the context of an 'altered state'?*

CURRENT (presence within last month)

1	2	3
Absent	Unclear	Present

LIFETIME (frequency)

1	2	3	4	5
Absent	Uncertain	Mild	Moderate	Severe

4) Visual anomalies (hallucinations):

a) Have you had ever had the experience of seeing something that other people couldn't see, or that you later found out was not there?

b) Have you had the experience of seeing someone's aura, or other manifestations of energy?

If yes:

Q. *Have you had this experience more than once, or was it an isolated event?*
Q *Do you still experience this (from time to time)?*
Q *How long has the experience lasted for? (Minimum and maximum duration)*
Q *Did this experience occur in the context of an 'altered state'?*

CURRENT (presence within last month)

1	2	3
Absent	Unclear	Present

LIFETIME (frequency)

1	2	3	4	5
Absent	Uncertain	Mild	Moderate	Severe

5) Auditory anomalies:

a) Have you had the experience of changes in your hearing, so that for example noises seem louder and more intrusive, or speech or music seem to sound different, peculiar or distorted?

If yes:

Q. *Have you had this experience more than once, or was it an isolated event?*
Q *Do you still experience this (from time to time)?*
Q *How long has the experience lasted for? (Minimum and maximum duration)*
Q *Did this experience occur in the context of an 'altered state'?*

CURRENT (presence within last month)

1	2	3

Absent Unclear Present

LIFETIME (frequency)

1	2	3	4	5
Absent	Uncertain	Mild	Moderate	Severe

6) Oversensitivity:

a) Have you had the experience of feeling as though you have a 'thinner skin', because sounds or visual stimuli can't be filtered out, and seem to flood or overwhelm you?

If yes:

Q. *Have you had this experience more than once, or was it an isolated event?*
Q *Do you still experience this (from time to time)?*
Q *How long has the experience lasted for? (Minimum and maximum duration)*
Q *Did this experience occur in the context of an 'altered state'?*

CURRENT (presence within last month)

1	2	3
Absent	Unclear	Present

LIFETIME (frequency)

1	2	3	4	5
Absent	Uncertain	Mild	Moderate	Severe

7) Somatic anomalies:

a) Have you ever had experiences of unusual sensations in your body, not created by any obvious physical cause, for example of heat or cold, energy moving, or something entering or passing through your body?

If yes:

Q. *Have you had this experience more than once, or was it an isolated event?*
Q *Do you still experience this (from time to time)?*
Q *How long has the experience lasted for? (Minimum and maximum duration)*
Q *Did this experience occur in the context of an 'altered state'?*

CURRENT (presence within last month)

1	2	3
Absent	Unclear	Present

LIFETIME (frequency)

1	2	3	4	5
Absent	Uncertain	Mild	Moderate	Severe

8) Lost automatic skills:

a) Have you experienced the loss of automatic skills, so that things you could normally do easily and without really thinking suddenly require all your attention and have be taken one step at a time?

If yes:

Q. *Have you had this experience more than once, or was it an isolated event?*
Q *Do you still experience this (from time to time)?*
Q *How long has the experience lasted for? (Minimum and maximum duration)*
Q *Did this experience occur in the context of an 'altered state'?*

CURRENT (presence within last month)

1	2	3
Absent	Unclear	Present

LIFETIME (frequency)

1	2	3	4	5
Absent	Uncertain	Mild	Moderate	Severe

8b) Can't divide attention:

a) Have you noticed that it is more difficult than it used to be to do two things at the same time? E.g. to talk to someone and do some cooking at the same time?

If yes:

Q. *Have you had this experience more than once, or was it an isolated event?*
Q *Do you still experience this (from time to time)?*

Q *How long has the experience lasted for? (Minimum and maximum duration)*
Q *Did this experience occur in the context of an 'altered state'?*

CURRENT (presence within last month)

1	2	3
Absent	Unclear	Present

LIFETIME (frequency)

1	2	3	4	5
Absent	Uncertain	Mild	Moderate	Severe

9) *Language Disturbance:*

a) Have you experienced being in a state in which it is difficult to follow a conversation or understand what someone is saying, because the words seem to stand on their own and don't make sense?

If yes:

Q. *Have you had this experience more than once, or was it an isolated event?*
Q *Do you still experience this (from time to time)?*
Q *How long has the experience lasted for? (Minimum and maximum duration)*
Q *Did this experience occur in the context of an 'altered state'?*

CURRENT (presence within last month)

1	2	3
Absent	Unclear	Present

LIFETIME (frequency)

1	2	3	4	5
Absent	Uncertain	Mild	Moderate	Severe

9b Concretism:

a) Have you noticed yourself misunderstanding what people say because they've used a metaphor or an expression that you've taken literally?

If yes:

Q. *Have you had this experience more than once, or was it an isolated event?*
Q *Do you still experience this (from time to time)?*
Q *How long has the experience lasted for? (Minimum and maximum duration)*
Q *Did this experience occur in the context of an 'altered state'?*

CURRENT (presence within last month)

1	2	3
Absent	Unclear	Present

LIFETIME (frequency)

1	2	3	4	5
Absent	Uncertain	Mild	Moderate	Severe

10 *Olfactory Anomalies*:

a) Have you ever experienced unusual smells which were not created by an obvious cause such as burning, smell of perfume?

If yes:

Q. *Have you had this experience more than once, or was it an isolated event?*
Q *Do you still experience this (from time to time)?*
Q *How long has the experience lasted for? (Minimum and maximum duration)*
Q *Did this experience occur in the context of an 'altered state'?*

CURRENT (presence within last month)

1	2	3
Absent	Unclear	Present

LIFETIME (frequency)

1	2	3	4	5
Absent	Uncertain	Mild	Moderate	Severe

Part 2: Current Appraisals and Emotional Responses

I'd like to ask you a bit more about the experiences you are currently having, like how you feel about it

1) Valence:

Q To start with, *how do you feel when this happens?*

Prompts:
Q *Do you feel very surprised, puzzled, or curious?*
Q *Do you have any bad feelings; worries or fears?*
Q *Do you have any good feelings at all?*

…….

…….

…….

…….

Valence Response Rating:

1	2	3	4	5
Strongly negative	Slightly negative	Neutral	Slightly Positive	Strongly positive

2) Self-rated anxiety and excitement

Q *You've told me you felt [feeling]; can I ask you to tell me how anxious you feel? Say, from 1 to 5, if 1 is 'not at all', and 5 is 'as anxious as you've ever been'?*

1	2	3	4	5
Not at all	A little	Somewhat	Rather	Extremely

Q *Could you give me an idea of how excited you are when you experienced [that]? From 1 to 5, if 1 is 'not at all excited' and 5 is 'as excited as you've ever been'?*

1	2	3	4	5
Not at all	A little	Somewhat	Rather	Extremely

3) Perceived controllability

Q *When you experience [this], how much control do you feel you have over the experience? For example, could you stop the experience if you wanted, or do you deliberately elicit it*? **Y/N**

……

……

1	2	3	4	5
None	Minimal	Some	Mostly	Total control

4) Externality

Q Do you think [this] is caused by changes in you, or something outside of you?

……

……

1	2	3	4	5
Strongly internal	Slightly internal	Neither	Slightly external	Strongly external

Appendix F: Depression, Anxiety and Stress Scale

DASS

Name: *Date:*

Please read each statement and circle a number 0, 1, 2 or 3 which indicates how much the statement applied to you *over the past week*. There are no right or wrong answers. Do not spend too much time on any statement.

The rating scale is as follows:

0 Did not apply to me at all
1 Applied to me to some degree, or some of the time
2 Applied to me to a considerable degree, or a good part of time
3 Applied to me very much, or most of the time

1	I found myself getting upset by quite trivial things	0	1	2	3
2	I was aware of dryness of my mouth	0	1	2	3
3	I couldn't seem to experience any positive feeling at all	0	1	2	3
4	I experienced breathing difficulty (eg, excessively rapid breathing, breathlessness in the absence of physical exertion)	0	1	2	3
5	I just couldn't seem to get going	0	1	2	3
6	I tended to over-react to situations	0	1	2	3
7	I had a feeling of shakiness (eg, legs going to give way)	0	1	2	3
8	I found it difficult to relax	0	1	2	3
9	I found myself in situations that made me so anxious I was most relieved when they ended	0	1	2	3
10	I felt that I had nothing to look forward to	0	1	2	3
11	I found myself getting upset rather easily	0	1	2	3
12	I felt that I was using a lot of nervous energy	0	1	2	3

13	I felt sad and depressed	0	1	2	3
14	I found myself getting impatient when I was delayed in any way (eg, lifts, traffic lights, being kept waiting)	0	1	2	3
15	I had a feeling of faintness	0	1	2	3
16	I felt that I had lost interest in just about everything	0	1	2	3
17	I felt I wasn't worth much as a person	0	1	2	3
18	I felt that I was rather touchy	0	1	2	3
19	I perspired noticeably (eg, hands sweaty) in the absence of high temperatures or physical exertion	0	1	2	3
20	I felt scared without any good reason	0	1	2	3
21	I felt that life wasn't worthwhile	0	1	2	3

Please turn the page ☞

Reminder of rating scale:

0 Did not apply to me at all
1 Applied to me to some degree, or some of the time
2 Applied to me to a considerable degree, or a good part of time
3 Applied to me very much, or most of the time

22	I found it hard to wind down	0	1	2	3
23	I had difficulty in swallowing	0	1	2	3
24	I couldn't seem to get any enjoyment out of the things I did	0	1	2	3
25	I was aware of the action of my heart in the absence of physical exertion (eg, sense of heart rate increase, heart missing a beat)	0	1	2	3

26	I felt down-hearted and blue	0	1	2	3
27	I found that I was very irritable	0	1	2	3
28	I felt I was close to panic	0	1	2	3
29	I found it hard to calm down after something upset me	0	1	2	3
30	I feared that I would be "thrown" by some trivial but unfamiliar task	0	1	2	3
31	I was unable to become enthusiastic about anything	0	1	2	3
32	I found it difficult to tolerate interruptions to what I was doing	0	1	2	3
33	I was in a state of nervous tension	0	1	2	3
34	I felt I was pretty worthless	0	1	2	3
35	I was intolerant of anything that kept me from getting on with what I was doing	0	1	2	3
36	I felt terrified	0	1	2	3
37	I could see nothing in the future to be hopeful about	0	1	2	3
38	I felt that life was meaningless	0	1	2	3
39	I found myself getting agitated	0	1	2	3
40	I was worried about situations in which I might panic and make a fool of myself	0	1	2	3
41	I experienced trembling (eg, in the hands)	0	1	2	3
42	I found it difficult to work up the initiative to do things	0	1	2	3

Appendix G: Demographic questionnaire

Demographic Questionnaire

1) What is your gender (please ring the appropriate answer): *Male / Female*

2) What is your Age: _____

3) Do you have parents who have been diagnosed with psychosis?
(please ring as appropriate) *Yes/No*

4) Which is your dominant hand (please ring the appropriate answer): *Left/Right*

Appendix H: Information Sheet for Clinicians Versions 1 and 2

Norfolk and Suffolk NHS
NHS Foundation Trust

University of East Anglia

Visual Perception Study

Title: Are a group of young people reporting psychotic-like experiences less susceptible to visual illusions than a non-clinical comparison?

Study aim: Previous research has found differences in the way people with psychosis process visual information. In particular researchers have found that people with psychosis are less able to draw on context to make sense of their environment. This has been investigated using visual illusion tasks which rely on context to give an image which is different from what is actually being shown.

Previous studies have found that people with psychosis are less susceptible to visual illusions because they are less able to draw on contextual information which means that their visual experience of the world is very different to individuals who do not have psychosis.

This study aims to explore whether young people reporting unusual experiences (e.g. seeing things other people cannot) but who do not have a diagnosis of psychosis have similar experiences using a visual task. Understanding how this population process visual information could help to inform clinical interventions for people having anomalous experiences.

Participants:

Control group

45 young people aged between 18 – 25 years who are not reporting anomalous experiences are being recruited from the University of East Anglia (UEA). This data is being collected by a third year psychology undergraduate student as part of a separate study.

Version 1 January 2015

Clinical group

45 young people aged between 16 – 25 years reporting anomalous experiences are being recruited from secondary mental health services.

The following **inclusion** criteria will be applied:

- Aged 16-25 years, accessing secondary mental health services.
- Reporting psychotic-like experiences (e.g. seeing or hearing things other cannot)

The following **exclusion** criteria will be applied:

- Current or historical use of anti-psychotic medication
- History of psychosis
- Severe learning disability or a diagnosis of autistic spectrum disorder
- Visual impairment which cannot be corrected by visual aids such as reading glasses or
- contact lenses
- Insufficient proficiency in the English language

Study design: After participants have provided written consent they will complete a screening questionnaire (Prodromal Questionnaire) measuring severity of distress associated with their unusual experiences (approximately 5 minutes completion time).

If participants are eligible for the study the researcher will ask them whether they would prefer to complete the study in one session or arrange to meet a second time and complete the study in a second session. This will include participants completing a visual task on a computer (approximately 25 minutes) and answering a couple of questionnaires and questions regarding their visual experiences (approximately 45 minutes). Participants will be invited to take a refreshment break during the session and may withdraw at anytime without providing a reason. Depending on participant preference, the researcher will meet with participants at the service where they usually receive care or at their home address.

Version 1 January 2015

Referring to the study: Please contact the researcher if you identify potential participants who are under your care using the contact details below. If your client has given verbal consent to be contacted by a researcher they will get in touch to arrange a meeting and discuss the project in more detail. The researcher will also send out an information sheet to potential participants so that they receive it 48 hours before meeting with the researcher to allow them time to read the information.

Timescale: Recruitment of participants will aim to begin in February 2015.

Contacts: Please get in touch if you have any questions on the following email: Emily.Drake@uea.ac.uk or contact: 07XXX XXXXXX, or Jo Hodgekins: Tel: 01603 591890, Email: J.Hodgekins@uea.ac.uk

If you would like to make a complaint about any area of the research you can contact Professor Ken Laidlaw. Tel: 01603 593600 Email:K.Laidlaw@uea.ac.uk

Many Thanks

Version 1 January 2015

Information Sheet for Clinicians

Norfolk and Suffolk NHS
NHS Foundation Trust

University of East Anglia

Visual Perception Study

Title: Are a group of young people reporting psychotic-like experiences less susceptible to visual illusions than a non-clinical comparison?

Study aim: Previous research has found differences in the way people with psychosis process visual information. In particular researchers have found that people with psychosis are less able to draw on context to make sense of their environment. This has been investigated using visual illusion tasks which rely on context to give an image which is different from what is actually being shown.

Previous studies have found that people with psychosis are less susceptible to visual illusions because they are less able to draw on contextual information which means that their visual experience of the world is very different to individuals who do not have psychosis.

This study aims to explore whether young people reporting unusual experiences (e.g. seeing things other people cannot) but who do not have a diagnosis of psychosis have similar experiences using a visual task. Understanding how this population process visual information could help to inform clinical interventions for people having anomalous experiences.

Participants:

Control group

45 young people aged between 16 – 25 years who are not reporting anomalous experiences are being recruited from the University of East Anglia (UEA). This data is being collected by a third year psychology undergraduate student as part of a separate study.

Version 2 October 2015

Information Sheet for Clinicians

Clinical group

45 young people aged between 18 – 25 years reporting anomalous experiences are being recruited from secondary mental health services.

The following **inclusion** criteria will be applied:

- Aged 16-25 years, accessing secondary mental health services.
- Reporting psychotic-like experiences (e.g. seeing or hearing things other cannot)

The following **exclusion** criteria will be applied:

- History of psychosis
- Severe learning disability or a diagnosis of autistic spectrum disorder
- Visual impairment which cannot be corrected by visual aids such as reading glasses or contact lenses
- Insufficient proficiency in the English language

Study design: After participants have provided written consent they will complete a screening questionnaire (Prodromal Questionnaire) measuring severity of distress associated with their unusual experiences (approximately 5 minutes completion time).

If participants are eligible for the study the researcher will ask them whether they would prefer to complete the study in one session or arrange to meet a second time and complete the study in a second session. This will include participants completing a visual task on a computer (approximately 25 minutes) and answering a couple of questionnaires and questions regarding their visual experiences (approximately 45 minutes). Participants will be invited to take a refreshment break during the session and may withdraw at anytime without providing a reason. Depending on participant preference, the researcher will meet with participants at the service where they usually receive care or at their home address.

Version 2 October 2015

Referring to the study: Please contact the researcher if you identify potential participants who are under your care using the contact details below. If your client has given verbal consent to be contacted by a researcher they will get in touch to arrange a meeting and discuss the project in more detail. The researcher will also send out an information sheet to potential participants so that they receive it 48 hours before meeting with the researcher to allow them time to read the information.

Timescale: Recruitment of participants will begin in February 2015.

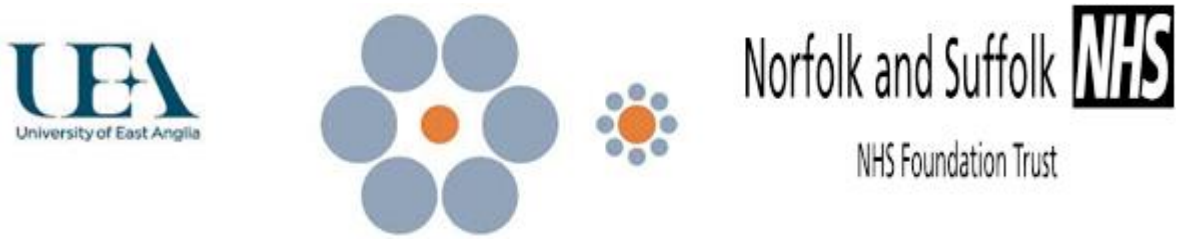
Contacts: Please get in touch if you have any questions on the following email: Emily.Drake@nsft.nhs.uk or Emily.Drake@uea.ac.uk, Tel: 07708523590 or Sian Coker, Tel: 01603 593544, Email: S.Coker@uea.ac.uk

If you would like to make a complaint about any area of the research you can contact Professor Ken Laidlaw. Tel: 01603 593600 Email: K.Laidlaw@uea.ac.uk

Many Thanks

Version 2 October 2015

Appendix I: Study Poster



Visual Perception Study

Earn £5 and take part in a **research**

Would you like to take part in research?

The UEA are exploring how we see the world using a visual programme which could be helpful in developing treatments for people having unusual experiences.

What does the study involve?

- Filling in a few questionnaires and answering some questions about your visual experiences in a relaxed and friendly environment
- Completing a visual task on a computer

The study can take place at either your home address or at the service you usually attend. It can also be carried out in one session or spread out over two sessions, depending on your preference.

The study will take approximately 2 hours in total.

How do I get involved?

If you are aged between 16—25 years old and are having some unusual experiences e.g. (perhaps noticing things other people don't) and you are interested in taking part or would just like some further information please get in touch by texting, calling or emailing using the contacts below. Alternatively, you can speak to your case manager and they can get in touch with the researcher.

Emily.Drake@uea.ac.uk Tel:
Emily.Drake@uea.ac.uk Tel:
Emily.Drake@uea.ac.uk Tel:
Emily.Drake@uea.ac.uk Tel:
Emily.Drake@uea.ac.uk Tel:
Emily.Drake@uea.ac.uk Tel:
Emily.Drake@uea.ac.uk Tel:
Emily.Drake@uea.ac.uk Tel:
Emily.Drake@uea.ac.uk Tel:
Emily.Drake@uea.ac.uk Tel:

Appendix J: Participant Information Sheets Versions 1 and 2

Visual Perception Study

Participant Information Sheet

You have been given this information sheet because you are being invited to take part in the visual perception study. This sheet provides you with more information about the research. It is important that you read this information as it will help you decide whether you would like to take part. Please take as much time as you would like to read the following information. If you have any questions regarding the research please get in touch with a member of the research team using the contact details at the end of this sheet.

Why is this research being done?

The University of East Anglia (UEA) are exploring how people see the world using a visual task. Their aim is to get a better understanding of how different people process visual information in order to find out where difficulties may occur. This information could be helpful in developing treatments for people having unusual experiences.

Why have I been invited to take part?

We are inviting young people from secondary mental health services who are having some unusual experiences (e.g. perhaps noticing things other people don't) to take part in the project.

If you would like to take part in the study we will ask you some questions about these experiences in a short questionnaire in order to decide whether the project is right for you.

Version 1: January 2015

Do I have to take part?

No, it is entirely up to you if you would like to take part. If you wish to take part you will be asked to sign a consent form and receive £5 as a compensation for your time. If you have signed the consent form and would like to withdraw this is okay too and you do not have to provide a reason. All your information will then be destroyed and not used as part of the project. This will not affect any clinical care you are currently receiving.

What does the study involve if I decide to take part?

If you take part in the study you will meet with the researcher at a time and place which is convenient for you (e.g. your home address or at the service you attend). You will then be asked to sign a consent form before completing a 5 minute questionnaire to see if the project is right for you. If you are eligible for the study you will be invited to take part in a visual task on a computer which takes approximately 25 minutes. You will then be asked to complete a few questionnaires about your recent experiences. This will take approximately 45 minutes. The total to complete this research is approximately 2 hours. This can be carried out in one session or spread over two sessions, whichever you would prefer and you are welcome to take a refreshment break during the appointments if you would like one.

After the study has ended, we may be interested in contacting you again in the next 12 months to see how you are getting on. If you are happy for us to do this, we will keep your personal details. However, this is completely up to you. If you do not wish to be contacted again, we will not keep any personal details after the end of the study.

What are the possible risks of taking part?

Sometimes it can be anxiety provoking to talk about difficult experiences but all discussions will be at your own pace in a friendly and informal environment. You are also welcome to take a break during the session, or stop at any point.

What are the possible benefits of taking part?

We hope that finding out more about how people process visual information will allow us to understand where difficulties may occur. This could help to inform psychological interventions for unusual experiences in the future. You will receive £5 as a token of gratitude for taking part.

What happens if something goes wrong?

If you are harmed by taking part in the project there are no special compensation arrangements. However, if you would like to make a complaint about any area of the research you can contact Professor Ken Laidlaw. Tel: 01603 593600 Email:K.Laidlaw@uea.ac.uk. If you remain unhappy and wish to complain formally, you can make a complaint through the NHS Complaints Procedure. Details can be obtained from: *http://www.nhs.uk/choiceinthenhs/rightsandpledges/complaints/pages/nhscomplaints.aspx*

Will my information be kept confidential?

Yes, all information relating to the study will be confidential. You will be given a study number which will be used on all of your research questionnaires to ensure that all the answers you give are entirely anonymous. All information will be stored in a locked filing cabinet or on secure computer systems which are only accessible by the research team. At the end of the study, if you are happy for us to do so, a fully anonymised electronic copy of the study data will be stored at UEA and may be used in future research projects to understand more about unusual experiences. Your identity will be protected at all times. Only genuine researchers will have access to the study data and all will be asked to agree to preserve the confidentiality of the information collected in this study.

What will happen to the results of the research?

The result of the study will be disseminated to local research teams and the results of the study may also be published in psychology journals. All information relating to your answers will remain entirely anonymous throughout this process. You are welcome to receive the results of the study if you would like them, please let the researcher know.

Version 1: January 2015

Who has approved the research?

This type of research cannot take place without seeking approval from ethics committees who check studies for any risks and ensure that enough information is provided to allow you to make a decision as to whether you would like to take part. This study has been approved by the Wales REC and NSFT Research and Development.

Where can I get further information?

If you would like any further information regarding this study please get in touch with: Emily Drake. Tel: 07XXXX XXXXXX Email: Emily.Drake@uea.ac.uk, or
Jo Hodgekins: Tel: 01603 591890 Email: J.Hodgekins@uea.ac.uk

Version 1: January 2015

Participant Information Sheet

Visual Perception Study
Participant Information Sheet

You have been given this information sheet because you are being invited to take part in the visual perception study which is being conducted as part of a Clinical Psychology Doctorate qualification. This sheet provides you with more information about the research. It is important that you read this information as it will help you decide whether you would like to take part. Please take as much time as you would like to read the following information. If you have any questions regarding the research please get in touch with a member of the research team using the contact details at the end of this sheet.

Why is this research being done?

The University of East Anglia (UEA) are exploring how people see the world using a visual task. Their aim is to get a better understanding of how different people process visual information in order to find out where difficulties may occur. This information could be helpful in developing treatments for people having unusual experiences.

Why have I been invited to take part?

We are inviting young people from secondary mental health services who are having some unusual experiences (e.g. perhaps noticing things other people don't) to take part in the project.

If you would like to take part in the study we will ask you some questions about these experiences in a short questionnaire in order to decide whether the project is right for you.

Do I have to take part?

No, it is entirely up to you if you would like to take part. If you wish to take part you will be asked to sign a consent form and receive £5 as a compensation for your time.

Version 2: October 2015

If you have signed the consent form and would like to withdraw this is okay too and you do not have to provide a reason. All your information will then be destroyed and not used as part of the project. This will not affect any clinical care you are currently receiving.

What does the study involve if I decide to take part?

If you take part in the study you will meet with the researcher at a time and place which is convenient for you (e.g. your home address or at the service you attend). You will then be asked to sign a consent form before completing a 5 minute questionnaire to see if the project is right for you. If you are eligible for the study you will be invited to take part in a visual task on a computer which takes approximately 25 minutes. You will then be asked to complete a few questionnaires about your recent experiences. This will take approximately 45 minutes. The total to complete this research is approximately 2 hours. This can be carried out in one session or spread over two sessions, whichever you would prefer and you are welcome to take a refreshment break during the appointments if you would like one.

After the study has ended, we may be interested in contacting you again in the next 12 months to see how you are getting on. If you are happy for us to do this, we will keep your personal details. However, this is completely up to you. If you do not wish to be contacted again, we will not keep any personal details after the end of the study.

What are the possible risks of taking part?

Sometimes it can be anxiety provoking to talk about difficult experiences but all discussions will be at your own pace in a friendly and informal environment. You are also welcome to take a break during the session, or stop at any point.

What are the possible benefits of taking part?

We hope that finding out more about how people process visual information will allow us to understand where difficulties may occur. This could help to inform psychological interventions for unusual experiences in the future. You will receive £5 as a token of gratitude for taking part.

Version 2 October 2015

What happens if something goes wrong?

If you are harmed by taking part in the project there are no special compensation arrangements. However, if you would like to make a complaint about any area of the research you can contact Professor Ken Laidlaw. Tel: 01603 593600 Email:K.Laidlaw@uea.ac.uk. If you remain unhappy and wish to complain formally you can write to: The Patient Safety and Complaints Team, Norfolk and Suffolk NHS Foundation Trust, Hellesdon Hospital, Drayton High Road, Norwich, NR65BE or call: 01603 421421 and ask to be directed to the complaints team. Alternatively you can email: complaints@nsft.nhs.uk. The complaints team will let you know that they have received your complaint within 3 working days and tell what they are doing and how long it will take to give you a clear answer. If you are unhappy with the answer you can also ask the Ombudsman to look at your complaint by writing to: The Parliamentary and Health Ombudsman, Millbank Tower, Millbank, London, SW1P 4QP or contact: 0345 015 4033.

Will my information be kept confidential?

Yes, all information relating to the study will be confidential. Confidentiality will only need to be broken if it is evident that you or others may be at risk of harm. If possible, the researcher will discuss this with you before passing the relevant information on to a member of the care team. You will be given a study number which will be used on all of your research questionnaires to ensure that all the answers you give are entirely anonymous. All information will be stored in a locked filing cabinet or on secure computer systems which are only accessible by the research team. At the end of the study, if you are happy for us to do so, a fully anonymised electronic copy of the study data will be stored at UEA and may be used in future research projects to understand more about unusual experiences. Your identity will be protected at all times. Only genuine researchers will have access to the study data and all will be asked to agree to preserve the confidentiality of the information collected in this study.

Version 2: October 2015

What will happen to the results of the research?

The result of the study will be disseminated to local research teams and the results of the study may also be published in psychology journals. All information relating to your answers will remain entirely anonymous throughout this process. You are welcome to receive the results of the study if you would like them, please let the researcher know.

Who has approved the research?

This type of research cannot take place without seeking approval from ethics committees who check studies for any risks and ensure that enough information is provided to allow you to make a decision as to whether you would like to take part. This study has been approved by NHS ethics and the Norfolk and Suffolk Research and Development department.

Where can I get further information?

If you would like any further information regarding this study please get in touch with: Emily Drake. Email: Emily.Drake@nsft.nhs.uk or Emily.Drake@uea.ac.uk, Tel: 07708523590 or Sian Coker, Tel: 01603 593544, Email: S.Coker@uea.ac.uk

Version 2: October 2015

Appendix K: Participant Consent Forms Version 1 and 2

UNIVERSITY OF EAST ANGLIA

DOCTORAL PROGRAMME IN CLINICAL PSYCHOLOGY

Participant consent to take part in the study: Visual Perception Study

Thank you for taking the time to consider the above study. If you decide to take part, it is important that you are able to show that you agree and understand the following:

- You have had an opportunity to read the participant information sheet and ask questions
- Your consent is voluntary and you may withdraw from the study without providing a
- reason
- All identifying details (such as your name) will be removed from all written reports
- relating to the study
- All your information will be stored securely and can only be accessed by a member of
- the research team

Version 1 January 2015

Please read the following statements about the current study carefully and initial each box:

I confirm that I have read the participant information sheet dated January 2015 (version 1). I have had the opportunity to consider the information, ask questions and have these satisfactorily answered.	
I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, without my medical care or legal rights being affected.	
I agree to my data being used for analysis and in a written report about the study.	
I understand that all research material will be stored securely and that identifying information will be removed from any study reports.	
I agree that the researcher can discuss my progress in the study with a relevant member of my care team.	
I consent to the research session being audio-recorded for training purposes. I understand that the recordings will be destroyed when no longer needed.	
I consent to take part in the above study	

The following statements are about what happens at the end of the study. Please initial each box if you agree with each statement:

I agree that an anonymised version of the information I provide can be used as part of other research projects.	
I would be happy to be contacted again about this study in the next 12 months.	

Version 1 January 2015

If you would like to receive information regarding the outcome of the study please let the researcher know and they can send you the results once the research has been completed.

For participant

Name of **Participant:** _____

Signature _____ Date: _____

For researcher

Name of **Researcher:** _____

Signature _____ Date: _____

Version 1 January 2015

UNIVERSITY OF EAST ANGLIA

DOCTORAL PROGRAMME IN CLINICAL PSYCHOLOGY

Participant consent to take part in the study: Visual Perception Study

Thank you for taking the time to consider the above study. If you decide to take part, it is important that you are able to show that you agree and understand the following:

- You have had an opportunity to read the participant information sheet and ask questions
- Your consent is voluntary and you may withdraw from the study without providing a
- reason
- All identifying details (such as your name) will be removed from all written reports
- relating to the study
- All your information will be stored securely and can only be accessed by a member of
- the research team

Version 2 October 2015

Participant Consent Form

Please read the following statements about the current study carefully and initial each box:

I confirm that I have read the participant information sheet dated October 2015 (version 2). I have had the opportunity to consider the information, ask questions and have these satisfactorily answered.	
I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, without my medical care or legal rights being affected.	
I agree to my data being used for analysis and in a written report about the study.	
I understand that all research material will be stored securely and that identifying information will be removed from any study reports.	
I agree that the researcher can discuss my progress in the study with a relevant member of my care team.	
I consent to the research session being audio-recorded for training purposes. I understand that the recordings will be destroyed when no longer needed.	
I consent to take part in the above study	

The following statements are about what happens at the end of the study. Please initial each box if you agree with each statement:

I agree that an anonymised version of the information I provide can be used as part of other research projects.	
I would be happy to be contacted again about this study in the next 12 months.	

Version 2 October 2015

If you would like to receive information regarding the outcome of the study please let the researcher know and they can send you the results once the research has been completed.

For participant

Name of **Participant:** _____

Signature _____ Date: _____

For researcher

Name of **Researcher:** _____

Signature _____ Date: _____

Version 2 October 2015

Appendix L: Participant receipt

Participant Receipt: Visual Perception Study

I confirm that I have received a payment of £5 in cash.

For participant

Name of **Participant:** _____

Signature _____ Date: _____

For researcher

Name of **Researcher:** _____

Signature _____ Date: _____

Appendix M: Summary of Research Findings for Participants

Faculty of Medicine and Health Sciences

Elizabeth Fry Building

University of East Anglia

Norwich, NR4 7TJ

Email: Emily.Drake@uea.ac.uk

Research Study:

Is a group of individuals reporting psychotic-like experiences less susceptible to visual illusions than a non-clinical group?

Dear …,

Thank you for taking part in the above research study. The research would not have happened without people kindly offering their time as you did, you help is very much appreciated.

When you took part in the study you told me that you would like to have a summary of the research findings. Please find a summary enclosed which provides a general summary of the findings of from this study.

Thank you once again for taking part in this research

Yours sincerely,

Emily Drake

Trainee Clinical Psychologist

University of East Angli

Faculty of Medicine and Health Sciences

Elizabeth Fry Building

University of East Anglia

Norwich, NR4 7TJ

Email: Emily.Drake@uea.ac.uk

Summary of Research Findings:

Is a group of individuals reporting psychotic-like experiences less susceptible to visual illusions than a non-clinical group?

Background to the study

Previous research has found differences in the way people with psychosis process visual information. In particular researchers have found that people with psychosis are less able to draw on context to make sense of their environment. This has been investigated using visual illusion tasks which rely on context to give an image which is different from what is actually being shown.

Previous studies have found that people with psychosis are less susceptible to visual illusions because they are less able to draw on contextual information which means that their visual experience of the world is very different to individuals who do not have psychosis.

This study aims to explore whether young people reporting unusual experiences (e.g. seeing things other people cannot) but who do not have a diagnosis of psychosis have similar experiences using a visual task. Understanding how this population process visual information could help to inform clinical interventions for people having anomalous experiences.

What we did

We asked a group of people who had been involved with the Youth team who were having some unusual experiences to take part in a visual illusions task and fill in some questionnaires measuring unusual experiences, low mood and feelings of anxiety. We analysed this information using statistical packages to see if there was a relationship between these items.

The findings

Contrary to what we expected we found a group of people having unusual experiences were significantly more susceptible to visual illusion in comparison with a student population. Although the finding was in the opposite direction to what we had anticipated, differences in perceptual processing may be useful clinically. For example, these findings could be used to as part of a clinical intervention, informing people that their unusual experiences are due to differences in the way they process visual information rather than other explanations (e.g. "There's something wrong with me") which may impact on these experiences as well as feelings of anxiety and low mood.

Appendix N: Debriefing sheet

Debriefing for a study on visual perception

This study was looking at whether a group of people with unusual experiences (e.g. seeing or hearing things others cannot) were less likely to see visual illusions in comparison to a group who were not having unusual experiences. Visual illusions make us see something differently than it actually exists, so what we see does not correspond to physical reality.

Most people experience visual illusions and they are useful in measuring the ability of the visual system to put together small details of a scene into a wider context, informing the 'bigger picture' (e.g. seeing the image of square instead of four individual lines).

Previous research has found individuals with psychosis are less susceptible to visual illusions than people without psychosis, suggesting that visual information is processed differently in people with psychosis. In this study we wanted to see how individuals who do not have psychosis but who do report having unusual experiences perceive visual illusions. Having unusual experiences is very common and does not mean you will go on to have psychosis. However, we might be able to learn things about psychosis by talking to people who have unusual experiences.

In this study we asked you to adjust a target picture to the same size as a standard picture. We anticipate that individuals having unusual experiences will more accurate in this task when compared to individuals who do not have these experiences. This will help us to understand how people who have unusual experiences (e.g. see or hear things other people do not)

experience the world around them. This will help us to explain unusual experiences and hopefully also develop interventions which might help reduce distress associated with them. .

If you would like any further information regarding this study please get in touch with: Emily Drake. Tel: 07XXXX XXXXXX Email: Emily.Drake@uea.ac.uk, or Sian Coker: Tel: 01603 593544 Email: S.Coker@uea.ac.uk

Sources of Support

If you feel distressed and would like to talk to someone please get in touch with your case manager or GP.

Thank you for taking part in the visual perception study

Appendix O: Ethical approvals and correspondence

Wales REC 4
G1/G2 Croesnewydd Hall
Croesnewydd Road
Wrexham Technology Park
Wrexham LL13 7YP

Telephone : 01978 726377

E-mail : tracy.biggs@wales.nhs.uk

Website : www.nres.nhs.uk

24 April 2015

Miss Emily Drake
University of East Anglia
Norwich Research Park
Norwich
NR47TJ

Dear Miss Drake

Study title: **Is a group of individuals reporting psychotic-like experiences less susceptible to visual illusions than a non-clinical group?**
REC reference: **15/WA/0167**
Protocol number: **N/A**
IRAS project ID: **161513**

Thank you for your application for ethical review, which was received on 23 April 2015. I can confirm that the application is valid and will be reviewed by the Proportionate Review Sub-Committee on 30 April 2015. To enable the Proportionate Review Sub Committee to provide you with a final opinion within 10 working days your application documentation will be sent by email to Committee members.

One of the REC members is appointed as the lead reviewer for each application reviewed by the Sub-Committee. The lead reviewer for your application is Mr Philip Richards.

Please note that the lead reviewer may wish to contact you by phone or email between 28 April 2015 and the meeting date to clarify any points that might be raised by members and assist the Sub-Committee in reaching a decision.

If you will not be available between these dates, you are welcome to nominate another key investigator or a representative of the study sponsor who would be able to respond to the lead reviewer's queries on your behalf. If this is your preferred option, please identify this person to us and ensure we have their contact details.

You are not required to attend a meeting of the Proportionate Review Sub-Committee.

Please do not send any further documentation or revised documentation prior to the review unless requested.

Documents received

The documents to be reviewed are as follows:

Document	*Version*	*Date*
Copies of advertisement materials for research participants [Study Poster for Participants]		
Covering letter on headed paper [Covering Letter]		

Evidence of Sponsor insurance or indemnity (non NHS Sponsors only) [UEA insurance documents]		09 May 2014
IRAS Checklist XML [Checklist_23042015]		23 April 2015
Other [CV for Secondary Academic Supervisor (Dr Sian Coker)]		
Participant consent form [Consent Form for Participant]	1	January 2015
Participant information sheet (PIS) [Participant Information Sheet]	1	January 2015
REC Application Form [REC_Form_23042015]		23 April 2015
Referee's report or other scientific critique report [Internal review and feedback regarding changes made based on this review]		
Research protocol or project proposal [Research Protocol]		
Summary CV for Chief Investigator (CI) [Chief Investigator CV]		08 December 2014
Summary CV for supervisor (student research) [CV for Primary Supervisor (Dr Jo Hodgekins)]		17 February 2015

No changes may be made to the application before the meeting. If you envisage that changes might be required, you are advised to withdraw the application and re-submit it.

Notification of the Sub-Committee's decision

We aim to notify the outcome of the Sub-Committee review to you in writing within 10 working days from the date of receipt of a valid application.

If the Sub-Committee is unable to give an opinion because the application raises material ethical issues requiring further discussion at a full meeting of a Research Ethics Committee, your application will be referred for review to the next available meeting. We will contact you to explain the arrangements for further review and check they are convenient for you. You will be notified of the final decision within 60 days of the date on which we originally received your application. If the first available meeting date offered to you is not suitable, you may request review by another REC. In this case the 60 day clock would be stopped and restarted from the closing date for applications submitted to that REC.

R&D approval

All researchers and local research collaborators who intend to participate in this study at sites in the National Health Service (NHS) or Health and Social Care (HSC) in Northern Ireland should apply to the R&D office for the relevant care organisation. A copy of the Site-Specific Information (SSI) Form should be included with the application for R&D approval. You should advise researchers and local collaborators accordingly.

The R&D approval process may take place at the same time as the ethical review. Final R&D approval will not be confirmed until after a favourable ethical opinion has been given by this Committee.

For guidance on applying for R&D approval, please contact the NHS R&D office at the lead site in the first instance. Further guidance resources for planning, setting up and conducting research in the NHS are listed at http://www.rdforum.nhs.uk. There is no requirement for separate Site-Specific Assessment as part of the ethical review of this research.

Communication with other bodies

All correspondence from the REC about the application will be copied to the research sponsor and to the R&D office for Norfolk and Suffolk Foundation Trust. It will be your responsibility to ensure that other investigators, research collaborators and NHS care organisation(s) involved in the study are kept informed of the progress of the review, as necessary.

HRA Training

We are pleased to welcome researchers and R&D staff at our training days – see details at http://www.hra.nhs.uk/hra-training/

15/WA/0167	**Please quote this number on all correspondence**

Yours sincerely

T.a. Biggs.

Mrs Tracy Biggs
Research Ethics Committee Manager

E-mail: tracy.biggs@wales.nhs.uk

Copy to: *Sponsor contact - Mrs Sue Steel*

Lead NHS R&D contact -Dr Bonnie Teague, NHS

Wales REC 4
G1/G2 Croesnewydd Hall
Croesnewydd Road
Wrexham Technology Park
Wrexham LL13 7YP

Telephone : 01978 726377

E-mail : tracy.biggs@wales.nhs.uk

Website : www.nres.nhs.uk

25 June 2015

Miss Emily Drake
University of East Anglia
Norwich Research Park
Norwich
NR47TJ

Dear Miss Drake

Study title: **Is a group of individuals reporting psychotic-like experiences less susceptible to visual illusions than a non-clinical group?**
REC reference: **15/WA/0167**
Protocol number: **N/A**
IRAS project ID: **161513**

Thank you for your letter of 25 June 2015, responding to the Proportionate Review Sub-Committee's request for changes to the documentation for the above study.

The revised documentation has been reviewed and approved by the sub-committee.

We plan to publish your research summary wording for the above study on the HRA website, together with your contact details. Publication will be no earlier than three months from the date of this favourable opinion letter. The expectation is that this information will be published for all studies that receive an ethical opinion but should you wish to provide a substitute contact point, wish to make a request to defer, or require further information, please contact the REC Manager Mrs Tracy Biggs, Tracy.Biggs@Wales.nhs.uk. Under very limited circumstances (e.g. for student research which has received an unfavourable opinion), it may be possible to grant an exemption to the publication of the study.

Confirmation of ethical opinion

On behalf of the Committee, I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form, protocol and supporting documentation as revised.

Conditions of the favourable opinion

The favourable opinion is subject to the following conditions being met prior to the start of the study.

Management permission or approval must be obtained from each host organisation prior to the start of the study at the site concerned.

Management permission ("R&D approval") should be sought from all NHS organisations involved in the study in accordance with NHS research governance arrangements.

GIG CYMRU NHS WALES
Bwrdd Iechyd Addysgu Powys
Powys Teaching Health Board

Ariennir gan Lywodraeth Cymru
Funded by Welsh Government

Guidance on applying for NHS permission for research is available in the Integrated Research Application System or at http://www.rdforum.nhs.uk.

Cynhelir Cydweithrediad Gwyddor Iechyd Academaidd y Sefydliad Cenedlaethol ar gyfer Ymchwil Gofal Cymdeithasol ac Iechyd gan Fwrdd Addysgu Iechyd Powys. The National Institute for Social Care and Health Research Academic Health Science. Collaboration is hosted by Powys Teaching Health Board

Where a NHS organisation's role in the study is limited to identifying and referring potential participants to research sites ("participant identification centre"), guidance should be sought from the R&D office on the information it requires to give permission for this activity.

For non-NHS sites, site management permission should be obtained in accordance with the procedures of the relevant host organisation.

Sponsors are not required to notify the Committee of approvals from host organisations.

Registration of Clinical Trials

All clinical trials (defined as the first four categories on the IRAS filter page) must be registered on a publically accessible database. This should be before the first participant is recruited but no later than 6 weeks after recruitment of the first participant.
There is no requirement to separately notify the REC but you should do so at the earliest opportunity e.g. when submitting an amendment. We will audit the registration details as part of the annual progress reporting process.

To ensure transparency in research, we strongly recommend that all research is registered but for non-clinical trials this is not currently mandatory.

If a sponsor wishes to request a deferral for study registration within the required timeframe, they should contact hra.studyregistration@nhs.net. The expectation is that all clinical trials will be registered, however, in exceptional circumstances non registration may be permissible with prior agreement from NRES. Guidance on where to register is provided on the HRA website.

It is the responsibility of the sponsor to ensure that all the conditions are complied with before the start of the study or its initiation at a particular site (as applicable).

Ethical review of research sites

The favourable opinion applies to all NHS sites taking part in the study, subject to management permission being obtained from the NHS/HSC R&D office prior to the start of the study (see "Conditions of the favourable opinion" above).

Approved documents

The documents reviewed and approved by the Committee are:

Document	*Version*	*Date*
Copies of advertisement materials for research participants [Study Poster]	2	25 June 2015
Covering letter on headed paper [Covering letter reviesed 25 06 15]		25 June 2015
Evidence of Sponsor insurance or indemnity (non NHS Sponsors only) [UEA insurance documents]		
IRAS Checklist XML [Checklist_23042015]		23 April 2015
IRAS Checklist XML [Checklist_25062015]		25 June 2015
Other [CV for Secondary Academic Supervisor (Dr Sian Coker)]		
Participant consent form [Consent Form for Participant]		
Participant information sheet (PIS) [Participant Information Sheet]	2	25 June 2015
REC Application Form [REC_Form_23042015]		23 April 2015
Referee's report or other scientific critique report [Internal review and feedback regarding changes made based on this review]		
Research protocol or project proposal [Revised research protocol]	Second version	14 May 2015
Summary CV for Chief Investigator (CI) [Chief Investigator CV]		
Summary CV for supervisor (student research) [CV for Primary Supervisor (Dr Jo Hodgekins)]		

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

After ethical review

Reporting requirements

The attached document "After ethical review – guidance for researchers" gives detailed guidance on reporting requirements for studies with a favourable opinion, including:

- Notifying substantial amendments
- Adding new sites and investigators
- Notification of serious breaches of the protocol
- Progress and safety reports
- Notifying the end of the study

The HRA website also provides guidance on these topics, which is updated in the light of changes in reporting requirements or procedures.

Feedback

You are invited to give your view of the service that you have received from the National Research Ethics Service and the application procedure. If you wish to make your views known please use the feedback

form available on the HRA website: http://www.hra.nhs.uk/about-the-hra/governance/quality-assurance

We are pleased to welcome researchers and R & D staff at our NRES committee members' training days – see details at http://www.hra.nhs.uk/hra-training/

15/WA/0167	**Please quote this number on all correspondence**

With the Committee's best wishes for the success of this project.

Yours sincerely

T.a. Biggs.

Dr Kath Clarke
Chair

E-mail: tracy.biggs@wales.nhs.uk

Enclosures: *"After ethical review – guidance for researchers"*

Copy to: *Mr Tom Rhodes*

Mrs Sue Steele- sponsor contact

Norfolk and Suffolk NHS
NHS Foundation Trust

Research and Development
The Knowledge Centre
Hellesdon Hospital
Drayton High Road
Norwich
NR6 5BE

Telephone 01603 421255 **E mail:** RDofficemailbox@nsft.nhs.uk

Miss Emily Drake
Trainee Clinical
Psychologist University of
East Anglia Norwich
Research Park Norwich
NR4 7TJ

1st July 2015

Dear Miss Drake,

Re: Is a group of individuals reporting psychotic-like experiences less susceptible to visual illusions than a non-clinical group?

Thank you for submitting the above project for local research governance approval. I am pleased to inform you that your project has been given full approval and you may begin your research at the following site:

- Norfolk & Suffolk NHS Foundation Trust

I have enclosed two copies of the Standard Terms and Conditions of Approval. Please sign both copies returning one copy to the Research and Development office, at the above address, and keeping the other in your study file. Failure to return the standard terms and conditions may affect the conditions of approval. Under the agreed Standard Terms and Conditions of Approval you must inform the R&D department of any proposed changes to this study and submit annual progress reports to the R&D department.

Any researcher(s) whose substantive employer is not the Norfolk & Suffolk NHS Foundation Trust must have a Letter of Access or Honorary Research contract and evidence of Good Clinical Practice (GCP) training before coming on site to conduct their research in this project. Please note that you cannot take part in this study until you have this documentation. If a Letter of Access / Honorary Research Contract has not been issued – please contact us immediately.

If you have any queries regarding this or any other project, please contact, Tom Rhodes, Senior Research Facilitator, at the above address.

The reference number for this study is: **RD #15 161513,** and this should be quoted on all correspondence.

Yours sincerely,

Bonnie Teague (Research Manager)

Chair: Gary Page

Chief Executive: Michael Scott
Trust Headquarters: Hellesdon Hospital,
Drayton High Road, Norwich, NR6 5BE
Tel: 01603 421421 Fax: 01603 421440 www.nsft.nhs.uk

Your research governance approval is valid providing you comply with the conditions set out below:

1. You commence your research within one year of the date of this letter. If you do not begin your work within this time, you will be required to resubmit your application.
2. You notify the Research and Development Office should you deviate or make changes to the approved documents.
3. You alert the Research and Development Office by contacting the address above, if significant developments occur as the study progresses, whether in relations to the safety of individuals or to scientific direction.
4. You complete and return the standard annual self-report study monitoring form when requested to do so at the end of each financial year. Failure to do this will result in the suspension of research governance approval.
5. You comply fully with the Department of Health Research Governance Framework and Trust Research Policies, and in particular that you ensure that you are aware of and fully discharge your responsibilities in respect to Data Protection, Health and Safety, financial probity, ethics and scientific quality. You should refer in particular to Sections 3.5 and 3.6 of the Research Governance Framework.
6. You ensure that all information regarding patients or staff remains secure and strictly confidential at all times. You ensure that you understand and comply with the requirements of the NHS Confidentiality Code of Practice, Data Protection Act and Human Rights Act. Unauthorised disclosure of information is an offence and such disclosures may lead to prosecution.
7. **UKCRN Portfolio Studies only**: You will make local Trust research team members aware that it is expected that the "first participant, first visit" date should be within 70 days of the full submission for Trust Research Governance Approval, and this date must be reported to the Research and Development office using the email address above. Delay to recruitment due to study-wide developments must be reported to the Trust as soon as possible.
8. **UKCRN Portfolio Studies only**: You will report and upload Trust recruitment to the UKCRN portfolio accurately and in a timely manner, and will provide recruitment figures to the Trust upon request.

Version Control

Document	Version	Date
Protocol		14.05.15
Participant Information Sheet	2	25.06.15
Consent Form	1	Jan-15
Study Poster	2	25.06.15

Appendix P: End of Study Report for Ethics Committee

Faculty of Medicine and Health Sciences

Elizabeth Fry Building

University of East Anglia

Norwich, NR4 7TJ

Email: Emily.Drake@uea.ac.uk

End of Study Report:

Is a group of individuals reporting psychotic-like experiences less susceptible to visual illusions than a non-clinical group?

(REC reference no: 15/WA/0167)

Chief Investigator: Emily Drake

Background to the research

This study aimed to explore how individuals with psychotic-like experiences perceive the world around them in comparison to healthy controls. In doing so it aims to consider whether disruptions in visual processing may underlie unusual experiences using a visual illusion paradigm. The study also aims to explore the role of appraisals and emotions which may contribute to symptom development and maintenance.

Previous research hypothesises a "basic cognitive disruption" occurring in the neural circuits as a potential mechanism underlying psychotic experiences (Hemsley, 2005). The disruption is thought to arise as the result of a combination of factors (genetic and

environmental) all of which operate through a "final common pathway" (Hemsley, 2005). The outcome is hypothesised to be a mismatch in the coordination of two mechanisms (bottom-up and top-down processing) which are required to provide a coherent internal representation of the external world. Specific psychotic experiences implicated by this disruption include hallucinatory phenomena; feelings the world has altered and the formation of delusional beliefs. Visual illusion paradigms may be useful in exploring this potential disruption because they illustrate the visual system's ability to integrate top-down and bottom-up processing in perception. (Notredame, Pins, Deneve, & Jadri, 2014).

Research method

A quantitative cross-sectional design was used to compare visual illusion susceptibility scores from a clinical group of young people reporting psychotic-like experiences with a non-clinical comparison group from a student population. Relationships between illusion susceptibility and 1) the frequency of psychotic-like experiences and 2) appraisals and emotional responses to psychotic-like experiences were explored within the clinical group only. Twenty-five clinical participants and 53 non-clinical participants completed a visual illusions task (measuring illusion susceptibility) and measures examining psychotic-like symptoms and mental-health symptomology. The clinical group only completed measures examining frequency, appraisals and emotional responses to psychotic-like experiences.

Results

The research found the clinical group were significantly more susceptible to visual illusions than the non-clinical group. However, when depression, anxiety and stress scores were controlled for, no significant difference was found between the groups for illusion

susceptibility. No relationship was found between susceptibility scores in the clinical group and frequency, appraisals or emotional responses to anomalous experiences.

Conclusions from the research

The research adds to psychosis literature exploring visual illusion susceptibility with a novel population (a clinical group reporting psychotic-experiences outside of a clinical diagnosis) using a large set of 13 visual illusions. The majority of existing studies examining visual illusions in psychosis populations have taken place in samples of individuals with chronic schizophrenia, examining visual illusions in isolation or in small numbers.

The study aimed to explore how individuals with psychotic-like experiences perceive the world around them in comparison to healthy controls. In doing so the research hoped to explore particular mechanisms which may underlie anomalous experiences. The particular mechanism which this study aims to focus on is whether disruptions in visual processing may underlie psychotic symptoms.

The finding that a clinical group were more susceptible to visual illusions than a non-clinical group suggested that psychotic-like experiences outside of a clinical diagnosis did not occur as a result of the "basic cognitive disruption" as implicated by Hemsley's (2005) cognitive model.

However, differences in perceptual processing were observed between the groups is useful clinically. Having an explanation for anomalous experiences as the result of a different perceptual style may support individuals to not go down a route in which they could develop of psychosis. Previous research has found that normalising explanations have positive outcomes for psychotic experiences, including reduced hospital admission (Kingdon and Turkingdon, 1991).

Plans for publication

Findings will disseminated at the UEA Clinical Doctorate Conference in September 2016.

Some participants requested a summary of research findings, which will be forwarded in September 2-16. A summary will also be provided to teams which assisted with recruitment if requested.