

**The impact of attachment and interpersonal contingency on  
trust in people with psychosis and paranoia**

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**Thesis declaration form**

I confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

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## Overview

Part One is a systematic review, which summarises and critically evaluates empirical studies that have conducted mediation analyses looking at the attachment-psychosis relationship across the psychosis continuum. Results are presented according to five groups of psychological mediating factors 1) mentalisation 2) emotion regulation strategies 3) negative self-esteem 4) beliefs about others and 5) beliefs about voices. Emerging findings are highlighted and evaluated in the context of methodological and statistical limitations. Directions for future research are suggested.

Part Two is an empirical study that was jointly conducted with Melissa Hoban (MH), a fellow DClinPsy trainee at University College London. MH's thesis findings are presented separately. Using a virtual reality paradigm, associations between attachment, interpersonal contingency and trust were explored in a first episode psychosis sample with high paranoia. Fearful attachment and high contingency appeared to elicit mistrust through greater interpersonal distance. However, these outcomes were not reflected in subjective reports of trust.

Part Three is a critical appraisal of the research process. Whilst reflections are discussed for both the empirical and review papers, the main focus is on recruitment for the empirical study. Challenges to clinical recruitment included participant factors, organisational barriers and wider unforeseen circumstances. Reflections on the importance of recruiting clinical populations are outlined. Finally, the process of the systematic review and the current evidence base are discussed with recommendations for further research.

## **Impact Statement**

Attachment insecurity is a recognised risk factor in the development of psychosis. The current thesis aims to further this field of research by providing greater understanding of the mechanisms and processes that may elucidate this relationship.

### **The existing evidence base**

The current review addressed a gap in the literature as the first to systematically synthesise findings from empirical studies looking at the mediators of the attachment-psychosis relationship across the psychosis continuum. Findings highlighted the fragmented nature of the existing evidence base with just 10 eligible studies, which identifies directions for further research. Considerable heterogeneity prevented the quantitative synthesis of findings. This would be an important next step in establishing the relative strength of each putative mediating factor. Understanding these mechanisms has significant theoretical and clinical implications. Existing models and formulations of psychosis may be enhanced by incorporating attachment-related processes. Further, this line of enquiry has the exciting potential to inform preventative interventions or specific treatment targets.

### **Interpersonal adaptation in therapy**

Findings from both part one and two of the current thesis may have implications in the therapeutic context. The review highlights potential specificity between different attachment dimensions and particular pathways to psychotic symptomology. As such, therapists may need to tailor their approach to fit service users' attachment needs, which could enhance engagement and treatment outcomes. For example, service users with high attachment anxiety may need more support with emotional containment whilst those high in attachment avoidance may require an assertive outreach approach to engagement.

Further, promoting security in the therapeutic alliance could have protective benefits against psychotic symptoms and may facilitate recovery.

With regard to the empirical paper, findings suggest that contingent therapist behaviour could elicit mistrust for people with psychosis who are high in paranoia and attachment insecurity. Non-verbal sensitivity and responsiveness to clients are therapeutic skills that are generally considered as important for the therapeutic alliance and to demonstrate empathy and therapist competence. However, this interpersonal approach may need to be adapted in psychosis settings, which may help to ameliorate issues with engagement in this population.

### **Use of virtual reality**

The current findings highlight the acceptability and safety of virtual reality in psychosis populations. Some of the challenges are also highlighted and recommendations are offered for future research to make virtual reality more accessible to all, such as portable headsets that would eliminate the need for travel to participate. The present findings contribute to a growing body of evidence that indicates the promise of virtual reality as a viable tool that could enhance future therapeutic interventions for people with psychosis.

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## **Part 1: Literature Review**

### **Psychological mediators of the attachment-psychosis relationship: A systematic review**

## **Abstract**

**Objective:** The current review was the first to summarise and critically evaluate empirical studies that have conducted mediation analyses looking at the attachment-psychosis relationship across the psychosis continuum.

**Method:** A systematic search of three databases identified 10 studies. A narrative synthesis and quality appraisal were conducted.

**Results:** Results were presented according to five groups of psychological mediating factors 1) mentalisation 2) emotion regulation strategies 3) negative self-esteem 4) beliefs about others and 5) beliefs about voices. Emerging findings are highlighted and evaluated in the context of methodological and statistical limitations.

**Conclusions:** Attachment theory provides a developmental framework for understanding the origins of specific psychotic symptoms. Future research could utilise statistical modelling to determine the relative contributions of different, interconnected mediating pathways, which would enable the identification of specific targets for interventions.

## **1. Introduction**

### **1.1 Psychosis continuum**

Psychosis is an umbrella term for a cluster of mental health diagnoses characterised by anomalous experiences which can cause distress and impact on functioning (APA, 2013). It is proposed that these unusual experiences can arise from interactions between cognitive biases, emotional factors and stressful life events that an individual aims to make sense of (Freeman et al., 2002). Previously, there was an established assumption that psychotic phenomena were distinct features of clinical conditions that were functionally discrete from 'normal' experiences (Jaspers, 1913). Over the past few decades there has been a shift in perspective that these anomalous experiences may be better conceptualised along a continuum with healthy functioning (Chapman & Chapman, 1980; Strauss, 1969; van Os et al., 2009). Examples include paranoia and hallucinations, which are hallmark features of psychosis.

Paranoia is reported in up to 90% of individuals with psychosis (Moutoussis et al., 2007), although this ranges widely in the level of intensity and conviction. Suspiciousness is a relatively common occurrence in the general population, especially regarding social evaluative concerns such as fears of rejection (Freeman et al., 2005). Wariness of others' intentions is not in itself pathological and can have an adaptive and self-protective function. In clinical presentations this suspiciousness can be excessive or unfounded, with distressing persecutory delusions at the severe end of the continuum. Persecutory delusions are strongly held beliefs of intended harm from another (Freeman & Garety, 2000).

Auditory hallucinations (AH), the experience of hearing voices or other sounds in the absence of external origin, are a hallmark feature of psychosis reported in up to 80% of psychosis populations (Lim et al., 2016). In support of the continuum-based understanding, robust

evidence indicates that AH's are also experienced by as many as 10% of the general population (Beaven et al., 2011).

Paranoia and AH's are widely researched experiences given the high level of distress and functional impairment that can result from the severe end of these spectrums. Based on the psychosis-continuum understanding of paranoia and AH experiences, the current review will include both clinical and non-clinical participants.

## **1.2 Attachment**

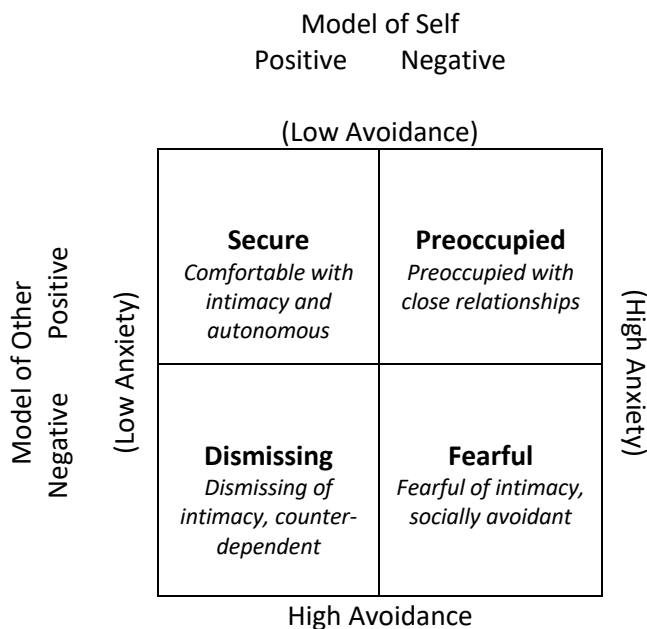
Attachment theory (Ainsworth & Bowlby, 1991; Bowlby, 1969) initially focused on parent-infant relationships but has since been broadened as a lifespan theory, considering the influence on adult relationships (Hazan & Shaver, 1987). The function of attachment is evolutionarily significant as it provides a "safe haven" for exploration yet motivates an infant to seek proximity to a caregiver when there is a threat, which serves to regulate distress and ensure safety. Bowlby (1969) proposed that early attachment relationships are internalised to form internal working models (IWM), which act as frameworks of mental representations about the self and others to guide interpersonal functioning across the lifespan.

Those who have consistently experienced reliable caregiving and have therefore learnt to expect that their needs will be met will likely develop a secure attachment style (Bowlby, 1969, 1984, 1988). In adulthood, attachment security is characterised by positive representations of self and other (Bartholomew & Horowitz, 1991). In insecure attachment, negative IWMs develop and are expressed through the use of two main 'secondary' strategies to manage distress (Mikulincer & Shaver, 2003). Those with high attachment anxiety have a negative view of self and have learnt that needs for proximity and comfort must be exaggerated for a caregiver to notice and respond. Conversely, in attachment

avoidance the view of others is negative as an absence of caregiver response (or even punishment) has taught the child to stop requesting comfort and to downplay needs (Bartholomew & Horowitz, 1991; Mikulincer & Shaver, 2003).

The degree of attachment anxiety and avoidance is proposed to produce four theoretical styles of attachment. These vary in terminology but are often referred to in adulthood as secure, preoccupied, dismissing and fearful (see Figure 1) (Bartholomew & Horowitz, 1991). However, taxometric analyses provide little support for categorical models of attachment and instead promote the use of continuous attachment data in research (Fraley et al., 2015). Attachment anxiety and avoidance have been reliably confirmed as two underlying dimensions of attachment (e.g., Brennan et al., 1998; Griffin & Bartholomew, 1994b; Kurdek, 2002) and much of the literature now applies this dimensional approach.

**Figure 1.** *Model of adult attachment.* Adapted from Bartholomew & Horowitz (1991).





### **1.3 Attachment and psychosis**

Whilst attachment insecurity appears to be an adaptive approach to managing rejecting and unpredictable environments, research has consistently shown an association with psychopathology in adulthood, including psychosis (Dozier et al. 1999; Mickelson et al., 1997). A recent meta-analysis highlighted that individuals with psychosis have a significantly higher prevalence of insecure attachment (76%) in comparison to non-clinical populations (38%), with a small but significant association between attachment insecurity and the severity of positive symptoms across the psychosis continuum (Carr et al., 2018). Such observations have led many to theorise about the role of attachment insecurity in the development and maintenance of psychosis.

An emerging body of research indicates a level of specificity, in that different dimensions of attachment insecurity may predispose to different psychotic symptoms (Berry et al., 2007; Korver-Nieberg et al., 2014). With regard to positive symptomology, recent reviews highlight stronger links to attachment anxiety (Lavin et al., 2020; Carr et al., 2018) yet previous reviews placed greater emphasis on the role of attachment avoidance (Berry, Barrowclough & Wearden, 2007; Korver-Nieberg et al., 2014). Both attachment dimensions appear to play a role, and this variability in findings may highlight the complexity of the attachment – psychosis relationship that is yet to be fully understood. Particular mechanisms may function in response to early attachment adversity, which may indirectly contribute to the development of specific symptoms such as paranoia and hallucinations (Bentall & Fernyhough, 2008).

### **1.4 Mediation**

Mediation analysis seeks to explain an observed relationship between an independent (IV) and dependent variable (DV) through an intermediate variable, termed a ‘mediator’.

Statistical approaches to mediation have seen important developments in the past two decades, allowing for hypothesised mediators to be tested and quantified with increasing methodological rigour (Hayes, 2013; MacKinnon et al., 2007). These advances allow for the elucidation of various direct and indirect pathways through which attachment may influence the development of psychosis symptomology. For example, attachment insecurity (particularly avoidance) is thought to result in a negative internal working model of others, which acts as a template for future relationships (Bowlby, 1969). This model informs expectations of others that are negative and mistrustful, which may in turn increase paranoia. As such, attachment avoidance could indirectly contribute to paranoia through beliefs about others.

Whilst there are numerous methods of mediation analysis, the most popular is the 'causal steps' approach outlined in seminal work by Baron and Kenny (1986). This approach involves conducting a series of regression analyses, where mediation is determined by fulfilling four conditions: 1) IV is significantly related to DV (known as the total effect), 2) IV is significantly related to mediator, 3) there is an association between mediator and DV, after accounting for the IV and 4) the effect of the IV on the DV decreases when controlling for the mediator (termed the indirect effect). Step one is particularly controversial and widely considered to be outdated (Hayes & Rockwood, 2017), as the tests of total effect are low in power and do not constrain the size or significance of the indirect effect (Kenny & Judd, 2014). Multivariate techniques such as structural equation modelling (SEM) permit the simultaneous estimation of direct and indirect effects and can account for a more complex interplay of multiple independent, mediator or dependent variables (Gunzler et al., 2013). This approach has many advantages over standard regression procedures (see Iacobucci et al., 2007), yet the causal-steps method remains the most widely used. To evaluate mediation models, various methods exist for testing the significance of indirect effects. The most common include the

Sobel test (Sobel, 1982), and bootstrapping (Preacher & Hayes, 2004), with the latter having increased statistical power (MacKinnon et al., 2002).

Inferences of mediation also rely heavily on various methodological requirements. For example, mediators should have a strong theoretical basis and potential confounding variables should be adjusted for to prevent the spurious inflation of mediating effects (Cole & Maxwell, 2003). Longitudinal designs are also required to establish temporal precedence (from predictor to mediator to outcome variables) and to rule out reverse patterns of influence (Kazdin, 2007). A lack of adherence to such design requirements limits the conclusions that can be drawn, irrespective of the statistical rigor of analyses.

### **1.5 Hypothesised mediating factors of the attachment-psychosis relationship**

Mediational designs are often referred to as vital for theory development (Rucker et al., 2011). Existing models of psychosis may be enhanced with the integration of attachment theory, by providing a conceptual framework to consider the impact of mediating mechanisms (Read & Gumley, 2008). There are numerous psychological processes that may arise from attachment insecurity, but further research is required to understand the specific mechanisms through which particular attachment styles can influence the development of psychosis (Mathews et al., 2016). Whilst not an exhaustive list, below is a summary of the existing evidence for some of the key factors that have been hypothesised to mediate the relationship between attachment and psychosis. This conceptual grouping of factors is presented for clarity, whilst acknowledging that these are overlapping processes that are intrinsically interdependent. There is increasing recognition of how these factors interact through both serial and parallel mediation processes to influence positive psychotic phenomena (Garety et al., 2001).

### **1.5.1 Mentalisation**

One of the pathways that attachment is theorised to be associated with psychosis is through mentalisation. Mentalisation (or Theory of Mind; ToM) is a social-cognitive ability which enables an individual to understand the behaviour of self and others by making inferences about intentional mental states such as thoughts and feelings (Fonagy, Bateman, & Luyten, 2012). The capacity to mentalise is developed within the context of a secure attachment environment (Fonagy & Target, 1997). Therefore, those with early attachment experiences that foster insecurity are likely to have impaired mentalisation skills in later life (Fonagy et al., 2012), making it difficult to accurately interpret the mental states others. This increases the likelihood of misattributing others' intentions, which may manifest as paranoia in psychosis (Frith, 1992). This is supported by robust, meta-analytic results showing a large effect size for the relationship between ToM deficits and schizophrenia (Sprong et al., 2007). Thus, several researchers have theorised that mentalisation may play a key mediating role in the development of psychosis from attachment insecurity (Gumley & Schwannauer, 2006; Korver-Nieberg et al., 2014; MacBeth et al., 2011; Read & Gumley, 2008).

### **1.5.2 Emotion regulation**

A limited capacity for mentalisation manifests itself in maladaptive emotion regulation (Berry et al., 2015; Weijer et al., 2020). Whilst emotion regulation is a widely researched concept in the field of mental health, there is a lack of consensus about how it is best operationalised (Bloch et al., 2010). It has typically been conceptualised through the use of specific cognitive/behavioural strategies (e.g. reappraisal, suppression) intended to reduce or manage arousal (Gross, 1998). More recent developments recognise the complexity of the construct, suggesting that dispositional abilities influence an individual's capacity to utilise strategies to adaptively regulate emotions (Gratz et al., 2018). The current review will focus

on the use of emotion regulation *strategies*, whilst holding in mind the factors which may influence the development of these.

Attachment theory provides a developmental framework for understanding the origins of certain emotion regulation strategies. Individuals adapt to adverse experiences with attachment figures through the use of particular strategies to get their needs met and regulate distress (hyperactivating in anxiety/ deactivating in avoidance) (Mikulincer & Shaver, 2003). These short-term strategies for coping with negative affect increase hypervigilance towards potential threat and may influence symptom development.

Numerous papers have shown links between paranoia and strategies that are considered as 'hyperactivating' or 'deactivating'. With regard to the former, paranoia was found to be associated with catastrophising (Westermann et al., 2013), increases in persecutory delusions were preceded by rumination (Hartley et al., 2014), and worry prospectively predicted the persistence of paranoid delusions (Startup et al., 2007). The manifestation of attachment avoidance in adulthood may be through the use of different, deactivating strategies such as experiential avoidance and the external attribution of blame, both of which have been evidenced to be related to paranoia and persecutory delusions (So et al., 2015; Udachina et al., 2014). People with schizophrenia generally experience greater difficulties with emotion regulation and engage in more maladaptive emotion regulation strategies such as experiential avoidance (O'Driscoll et al., 2014). Further, maladaptive emotion regulation strategies (such as rumination, self-blame and distraction) appear to be associated with positive symptom severity, with meta-analytic effect sizes of moderate-large magnitude (Ludwig et al., 2019).

Based on this, a plausible hypothesis is that there may be different mediating pathways from attachment to paranoia; through hyper/deactivating emotion regulation strategies specific to the attachment dimensions.

### **1.5.3 Negative self-esteem**

Negative self-esteem may be the driving force for certain emotion regulation strategies such as blaming others. According to the attributional model, persecutory delusions arise from attempts to prevent negative self-esteem reaching conscious awareness by externally attributing blame for adverse events, thus implicating the malevolent intent of others (Bentall et al., 2001). However, this defence is rarely effective, hence the negative correlation that is observed between self-esteem and paranoia in psychosis (Murphy et al., 2018). Negative self-esteem may also be incorporated in the content of delusions, as in 'Bad-Me' paranoia (Trower & Chadwick, 1995). Further, negative self-esteem is more likely to develop in the context of negative developmental experiences with attachment figures (Bentall et al., 2001), and appears to be specifically associated with anxious attachment style in psychosis (Ringer et al., 2014). Taken together, this body of evidence indicates that negative self-esteem may play an important mediating role in the attachment-psychosis relationship.

### **1.5.4 Beliefs about others**

Psychosocial models of psychosis strongly implicate negative schematic beliefs in the formation and maintenance of psychotic experiences. Freeman's (2002) cognitive model argues that persecutory delusions are more likely to develop when an individual has pre-existing negative beliefs about the self, others and the world. Beliefs about the self as vulnerable and others being powerful or threatening can develop in the context of attachment insecurity, contributing to paranoia and hallucinations (Garety et al., 2001). Paranoia in particular has consistently been linked to attachment avoidance (Berry et al., 2008; Macbeth et al., 2011). It may be that negative schematic beliefs about others perpetuate paranoia through avoidance of others, preventing opportunities to disconfirm their expectations that others are out to harm them.

### **1.5.5 Beliefs about voices**

The experience of auditory hallucinations has been suggested to parallel external social relationships in terms of interpersonal schema such as power (Birchwood et al., 2004). Cole (2012) suggests a two-stage mediation model, where attachment insecurity drives negative schematic beliefs, which in turn drive negative beliefs about voices and resultant distress. Literature on beliefs about voices encompasses a range intermediate of concepts that determine distress, including the subjective meaning made of the experience such as voice omnipotence and malevolence (as in the cognitive model; Chadwick & Birchwood, 1994) and more interpersonal beliefs about the relationship between the voice and the hearer such as hearer distance (e.g. Vaughan & Fowler, 2004). Whilst these are represented as distinct in the literature, it is argued that they reflect similar principles. For example, voice omnipotence and malevolence from the cognitive literature overlap with the interpersonal concepts of voice dominance and intrusiveness (Hayward et al., 2008). In psychosis populations, attachment dimensions have been found to relate to negative beliefs about voices and associated distress (Berry et al., 2012).

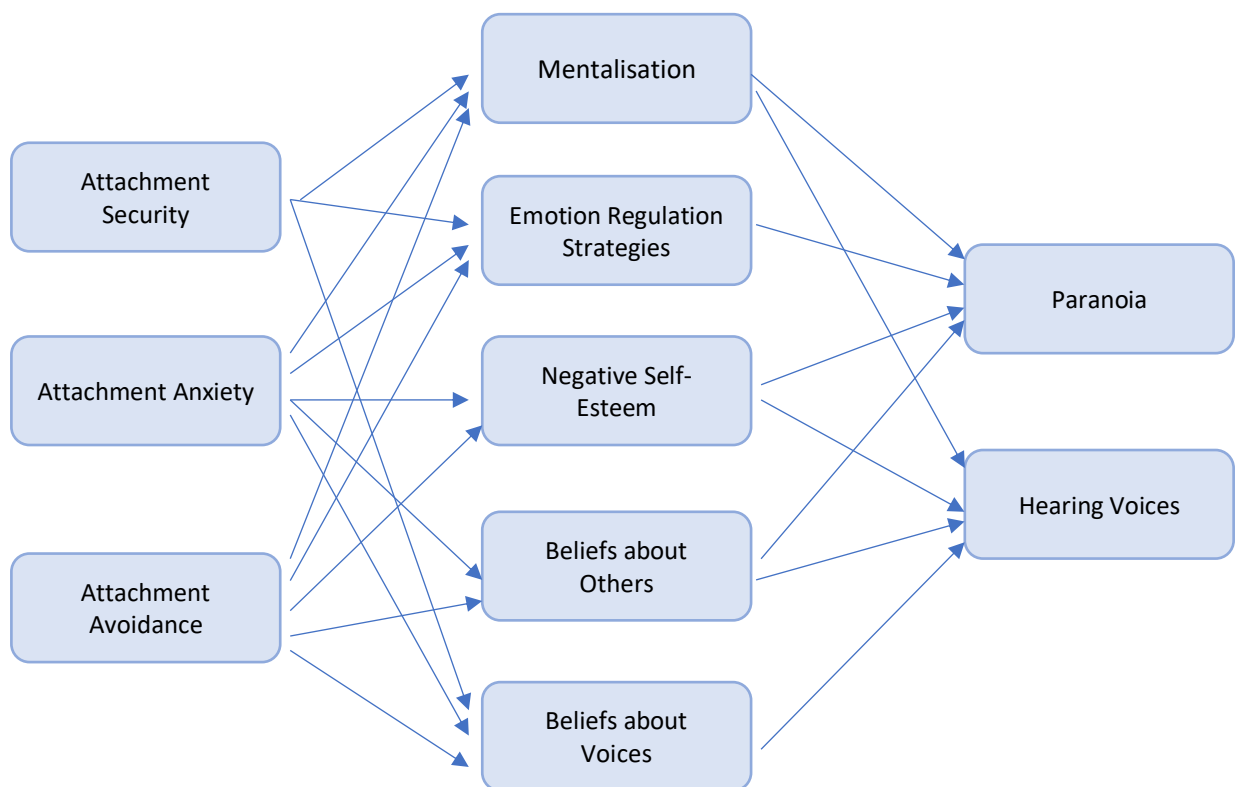
### **1.6 Previous reviews and aims for current study**

To date, there have been four narrative reviews (Berry et al., 2007; Lavin et al., 2020; Gumley et al., 2014; Korver-Nieberg et al., 2014) and one meta-analysis (Carr et al., 2018) which highlight the relevance of attachment insecurity in psychosis symptomology. Within the literature there are comprehensive theoretical discussions which attempt to explain this relationship through potential mediating mechanisms (Berry et al., 2007; Harder, 2014; Korver-Nieberg et al., 2014; Read & Gumley, 2008). Whilst the empirical evidence base has been much slower to develop, there has been considerable progress in recent years. Based on the summarised literature, a network of the putative mediating pathways between attachment and specific psychosis symptoms has been illustrated in Figure 2. Understanding

these mechanisms may have important implications for the prevention, assessment and treatment of psychosis (Berry et al., 2007). Despite this, no review to date has systematically synthesised these mediation findings.

Therefore, the current review aims to identify, summarise and evaluate empirical studies that have looked at psychological mediating factors of the attachment-psychosis relationship across the psychosis continuum. For each factor, a narrative synthesis and critical appraisal of the evidence will be presented.

**Figure 2.** Summary of the putative mediator pathways between attachment and psychosis



## 2. Methods

### 2.1 Inclusion criteria

Studies were included if they were 1) written in English, 2) published in a peer reviewed journal prior to 1<sup>st</sup> September 2019, 3) reported on specific psychological mediators between



attachment style and psychosis symptoms, 4) used a formal measure of an individual's attachment style as the independent variable, 5) used a measure of positive psychosis experiences as the dependent variable (e.g. paranoia and hearing voices) 6) used formal mediation analysis or significance tests of mediation.

Whilst studies may have examined multiple types of mediators, the scope of the current review focused only on psychological factors. The current definition of 'psychological' was adapted from Williams and colleagues (2018) and encompassed any intrapersonal emotional, behavioural or cognitive processes.

## **2.2 Exclusion criteria**

Studies were excluded if they were 1) book chapters, 2) conference posters, 3) theoretical or review papers, 4) unpublished studies, 5) protocols, 6) letters to editors, 7) considered attachment as the mediator rather than the IV, 8) measured attachment in someone different to the person with psychotic experiences e.g. attachment style of the therapist. 9) In line with previous reviews (Carr et al., 2018; Korver-Nieberg et al., 2014), studies using attachment-related constructs such as parental bonding in place of directly assessing attachment style were not considered.

## **2.3 Literature search**

A systematic search of the literature was conducted on the databases PsychINFO, Medline and Web of Science. The following search terms were used: ("attachment style" OR attach\*) AND (psychosis OR "psychosis symptom\*" OR psychotic OR paranoi\* OR hallucination\* OR "hear\* voice\*" OR delusion\* OR schizo\*) AND (mediat\* OR indirect OR "structural equation model?ing" OR SEM OR "Baron AND Kenny" OR Mackinnon OR "product of coefficient" OR "difference in coefficient" OR sobel OR "causal pathway" OR intermediate OR "indirect

effect" OR mechanism). The reference lists of relevant articles and existing reviews (Berry et al., 2007; Carr et al., 2018; Gumley et al., 2014; Korver-Nieberg et al., 2014) were searched by hand to identify any additional papers.

#### **2.4 Quality assessment**

Papers were quality assessed using an appraisal framework developed for observational mediation studies (Lee et al., 2015) (see Table 2). This was adapted for the current review to assign separate scores for the psychometric properties of (IV, mediator, DV) measures. An additional item to assess power was also added, given the inconsistent reporting in the primary papers. The author rated each eligible paper, assigning a score of 0 (no) or 1 (yes) to each of the criteria, giving a maximum quality score of 10. Total scores for separate studies were not considered as Cochrane guidance considers descriptive summaries of each quality criteria as more useful and reliable (Higgins & Green, 2011).

#### **2.5 Data extraction and synthesis**

For the purpose of the current review, mediators are presented according to five conceptual categories that are deemed to have conceptually similar pathways of influence in the attachment-psychosis relationship: 1) mentalisation 2) emotion regulation 3) negative self-esteem 4) beliefs about voices and 5) beliefs about others (see Table 3). Whilst it is acknowledged that these mechanisms do not exist in isolation and are more likely to operate through complex interactions of influence, findings are presented in this format for clarity.

The following information was extracted for a narrative synthesis of mediators examined in the primary studies: design, sample characteristics, measures of predictors, mediators, outcomes, type of mediation analysis and key findings.

### **3. Results**

#### **3.1 Study selection**

The study selection flow (as illustrated in Figure 3) followed that recommended by the PRISMA statement (Moher et al., 2009). Initially, 702 papers were identified, of which 182 were duplicates. The titles and abstracts were screened for the remaining 520 records, resulting in 42 papers that were retrieved for a full text eligibility assessment. A total of 10 papers met the inclusion criteria for the systematic review.

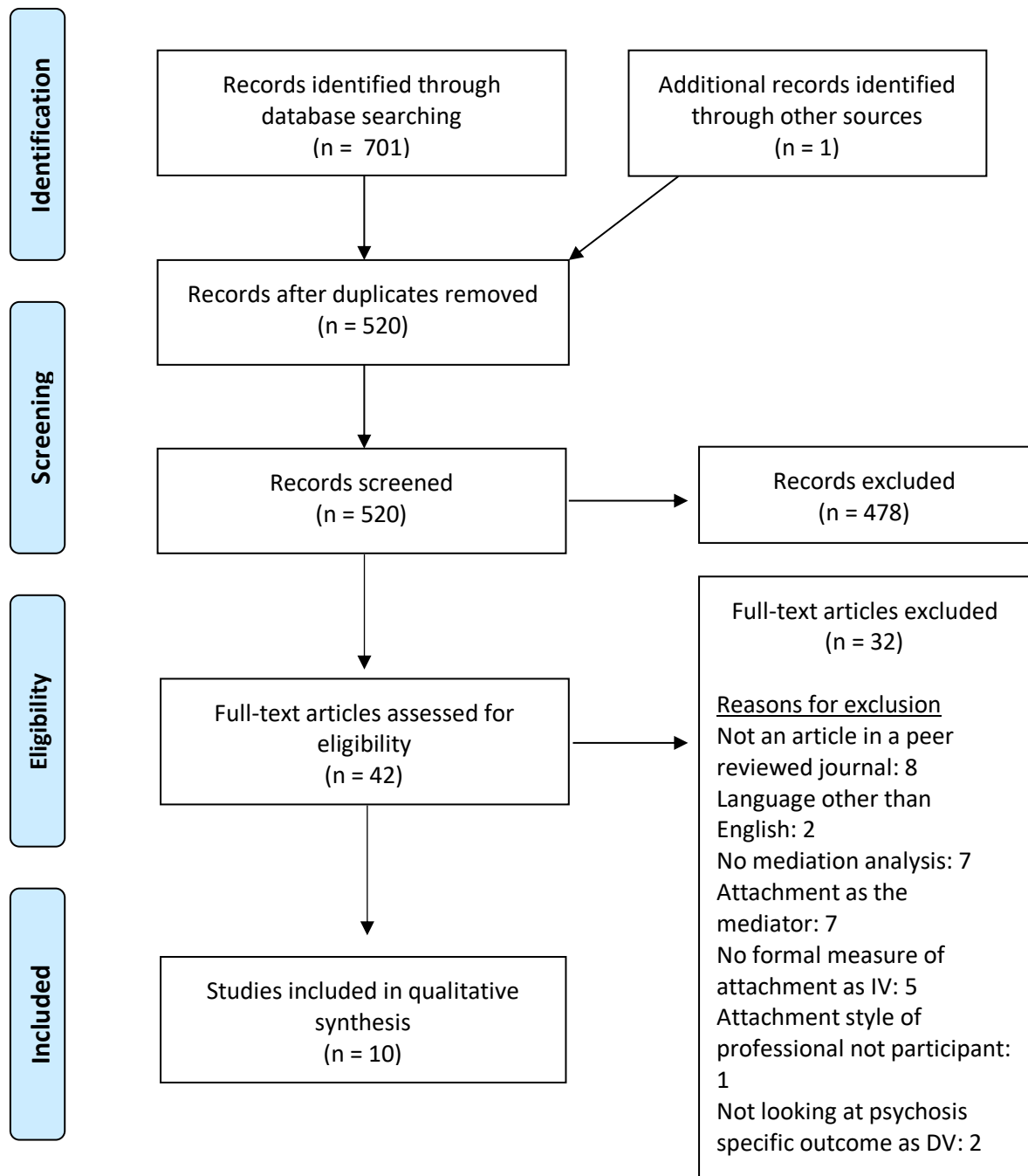
#### **3.2 Study characteristics and design**

Ten studies were included in the review. The characteristics from these studies are summarised in Table 1. Based on the reported data, there were 1984 independent participants, with mean study ages ranging from 15.33 – 42.16 years. Five studies recruited clinical participants with a confirmed psychosis-spectrum diagnosis, from community and inpatient mental health services (Ascone et al., 2019; Castilho et al., 2017; Gumley et al., 2014; Pilton et al., 2016; Wickham et al., 2015). Two studies recruited from online hearing voices forums (Cole et al., 2017; Robson et al., 2014). Whilst a diagnosis of psychosis was not an explicit inclusion criterion, this was self-reported in 57-86% of participants. One study recruited a high-risk sample from an adolescent inpatient unit, with heterogenous emotional and behavioural disorders, and assessed for emerging psychosis symptoms (Hart et al., 2017).

For the purpose of this review, data from the above samples were presented together as 'clinical' results. Samples were classified as clinical if the majority of the sample had a psychosis spectrum diagnosis or were classified as at-risk mental state participants. Data collected from the general population is reviewed separately under 'non-clinical' results, which included four studies (Ascone et al., 2019; Pickering et al., 2008; Udachina & Bentall, 2014; Wickham et al., 2015) two of which exclusively comprised of students (see Table 1).

Overall there were 1026 clinical ( $k=8$ ) and 845 non-clinical ( $k=3$ ) participants included. Nine studies were of a cross-sectional, observational design, with just one longitudinal study (Gumley et al., 2014).

**Figure 3.** PRISMA flow diagram for systematic search



**Table 1.** Summary of study characteristics

<b>Study</b>	<b>N<sup>a</sup>, sample</b>	<b>Age M(SD) gender (% female)</b>	<b>Study design</b>	<b>Attachment (measures)</b>	<b>Mediating factors<sup>b</sup> (measures)</b>	<b>Psychosis outcome (measures)</b>	<b>Mediation; Sig test; single/ multivariate model; confounders</b>
Ascone et al., (2019)	60, PSY, inpatient & community 40, NC	PSY: 40 (12) 63% NC: 40 (11) 68%	CS	Anxiety Avoidance (RSQ)	Hyperactivating (CERQ) Blaming others (CERQ)	Paranoia (PC)	SEM; Bootstrapping; Multivariate; N
Castilho et al., (2017)	37, PSY, Inpatient & community	37 (7) 19%	CS	Anxiety (ECR-RS)	Experiential avoidance (AAQ-II)	Paranoia (PC)	PROCESS macro; Bootstrapping; Single; N
Cole et al., (2017)	180, 'Voice hearers' from online voice networks (57% SR PSY)	37 (11) 62%	CS	Anxiety Avoidance (ECR-R)	Negative self schema (BCSS) Negative other schema (BCSS) Persecutory beliefs about voices (BAVQ-R)	Voice-related distress (HPSVQ)	Path analysis; Multivariate; N
Gumley et al., (2014)	54 <sup>e</sup> , PSY, inpatient & community	25 (7) 32% <sup>f</sup>	LONGL	Security (AAI)	Insight (PANSS G12)	Positive symptoms <sup>h</sup> (PANSS)	Path Analysis; Multivariate; Y

<b>Study</b>	<b>N<sup>a</sup>, sample</b>	<b>Age M(SD) gender (% female)</b>	<b>Study design</b>	<b>Attachment (measures)</b>	<b>Mediating factors<sup>b</sup> (measures)</b>	<b>Psychosis outcome (measures)</b>	<b>Mediation; Sig test; single/ multivariate model; confounders</b>
Hart et al., (2017)	361 <sup>d</sup> , ARMS inpatients, heterogenous MH	15 (1) 61%	CS	Security (CAI)	ToM (MASC)	Thought problems (YSR)(CBCL)	PROCESS macro; Bootstrapping; Single; Y
Pickering et al., (2008)	503, NC, students	21 (5) 70%	CS	Anxiety Avoidance (RQ)	Negative self-esteem (SERS) Powerful others (LoC scale)	Paranoia (PaDS-P)	Baron & Kenny; Sobel; Single; Y
Pilton et al., (2016)	55, PSY, community	42 (11) 20%	CS	Anxiety (PAM)	Persecutory beliefs about voices (BAVQ-R) Relationship with voices (VAY)	Voice-related distress (PSYRATS-DS)	Product of coefficient; Bootstrapping; Single; N
Robson et al., (2014)	44, 'Voice hearers' from online voice networks (86% SR PSY)	40 (12) 66%	CS	Anxiety Avoidance (PAM)	Persecutory beliefs about voices (BAVQ-R) Relationship with Voices (VAY)	Voice-related distress (Likert scale)	Baron & Kenny; Bootstrapping; Single; N

Study	N <sup>a</sup> , sample	Age M(SD) gender (% female)	Study design	Attachment (measures)	Mediating factors <sup>b</sup> (measures)	Psychosis outcome (measures)	Mediation; Sig test; single/ multivariate model; confounders
Udachina & Bentall (2014)	302, NC, students	22 (NR) 76%	CS	Security (RQ)	Experiential avoidance (AAQ-II) Negative self-esteem (SERS-SF)	Paranoia (PaDS- P)	SEM; Sobel; Multivariate; N
Wickham et al., (2015)	172 <sup>e</sup> , PSY, inpatient & community	38 (NR <sup>g</sup> ) 30%	CS	Anxiety Avoidance (RQ)	Negative self-esteem (SERS)	Paranoia (PaDS- P, PANSS)	SEM; Bootstrapping; Multivariate; Y

**Notes:** <sup>a</sup> Only the number of participants included in the mediation analysis is presented here, which is sometimes lower than the total recruited sample; <sup>b</sup> Only mediating factors that were included in the primary studies analyses are presented in this table; <sup>c</sup> 79 ppts in total, but only 54 completed attachment measure and therefore included in mediation; <sup>d</sup> 361 ppts completed YSR, 352 parents completed CBCL; <sup>e</sup> 176 ppts in total, but only 72 completed attachment measure and therefore included in mediation; <sup>f</sup> of the overall sample of 79; <sup>g</sup> SD not reported for overall sample; <sup>h</sup> at 12m follow-up.

**Abbreviations:** ARMS = At risk mental state; CI = Confidence Interval; CS = cross-sectional; HC = Healthy controls; LONGL = Longitudinal; M = Mean; MH = Mental Health; N = No; NC = Non-clinical; NR = Not reported; Ppt = Participant; PSY = psychosis; SD = Standard deviation; SEM = Structural Equation Modelling; SR = Self-reported; ToM = Theory of Mind; Y = Yes.

**Attachment Measures:** Adult Attachment Interview (AAI: George et al., 1985); Child Attachment Interview (CAI: Target et al., 2007); Experiences in Close Relationships - Revised (ECR-R: Fraley et al., 2000); Experiences in Close Relationships - Relationship Structure (ECR-RS: Fraley et al., 2011); Psychosis Attachment Measure (PAM: Berry et al., 2006); Relationship Scales Questionnaire (RSQ: Griffin and Bartholomew, 1994); Relationship Questionnaire (RQ: Bartholomew and Horowitz, 1991).

**Mediator Measures:** Acceptance and Action Questionnaire II (AAQ-II: Bond et al., 2011); Beliefs about Voices Questionnaire – Revised (BAVQ-R: Chadwick et al., 2000); Brief Core Schema Scales (BCSS: Fowler et al., 2006); Cognitive Emotion Regulation Questionnaire (CERQ: Garnefski & Kraaij, 2007); Locus of Control Scale (LoC: Levenson, 1973); Movie for the Assessment of Social Cognition (MASC: Dziobek et al., 2006); Negative Events Scale (NES: Kaney et al., 1997); VAY: The Voice and You (YAY: Hayward et al., 2008); Self-esteem Rating Scale (SERS: Nugent & Thomas, 1993); Self-Esteem Rating Scale-Short Form (SERS-SF: Lecomte et al., 2006).

**Measures of Psychotic Experiences:** Child Behaviour Checklist (CBCL; Achenbach & Rescorla, 2001); Hamilton Program for Schizophrenia Voices Questionnaire (HPSVQ: Van Lieshout & Goldberg, 2007); Paranoia Checklist (PC: Freeman et al., 2005); Persecution and Deservedness Scale - Persecution Subscale (PaDS-P: Melo et al., 2009); Positive and Negative Syndrome Scale (PANSS: Kay et al., 1987); Psychotic Symptom Rating Scales–Auditory Hallucinations Scale (PSYRATS-AH: Haddock et al., 1999); Psychotic Symptom Rating Scales– Voice Related Distress (PSYRATS-DS: Woodward et al., 2014); Youth Self Report (YSE: Achenbach & Rescorla, 2001).

### **3.3 Quality ratings**

The majority of the papers (80%) cited a clear theoretical framework for the proposed mediating factors (see Table 2). All papers used valid and reliable measures of IV and mediator variables, and 80% used DV measures that had good psychometric properties. Only one study made reference to a study specific power analysis and had sufficient power, despite having a relatively small sample (Gumley et al., 2014). Whilst the required number of participants depends on anticipated effect sizes and the statistical method used, it is recommended that a sample size of at least 150 is required to detect mediation in the absence of type-II errors (Fritz & MacKinnon, 2007; Holbert & Stephenson, 2002). 50% of the studies had a sample size of <150 for mediation analyses. As such, in the absence of study specific power analyses, half were likely to have been underpowered. 90% of papers used appropriate statistical methods of mediation. None of the studies established whether changes in the IV preceded changes in the mediator, and only one study looked at temporal precedence of mediator to outcome (Gumley et al., 2014). 40% of the studies controlled for possible confounding variables. The quality assessment ratings for individual studies are presented in Table 2.



**Table 2. Quality assessment**

	Ascone et al., (2019)	Castilho et al., (2017)	Cole et al., (2017)	Gumley et al., (2014)	Hart et al., (2017)	Pickering et al., (2008)	Pilton et al., (2016)	Robson et al., (2014)	Udachina & Bentall (2014)	Wickham et al., (2015)	%
1. Theoretical framework cited apriori to justify hypothesised mediating factors	1	1	1	1	1	0	1	1	1	0	<b>80</b>
2. Reliable/ valid psychometric properties of measures											
2a. IV	1	1	1	1	1	1	1	1	1	1	<b>100</b>
2b. M	1	1	1	1	1	1	1	1	1	1	<b>100</b>
2c. DV	1	1	0	1	1	1	1	0	1	1	<b>80</b>
3a. Study specific power calculation reported	0	0	0	1	0	0	0	0	0	0	<b>10</b>
3b. If yes, was the study adequately powered to detect mediation? / If no, sample size of >150? *	0	0	1	1	1	1	0	0	1	1	<b>60</b>
4. Appropriate statistics used? (Incl. product of coefficient with bootstrapping, SEM)	1	1	1	1	1	0	1	1	1	1	<b>90</b>
5. Changes in M preceded changes in the DV?	0	0	0	1	0	0	0	0	0	0	<b>10</b>
6. Changes in the IV preceded changes in M?	0	0	0	0	0	0	0	0	0	0	<b>0</b>
7. Controlled for possible confounds? * <sup>2</sup>	0	0	0	1	1	1	0	0	0	1	<b>40</b>

Abbreviations: DV = dependent variable; M = Mediator; IV = independent variable. \* As a general guide, a minimum of 150 participants is required to efficiently detect mediating effects (Fritz & MacKinnon, 2007; Holbert & Stephenson, 2002) \*<sup>2</sup> confounds such as demographics, comorbidities etc.

### **3.4 Overview of the measures used**

Whilst the studies may have measured multiple variables, only those that were used in mediation analyses are summarised below.

#### **3.4.1 Attachment measures**

Six different measures of attachment were used in the 10 primary papers, all of which were reliable and validated (see Table 1). The most commonly used measure was the Relationship Questionnaire (RQ; Bartholomew & Horowitz, 1991;  $k=3$ ). Two studies (Pilton et al., 2016; Robson et al., 2014) used the psychosis attachment measure (PAM; Berry et al., 2006). The PAM is an alternative measure based on Bartholomew's (1990) model of attachment which was specifically developed and validated in psychosis populations.

Two out of eight of the reviewed papers used interview-based measures of attachment. The Adult Attachment Interview (AAI; George et al., 1985) was used by Gumley et al., (2014) and the Child Attachment Interview (CAI; Target et al., 2007) by Hart et al., (2017). Whilst these measures are generally considered to be the gold standard approaches to measuring attachment (Jewell et al., 2019), there has been controversy around whether this same standard applies to psychosis populations, where interpretation can be obscured with psychosis symptoms (Berry et al., 2006). However, these measures have been validated in first episode psychosis populations (e.g. MacBeth et al., 2011). There is also ongoing debate about the convergent validity of self-report and interview-based approaches to the measurement of attachment. Meta-analytic findings highlight that the empirical overlap between these approaches are trivial-to-small, raising questions over whether they are capturing the same underlying attachment constructs (Roisman et al., 2007). It is argued that self-report measures assess conscious appraisals of the self in relationships, whilst interview

methods tap into unconscious attachment representations and processes (Jacobvitz et al., 2002).

The majority of the studies used composite scores for the attachment dimensions of anxiety ( $k=7$ ) and avoidance ( $k=5$ ) as predictors in the mediation analyses. Three studies focused on attachment security.

### **3.4.2 Measures of psychotic experiences**

The outcomes of positive psychotic experience can be clustered into paranoia, auditory hallucinations and broader positive symptoms.

Five studies focused on paranoia as the outcome of mediation (Ascone et al., 2019; Castilho et al., 2017; Pickering et al., 2008; Udachina et al., 2014; Wickham et al., 2015). Three different measures of paranoia were used, two self-report measures and one observer rated (see Table 1). All studies used subscales from the original measures, each of which independently had good psychometric properties. The most frequently used measure was the PaDS persecution subscale ( $k=3$ ) (Pickering et al., 2008; Udachina & Bentall, 2014; Wickham et al., 2015); which involves rating agreement with statements that imply that the individual is subject to malevolent intentions (e.g. "There are times when I worry that others might be plotting against me"). This measure is validated for use in both clinical and non-clinical populations (Melo et al., 2009). The Paranoia Checklist (PC) was used in two studies (Ascone et al., 2019; Castilho et al., 2017), which captures the frequency of different facets of paranoid ideation, including reference (e.g. 'Bad things are being said about me behind my back') and persecution (e.g. 'People would harm me if given an opportunity'). One study included two separate measures of paranoia in the mediation analyses (Wickham et al., 2015).

Three studies examined auditory hallucinations as an outcome of mediation, each focused on distress (Cole et al., 2017; Pilton et al., 2016; Robson et al., 2014). This is on the basis that the experience of hearing voices is not pathological in itself, rather the distress associated is of clinical importance (Birchwood & Trower, 2006). Whilst most studies administered measures of auditory hallucinations that have strong psychometric properties, such as the HPSVQ and PSYRATS-AH, two papers extracted single unvalidated self-report items as a measure of voice-related distress in the mediation analyses (Cole et al., 2017; Robson et al., 2014). These studies were marked down in their quality rating score.

One study (Gumley et al., 2014) used observer ratings of general positive symptoms using the PANSS, which includes both paranoia and hallucinations along with other domains such as grandiosity and disorganised thinking. Another study measured both parent and child-rated 'Thought Problems' subscales as transdiagnostic assessments of psychotic-like symptoms in an ARMS adolescent sample (Hart et al., 2017).

### **3.5 Overview of mediation analyses**

Most studies used multiple components to mediation analysis within the same study, e.g. Baron & Kenny's causal steps to test mediation, accompanied by Sobel to test for the significance of indirect effects. The most widely applied approach was bootstrapping approach to significance testing ( $k=6$ ), followed by structural equation modelling and path analysis ( $k=4$ ). These approaches are considered to be more powerful and efficient than Baron and Kenny's causal steps approach ( $k=2$ ) and the Sobel test ( $k=2$ ) used by fewer studies (Hayes, 2009). Only one study (Pickering et al., 2008) was marked down in the quality criteria, which combined Baron and Kenny's causal steps with Sobel's test of significance. One of the main limitations of the Sobel test lies in the lack of power, hence the penalisation by the quality appraisal tool. However, power was not a problematic factor for the Pickering et al.,

(2008) study, which recruited a large sample of 503 participants and found a significant mediation effect. Five studies tested simple mediation models (Castilho et al., 2017; Hart et al., 2017; Pickering et al., 2008; Pilton et al., 2016; Robson et al., 2014), and five used multivariate mediation analyses (Ascone et al., 2019; Cole et al., 2017; Gumley et al., 2014; Udachina & Bentall, 2014; Wickham et al., 2015), where they simultaneously tested multiple variables in one model.

### **3.6 Synthesis of the attachment-psychosis mediation results**

A range of psychological mediators were investigated using various measures (see Table 3 for details). All studies used reliable and valid measures for their mediators of interest. Psychological mediating factors tested included mentalisation ( $k=2$ ) emotional management strategies ( $k=3$ ) negative self-esteem ( $k=4$ ), beliefs about others ( $k=4$ ) and beliefs about voices ( $k=3$ ).

**Table 3** Mediator categories and measures

<b>Mediator category</b>	<b>Definition</b>	<b>Variables in category</b>	<b>Measures</b>	<b>Studies</b>
<b>Mentalisation</b>	A social-cognitive ability which enables insight into the intentional mental states of self and others.	Theory of mind	MASC	Hart et al., 2017
		Insight	PANSS (G12)	Gumley et al., 2014
<b>Emotion regulation strategies</b>	The use of specific strategies to modulate emotional experiences or expression.	Hyperactivating emotion regulation	CERQ <sub>subscale</sub>	Ascone et al., 2019
		Blaming others	CERQ <sub>subscale</sub>	
		Self-blame	CERQ <sub>subscale</sub>	
		Experiential avoidance	AAQ-II	Castilho et al., 2017; Udachina & Bentall, 2014
<b>Negative self-esteem</b>	Negative self-evaluation about one's own worth, value and abilities.	Negative self-schema	BCSS	Cole et al., 2017
		Negative self esteem	SERS	Pickering et al., 2008; Wickham, 2015
			SERS-SF	Udachina & Bentall, 2014

Mediator category	Definition	Variables in category	Measures	Studies
<b>Beliefs about others</b>	Views/cognitions that inform what to expect from people	Negative other schema	BCSS	Cole et al., 2017
		Belief in Powerful Others	MLCS <sub>subscale</sub>	Pickering et al., 2008; Wickham, 2015
<b>Beliefs about voices</b>	Interpretation of the anomalous experience of hearing voices; appraisals of and relation to the agent	Voice omnipotence, malevolence etc.	BAVQ-R	Cole et al., 2017; Pilton et al., 2016; Robson et al., 2014
		Voice dominance, intrusiveness etc.	VAY	Pilton et al., 2016; Robson et al., 2014

**Measures:** Acceptance and Action Questionnaire II (AAQ-II: Bond et al., 2011); Beliefs about Voices Questionnaire – Revised (BAVQ-R: Chadwick et al., 2000); Brief Core Schema Scales (BCSS: Fowler et al., 2006); Cognitive Emotion Regulation Questionnaire (CERQ: Garnefski & Kraaij, 2007); Locus of Control Scale (LoC: Levenson, 1973); Movie for the Assessment of Social Cognition (MASC: Dziobek et al., 2006); Negative Events Scale (NES: Kaney et al., 1997); VAY: The Voice and You (YAY: Hayward et al., 2008); Self-esteem Rating Scale (SERS: Nugent & Thomas, 1993); Self-Esteem Rating Scale-Short Form (SERS-SF: Lecomte et al., 2006)

A synthesis of key mediation findings is presented in Table 4 below. The following sections provide narrative summaries and evaluate of the strength of evidence for each group of mediators.

### **3.6.1 Mentalisation**

Two studies looked factors that were classified as ‘mentalisation’ (insight: Gumley et al., 2014) (ToM: Hart et al., 2017), which both converged to show a mediating role in the relationship between attachment security and variants of positive psychosis experiences. One sample comprised of adults with psychosis (Gumley et al., 2014) and the other ARMS adolescents (Hart et al., 2017). According to the quality criteria, both studies used acceptable statistical techniques and controlled for potential confounding variables such as age and gender, increasing the strength of mediation inferences that can be drawn (Cole & Maxwell, 2003). Hart et al., (2017) used a single mediation model, whilst Gumley et al., (2014) considered multiple variables in the same model using path analysis, allowing and controlling for covariance between variables. Further, Gumley et al., (2014) was the only longitudinal study in the current review, allowing time to elapse between the theoretical influence of insight and the anticipated effect on psychosis symptomology. However, the limited research and variable tools used to capture the concept make comparisons challenging.



**Table 4.** Key mediation findings

Mediating factor category	Attachment (IV)	Psychosis outcome (DV)	Clinical samples								Non-clinical samples				
			Ascone	Castilho	Cole	Gumley	Hart	Pilton	Robson	Wickham	Ascone	Pickering	Udachina	Wickham	
Mentalisation	Security	Positive Sx	-	-	-	✓	✓	-	-	-	-	-	-	-	-
Emotion regulation	Anxiety	Paranoia	✓	✓	-	-	-	-	-	-	-	X	-	-	-
	Avoidance	Paranoia	X	?	-	-	-	-	-	-	-	X	-	-	-
	Security	Paranoia	-	-	-	-	-	-	-	-	-	-	-	✓	-
Negative self-esteem	Anxiety	Paranoia	-	-	-	-	-	-	-	-	✓	-	✓	-	?
		Hallucinations	-	-	✓	-	-	-	-	-	?	-	?	-	?
	Avoidance	Paranoia	-	-	-	-	-	-	-	-	✓	-	✓	-	?
		Hallucinations	-	-	✓	-	-	-	-	-	?	-	?	-	?
Security	Paranoia	-	-	-	-	-	-	-	-	-	-	-	✓	-	
Beliefs about others	Anxiety	Paranoia	-	-	-	-	-	-	-	-	?	-	✓	-	?
		Hallucinations	-	-	✓	-	-	-	-	-	?	-	?	-	?
	Avoidance	Paranoia	-	-	-	-	-	-	-	-	?	-	✓	-	?
		Hallucinations	-	-	✓	-	-	-	-	-	?	-	?	-	?
Beliefs about voices	Anxiety	Hallucinations	-	-	✓	-	-	✓	✓	-	-	-	-	-	-
	Avoidance	Hallucinations	-	-	✓	-	-	?	✓	-	-	-	-	-	-

**Key:** ✓ = significant mediation finding. X = non-significant mediation finding. ? = inconclusive. Variables measures but not tested in mediation model.

### 3.6.2 Emotion regulation strategies

Three studies examined emotion regulation strategies, one focused on a clinical sample (Castilho et al., 2017), one non-clinical (Udachina & Bentall, 2014) and one recruited both clinical and non-clinical controls (Ascone et al., 2019). Paranoia was the only psychosis outcome explored. Castilho et al., (2017) measured both attachment anxiety and avoidance for multiple attachment figures, but in accordance with Baron & Kenny's (1986) recommendations, only computed mediation models for variables with significant associations between IV and DV variables; 'attachment anxiety with respect to mother'. More recent literature has disputed this requirement, highlighting that there are instances where significant mediation exists in the absence of a significant association between predictor and outcome variables (MacKinnon et al., 2007). Thus, the role of attachment avoidance and in relation to other attachment figures may have been underestimated due to the exclusion of non-significant associations.

Whilst all studies scored as employing adequate statistical techniques, some methods were more sophisticated than others. As covariation between attachment dimensions or different mediating factors is expected, examining all mediation pathways in one SEM model limits the risk of type I errors (e.g. Ascone et al., 2019; Udachina & Bentall, 2014). Ascone et al., (2019) examined the role of emotion regulation strategies that were specific to attachment anxiety (hyperactivating) and avoidance (blaming others) and found significant mediation only for the attachment anxiety-hyperactivating pathway. Further this effect only reached significant in the clinical sample, indicating a possible moderating role of factors specific to clinical populations. However, the non-clinical sample was smaller and thus had reduced power to detect true mediation effects. Udachina and Bentall's (2014) larger, non-clinical sample found experiential avoidance to play a significant mediating role in the relationship between attachment security and paranoia. In sum, the limited evidence that exists appears to

indicate that emotion regulation strategies may specifically mediate the relationship between attachment and paranoia.

### **3.6.3 Negative self-esteem**

Two clinical (Cole et al., 2017; Wickham et al., 2015), and two non-clinical studies (Pickering et al., 2008; Udachina & Bentall, 2014) examined the role of negative self-esteem as a mediator of the attachment-psychosis relationship. Greater consistency in the mediator measures used increases the comparability of findings.

In clinical samples, negative self-esteem was found to mediate the relationship between both attachment anxiety and avoidance to paranoia (Wickham et al., 2015) and hallucinations (Cole et al., 2017). In non-clinical samples, significant effects were only found for paranoia (Pickering et al., 2008; Udachina & Bentall, 2014) although Wickham et al., (2015) did not consider their non-clinical control participants in mediation analyses. Udachina and Bentall (2014) considered the role of negative self-esteem as part of a more complex sequential mediation pathway; attachment security was linked to negative self-esteem, which in turn was associated with experiential avoidance, and resultant paranoia. However, these variables were only associated on a cross-sectional basis so no conclusions of temporal precedence can be drawn.

Overall, negative self-esteem appears to have some support as a non-specific mediator for all attachment types and both paranoia and hallucinations. However, it must be noted that studies with hallucinations as the outcome did not control for co-occurring paranoia (Cole et al., 2017). This may be important given that controlling for comorbidity between paranoia and hallucinations eliminated any independent predictive effect of attachment on

hallucinations (Pickering et al., 2008) and was utilised as a control variable in mediation analyses (amongst other demographic variables), in research by Wickham et al., (2015).

Although no studies explicitly reported non-significant mediation effects of negative self-esteem, it must be highlighted that some studies did not pursue mediation analyses with hallucinations as an outcome despite having measured this (Pickering et al., 2008; Wickham et al., 2015). Whilst this approach is consistent with the causal steps recommendations (Baron & Kenny, 1986), it may also reflect a possible bias in selecting and reporting positive effects. It also precludes conclusions about null effects of negative self-esteem in pathways to hallucinations.

#### **3.6.4 Beliefs about others**

Three papers examined the potential mediating impact of beliefs about others in two clinical (Cole et al., 2017; Wickham et al., 2015) and two non-clinical samples (Pickering et al., 2008; Wickham et al., 2015). This was explored across both attachment dimensions and psychosis outcomes. Cole et al., (2017) found that beliefs about others played a mediating role in a multivariate model between both attachment dimensions and hallucinations. However, the potentially confounding effects of comorbid paranoia were not considered. When focused on paranoia outcomes, there is inconsistent evidence. Pickering et al., (2008) found beliefs about others to mediate the relationship from both attachment dimensions. Despite looking at the same variable (belief in powerful others) using the same measure, Wickham et al., (2015) failed to replicate this finding, which could possibly be attributable to the smaller sample size. No associations were found between beliefs about others and attachment dimensions for clinical nor non-clinical samples. Therefore, following Baron & Kenny's (1986) recommendations, mediation analyses were not pursued further. As previously discussed, these recommendations are outdated and this may have been a premature termination of

analysis. Nevertheless, the existing evidence for the mediating role of 'beliefs about others' is very limited.

### **3.6.5 Beliefs about voices**

Three studies looked at the mediating role of beliefs about voices in clinical samples in voice-related distress. Beliefs related to attributing to an external agent that was perceived to be responsible for the voices heard, which influenced how adverse the experience of hearing voices was. Findings converged to show the mediating effects of voice omnipotence and voice malevolence for attachment anxiety (Cole et al., 2017; Pilton et al., 2016; Robson et al., 2014) and attachment avoidance (Cole et al., 2017; Robson et al., 2014). Cole et al., (2017) used path analysis to implicate beliefs about voices in sequential mediating pathways, preceded by beliefs about others and beliefs about the self. The other two were limited by small sample sizes and used single mediator models. None of the studies controlled for potentially confounding variables. This is a limitation given that independent analyses found paranoia also mediated the relationship between attachment and voice-related distress (Robson et al., 2014); thus, highlighting a potential confounding impact of other psychosis symptoms. Further, two papers were marked down in the quality assessment for their use of unvalidated single item outcome measures (Cole et al., 2017; Robson et al., 2014).

## **4. Discussion**

The aims of this paper were to 1) systematically review studies investigating psychological mediating factors connecting attachment and positive psychotic symptoms; and 2) to critically evaluate the quality and strength of the evidence for each. From the 10 included studies, five groups of mediating factors were identified: mentalisation, emotion regulation strategies, negative self-esteem, beliefs about others and beliefs about voices.

#### **4.1 Summary of key findings**

Given the variability in methodology and findings it is difficult to derive summative conclusions. The existing evidence is not sufficiently consistent to support specific mediation claims between attachment dimensions and symptom types.

The support for mediation effects in paranoia outcomes across both clinical and non-clinical samples is consistent with the psychosis continuum approach. Overall, effects appeared to be more pronounced in clinical samples. This was despite the typically smaller sample sizes and reduced power, which could suggest a dose-response mediation effect increasing in strength with severity of paranoid ideation. However, for hallucination outcomes there were no significant mediation outcomes amongst non-clinical samples. For the outcome of hallucinations in general, the only mediating category that had consistent support in clinical samples was 'beliefs about voices'.

The current review only included two studies which were deemed to indirectly capture aspects of the complex construct that is mentalisation, although this domain appears to indicate links with attachment security and positive symptoms more generally. Negative self-esteem was the most widely researched factor, which has some support as a non-specific mediator for all attachment types and both psychosis symptom outcomes. Evidence for beliefs about others was inconsistent. Specific to paranoia symptoms, there is some preliminary evidence for the role of strategies such as hyperactivating emotion regulation and experiential avoidance.

#### **4.2 Fearful attachment**

Many studies focused on underlying attachment dimensions in mediation analyses, but none considered fearful attachment. Fearful attachment (comparable to "disorganised

attachment” in interview-based attachment measures) is thought to develop in response to disrupted caregiving experiences involving frightened or frightening responses from attachment figures (Main & Solomon, 1986, 1990). This often occurs in the context of abuse, neglect or early loss where the caregiver is simultaneously a source of comfort and distress (Shaver & Clark, 1994). In adulthood, people with fearful (or disorganised) attachment experience a conflicting desire for and resistance to emotional intimacy, simultaneously presenting as high in both attachment anxiety and avoidance dimensions (see Figure 1: Bartholomew & Horowitz, 1991). Whilst three-way (secure, anxious, avoidant) attachment classifications are generally considered to be adequate in non-clinical populations, the four-way distinction involving fearful attachment is highly relevant when considering psychopathology (Mikulincer & Shaver, 2003). Fearful (or equivalent) attachment was not considered as part of the mediation analysis in any of the primary papers of the present review. The two papers using interview-based measures focused on attachment security (Gumley et al., 2014; Hart et al., 2017), and one study used self-report assessments of attachment security (Udachina & Bentall, 2014). All other studies examined the dimensions of attachment anxiety and avoidance separately. To only consider the two dimensions in isolation is a significant shortcoming given that a recent meta-analysis found that fearful attachment (high anxiety and avoidance) was the most prevalent attachment style in psychosis populations, accounting for 38% of the sample (Carr et al., 2018). Many facets of the fearful profile are highly relevant to the mediating categories of the present review such as ineffective emotion regulation strategies (Ponizovsky et al., 2013), low self-esteem (Bentall & Fernyhough, 2008) and negative beliefs about others (Mason et al., 2005). The synergy of high attachment anxiety and avoidance could be central to the development of psychosis psychopathology and should be considered in future research.

#### **4.3. Limitations**

#### **4.3.1 Study methodologies and measurement**

Across studies there were substantial levels of heterogeneity in measures of the putative mediating factors, attachment and psychosis, making it difficult to draw overall conclusions from the narrative summaries and preventing a meta-analytic synthesis of findings. Further, grouping of mediator categories was conducted on a conceptual basis, which resulted in some mediating factors (e.g. negative self-esteem and beliefs about voices) being more homogenous than others (e.g. emotion regulation strategies and mentalisation) influencing the scope of comparison.

Further, participants recruited across and within studies were highly heterogenous making it difficult to categorise participants into clear clinical or non-clinical samples. This limited the scope of the current review to comment on between group differences and whether certain factors may moderate the pathways between attachment and psychosis symptoms.

With one exception, all studies in the current review are of a cross-sectional design. This is a significant limitation, given that a crucial requirement for establishing mediation is temporal precedence from predictor to mediator to outcome variables (Kazdin, 2007). Although it makes theoretical sense that attachment may lead to psychosis through various pathways, this direction of effect cannot be assumed. Whilst attachment patterns are largely stable (Fraley, 2002), there is evidence that adverse life events can alter attachment representations (Waters et al., 2000). Given that a psychotic episode can be traumatic in itself (Mueser et al., 2010), it is not possible to rule out a reverse effect whereby attachment changes as a result of psychosis. Prospective, longitudinal designs are required to fully understand the attachment-psychosis association.



### **4.3.2 Mediation**

There is a high degree of variability in the statistical approaches to mediation and reporting of effect estimates. Many of the studies relied on the causal steps' logic of which the significance of the predictor-outcome relationship is a prerequisite to establish if there is any effect to be mediated (Baron & Kenny, 1986). This results in a data-driven rather than an apriori theory-driven approach; whereby only significant associations are pursued further. Not only does this mean that possible indirect effects of significance may have been missed, but also leaves a lack of effects to collate for metanalytic purposes. This reduces the power to detect real mediation effects. Further, many of the studies do not fill the conceptual criteria for establishing mediation, such as ruling out confounding variables or reverse causation (Judd and Kenny, 2010).

Some studies estimated specific mediation effects between constructs (e.g. Castilho et al., 2017; Robson et al., 2014), whilst others took a globally focused approach, evaluating the overall fit of a network of variables (e.g. Cole et al., 2017; Gumley et al., 2014). Both approaches are meaningful and dependent upon the primary study research question and methodological parameters (Agler & De Boeck, 2017). However, this is another divarication in the approaches of the reviewed papers that makes comparison more challenging. Further, some studies that tested multiple mediators in separate analyses may be vulnerable to multiple testing and the inflation of type I error.

### **4.3.3 The current review**

There were also limitations to the review itself. The lack of a second independent researcher for paper selection and for double rating using the quality appraisal criteria reduces reliability. The search strategy, which encompassed a breadth of different mediating factors,

was designed to compensate for the scarcity of empirical mediation studies in this area. However, this exacerbated the issue of heterogeneity and prevented the planned quantitative synthesis of data. Further, the requirement for studies to have statistically examined mediation processes missed the wealth of evidence that exists looking at links between various separate components of the attachment-mediator-psychosis relationship. For example, studies reporting correlations between attachment anxiety and negative self-esteem (Berry et al., 2006), links between mentalisation and paranoia (Bentall et al., 2009), or associations between emotion regulation strategies such as experiential avoidance and hallucinations (Varese et al., 2016). Whilst none of these studies included all of the putative independent, dependent and mediator variables, there are approaches that could support the quantitative synthesis of this relevant data into one coherent model, such as meta-analytic structural equation modelling (MASEM) (Viswesvaran & Ones 1995). MASEM allows for the computation of an overall model using data from multiple studies looking at relationships between different sets of variables. Such an approach would have allowed for the inclusion of relevant data to investigate the current research question, regardless of whether mediation was addressed in the primary studies. It would also ameliorate a key limitation of the current review, which was the arbitrary separation of interconnected mediation processes.

#### **4.4 Future research**

Applying an approach such as MASEM would enable a coherent, quantitative synthesis of the existing evidence, which could disentangle the relevant contribution of each putative mediating factor. Multiple mediators may capture the same underlying processes; thus, it would be important to assess the degree of overlap, the impact of moderators on mediated pathways and to explore serial mediator pathways. Key examples of serial mediator pathways would be to include the impact of trauma, as attachment itself has been implicated

as a robust mediator of the trauma-psychosis relationship with a high degree of specificity between types of trauma, attachment dimensions and different psychotic symptoms (Sitko, et al., 2014; Williams et al., 2018).

The scope of the current review has focused on individual psychological mediators, yet a broader web of biopsychosocial factors are likely entangled. With regard to neurobiology, early attachment adversity may have a lasting impact on the stress regulation functions of the brain (Barker et al., 2015; Read et al., 2009). Adults with attachment insecurity were found to release higher levels of cortisol in response to activation of the attachment system (Mikulincer & Shaver, 2007), and other research suggests that heightened reactivity to interpersonal stress predicts paranoia (Lataster et al., 2013; Masillo et al., 2012). Thus, strategies to manage emotion dysregulation may provide insight into the development of psychosis through a stress-vulnerability model (Barker et al., 2015). When considering social and interpersonal factors, insecure attachment is associated with poorer service engagement (MacBeth et al., 2011) and a delay in accessing treatment which can lead to a worsening of psychotic symptoms (Gumley et al., 2014). Thus, the attachment-psychosis relationship is likely made up of a far more complex network of pathways than is currently understood.

Whilst the current paper provides a comprehensive review of the psychological mediators in the existing evidence base, previous unsystematic reviews of the literature highlighted additional psychological factors as potential mediators of the attachment-psychosis association. Examples include expressed emotion (Berry et al., 2007) dissociation (Harder, 2014) and interpersonal processes such as isolation and communication style (Read & Gumley, 2008). Whilst these factors remain plausible mediating processes, further research is required as there is no empirical evidence from mediation analyses to substantiate these hypotheses at present.

The current review only included two studies which were deemed to indirectly capture aspects of complex construct that is mentalisation. Given the strong theoretical background in this field (e.g. Korver-Nieberg et al., 2014) this domain warrants further exploration with a more explicit assessment of mentalisation.

If attachment-related processes are found to influence the development of specific psychosis symptoms, this will have important implications for both intervention and prevention. However, at present, research collaboration with larger databases is required to further understand the role of mediating factors in the attachment psychosis relationship.

#### **4.5 Clinical and academic implications**

With regard to specific factors, negative self-esteem appears to show the most promise as a non-specific mediator in the relationship between attachment and both paranoia and hallucination symptoms. Negative self-esteem is also the most widely and reliably researched mediator in this field at present and may be a useful direction for future research to pursue. Beliefs about voices also appears to be a promising mediating factor for hallucinations as a specific outcome, although larger scale studies would be required to corroborate these preliminary findings.

Establishing the mediating factors that link attachment and psychosis could have important clinical implications. It highlights the value in assessing attachment in people with psychosis and incorporating this into longitudinal formulations to guide therapy. Therapists may need to tailor their approach to fit service users' attachment needs, which could enhance engagement and treatment outcomes (Berry & Bucci, 2016). For example, service users with high attachment anxiety may need more support with emotional containment whilst those

high in attachment avoidance may require an assertive outreach approach to engagement (Bucci et al., 2015). This line of research may also identify mediators that could be specifically targeted in treatment to influence psychotic symptoms. Mentalisation based therapy (MBT) has been suggested as a promising treatment option for people with psychosis by enhancing the capacity to mentalise, particularly in attachment relationships (Brent & Fonagy, 2014). Replacing experiential avoidance with more adaptive emotion regulation strategies such as mindfulness has been found to have positive effects on psychosis symptoms (Khoury et al., 2014) and improving negative self-esteem through cognitive restructuring has been shown to reduce persecutory delusions (Freeman et al., 2014). Finally, it is important to recognise the protective value of attachment security, which may buffer against symptoms of psychosis and facilitate recovery through multifaceted pathways (Harder, 2014).

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## **Part 2: Empirical Paper**

**The impact of attachment and interpersonal contingency on trust in  
people with psychosis and paranoia**

## **Abstract**

**Aims:** Interpersonal contingency plays an important role in attachment formation. Those with high paranoia have a tendency to over-attribute hostile intentionality in behavioural contingency. This study aimed to use virtual reality to investigate potential associations between attachment, contingency and trust in a psychosis sample.

**Method:** A sample of 22 early intervention psychosis participants with active paranoia completed a series of questionnaires assessing attachment style and psychosis symptoms. During a brief virtual reality scenario, participants engaged in a social interaction with an avatar. Participants were randomly assigned to one of two interpersonal contingency conditions, in which the avatar would be more or less responsive in body language. Both subjective (self-report) and objective (interpersonal distance) indicators of trust were recorded.

**Results:** Fearful attachment was the most predominant attachment style. A significant correlation was found between fearful attachment and trusting behaviour, where more fearful participants would stand further away from the avatar. The difference in interpersonal distance between contingency groups approached significance, indicating that participants found the highly responsive avatar less trustworthy. Findings were less pronounced for subjective trust outcomes, although some trends appeared to be emerging through exploratory graphical analysis.

**Conclusions:** The present findings are considered in the context of a lack of statistical power. Attachment insecurity appears to influence trust in social interactions with strangers. Findings are interpreted in light of the attachment behavioural system. Conceptual mechanisms are explored to understand the aversion to interpersonal contingency observed in the current highly paranoid sample. Future directions for research and clinical implications are discussed.



## **1. Introduction**

### **1.1 Psychosis and paranoia**

The term psychosis captures a set of symptoms in which there is a loss of touch with reality, typically involving hallucinations and/or delusions (American Psychiatric Association, 2013). Paranoia is a common feature of psychosis, whereby individuals are excessively suspicious or mistrustful of others (Freeman & Garety, 2000). Paranoia is considered to sit on a continuum of severity across both clinical and non-clinical populations (van Os et al., 2009). People with psychosis experience extreme levels of paranoia which can lead to persecutory delusions, defined as a strongly held unfounded belief that someone intends to harm them (Freeman & Garety, 2000). Persecutory delusions are the second most common symptom of psychosis, reported in as many as half of individuals in mental health services (Sartorius et al., 1986). This category of delusional belief is associated with significant levels of distress (Freeman et al., 2002) and increased hospital admissions (Castle et al., 1994).

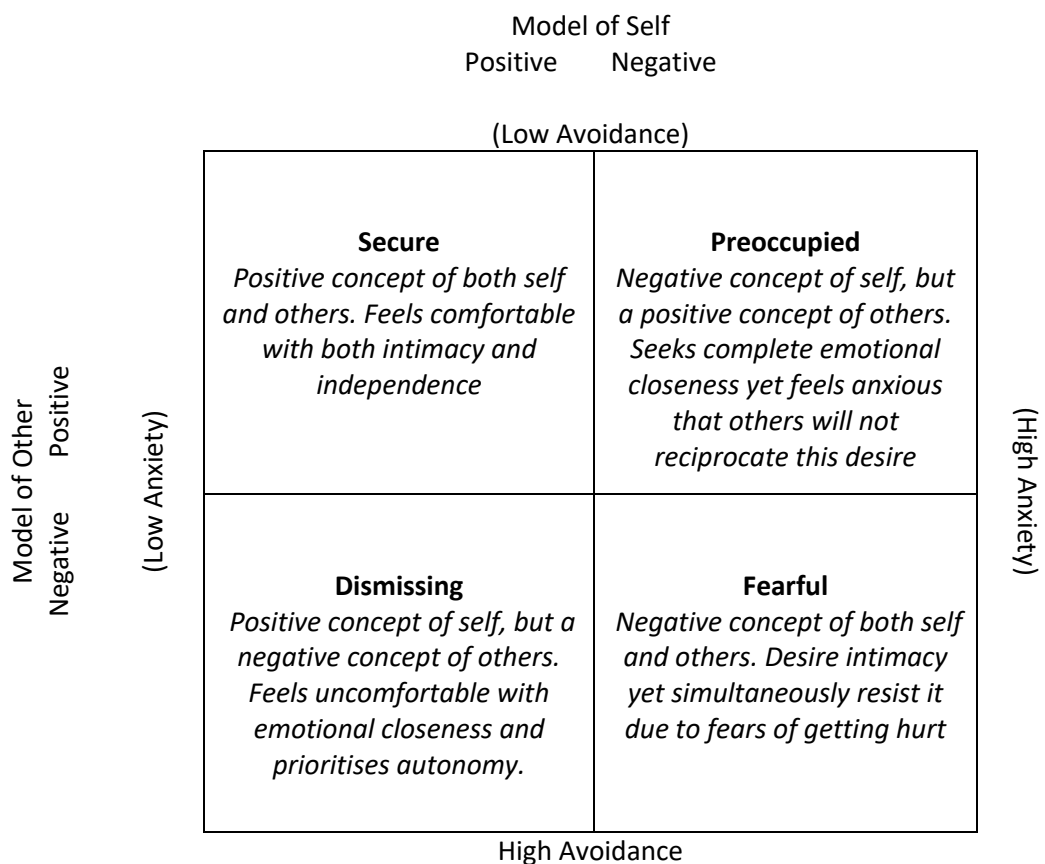
### **1.2 Attachment**

Attachment theory proposes that humans form enduring emotional bonds which allow them to connect with others across space and time (Ainsworth, 1973; Bowlby, 1969). Infants are reliant on their caregiver for survival at a premature stage in their cognitive, emotional and social development. From an evolutionary perspective attachment facilitates survival (Bowlby, 1958), whereby the primary function is to maintain proximity to an attachment figure who can provide protection and facilitate emotion regulation during times of distress (Bowlby, 1982).

Early caregiving experiences are internalised to create an internal working model (IWM); a mental framework consisting of representations of self and others (Bowlby, 1969). Securely attached Infants who receive reliable and sensitive caregiving develop positive

representations of the self and others (Bowlby, 1973). In contrast, those with insecure attachment styles will hold negative IWM's which are expressed through the use of two types of behavioural strategies to regulate distress (Cassidy & Kobak, 1988; Main, 1990). In inconsistent caregiving environments where children learn they need to exaggerate their needs for comfort and proximity in order to be noticed, children will develop a negative view of the self and experience high attachment anxiety. Conversely, children will adapt to experiences of unavailable or hostile caregiving by downplaying their needs. These children will develop a negative IWM of others as untrustworthy and be high in attachment avoidance (Mikulincer & Shaver, 2003).

**Figure 1.** *Model of adult attachment.* Adapted from Bartholomew & Horowitz (1991).



Importantly, these patterns of attachment are known to remain relatively stable and their organisational influence on interpersonal behaviour persists throughout the lifespan (Bowlby, 1982; Grossman et al., 2006; Sroufe, 2005). In adulthood, IWM's and the degree of attachment anxiety/avoidance map onto a matrix of four distinct attachment styles. These vary in terminology but are often referred to in adulthood as secure, preoccupied, dismissing and fearful (see Figure 1) (Bartholomew & Horowitz, 1991). These mental representations act as a template for expectations of trust in future relationships and guide social and emotional behaviour in interactions with others (Bretherton & Munholland, 1999).

### **1.3 Attachment and paranoia**

A central tenet of attachment theory posits that it is vital in psychological adaptation (Bowlby, 1969), with consistent associations evidenced between attachment insecurity and the development of psychopathology (Bowlby, 1973; Mikulincer & Shaver, 2012). Psychosis has consistently been linked to attachment insecurity, with meta-analytic findings indicating fearful attachment to be the most prevalent style in psychosis populations (38%)(Carr et al., 2018). Insecure attachment, especially anxious attachment, appears to be specifically involved in the development and maintenance of paranoia in psychosis (Lavin et al., 2020).

A number of cognitive and emotional mechanisms are theorised to be involved in the development of paranoid delusions such as negative beliefs about the self and others (Freeman et al., 2002; Penn et al., 1997), attributional biases (Kaney & Bentall, 1989; Bentall et al., 1994) and theory of mind deficits (Frith & Corcoran, 1996). Attachment theory offers a conceptual framework to understand how such factors may contribute to the formation and maintenance of paranoia (Berry et al., 2007). As mentioned, Theory of Mind (ToM) deficits are a widely recognised feature of psychosis (Bora & Pantelis, 2013) and are associated with the severity of paranoia (Bentall et al., 2001; Randall et al., 2003). This may

be the result of an impaired mentalising capacity, defined as an imaginative activity about self and others involved in understanding behaviour in terms of intentional mental states (Fonagy & Allison, 2012). Importantly, development of the capacity to mentalise is dependent on the caregiver's contingent responses and accurate attributions of their infant's internal states (Fonagy et al., 2007).

Those with insecure attachment hold a negative view of the self and/ or other, which could lead to a heightened perception of threat and intentionality where there is none thus increasing paranoia (Bentall et al., 2001; Bentall & Fernyhough, 2008). Consistent with this, 'over-mentalising' appears to be associated with delusional thinking in both those with a diagnosis of paranoid schizophrenia (Montag et al., 2011) and healthy adults (Fyfe et al., 2008), and may be a process that leads to the perception of intentionality and meaning from unrelated events.

#### **1.4 Contingency and trust**

Contingency in interpersonal interactions involves responsiveness to another's communicative actions, which can include synchrony. The importance of interpersonal contingency has been reported across the lifespan. In early infancy, Ainsworth (1969) outlined the importance of caregiver sensitivity in the development of a secure attachment, whereby parents who are able to accurately interpret their infant's communications and respond with appropriate interpersonal contingency will be more likely to foster a secure attachment relationship. Further, parental responsiveness has been shown to play a crucial role in interpersonal trust (Dunst & Kassow, 2008).

The function of contingency is also considered to play an important role in adult interactions, where it can influence positive appraisals of another by facilitating trust and rapport (Chartrand & Bargh, 1999; Kendon, 1970). A non-clinical virtual reality study found that close

mimicking (a specific type of contingent responding) of participants body language had a positive influence on their ratings of trust and likeability towards the avatar (Bailenson et al., 2008).

The impact of interpersonal contingency in highly paranoid individuals is not yet clear. One study asked participants to rate the strength of the relationship between the movement of two shapes, which were either contingent upon one another or random (Blakemore et al., 2003). Whilst control subjects were able to distinguish between contingency conditions no significant difference was found in schizophrenic patients with persecutory delusions, who were more likely to perceive contingency between random movements of shapes. It was concluded by the authors that this may indicate a tendency to over-attribute intention in behavioural contingency.

### **1.5 Interpersonal distance and trust**

Interpersonal distance is a fundamental feature of social interactions and is an implicit indicator of responsiveness and feelings of safety and comfort with others (Birtchnell, 1996; Feeney, 1999; Meisels & Guardo, 1969; Roberts, 1997). Whilst optimal interpersonal distance varies between cultures (Perry et al., 2013), the use of social space is considered to universally play an important role in regulating a comfortable and safe level of intimacy (Kaitz et al., 2004). Given that we stand in closer proximity to friends and those who we are familiar with, compared to strangers, interpersonal distance can be considered to be a reliable signal of affiliation (Gürođlu et al., 2008). Therefore, in the present study interpersonal distance will be conceptualised as a behavioural indicator of trust.

### **1.6 Virtual reality research in paranoia**

Paranoia research in clinical populations can be confounded by issues of reliability and validity (Chan & Chen, 2011; Montag et al., 2011). Not all paranoia is unfounded and there

are many with psychosis who experience situations where others are in fact persecuting them. Further, safety behaviours that an individual experiencing paranoia uses might elicit others to act with suspicion in relation to them. Therefore, self-report research may not always be valid in measuring 'unfounded' paranoia. The use of virtual reality (VR) circumvents such limitations by allowing a standardised manipulation of another's behaviour in a controlled environment, allowing researchers to separate and observe the effects on paranoia on social interactions (Freeman et al., 2008).

VR has been previously used to examine the effect of interpersonal contingency on trust in the context of paranoia (Fornells-Ambrojo et al., 2016). Healthy male participants were randomly allocated to either a high or low contingency interaction with an avatar. Based on the attachment literature about caregiver contingency (Maccoby, 1980; Dunst & Kassow, 2008), those low in paranoia were anticipated to find the avatar in the high-contingency condition more trustworthy. Unexpectedly, only those with high levels of paranoia were sensitive to and experienced a highly contingent avatar as more trustworthy than one with low contingency responses. The contingency manipulation had no impact on individuals with low paranoia. It was suggested that highly paranoid individuals may be hypersensitive to non-contingent behaviour, which may manifest as suspicion of those who are not highly responsive in day to day interactions.

In the same study, dismissive attachment style was also found to be predictive of maintaining a greater interpersonal distance from the virtual character (mistrusting behaviour) yet was simultaneously associated with greater subjective trust. This could be understood in the context of an unstable attachment history, whereby the subjective experience of trust towards another may be experienced as dangerous (Horowitz et al., 1964). Therefore, the

authors hypothesised that the maintenance of interpersonal distance may have functioned to deactivate the attachment system.

Further investigation using the same VR paradigm was conducted by Bourke (2018), however this finding was not replicated. Whilst both studies were conducted in non-clinical populations, Fornells-Ambrojo and colleagues (2016) specifically recruited to capture a range of paranoid ideation. As paranoia appeared to have a moderating effect on trust between contingency manipulations (Fornells-Ambrojo et al., 2016), it may be that the less paranoid healthy sample utilised by Bourke could have contributed to a null effect.

### **1.7 Aims and hypotheses**

In sum, attachment insecurity is particularly prevalent in those with psychosis and paranoia and is known to influence ways of relating. Interpersonal contingency plays an important role in attachment formation and those with high paranoia appear to be uniquely sensitive to the effects of interpersonal contingency in adulthood, requiring a more contingent response to develop trust. The current study aims to use a VR interaction to investigate potential associations between attachment, contingency and trust in a sample with a diagnosis of psychosis who are experiencing high levels of paranoia.

#### **Aim 1 – Attachment and trust**

- **Hypothesis 1A.** Participants with a secure attachment style will subjectively rate the avatar as more trustworthy and maintain closer proximity to the avatar than the insecure group.
- **Hypothesis 1B.** For objective trusting behaviour, it is predicted that there will be a significant positive correlation between the distance kept from the avatar for fearful

and dismissive attachment dimensions. This is based on their high attachment avoidance and negative model of others. Conversely, for secure and preoccupied attachment dimensions a negative association is hypothesised with trusting behaviour. This is because the former group will genuinely experience more trust towards the avatar, whilst the latter group may be motivated by their desire for intimacy. Of note, in research conducted using this paradigm to-date among healthy participants, only dismissive attachment has approached significance in predicting low enacted trust (i.e. greater distance; Fornells-Ambrojo et al., 2016).

- **Hypothesis 1C.** Attachment security will predict higher subjective trust. Paradoxically, dismissive attachment is also expected to predict higher subjective trust, in replication of findings by Fornells-Ambrojo et al. (2016).

#### **Aim 2 - Contingency and trust**

- **Hypothesis 2A.** It was hypothesised that in this highly paranoid sample, those in the contingent condition would experience the avatar as more subjectively trustworthy than those exposed to low contingency interaction.
- **Hypothesis 2B.** It was hypothesised that this difference in trust would not be enacted behaviourally, and there would be no significant difference in interpersonal proximity between contingency conditions.



## **2. Method**

### **2.1 Design**

The current experimental study was jointly conducted with another UCL trainee (MH, see Appendix 1 for researchers' respective contributions). The quantitative design involved between-groups comparisons to test all hypotheses. The dependent variables were the two indicators of trust, both subjective (self-rated) and objective (distance) which were continuous measures. Hypothesis 1A compared trust between binary categorisations of secure and insecurely attached participants, whilst 1B used continuous attachment scores. Participants were randomised to receive either high or low contingency from the avatar, with this as the basis for between-group comparisons for hypotheses 2 and 3.

#### **2.1.1 Participants**

Adult males<sup>1</sup> were recruited from seven Early Intervention in Psychosis (EIP) services across three London NHS trusts. Inclusion criteria required participants to have a confirmed psychiatric diagnosis of a psychosis-spectrum disorder, and to be currently experiencing paranoia<sup>2</sup>. Exclusion criteria included a history of epilepsy (due to the potentially adverse impact of VR); an inability to read or speak English; a current clinical presentation which prevented engagement with the virtual scenario or completion of the questionnaires; and anyone under a Section of the Mental Health Act.

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<sup>1</sup> An all-male sample was selected on the basis that gender can significantly influence the sense of presence experienced by participants during VR (Felnhofer et al. 2012). Further, an all-male sample reduces the confounding effect of gender differences in the appraisal of the male VR flatmate.

<sup>2</sup> A score of 33+ on section A or B of the GPTS (Green et al, 2008) was used as a threshold for paranoia.

### **2.1.2 Sample size and power analysis**

The G\*Power computer programme (Faul et al., 2007) was used for all power calculations ( $\alpha = 0.05$ ,  $\beta = 0.80$ ). Effect size estimates were taken from Fornells-Ambrojo et al. (2016)'s study, which used the same VR scenario as in the current study. Based on the 'moderate' association (Cohen, 1992) previously found between dismissive attachment and subjective trust ( $r = .31$ ,  $p = .016$ ) G\*Power indicated that 60 participants would be required. To detect an effect of the contingency manipulation on trust, a sample size of 52 (26 per high/low condition) was calculated based on a large effect size ( $d = 0.8$ ). Therefore, the recruitment target was for 60 participants.

However, the current study did not meet this target, recruiting a total of 22 participants who met inclusion criteria. With this sample size, the study had 80% power to detect correlation coefficients of 0.54 using a two-tailed significance level of 0.05 (G\* Power). For comparisons of means between two independent groups (e.g. categorical attachment styles or contingency conditions) 11 participants per group gave the study 80% power to detect an effect size (Cohen's  $d$ ) of 1.3. Thus, the present study only had power to detect large effect sizes. Exploratory data analysis was used to supplement the interpretation of the data by looking for emerging trends.

### **2.1.3 Ethics**

Ethical approval was obtained through Camberwell St Giles NRES Committee (see Appendix 2&3) and permission was given at a local level from each trust's R&D. Informed, written consent was sought prior to participation with the opportunity to ask questions. Participants were aware of their right to discontinue at any point. VR has been demonstrated to be a safe environment for people with at risk mental states (Fornells-Ambrojo et al., 2008). Further

the present study scenario was designed to be a pleasant, non-threatening experience. A debrief was completed following the VR scenario to ensure participants wellbeing, which included a repeated administration of the 'Positive and Negative Affect Schedule'. This provided an opportunity to detect distress and offer support where necessary. However, no adverse reactions resulted from the research procedure. Efficient liaison with care coordinators was ensured throughout the testing process, with researchers providing immediate feedback on participants' attendance and any risk issues.

Given the nature of samples clinical presentation, it was anticipated that travel to unfamiliar locations may be distressing. This was carefully considered and collaboratively planned for through discussions with participants and care coordinators, to ensure that the journey was no more than minimally anxiety provoking. Taxis were paid for where there were fears around public transport, and researchers accompanied participants to the laboratory where necessary.

## **2.2 Procedure**

### **2.2.1 Participant recruitment and screening**

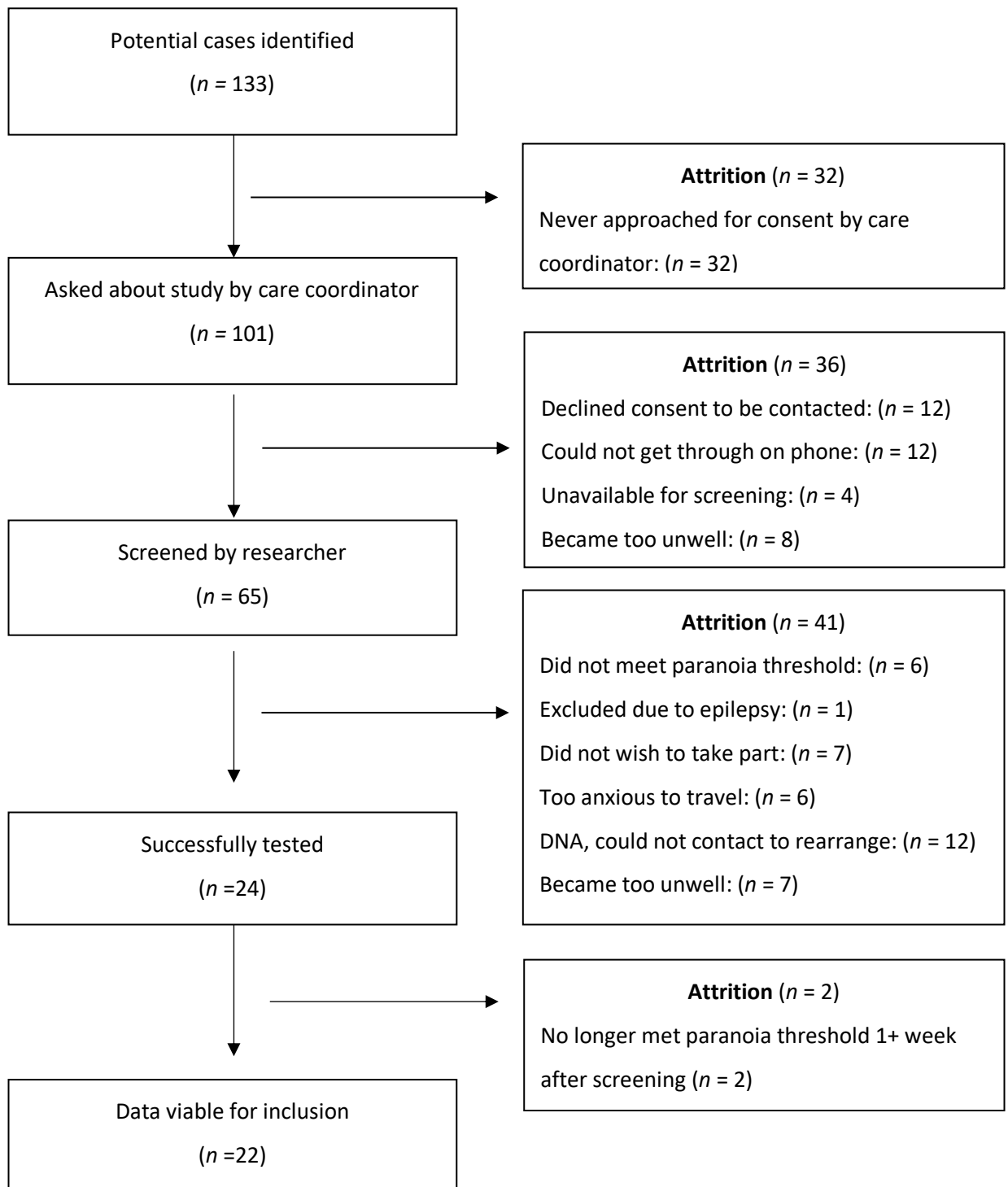
The purpose of the study and inclusion criteria were presented to care coordinators at local EIP team meetings. A researcher would attend the services regularly to sit with care coordinators on an individual basis to look through their caseload and identify and appropriate referrals. In total, 133 potential referrals were identified (see Figure 2).

In the first instance, the study was verbally introduced to potential participants by their care coordinator who also provided an information sheet (see Appendix 7). Where consent was given, researchers directly contacted participants to explain the study further. Participants were given the opportunity to ask questions and then were then given a minimum of 24

hours to decide if they wanted to take part. Interested participants were asked to complete the Green Paranoia Thoughts Scale (GPTS) (Green et al., 2008) as a screening measure for current paranoia. Those who scored above the cut-off of 33 in either part A (ideas of social reference) or part B (ideas of persecution) were invited to participate in the one-off VR experiment. Researchers aimed to test participants within one week of screening to minimise the risk of paranoia fluctuating below the required threshold for inclusion. Where this was not possible, participants were always re-screened on the day of testing to assess for their current level of paranoia. Unfortunately, this resulted in two participants falling below the paranoia threshold, invalidating this data.

The current study included 22 participants. Figure 2 delineates the participant flow from referrals to testing, highlighting that 18% of participants who were initially identified by their care coordinator completed the study. Reasons for attrition are outlined.

**Figure 2.** Participant flow



### **2.2.2 Overview of experimental procedure**

Participants were directed to the VR laboratory or were accompanied by a researcher for the journey. It was explained that the research aimed to investigate reactions to virtual environments, and factors that may influence social interactions for people with psychosis. Written consent was sought prior to starting (see Appendix 5). Participants were asked to complete a series of questionnaires, followed by the VR scenario and then some further questionnaires lasting up to 90 minutes in total (see Table 1 for overview of experimental procedure). At the end of the appointment participants were debriefed and paid £12.50, plus any travel expenses.

**Table 1.** *Overview of experimental procedure*

Pre-VR	During VR	Post-VR
Participant information sheet (and opportunity to ask questions)	Instructions to VR exercise	<i>Completion of following measures:</i>
Written consent	Brief rehearsal of questions to ask the avatar	Repeat PANAS
Demographic details		Subjective trust*
Previous experience of flat sharing and VR	Participant interviews virtual flatmate (four questions)	Attention checks SoPQ
Randomisation to contingency condition*	Avatar invites participant to follow him towards terrace	
<i>Completion of following measures:</i>		
RQ*	Interpersonal proximity from avatar recorded*	
CTQ <sup>+</sup>	Total amount of Avatar movement recorded	
BCSS <sup>+</sup>		
PS*		
PSYRATS-D		
PANAS		

*Note:* \* For variables directly related to current study's experimental hypotheses; <sup>+</sup> Measures used exclusively in joint researcher's (MH) thesis.

*Abbreviations:* BCSS = Brief Core Schema Scale (Fowler et al., 2006); CTQ = Childhood Trauma Questionnaire (Bernstein et al., 1994); PANAS = Positive and Negative Affect Schedule (Watson et al., 1988); PSYRATS-D = Psychotic Symptoms Rating Scale - Delusions (Haddock et al., 1999); PS = Paranoia Scale (Fenigstein & Venable, 1992); RQ = Relationship Questionnaire (Bartholomew & Horowitz, 1991); Sense of Presence Questionnaire (Slater et al., 1998).

### **2.3 Virtual reality experience**

Participants were told that the scenario would be based in a flat and involve meeting a prospective virtual character called Mark to discuss the prospect of flat sharing. A standardised script of four questions was provided to guide the conversation with Mark (see Appendix 12). There was an opportunity to practice these questions in advance, but participants were not expected to memorise these and were able to read from the script during the scenario. Participants were instructed that Mark would be the first to speak and their cue to begin with the first question was when he said “...I’m ready”. Subsequent questions were to be asked when Mark fell silent, following a turn-taking pattern of conversation.

All participants were placed on the same starting point, two meters from the avatar Mark. However, they were told that once the scenario began, they could move around freely to explore the virtual flat. Participants were reassured that they could stop at any point during the scenario and that the researcher would be present just behind the curtain. The scenario lasted for a total of three minutes. On completion of the VR scenario, participants were asked if they had experienced any negative side effects.

#### **2.3.1 Virtual reality apparatus**

The visuals of the VR scenario were displayed in an immersive projection system, within the Computer Aided Virtual Environment (CAVE) at University College London. High-resolution images were projected onto three back-projected wall screens (3m x 2.2m) and a floor screen (3m x 3m) in real-time. The virtual world was presented in stereo using Lightweight CrystalEyes shutter glasses, which produces 3D illusions by presenting separate images to each eye. An inertial/ultrasonic head-tracking device was mounted on the glasses, which enabled images to be presented in reference to the participants’ physical orientation and



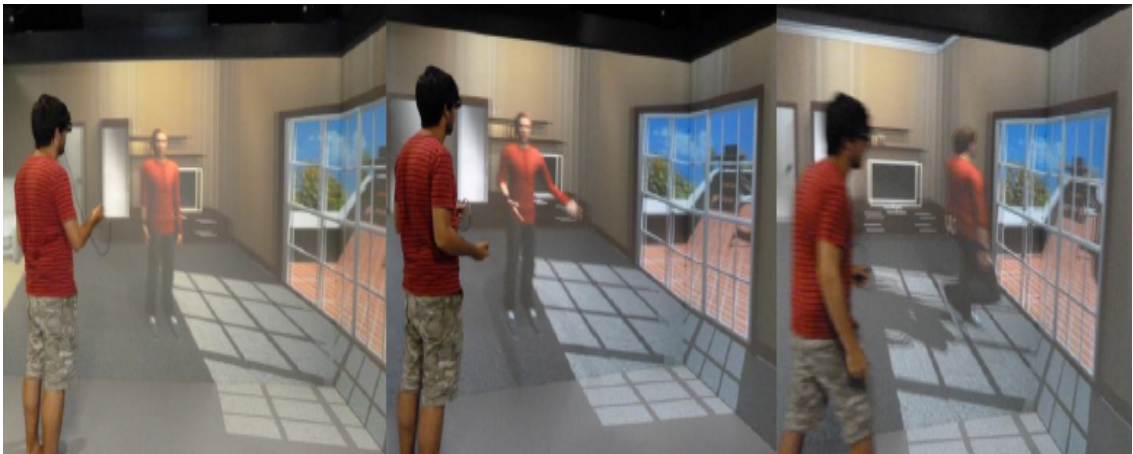
viewpoint. This equipment supported naturalistic sensorimotor contingencies for visual perception, meaning that as the participants moved around, the environment displayed perspective correct information. Spatialised audio was delivered through four corner speakers.

Avatar responses were controlled by the researcher with a wireless hand-held device. The left-hand button was used to trigger verbal responses to the scripted questions. The right-hand button prompted the avatar to nod his head, as a non-verbal response whilst the participant was still speaking.

### **2.3.2 The virtual reality scenario**

The virtual reality scenario was designed specifically for the original study (Fornells-Ambrojo et al., 2016), programmed by collaborators at the Department of Computer Science at UCL and the University of Barcelona. It was designed to be a neutral, non-threatening encounter in a naturalistic setting of a flat share (See Figure 3). From the participant's visual perspective, they were stood in a modern, tidy living room with a wall-mounted television directly in front. To the left there was a view of other rooms within the flat and to the right there was a French window looking onto a sunny terrace with a barbeque.

**Figure 3.** Images showing sequence of events during virtual interaction



### **2.3.3 The avatar**

A virtual flatmate 'Mark' was designed to appear as a friendly, Caucasian male in his twenties. At the beginning of the scenario Mark was positioned in the centre of the flat. Movement and voice were pre-recorded by an actor and mapped onto the avatar. To enhance realism, Mark was programmed to perform subtle movements such as regular blinking, baseline ambient body movements and gesturing with his arms during conversation. A head tracker fitted to the virtual reality glasses worn by participants enabled programming of the avatar's gaze to keep in the direction of the participant.

### **2.3.4 Contingency manipulation**

Participants were randomly assigned to one of two conditions, where the avatar's body movements were programmed to be either high or low in interpersonal contingency.

*High contingency condition.* When the participant tilted their head, Mark would also tilt his head in the same direction. If the participant moved their head in any other direction, the avatar would subtly sway his body. Mark would also nod his head when the participant was speaking to ask a question; a response controlled by the researcher with the remote control. In the high contingency condition, all of these behaviours would occur with a 1.5 second

delay. The variety of avatar responses, paired with the slight delay was intended to minimise the chance that participants would experience Mark as mimicking them. Mimicry detection has been found to have a negative impact on trust during social interactions (Bailenson et al., 2008).

*Low contingency condition.* In this condition the same responses were programmed but with a longer, 20 second delay to ensure participants would not attribute the avatar’s movements to be related to their own. Behaviours such as head tilts, body movements and nodding would be ‘queued’ for execution but would be over-ridden when the avatar was speaking or another response was elicited.

An overview of the contingency mapping across both contingency conditions is presented in Table 2.

**Table 2.** *Contingency mapping between participant behaviour and avatar responses*

<b>Participant behaviour</b>	<b>Avatar responses</b>
Head tilt – participant moves head side to side	Head tilt - Avatar tilts head in the same direction and returns head to original centre after participant has done so
Head movements – participant moves in any other direction (back/front, up/down)	Sway - Avatar moved his body (random choice of back to front or side to side)
Speaking	Head nod

### 2.3.5 Virtual scenario script

An extract of the dialogue between participants and the avatar is presented in table 3 (see Appendix 13 for full script). The conversation consisted of four main components:

- 1) Greetings
- 2) Participant asks and avatar responds to questions about flat sharing
- 3) Avatar moves to the terrace and invites participant to look
- 4) Avatar receives an unexpected phone call and asks if it is possible to reschedule the meeting. Conversation ends and scenario fades out.

**Table 3.** *Extract from scripted conversation between participants and the avatar*

Participant question	Avatar response
<i>[Asks third question]</i>	
<b>Who makes a good flatmate?</b>	Mhm... Good question... don't know... I'm trying to think.... Someone who is easy-going, friendly and fun but who also can give you space. It is also good to have something in common with them, like love for sport, or music. It's hard to answer because I think it really depends on the person... I've got on with people who were completely different from me... sometimes it just works.
<i>[Asks fourth and final question]</i>	
<b>What would you say is the best thing about this flat?</b>	The terrace, and the view! Come and have a look!  <i>[Avatar invites participant over as he moves to window. Gazes outside before turning back to face participant].</i>  It's amazing to have all this outside space, in the summer we practically live outside! We have great barbecues.  <i>[Avatar receives unexpected phone call]</i>

## 2.4 Measures

For clarity, only measures relevant to the current thesis are presented below. A further two measures were collected for use by the joint researcher (see Table 1). A researcher provided support to each participant in completing the questionnaires.

### 2.4.1 Pre-VR measures

*Paranoia: The Green et al. Paranoia Thoughts Scale (GPTS; Green et al., 2008)* (see Appendix 6). The GPTS is a 32-item self-report questionnaire, designed to measure paranoia across the psychosis continuum. Part A assesses ideas of social reference (e.g. “people definitely laughed at me behind my back”) and part B looks at ideas of persecution (e.g. “I was sure someone wanted to hurt me”). For each subscale, total scores range from 16 to 80, with higher scores indicative of more paranoia. This measure was used for screening. At the time the current research protocol was finalised there was no validated cut-off score for clinical paranoia. Thus, a score of 33+ on either part A or B was used as a cut-off to determine inclusion for the study, as was done in a previous clinical trial screening for paranoia in psychosis (Hardy et al., 2016).

*Paranoia: Paranoia Scale (PS; Fenigstein & Venable, 1992)* (see Appendix 9). The PS is the most widely cited dimensional measure of trait paranoia (Statham et al., 2019). It consists of 20 items which are self-reported on a five-point scale ranging from 1 (not at all applicable to me) to 5 (extremely applicable to me). The PS was originally designed for non-clinical populations but has been well validated in clinical samples (Smári et al., 1994).

*Severity of persecutory delusion: The Psychotic Symptoms Rating Scale – Delusions (PSYRATS-D; Haddock et al., 1999)* (see Appendix 10). The PSYRATS-D is a six-item, clinician-rated measure that is administered in a brief interview format. It measures the severity of

a participant's focal delusion by considering the level of conviction, associated distress and disruption to daily life. Scored range from 0 to 24 with higher scores indicating greater severity of delusions. The scale has been validated in first-episode psychosis (Drake et al., 2007) and has excellent internal consistency ( $\alpha = .90$ ) (Haddock et al., 1999)

*Attachment: The Relationship Questionnaire* (RQ; Bartholomew & Horowitz, 1991) (see Appendix 8). The RQ is a brief self-report measure of adult attachment style, which yields four potential models of self and other: (A) secure, (B) insecure-fearful, (C) insecure-preoccupied, (D) insecure-dismissing. Participants were presented with a description of each style of relating and asked to select which resembles them most closely. Ratings were also given on a seven-point Likert scale (1= strongly disagree/ 7= strongly agree) as to how much each description is characteristic of them, yielding four continuous scores for each participant. The RQ has good construct, convergent and discriminant validity (Griffin & Bartholomew, 1994).

*State Affect: Positive and Negative Affect Schedule* (PANAS; Watson et al., 1988) (see Appendix 11). The PANAS is 20-item self-report questionnaire comprised of two subscales; positive and negative state affect. On a five-point scale (1= 'Very slightly or not at all' to 5 = 'Extremely') participants rated the extent to which they were feeling each emotion 'right now at this present moment' (e.g. 'afraid', 'excited'). The PANAS has good psychometric properties (Crawford & Henry, 2004). This measure was used directly before the VR and repeated immediately after, in order to capture any change in affect as a result of the VR.

#### **2.4.2 During VR measures**

*Trusting behaviour: Interpersonal proximity from the avatar:* In the final phase of the VR scenario the mean distance (in metres) maintained by the participant was captured from the point where the avatar invited participant to view the terrace with him, up until the

phone call. Baseline distance was standardised as 2m for all participants. At each animation frame, 3D positions of the participant and avatar's heads were automatically recorded. Distance was calculated in terms of the horizontal Pythagorean distance to prevent any confounding effects of height difference. This outcome was conceptualised as an objective, behavioural indicator of trust (Bailenson et al., 2003).

### **2.4.3 Post VR measures**

*Subjective Trust Question:* Participants will be asked to retrospectively rate how trustworthy the avatar seemed using a 7-point Likert scale (1 = not at all/ 7 = very much). This measure has been used in previous studies using the same VR paradigm (Fornells-Ambrojo et al., 2016).

*Attention checks:* Two simple true/false questions were asked to ensure that sufficient attention was paid to the avatar's responses during the interaction (see Appendix 15).

*The Sense of Presence Questionnaire (SoPQ; Slater et al., 1998)* (Appendix 16). A six-item questionnaire used to assess the extent to which participants felt immersed in the virtual flat. Participants were asked questions such as "*During the experience, which was strongest on the whole, your sense of being in the virtual flat, or being in the real world of the laboratory?*" Each item was rated on a 7-point Likert scale, with higher scores indicating a stronger sense of presence in the virtual environment.

## **2.5 Planned data analysis**

All analyses were conducted using SPSS (Version 26). Two approaches to analysis were used; Confirmatory Data Analysis (CDA) and Exploratory Data Analysis (EDA; Tukey, 1977).

In the research proposal all analyses were based on CDA analyses, involving statistical hypothesis testing. Whilst this approach was still utilised, the sample size limited the power to ensure that non-significant findings were not simply the result of type-II error. Therefore, EDA was also used to augment interpretation of the data. EDA is an approach to analysing small datasets that is widely applied in the field of clinical psychology (Barker et al., 2002). This method emphasises displaying the data graphically in order to identify trends and patterns that may otherwise be missed due to a lack of statistical power. A combination of CDA and EDA is included throughout the results.

### **2.5.1 Attachment and trust**

Given the small sample and unequal group sizes, non-parametric Man-Whitney U tests were planned to compare subjective and objective trust outcomes between binary attachment categories (hypothesis 1A). For hypothesis 1B, Spearman's correlations were used to explore associations between scores on attachment dimensions and the two measures of trust in the avatar (interpersonal distance during VR and self-reported trust post-VR). Due to multiple analyses the Bonferroni correction was applied to minimise the risk of Type I error. Where results did not reach significance, emerging trends and differences were investigated graphically.

### **2.5.2 Contingency and trust**

Initially, ANCOVA analyses were planned to covary for the potential confounding effect of total avatar movements. But given the skewness in trust outcomes when splitting high and



low contingency groups, non-parametric group comparisons were used. For hypothesis 2A, a Mann-Whitney test was used to compare subjective trust between the high and low contingency groups. Mann-Whitney was also used to test hypothesis 2B with interpersonal distance as the outcome variable. Spearman's Rho correlations were used to consider the influence of total amount of avatar movement on trust outcomes. EDA boxplots were used to look for patterns of between group differences.

### **3. Results**

#### **3.1 Participants**

##### **3.1.1 Participant demographics**

The final sample consisted of 22 participants. As summarised in Table 4, the average age of participants was 25.91 years. White British or White 'other' individuals made up the majority of the sample. The 'other' category reflects ethnicities that were represented by three participants or less. The largest proportion of participants were unemployed.

##### **3.1.2 Clinical characteristics**

Psychiatric diagnoses consisted of first episode psychosis, schizophrenia, drug induced psychosis, schizotypal and delusional disorders. Table 4 presents clinical characteristics such as the level of paranoia (PS mean = 57.76), which is comparable to another early psychosis sample with active persecutory delusions (mean = 57.48) (Langdon et al., 2013). The severity of delusions in the current sample (PSYRATS-D mean = 15.00) is comparable to a UK-based sample of 280 outpatients with psychosis (mean = 15.04) (Woodward et al., 2014).

**Table 4.** *Demographic and clinical data*

Type	Variable	Summary Statistic ( <i>n</i> =22)
Demographic	Ethnicity, <i>n</i> (%)	
	Asian British	1 (4.55%)
	Black British or African	6 (27.27%)
	Mixed Race British	1 (4.55%)
	White British or 'Other'	14 (63.63%)
	Employment Status, <i>n</i> (%)	
	In education	3 (13.6%)
Employed	7 (31.8%)	
Unemployed	12 (54.5%)	
Clinical	Age, <i>M</i> ( <i>SD</i> )	25.91 (6.49)
	PS*, <i>M</i> ( <i>SD</i> )	57.76 (17.25)
	PSYRATS-D*, <i>M</i> ( <i>SD</i> )	15.00 (4.24)

\* PS and PSYRATS-D total *n*=21, one participant did not complete each measure

### 3.2 The virtual reality scenario

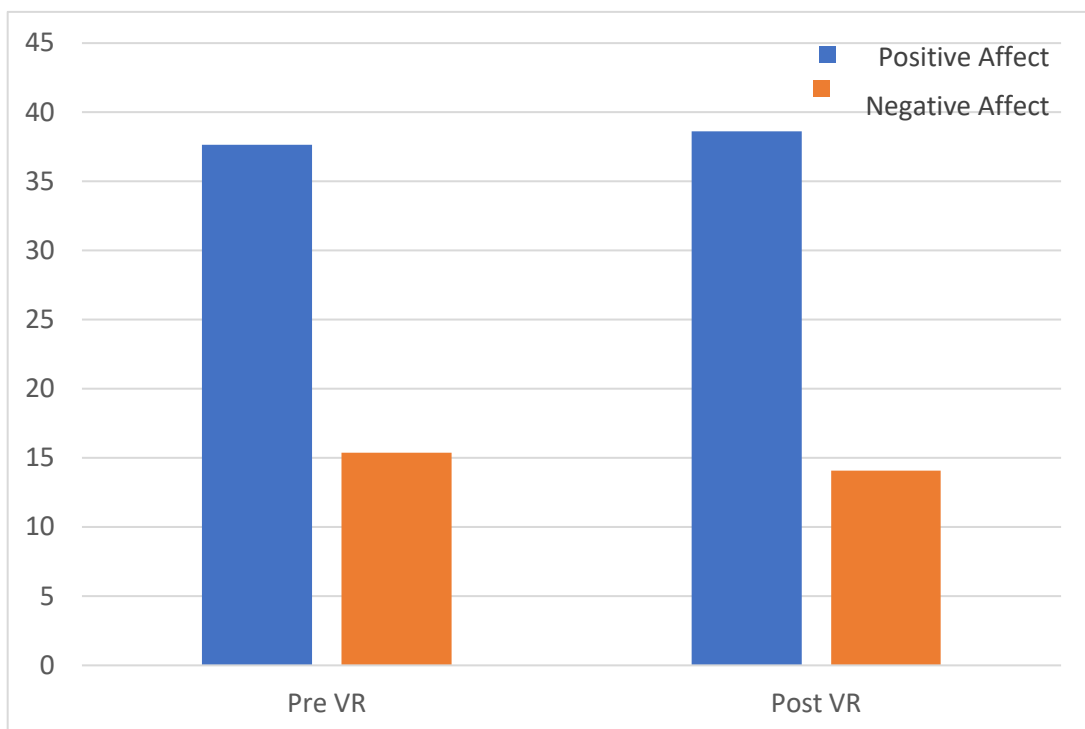
#### 3.2.1 Feasibility: sense of presence and attention check

Scores on the Sense of Presence Questionnaire were comparable in the current clinical sample (mean = 24.68, SD = 7.97), to that of a previous study's non-clinical population using the same VR scenario (mean 25.47, SD = 6.52) (Fornells-Ambrojo et al., 2016). Just over half of the current clinical sample answered both attention check questions correctly (54.55%). Nevertheless, the Sense of Presence checks indicate sufficient immersion in the VR scenario.

### 3.2.2 Safety and acceptability: PANAS

No adverse side effects were recorded as a result of the VR, nor did participants report any distress from the questionnaires. Prior to completing the VR, average scores from the positive affect items on the PANAS were more than twice as high as negative affect (see Figure 4). A slight increase in positive affect was observed from before the VR ( $Mdn = 38$ ) to after ( $Mdn = 42$ ). However, non-parametric comparisons of means found that this was not a significant difference ( $Z = -.656$   $p = .512$ ), suggesting that positive affect remained stable following exposure to the VR scenario. Low levels of negative affect were observed before the VR ( $Mdn = 14$ ), and this further reduced directly after completing the VR ( $Mdn = 12.5$ ). This reduction in negative affect was not significant ( $Z = -1.038$ ,  $p = .299$ ). These findings suggest that overall the scenario did not cause distress and was may have been a mildly positive experience.

**Figure 4.** Change in total positive and negative affect



### **3.3 Data screening and statistical assumptions**

All primary measures were fully completed apart from one participant who refused to complete the Paranoia Scale (n = 21) as they felt the items were too similar to those from the GTPS screening measure. Data from variables of interest were screened for normality through the inspection of skew, kurtosis and the Kolmogorov-Smirnov test (see Table 5).

When considering variables relevant to the study hypotheses, the K-S tests indicated significant non-normality for RQ fearful and dismissing attachment scores. The data analysis selected the appropriate parametric and non-parametric tests accordingly.

Just one outlier was identified for the PANAS negative scale (pre-VR). However, this was retained due to the already small sample size and as this variable was not involved in any of the experimental hypotheses. Whilst many variables appeared to meet statistical assumptions for normality, inspection of histograms highlighted more subtle issues with skew and kurtosis for further variables such as PS and RQ security.

**Table 5. Normality statistics**

Variable	Skewness	Kurtosis	K-S Test		Outlier
			<i>D</i>	<i>p</i>	
<i>Z scores</i>					
Pre-VR					
PS	-1.477	.090	.148	.200	n/a
RQ Secure	.908	.050	.152	.200	n/a
RQ Fearful	-1.295	-.197	.219	.007*	n/a
RQ Preoccupied	.116	-.931	.119	.200	n/a
RQ Dismissing	-.648	-1.271	.215	.009*	n/a
PANAS Positive	-1.456	0.404	.152	.200	n/a
PANAS Negative	4.576	7.666	.187	.044	One ppt (z=3.585)
During VR					
Average	.582	-.027	.118	.200	n/a
Interpersonal Distance					
Post-VR					
PANAS Positive	-3.004	1.166	.296	.001*	n/a
PANAS Negative	1.257	1.182	.257	.001*	n/a
Subjective Trust	-.972	-.633	.160	.172	n/a

\*K-S test interpreted at significant level  $p < .01$ . Abbreviations: Ppt = participant

### 3.4 Descriptive statistics

#### 3.4.1 Attachment

Descriptive statistics for both categorical and continuous attachment responses are presented in Table 6. When considering the dichotomous secure/insecure categorisation only one participant (4.55%) had a secure attachment style, with the remaining 95.45% classified as insecure. Overall, fearful attachment was most prevalent. Participants also rated themselves most highly on the fearful attachment continuous scale, with the lowest continuous scores for security. Subsequent analyses used the continuous measures of attachment scores in accordance with a dimensional understanding of attachment (Griffin & Bartholomew, 1994).

Table 6. *Descriptive statistics for attachment*

RQ score type	Attachment Style			
	Secure		Insecure	
	<i>Secure Style A</i>	<i>Fearful Style B</i>	<i>Preoccupied Style C</i>	<i>Dismissive Style D</i>
Categorical, <i>N</i> (%)	1 (4.55%)	12 (54.55%)	3 (13.63%)	6 (27.27%)
Continuous, <i>M</i> ( <i>SD</i> )	3.32 (1.59)	5.12 (1.49)	4.14 (1.91)	4.41 (1.84)

RQ continuous attachment scores range from 1-7.

#### 3.4.2 Interpersonal distance and subjective trust

Both subjective (self-report) and objective (interpersonal distance) measures were taken to assess how much participants trusted the avatar. The mean (*SD*) subjective trust, as assessed by a single self-report question, was 5.05 (1.65). This was consistent with subjective trust scores from the previous non-clinical sample 4.87 (1.07) (Fornells-Ambrojo et al., 2016).

Interpersonal distance maintained between the participant and the virtual flatmate in the final stage of the interaction (after being invited to the window to look at the terrace) had a mean (SD) of 1.62m (.36) This was in line with implicit social distance rules (Hall, 1966). However, average distance kept in the current clinical sample was greater than the 1.43m (.26) distance kept by non-clinical participants in the prior study (Fornells-Ambrojo et al., 2016).

Correlation analysis of the subjective trust and interpersonal distance maintained indicated a significant negative relationship between these indicators of trust ( $r = -.431$ ,  $p = .045$ ) whereby the more a participant reported to trust the avatar, the closer they would stand to him. This adds to the validity of the proposed interpretation of interpersonal distance and how the sample was engaging with the immersive scenario.

### **3.5 Hypotheses**

#### **3.5.1 Attachment and trust**

**Hypothesis 1A: Participants with a secure attachment style will subjectively rate the avatar as more trustworthy and maintain closer proximity to the avatar than the insecure group.**

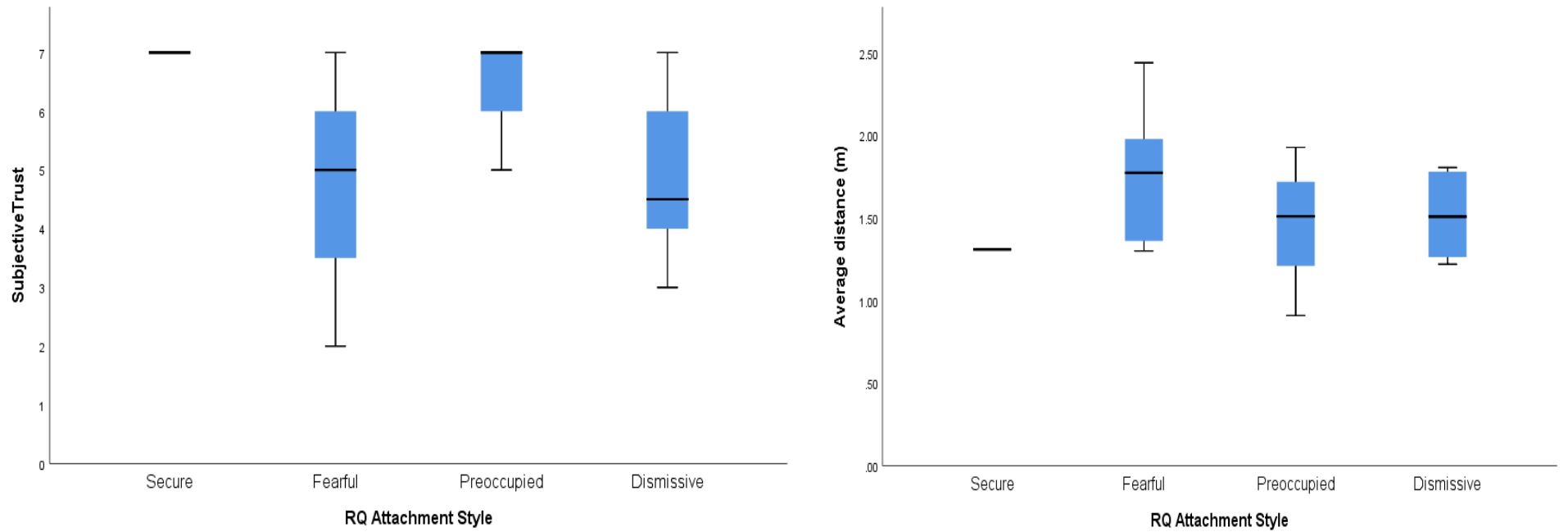
Only one participant was categorised as secure, meaning it was not possible to conduct statistical comparisons between secure and insecure groups as planned. In line with the high/low attachment avoidance grouping in hypothesis 1B we decided to explore whether this pattern was also observed in participants categorisation of their own attachment style. Those with secure and preoccupied attachment styles were classified as low attachment avoidance ( $n=4$ ), and fearful or dismissing individuals were classified as high avoidance ( $n=18$ ). From exploratory inspection of box plots (see Figure 5a), it appeared that dismissive

(*Mdn* = 4.5) and fearful (*Mdn* = 5) groups (high in attachment avoidance) scored similarly for subjective trust. In contrast, the preoccupied and secure groups (both low in attachment avoidance) had both given the maximum subjective trust score (*Mdn* = 7). However, it must be reiterated that the secure group consisted of a single participant.

This pattern of distinction between high and low attachment avoidance categories was more pronounced when looking at subjective trust than objective trust outcomes. Notably in subjective trust, all groups had a range spanning up to seven indicating a possible ceiling effect of the measure. Fearful attachment had the largest interquartile range and overall spread across both subjective and objective trust outcomes. However fearful attachment also made up the largest group of participants ( $n = 12$ ). It must be noted that the size of groups was not evenly distributed, with secure attachment made up of just one participant. Therefore, comparisons of data dispersion between groups are flawed. As highlighted in the normality data (Table 5), some attachment groups have asymmetric spread of data, indicative of skewness for dismissive (subjective trust) and fearful groups (objective trust).



Figures 5a and 5b. Box plots of subjective and objective trust outcomes in different attachment styles



**Hypothesis 1B. For trusting behaviour, a positive correlation is predicted for fearful and dismissive attachment scales, whilst a negative correlation is predicted for secure and preoccupied scales.**

A non-parametric Spearman's Rho correlation showed attachment security to have a significant, medium (Cohen, 1988) negative correlation with interpersonal distance, indicating more trust towards the avatar ( $r_s = -.493, p = .020$ ). However, this association no longer retained significance once the Bonferroni correction was applied ( $\alpha = (.05/4) = .013$ ). For fearful attachment a large positive correlation was observed, where a higher degree of fearful attachment was significantly associated with maintaining a greater distance from the avatar ( $r_s = .537, p = .010$ ).

No significant associations were found between preoccupied or dismissive scales and distance (see Table 7). However, when exploring the data graphically using EDA, a scatterplot indicated an emerging negative association with preoccupied attachment; the more preoccupied an individual the closer they would stand to the avatar (see Figure 6).

**Table 7. Correlation matrix for attachment styles and indicators of trust**

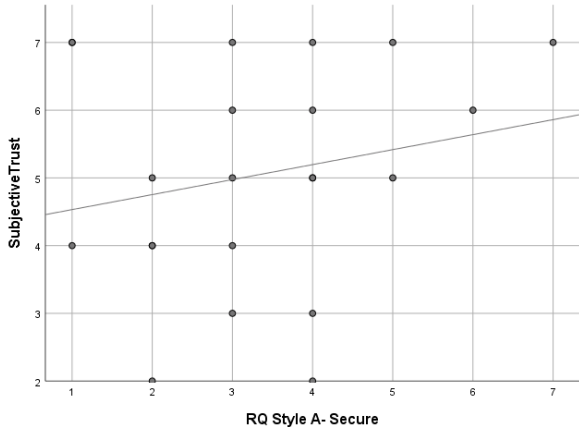
Continuous attachment styles (RQ)	Subjective Trust		Average Interpersonal Distance	
	$r_s$	$p$	$r_s$	$p$
Security	.198	.376	-.493	.020*
Fearful	-.269	.227	.537	.010**
Preoccupied	.012	.959	-.145	.518
Dismissing	-.013	.955	-.064	.777

*Note.* \* = significant association at the  $p < .05$  level. \*\* = retained significance under Bonferroni correction ( $\alpha = (.05/4) = .013$ )

Figure 6. EDA Scatterplots looking at each attachment dimension by trust outcomes

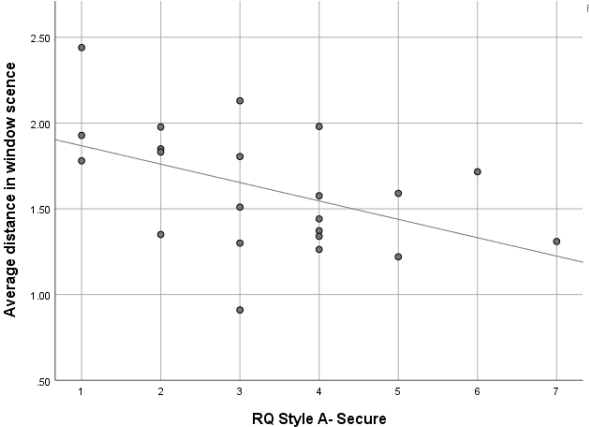
**Subjective trust**

Secure attachment ( $R^2 = .045$ )

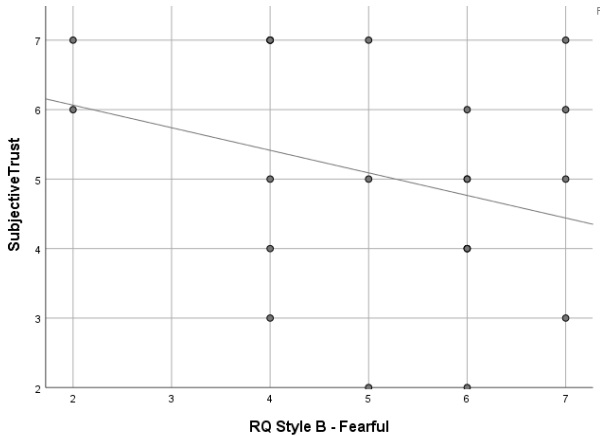


**Objective trust (distance)**

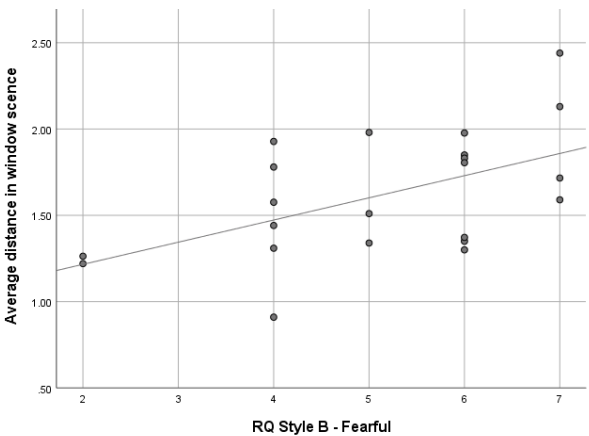
Secure attachment ( $R^2 = .225$ )



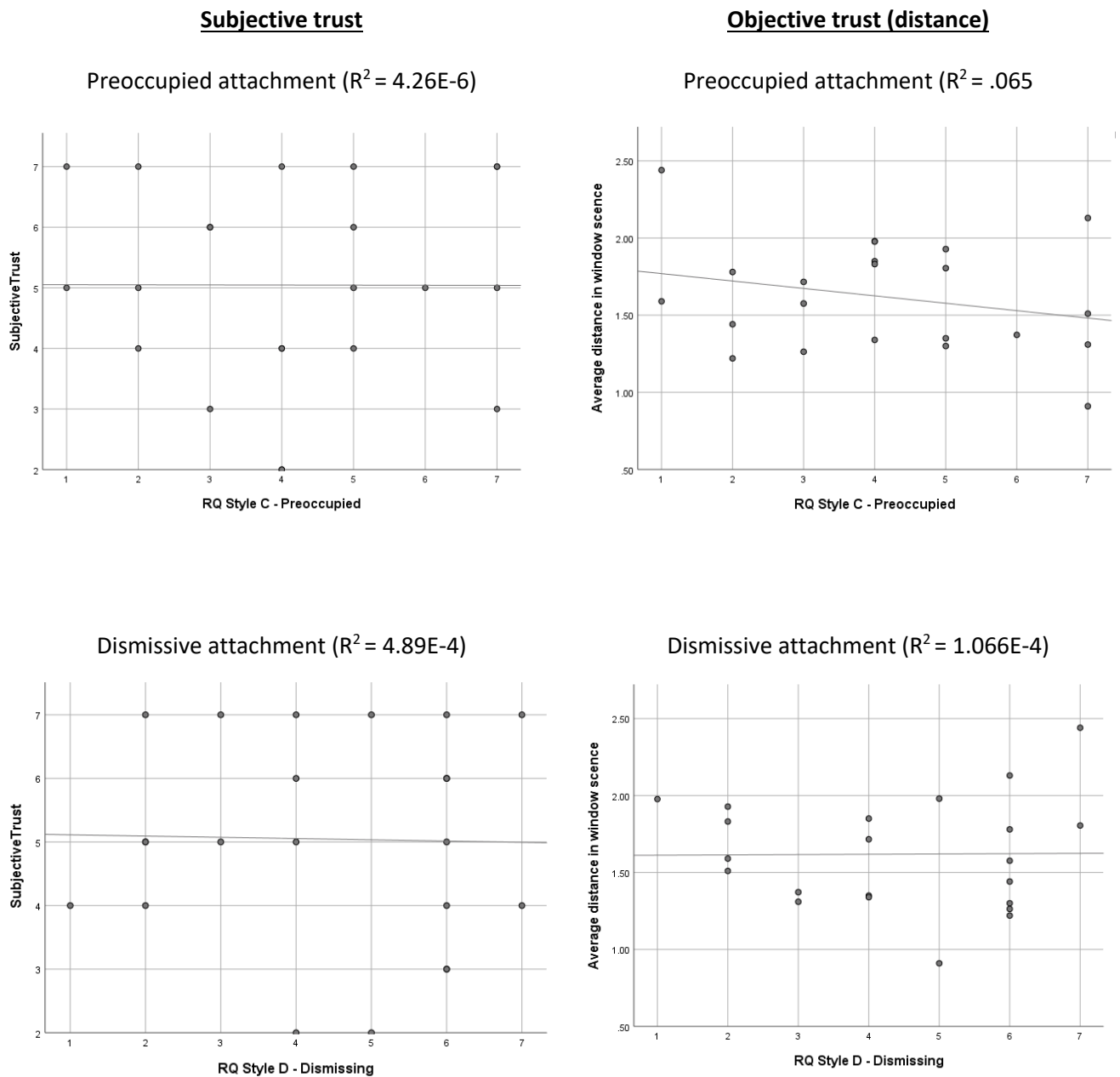
Fearful attachment ( $R^2 = .086$ )



Fearful attachment ( $R^2 = .285$ )



**(Continued) Figure 6.** EDA Scatterplots looking at each attachment dimension by trust outcomes



**Hypothesis 1C.** Both secure and dismissive attachment scores will predict higher subjective trust.

These attachment patterns of trusting behaviour were not reflected subjectively, as no attachment dimension was significantly associated with self-reported trust scores (see Table 7). EDA was used to explore any emerging trends in the data, results of which are summarised

in Table 8 (see Figure 6 for scatterplots). Unlike the finding by Fornells-Ambrojo et al., (2016) dismissive attachment was not close to approaching significance for either association with interpersonal distance or subjective trust, with negligible effect sizes (<.1) (Cohen, 1992). Thus, the null hypothesis was not rejected.

### Hypothesis 1 summary

Does attachment predict interpersonal trust? A summary of the findings is presented below in Table 8.

**Table 8.** Summary of attachment findings

		Subjective trust		Interpersonal distance	
		Categories	Dimensional	Categories	Dimensional
<b>Insecure</b>	<b>Secure</b>	?#	+?	?#	-✓
	Preoccupied	+?	✗	✗	-?
	Fearful	-?	-?	+?	+✓
	Dismissive	-?	✗	✗	✗

Table notes:

✓ Statistically significant result ✗ Non-statistically significant result and no observable trend in EDA  
 ? Trend observable in EDA. (+) positive correlation or higher value in this group. (-) Negative correlation or lower value in this group. # not possible to determine as n=1 so not a category  
 Categories refer to.... Analyses involve group comparisons, EDA boxplots  
 Dimensions refer to... Analysis involve correlations, EDA scatterplots

### 3.5.2 Contingency and trust

ANCOVA tests, covarying for total number of avatar movements, were originally planned. However, given the small sample size and the skew for trust outcomes within high and low contingency groups (see Figure 7a and 7b box plots) non-parametric Man Whitney tests were selected. Due to the 20 second delay in low contingency avatar, participants in this condition were exposed to significantly less avatar movements overall ( $Mdn = 6$ ) when compared to the high contingency condition ( $Mdn = 37$ ) [ $U = .00, p < .001$ ]. This could have had a confounding effect on trust. However, Spearman's Rho correlations across the whole sample did not show a significant association between total amount of avatar movement and subjective ( $r_s = -.138, p = .540$ ) or objective trust ( $r_s = .257, p = .249$ ).

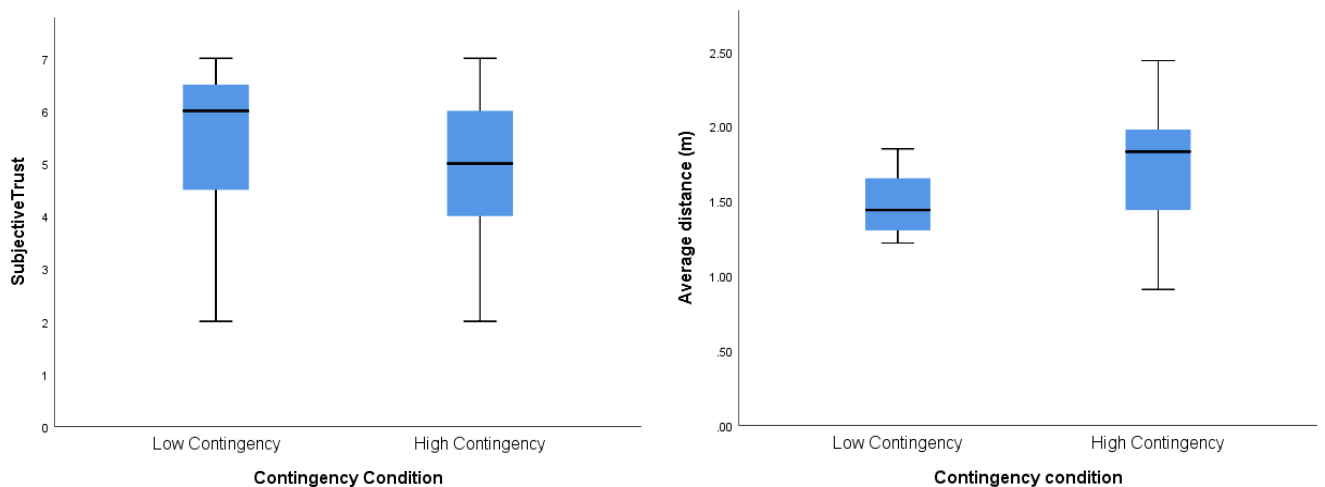
**Hypothesis 2A. It is hypothesised that in this highly paranoid sample, those in the contingent condition will experience the avatar as more subjectively trustworthy than those exposed to low contingency interaction.**

A non-parametric Mann-Whitney test indicated that participants in the high contingency condition reported lower trust ( $Mdn = 5$ ) towards the avatar than those in the less contingent version ( $Mdn = 6$ ), but this difference was not significant [ $U = 50.00, p = .519$ ]. This was in contrast to previous findings in a highly paranoid non-clinical sample (Fornells-Ambrojo et al., 2016). Hypothesis 2A was not supported by the data, although a post hoc power analysis using G\*Power3 indicated that the current study only had 9% power to detect a difference in subjective trust between contingency groups. Thus, the current investigation was underpowered.

Using EDA to investigate further, Figure 7a compares the spread of subjective trust between the different contingency conditions ( $n=11$  per group). Whilst the overall spread of the data is the same in each group, there appears to be a negative skew in the low contingency group,

with the median > mean. This indicates that more participants subjectively perceived the avatar to be more trustworthy. Trust ratings in the high contingency group were more evenly distributed.

**Figures 7a and 7b.** Box plots of subjective and objective trust outcomes between contingency conditions



**Hypothesis 2B.** It is hypothesised that there will be no significant difference in interpersonal proximity between contingency conditions.

Those in the highly contingent condition maintained greater distance from the avatar ( $Mdn = 1.83$ ) than those in the low contingency condition ( $Mdn = 1.44$ ). A post hoc power calculation using G\*Power3 highlighted that the current study was underpowered to detect an effect of the contingency manipulation on objective trust ( $\beta = .375$ ). Despite this, the between group difference in objective trust approached significance [ $U = 31, p = .056$ ]. Although no differences were hypothesised a priori, this effect was in the opposite direction of what was expected, where the contingent condition appeared to elicit greater mistrust in the participants' behaviour.

Using EDA a box plot was created to facilitate understanding of group comparisons (see Figure 7b). It is clear that there was considerably greater dispersion of the data in the high contingency group, whilst the distance scores were more concentrated around the median in the low contingency group. In the high contingency group, the median was closer to the upper quartile indicative of a negative skew, where more participants clustered around maintaining a greater distance.



## **4. Discussion**

### **4.1 Summary of findings**

Using a virtual reality paradigm, the present study investigated the role of attachment and interpersonal contingency on trust in a first-episode psychosis sample with paranoid ideation.

When graphically comparing categories of attachment, there was an emerging pattern for styles that are characteristically high in attachment avoidance (dismissive and fearful groups combined) to report less subjective trust than those with low avoidance (secure and preoccupied groups combined). This pattern was not observed for trusting behaviour (distance). However, such comparisons were flawed by the unequal group sizes. When considering continuous attachment ratings, attachment security was negatively associated interpersonal distance, although this association did not retain significance after correcting for the inflation of familywise error rate. Fearful attachment was positively correlated with interpersonal distance, indicative of mistrust. Whilst these correlations only reached significance in objective trusting behaviours, the same patterns appeared to be emerging from graphical EDA for subjective trust (see Table 8 for summary findings).

The contingency manipulation had an opposite effect to what had been hypothesised; the highly contingent avatar was perceived to be less trustworthy than the low contingency condition. Whilst this pattern was observed in both trust outcomes, a between group difference was closer to approaching significance for the objective indicator of trust.

Overall, a lack of power limits the conclusions that can be drawn about anything other than large effects. However, despite the limited sample size, these findings suggest that there are links between attachment and contingent behaviour with trust in those with clinical paranoia.

## **4.2 Interpretation of findings**

### **4.2.1 Validity of VR in psychosis sample**

The current study showed the safety and feasibility of VR technology in a highly paranoid sample with psychosis diagnoses. No adverse side effects were reported and overall emotional reactions to the VR were either neutral or positive, with many participants reporting how much they enjoyed the novel experience. Validating the methodology, interpersonal behaviour was in line with proxemics rules (Hall, 1966) and participants reported feeling immersed in the virtual environment.

### **4.2.2 Attachment insecurity and paranoia**

Just one participant was classified as securely attached, with the remaining 96% classified as insecurely attached. This prevented between group statistical comparisons which had planned a priori. Fearful attachment being the most predominant insecure attachment style (55%), followed by dismissive (27%) and then preoccupied (13%). Dimensional attachment scores supported these findings. Consistent with this, a recent review also found that fearful attachment was the most common style in psychosis populations, reporting a meta-analytic prevalence of 38% (Carr et al., 2018). The rate of fearful attachment was notably higher in the present study, which could be interpreted in light in the all-male sample. Males with psychosis score higher for discomfort with closeness (Mulligan & Lavender, 2010) and have poorer social functioning when compared to their female counterparts (Ochoa et al., 2012).

Those with a fearful attachment style are conceptualised as having a disorganised system of behaviour, driving contradictory approach/avoidance tendencies (Fonagy and Luyten, 2012). This pattern of attachment is highly prevalent in those reporting specific types of childhood trauma such as physical and sexual abuse (Alexander, 1993; Riggs et al., 2007; Shaver & Clark,

1994). The role of trauma is discussed in greater depth in the joint researcher's thesis (MH). Cross sectional studies support fearful attachment as a mediator between childhood trauma and paranoia in psychosis (Pearce et al., 2017) and prospective research has replicated this finding with subclinical paranoia (Sheinbaum et al., In press), suggesting that fearful attachment may act as an indirect pathway in the development of specific psychosis symptoms. In line with such, the severity of paranoia and persecutory delusions was very high in the present sample.

#### **4.2.3 Is attachment related to trust during a virtual interpersonal encounter?**

For individuals with clinical paranoia, attachment was significantly linked to a respondent's trusting behaviour under experimental conditions. When invited to explore the virtual flat, those high in fearful attachment maintained a significantly greater distance from the avatar and there was also an emerging trend for less subjective trust. Whilst the experimental design allowed some temporal precedence in the assessment of attachment and trust, causal inferences cannot be inferred from these correlational findings. However, this pattern could be conceptually interpreted in light of the attachment behavioural system (Bowlby, 1982). When a threat is perceived, a system of attachment behaviour is activated whilst other systems such as exploration are inhibited. Previous studies looking at the associations between adult attachment styles and the regulation of interpersonal distance with strangers similarly found that those with fearful attachment styles maintained greater physical distances (Kaitz et al., 2004). Those high in fearful attachment may rely upon interpersonal distancing as a deactivating strategy to protect against feared emotional intimacy (Mikulincer & Shaver, 2007). This attachment behaviour system is not just evident with attachment figures but appears to generalise to strangers, where expectations of trust are likely inferred from previous attachment experiences and internal working models (Feeney et al., 2008).

This might also serve to establish relationship boundaries and communicate the need for caution (Leary & Miller, 2000).

Why was this pattern only observed in fearful and not dismissive, where attachment avoidance is also high? Perhaps it is the combination of both high anxiety and avoidance in fearful attachment that renders interpersonal distancing as an only partially effective deactivating strategy, leaving an individual with residual feelings of low self-worth and distrust (Mikulincer and Shaver, 2007). In turn, interpersonal distancing may be exaggerated in a sustained attempt to relieve oneself of discomfort.

It is argued that the attachment behavioural system is usually activated when an individual perceives threat (Bowlby, 1982). The current scenario was designed to be a pleasant encounter, which was corroborated by comparisons of pre and post-VR affect scores. As such, it is possible that there was not sufficient stress to fully activate the attachment system. This appears to have been reflected in the high subjective trust scores, although this may also signify a measurement limitation as there appears to have been a ceiling effect of the scale itself. A mildly stressful scenario may have been better in activating the attachment safely seeking system for all participants. Given that those scoring high in fearful attachment are the most likely to have experienced historic violations of interpersonal trust (MacBeth et al., 2008) they may have a heightened sensitivity to perceived threat. A pervasive sense of vulnerability may activate paranoia, which may in turn be used to inform judgements about the relative trustworthiness of people during novel encounters.

#### **4.2.4 The impact of interpersonal contingency on trust in high paranoia**

The previous non-clinical study (Fornells-Ambrojo et al., 2016) concluded that those with high paranoia (paranoia scale (PS) score of 50+) found the highly contingent avatar more trustworthy. The current study anticipated to replicate this finding in our highly paranoid clinical sample (mean PS = 58) hypothesising that the contingent condition would be significantly associated with trust. However, the opposite pattern was observed.

This effect was stronger for objective trusting behaviour although still did not reach significance, possibly due to the study's lack of power. The friendly scenario may have also reduced the size of this effect given that negative attribution biases are known to be exacerbated in more ambiguous situations for those with high paranoia (Buck et al., 2016; Savulich et al., 2015). Importantly, the between group differences in trust were not attributable to total amount of avatar movement in general, as there was no significant relationship between total avatar movement and either trust variable. This indicates that it was something specific about the contingency of the behaviour that elicited mistrust.

This observed aversion to contingency may fit with the hostile attribution bias that is recognised in those with schizophrenia, who have a tendency to interpret others' actions as both intentional and hostile (Combs et al., 2009; Peyroux et al., 2014). In social interactions this may equate to interpersonal sensitivity, a personality trait characterised by an excessive awareness of the behaviour and feelings of others (Boyce & Parker, 1989). Those with at-risk mental state (ARMS) appear to show a hypersensitivity to interpersonal interactions, which is associated with persecutory ideation (Masillo et al., 2012; Valmaggia et al., 2007). Further understanding may be gleaned from the social anxiety literature, given that social evaluative concerns sit at the bottom of the paranoia 'hierarchy' and are considered to operate through similar processes to more severe, clinical paranoia in psychosis (Freeman et al., 2005). Whilst mimicry (a specific type of interpersonal contingency) was found to positively influence the

appraisal of an avatar in healthy participants (Bailenson & Yee, 2007), these preferential effects were not seen in those with social anxiety (Vrijzen et al., 2010).

In the current study, reduced trusting behaviour when exposed to a highly contingent avatar might result from an impaired ability to understand interpersonal behaviour in terms of intentional mental states, otherwise known as mentalisation (Fonagy et al., 2002). An underdeveloped capacity for mentalisation stems from early attachment experiences (Fonagy & Allison, 2012); relevant to the high levels of attachment insecurity reported in the present sample. When paired with negative representations of others, this may result in 'over-mentalising' the intent of others, which has been suggested to play a mediating role in paranoia (Fyfe et al., 2008; Versmissen et al., 2008).

The compassion focused therapy literature highlights how those with a history of early attachment adversity are less likely to experience kindness and warmth as positive experiences (Gilbert, 2009). Similarly, interpersonal warmth unexpectedly led to increased paranoia in certain social conditions (Butler et al., 2019). In the current study it is possible that exposure to a highly responsive agent was unnerving and made participants feel uncomfortable if this experience was unfamiliar or incongruent with their historic interactions.

Nevertheless, the question remains why the present study's findings were in a conflicting direction to the high paranoia group in the non-clinical study, who found that there was a stronger preference for high contingency as paranoia increased. If consistent with the psychosis continuum theory one might expect a dose-response effect, with the same direction of effect increasing in strength with the severity of paranoia (Freeman et al., 2010). This may simply be an artefact, attributable to a lack of power in both studies, with only eight

participants classified as high-paranoia in the non-clinical sample (Fornells-Ambrojo et al., 2016). However, there are other examples of studies finding significant effects of paranoia in clinical populations that are not replicated in ultrahigh risk groups (e.g. Janssen et al., 2006). At variance with the continuum hypothesis, taxometric evidence suggests that there is a nonarbitrary boundary that demarcates the latent entity of schizophrenia from normality (Linscott & van Os, 2010). Thus, there are likely many other moderating factors that distinguish clinical and non-clinical groups beyond the severity of paranoia.

On the contrary, there may have been a number of methodological reasons for this 'opposite' effect of contingency on trust. It is possible that the frequency of contingency responding might have been too high, resulting in an artificially responsive avatar, making it appear to behave outside what is considered to be normal interaction, or false/ fake. The literature shows that when participants are consciously aware of contingent responding and perceive someone to be mimicking them it is disliked (Bailenson et al., 2008). Further, perhaps a high level of interpersonal responsiveness is not expected from a stranger and thus might feel over familiar and untrustworthy. There may also be limitations of the scenario manipulation itself. Contingent responses were piloted in the development stages of the project, but no formal assessment was carried out in relation to different timings of delays on the contingent behaviours, which could undermine the validity of the different experience of each condition.

### **4.3 Limitations and future research**

#### **4.3.1 Power**

The current findings should be interpreted in the context of several limitations. An obvious limitation is the sample size that was only sufficiently powered to detect large effect sizes. Whilst EDA was valuable in looking for emerging trends, the interpretations can only be tentative and may have limited generalisability. In instances of multiple analyses, a

conservative approach was taken by applying the Bonferroni post hoc correction. However, it is acknowledged that this may have further reduced the power of the study by increasing the likelihood of a Type II error (Dienes, 2011; Nakagawa, 2004). It is also interesting to view these findings in light of the current “replication crisis” in psychological research (Open Science Collaboration, 2015), with a lack of power as a potential cause (Ioannidis, 2005). Future research with a larger sample would elucidate this further.

#### **4.3.2 Sample representativeness**

Only 16.5% of potential participants that were originally identified as potentially eligible were successfully tested and included in the analyses. This highlights potentially significant issues with sampling bias that may have prevented those with certain characteristics from participating. It is likely that those with the most extreme paranoia may have been fearful of travelling to central London. As such, the participant pool may not have been representative of the full spectrum of paranoia in the target population. It would be useful to explore whether these findings are specific to first-episode psychosis or whether they are also applicable to more chronic presentations.

Another issue of representation is the all-male sample, which were selected to minimise gender differences in the level of VR immersion. As women have been found to experience a lesser sense of presence during VR (Felnhofer et al., 2012), replication with a female sample would be required to ascertain the viability of this approach for both genders in clinically paranoid populations.

#### **4.3.3 Convergent validity**



It is important to note that both continuous and categorical ratings of fearful attachment in the relationship questionnaire are based on conscious self-appraisals. This approach to defining fearful attachment is based on social-psychological literature, developed in healthy student populations. In contrast, much of the clinical literature on fearful attachment has a higher threshold, referring to those scoring very highly in both anxiety and avoidance dimensions (Mikulincer & Shaver, 2003). However, whilst important to hold this distinction in mind, a review highlights convergent validity between self-reported attachment and external observations of attachment anxiety and avoidance behaviours (Shaver & Mikulincer, 2004).

#### **4.3.4 The challenges of virtual reality with clinical populations**

Just over half of the current sample passed the attention check (55%). This was considerably lower than the 90% of non-clinical participants using the same virtual reality scenario (Fornells-Ambrojo et al., 2016). Perhaps this is unsurprising in the current clinical sample given that cognitive deficits are a core feature of psychotic disorders (Sheffield et al., 2018) and impairments in receptive language have specifically been shown to precede the development of psychosis (Kremen et al., 2010; Meier et al., 2014). Therefore, answering attention questions based on a verbal interaction may have been difficult for this clinical sample. Further, some participants disclosed that they had been distracted by the experience of auditory hallucinations during the VR, reporting things such as *“I was distracted by a conversation in the background that I’ve heard lots of times before”*. Novel interpersonal interactions are known to be an activation context for hearing voices (Aleman & Laroi, 2008). Regardless of the source of constraint, the reduced capacity to sustain concentration during a three-minute conversation highlights potential challenges for future virtual reality research

involving verbal interactions. Despite this, sense of presence was comparable to that of other clinical (Wingham et al., 2016) and non-clinical VR studies (Fornells-Ambrojo et al., 2016).

The richness of real-life social interactions is curtailed by the analogue nature of the virtual reality. Future research could aim to capture this using more naturalistic designs. However, the use of VR allowed for a tightly controlled environment where the variables of interest can be investigated without interference from confounds. Further, the first-person perspective enabled by virtual reality increases the ecological validity in comparison to the third person approaches typically used in tasks investigating social-cognitive processes in paranoia (Chan and Chen, 2011).

#### **4.3.5 Understanding the mechanisms**

Interpretations about the links between attachment, interpersonal contingency and trust in psychosis are theoretical and cannot be ascertained based on the methodology of the current paper. Further research exploring these complex mechanisms would help to further our understanding of these associations. In particular, factors such trauma and beliefs that are considered in parallel by the joint researcher (MH) could be integrated and explored in synergy with the current focus of attachment.

#### **4.4 Clinical implications**

These findings may have clinical implications in the therapeutic context. Non-verbal sensitivity and responsiveness to clients are therapeutic skills that are generally considered as important for the therapeutic alliance and to demonstrate empathy and therapist competence (Dowell & Berman, 2013; Grace et al., 1995). In contrast, the current findings

suggest that contingent therapist behaviour could have the opposite effect by eliciting mistrust for people with psychosis who are high in paranoia and attachment insecurity. Perceived untrustworthiness of the therapist has been linked to a lack of therapeutic progress in psychosis (Lawlor et al., 2017). If the current findings were replicated in a larger sample, it would be important for therapists to have a good assessment of a client's history and presentation to formulate and to adapt their interpersonal style accordingly.

An emerging body of research highlights virtual reality as a valuable tool to integrate into therapeutic interventions for people with psychosis, where outcomes such as reduced paranoia and social avoidance show promise (Rus-Calafell et al., 2017). Interpersonally interactive virtual reality, such as the present study paradigm, could be used as exposure-based interventions. This would provide a safe and controlled environment to experiment with interpersonal distance whilst activating the attachment behavioural system.

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## **Part 3: Critical Appraisal**

## **1. Introduction**

This appraisal aims to provide critical reflections of this research and share my learnings from the process. Whilst reflections are discussed for both the empirical and review papers, the focus will be on the recruitment of participants for the empirical paper. Recruitment has been described as the most challenging component of research with clinical populations (Patel et al., 2003). This was certainly the case for the current study.

## **2. Challenges of recruitment**

### **2.1 Participant paranoia: Catch-22**

We found that our inclusion criteria of paranoia posed a paradoxical challenge to recruitment, requiring participants to be paranoid 'enough', yet not to the degree that it would prevent engagement. Further, paranoia can fluctuate rapidly which gave us a very narrow window of opportunity to engage and test participants. Heightened paranoia in psychosis can be an indication that an individual is beginning to relapse (Birchwood & Spencer, 2001). This was evident in our sample, where 14.9% of individuals who were approached about the research experienced a deterioration in their mental health prior to being able to participate, with some individuals admitted for inpatient care.

Individuals who were experiencing severe paranoia were highly suspicious about our intentions as researchers. Whilst some had given consent for us to contact them, many would not answer the phone to a new contact. For those who we did manage to get in contact with, many expressed anxieties about meeting new people, about the virtual reality itself, or about travelling to a new place.

We would sit with care coordinators to formulate possible anxieties based on the nature of each client's paranoid beliefs and would make an idiosyncratic plan to try and alleviate these

concerns as much as possible. For example, if individuals were suspicious about meeting new people, we would try to organise joint meetings with care coordinators in the first instance to establish familiarity. We paid for taxis for those worried about public transport. We would meet individuals at a familiar location and accompany them on their journey if they were afraid of travelling alone. For some participants, multiple telephone conversations or meetings were organised prior to testing to try and build rapport and encourage engagement. This required a great deal of flexibility and what felt like therapeutic input. Some of the early intervention psychosis (EIP) services were over an hour away from the virtual reality facilities at UCL. This undoubtedly was off-putting for many participants. Advances in technology mean that future VR research could utilise portable VR headsets that could be transported to the participant rather than expecting them to travel. This would have eliminated one of the barriers to engagement.

We had a high rate of 'did not attend' (DNA) on the day of testing, where several participants would agree to a scheduled research appointment and not turn up on the day. Sending text reminders 24 hours prior to appointments has been found to improve attendance rates by as much as 25% for service users with severe mental illness (Sims et al., 2012). Our DNA rate was still high despite this strategy. Although several participants who did not attend one appointment were rebooked and later able to engage.

## **2.2 Participant paranoia: Cyber fear**

The basis of a virtual reality study may have been off-putting for some individuals. Incorporation of technology into paranoid delusions is well documented at the severe end of the psychosis spectrum (Lerner et al., 2006). Whilst participants did not openly cite this as a reason for not wanting to participate, some of those who did take part expressed suspicions related to the VR itself, e.g. *"Will the virtual reality become actual reality and affect my*

*brain?*” and *“Are you sure the CIA can’t hack into these cameras to watch us?”* (referring to the movement trackers in the CAVE). It is possible that the concept of virtual reality may have tapped into existing delusional belief systems and prevented engagement for some individuals.

Nevertheless, we as researchers worked very hard to support engagement from those with extreme paranoia and levels of paranoia and delusions were severe and comparable to that expected in a first episode psychosis group (Langdon et al., 2013). I believe this is one of the main strengths of the study. The rate of conversion from being approached about the study to participation was 23.8% (see Figure 2 in the empirical paper for a detailed breakdown of participant recruitment). This is comparable to the 25% participation rate for another virtual reality study recruiting individuals with psychosis and persecutory delusions (Freeman et al., 2016).

### **2.3 Organisational barriers: Gatekeeping**

Ethical approval in the UK tends to favour the involvement of care coordinators in clinical research studies (Bucci et al., 2015). As such, care coordinators mediate access to potential participants, a term which has been coined as *“gatekeeping”* (Patterson et al., 2011). Care coordinators have the power to either facilitate or limit access to service users irrespective of their wishes, where participants are not always given the choice as to whether they would like to participate (Bucci et al., 2019; Tan et al., 2010). This a well-documented issue in clinical research and our project was no exception. 24% of referrals identified were never approached for consent by their care coordinator (see Figure 2 of empirical paper), with many expressing concerns that certain individuals were too unwell to participate and would not be able to cope. Making decisions on behalf of service users often comes from a well-intentioned position of wanting to protect their patients, known as paternalism, and is cited

as one of the main reasons for low recruitment in clinical trials (Howard et al. 2009). Regardless of the motivate, this contradicts the NHS 'No decision about me without me' guidance (Department of Health, 2012). Preventing service users from making their own decisions is particularly pertinent, given that empowerment has been linked to recovery from psychosis (Pritt et al., 2007). This selection bias also limits the generalisability of research findings, as service users who are considered to be able to 'cope' are likely to have particular characteristics (e.g. altruism, willingness), which may not represent the entire target population (Bucci et al., 2019).

Another constraint on recruitment was likely organisational. Identifying and following up with potential referrals was understandably not seen as a priority in the context of competing clinical demands such as time pressured targets (NHS England, 2016) and busy, high-risk caseloads (Belling et al., 2011). Whilst we attempted to alleviate these challenges as much as possible, we still continued to receive a very low rate of referrals.

#### **2.4 Organisation barriers: Consistence presence**

Prior to commencing recruitment, we met with the previous cohort of trainees who had attempted the project but had had to default to a non-clinical sample due to lack of referrals from services. They shared with us some of their learning, which informed our recruitment strategy. For example, they advised focusing on a smaller number of services to maximise rapport building. Therefore, my research partner and I had two allocated teams each at any given time.

We felt optimistic about recruitment given that the project already had ethics and we were able to start earlier than many other trainees in our cohort. Initially, we presented to our respective teams at team meetings to raise the profile of the study. A collaborative approach

was taken, asking the teams how we could best integrate our recruitment process with the team's way of working to make it as easy as possible to refer. For example, based on a suggestion from one team, I made business cards with the key inclusion/exclusion criteria and my contact details that they could be stuck inside care coordinators diaries. All teams said it would be helpful for researchers to have a consistent presence within the service. I aimed to spend a day a week in the service, attending team meetings to listen out for potential referrals and sitting with individual care coordinators to go through their caseloads and answer any questions. However, despite sending email reminders, being physically absent from the team for another week unfortunately also meant out of mind, and the momentum to follow up clients up was lost. Over the summer months when we had more research days, I was able to spend consecutive days in a service and this seemed to make a significant difference to recruitment. The ability to join care coordinators for impromptu meetings with clients was the most effective approach. I realised the difference it would have made having a full-time researcher imbedded within an existing team, rather than a part-time external body coming in and out. Unfortunately, this was not something we were able to sustain with all the other competing demands of DCLinPsy training such as placement, teaching and exams.

As a team, we continually reviewed the recruitment process to try and adapt to the challenges we encountered. Whilst screening participants at their local service prior to testing was our desired method, we realised that we were losing a considerable number of participants before this second testing appointment. Simplification of the recruitment protocol is a recommended approach in overcoming barriers to research referrals (Fletcher et al., 2010). In accordance with our existing ethics, we streamlined the process by offering flexible options to participants depending on preference, such as telephone screening or screening on the day of testing. This reduced the time participants were required to invest



and helped with engagement. However, our rate of recruitment was still very slow as this was not the only barrier.

In November 2019 we extended our ethics to NELFT, a site where our supervisor is well established in the clinical team. We were also able to involve assistant psychologists within the recruitment process. This was an enormous help, as these were integrated members of the team who could reliably follow up on referrals. In the space of two months we tested 8 participants, which was significantly better rate than before.

### **2.5 Unforeseen challenges: UCL strikes**

We encountered some circumstances that were beyond our control. Firstly, there were two occasions where the CAVE was closed due to UCL industrial action. This unfortunately happened to coincide with peak phases of recruitment in November 2019 and February 2020, where we were unable to test participants for an accumulated period of four weeks. During this time, we lost two eligible participants who had been screened but dropped out during the delay.

### **2.6 Unforeseen challenges: COVID-19**

By February we were on track for meeting our revised recruitment target of 30 participants and had another six-weeks of testing planned. Just as we were gaining traction with referrals from NELFT, the COVID-19 pandemic began. Prior to lockdown the decision was made to terminate recruitment early, as we did not want to put participants at risk travelling to central London for a non-essential contact. Shortly after, full lockdown was enforced.

Writing my thesis during lockdown has come with both great advantages and challenges. The restrictions on normal social life meant I had very few distractions or opportunities for

procrastination. I was able to work through my weekends in the knowledge that there was nothing better I could be doing with my time. Conversely, my established approach of setting clear environmental boundaries was disrupted. I would always work from the library, which made it easier to separate work and come home to my own space to relax. I had to adapt to this new way of working and work harder to establish these boundaries in the absence of a change of scene. Further, my usual outlets for stress were less available to me as I was not able to finish work and spend time with friends.

### **3. Benefits of recruiting a clinical population**

The feedback we received from the participants was overwhelmingly positive. Many participants were socially isolated and reported to find the novel experience of the virtual reality 'exciting' and 'inspiring', which was also corroborated by the high post VR PANAS scores (Watson et al., 1988) for these states of emotion.

Some participants shared that they found it therapeutic talking about their experiences with a researcher, as has been found in previous research (Woodall et al., 2011). Some of the measures used were deeply personal, enquiring about interpersonal relationships and traumatic childhood experiences (the focus of research partner's thesis). We found that participants were very open and expressed a sense of relief from sharing their experiences. With consent, we were able to share this information with care coordinators to inform treatment and on a couple of occasions suggest internal referrals for psychology within their local team.

Three participants initially declined the payment, expressing that they had enjoyed the experience and did not need any payment for their time. My impression was that the opportunity to engage in research was a meaningful experience that gave participants a

sense that they were making a valuable contribution and helping others. Further, contributing to research which may further improve services for people with similar experiences in the future was one of the key reasons cited for taking part.

This fits with the 'helper therapy principle' (Reissman, 1965; 1990) which highlights the benefits that may be experienced by those with mental health difficulties when positioned in a helping role. People with severe psychosis are often reliant on support from family or services and carers, so perhaps the opportunity to reverse this role promoted a valued sense of self-efficacy. Amidst the struggles of recruitment, this reiterated to me the value of conducting research in 'hard to engage' clinical populations.

#### **4. Categorisations**

Initially some of the analyses were planned as between group comparisons between those who scored as secure vs. insecurely attached. This was not possible due to the high prevalence of attachment insecurity, which left just 1 participant in the 'secure' attachment group. Firstly, this highlighted to me how pertinent relational distrust and interpersonal difficulties were both to this sample, and perhaps representative of those accessing psychosis services more widely. However, this also made me reflect on the validity of attachment categorisations, particularly considering the clinical usefulness of this arbitrary separation of individuals based on a relational construct as complex as attachment. Further, considering the categorisations of clinical vs. non-clinical groups for the literature review which was messy and arbitrary but also felt like a requirement for organising and presenting the review findings. This highlighted to me a disconnect between the process of research and how this can be translated into the nuance of working clinically with individuals where it may hold less validity or utility.

## **5. Joint project working**

Having the support from my joint researcher has been invaluable. Taking on such a big project together has made the whole process infinitely better. I feel that we worked very effectively as a team and it was helpful to have such as reciprocal relationship where we could take on additional work for each other at times where the other was less able to manage. Having a partner working to the same timeline has been especially reassuring.

## **6. Systematic review**

The current systematic review was initially intended to be a meta-analysis. Approximately four-months were spent working towards this target, extracting quantitative data from each primary paper and trying to learn how to use the meta-analysis programme 'R'. My review was based on statistical mediation, which made the quantitative synthesis of data a more complex task compared to a general meta-analysis. As the task became increasingly complex, it was referred onwards for more specialist statistical expertise. With the support of Dr Ciaran O'Driscoll, we began to work towards meta-analytic structural equation modelling (MASEM), incorporating all data into a single coherent model. This was an approach I had no prior knowledge of, and I spent many study days reading statistics books and trying to familiarise myself with this new methodology. Unfortunately, the statistical models would not converge due to the significant levels of heterogeneity in the data. At this point the decision was made to revert to a narrative synthesis of the evidence instead as I was already behind schedule and running out of time to complete my thesis.

This was very disappointing given how much time had been invested, which I then felt I had nothing to show for. However, it was also an important lesson for me; to work within the limits of my ability and the time available. Whilst a meta-analysis utilising MASEM was an exciting prospect, it was perhaps beyond the scope of a DClInPsy thesis and also my abilities.

I was extremely grateful for the time and expertise provided by Dr O’Driscoll and the opportunity to further my statistical knowledge and understanding in a new domain. However, upon reflection, I may have encountered challenges in defending a methodology I was a novice at, in the context of a viva. I have an appreciation for the value of a team approach to conducting research, where different expertise can come together to produce high quality work.

## **7. Conclusion**

Overall, I have learnt an enormous amount from the process of conducting this thesis throughout my training. Recruiting a difficult to engage population was excellent experience in developing my engagement and communication skills. I realise the importance of establishing strong relationships with clinical teams, which is pivotal in ameliorating the practical constraints that can accompany the implementation of research in busy NHS services. This experience has enabled me to develop my skills in conveying psychological ideas to multi-disciplinary staff when recruiting services. Further, encountering all the challenges with recruitment and analysis has given me insight into the realities of conducting research as a clinician. Despite the challenges, this experience has highlighted to me the importance of persevering with research in “difficult to engage” clinical populations, both for the validity of the findings and the valued service user experience. I am motivated and better prepared to engage in clinical research and aim to promote the integration of evidence-based practice in my role as a clinical psychologist.

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## Appendices



## **Appendix 1. Summary of Joint Project and Each Researcher's Contribution**

The virtual reality paradigm was developed and used in a previous doctoral thesis project by Dr Maikke Elenbaas, submitted in 2013. Since then, the paradigm has been used by other cohorts of trainees under the supervision of Dr Miriam Fornells-Ambrojo, once with a clinical population (Gail WIngham & Hannah Reidy, 2016) and once with a normative sample (Emilie Bourke & Hayley Dolan, 2018). Each thesis has had different variables of focus.

The present study was jointly conducted by Kate Watchorn (the author) and Melissa Hoban (fellow UCL D.Clin.Psy. Trainee and joint project researcher). Both projects were supervised by Dr Miriam Fornells-Ambrojo. In a clinically paranoid sample, the current thesis focused on the influence of attachment and interpersonal contingency on subjective trust and objective trusting behaviour. MH's thesis focused on associations between childhood trauma, schematic beliefs and trust.

Measures were selected from those in the existing ethically approved protocol to prevent any delays from substantial ethical amendments. Researchers chose measures that were relevant to their separate experimental hypotheses and jointly agreed on redundant measures to drop from the testing battery to streamline efficient data collection. Decisions were approved by Dr Miriam Fornells-Ambrojo. Both researchers shared the same dependent variables of subjective trust and objective trusting behaviour. Some measures used to characterise the sample (e.g. Paranoia Scale; Fenigstein & Venable, 1992) or measures used to determine immersion in the VR scenario (e.g. Sense of Presence Questionnaire; Slater et al., 1998) were utilised by both researchers. Measures relevant to experimental hypotheses (e.g. Relationship Questionnaire; Bartholomew & Horowitz, 1991) were unique to the present paper.

Ethical approval had already been attained. An amendment was jointly sought. Recruitment, screening participants, testing at the CAVE and data entry were shared endeavours between the joint researchers. Both researchers organised presentations at each early intervention psychosis service to promote recruitment. Then NHS sites were split between researchers to continue liaison and recruitment. The current researcher was responsible for Wandsworth, Harrow & Hillington, and Kensington & Chelsea EIS, whilst MH worked with Brent, Kingston & Richmond and NELFT.

Data analysis and write up of the current thesis was conducted independently with supervision from Dr Miriam Fornells-Ambrojo.

## **References**

Bourke, E. (2018). Attachment Security, Trust and Imagined Attachment Behaviours: An Exploratory Study within a General Population Sample (Doctoral thesis, University College London).

Dolan, H. (2018). Childhood trauma, negative schemas and trust: An exploration using virtual reality\_(Doctoral thesis, University College London).

Elenbaas, M. (2013). Paranoia and the role of contingency in the experience of trust and perceived empathy in interpersonal encounters (Doctoral thesis, University College London).

Reidy, H. (2016). No man is an island: Exploring the links between social connectedness and trust in clinical paranoia using a virtual reality paradigm (Doctoral thesis, University College London).

Wingham, G. (2016). The role of interpersonal contingency and self-focused attention in the development of trust in clinical paranoia: A virtual reality study (Doctoral thesis, University College London).

## Appendix 2. Favourable ethical approval confirmation



**Health Research Authority**  
NRES Committee London - Camberwell St Giles  
Level 3, Block B  
Whitefriars  
Lewins Mead  
Bristol  
BS1 2NT

Telephone: 0117 342 1391

10 August 2015

Dr. Miriam Fomells-Ambrojo  
Clinical Psychologist, Step Team  
South London and Maudsley NHS Foundation Trust  
Step Team, 12 Windsor Walk,  
Denmark Hill  
London  
SE5 8BB

Dear Dr. Fomells-Ambrojo

**Study title:** Investigating social factors and affective processes in individuals with clinical paranoia: a virtual reality study.  
**REC reference:** 15/LO/1197  
**IRAS project ID:** 172018

Thank you for your letter of 6<sup>th</sup> August 2015, responding to the Committee's request for further information on the above research and submitting revised documentation.

The further information was considered in correspondence by a Sub-Committee of the REC at a meeting held on 10<sup>th</sup> August 2015. A list of the Sub-Committee members is attached.

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, Tina Cavaliere, [nrescommittee.london-camberwellstgiles@nhs.net](mailto:nrescommittee.london-camberwellstgiles@nhs.net). 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, subject to the conditions specified below.

#### 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.*

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

*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](mailto: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

NHS 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" below).

#### Non-NHS sites

#### Approved documents

The final list of documents reviewed and approved by the Committee is as follows:

Document	Version	Date
Copies of advertisement materials for research participants [Research Poster]	3	03 August 2015
Evidence of Sponsor Insurance or Indemnity (non NHS Sponsors only) [Insurance Certificate]	1	12 June 2015
GP/consultant information sheets or letters [HCP Information Sheet]	1	15 January 2015
Interview schedules or topic guides for participants [Qual Interview QUS ]	2	01 July 2015
IRAS Checklist XML [Checklist_18062015]		18 June 2015
IRAS Checklist XML [Checklist_01072015]		01 July 2015
IRAS Checklist XML [Checklist_06082015]		06 August 2015
IRAS Checklist XML [Checklist_06082015]		06 August 2015
Letter from sponsor [Letter from Sponsor]	1	12 June 2015
Non-validated questionnaire [Sense of Presence non-validated]	2	01 July 2015
Non-validated questionnaire [TICR non-validated]	2	01 July 2015
Non-validated questionnaire [Detection of Contingency and Attention Checks]	2	01 July 2015
Non-validated questionnaire [Reading the Eyes non-validated]	2	01 July 2015
Participant consent form [Participant consent form]	2	03 August 2015
Participant information sheet (PIS) [Participant Information Sheet]	3	03 August 2015
REC Application Form [REC_Form_18062015]		18 June 2015
REC Application Form [REC_Form_06082015]		06 August 2015
Research protocol or project proposal [Research Protocol]	3	06 May 2015
Summary CV for Chief Investigator (CI) [CI CV]	1	13 March 2015
Summary CV for student [CV Gail Wingham and Hannah Reidy merged]	1	12 June 2015
Summary CV for supervisor (student research) [Chris Barker CV]	1	01 July 2015
Summary, synopsis or diagram (flowchart) of protocol in non technical language [Research Flow Chart]	1	01 April 2015
Validated questionnaire [RQ]	1	12 June 2015
Validated questionnaire [CAPE 42 Item]	2	01 July 2015
Validated questionnaire [FAQ validated]	2	01 July 2015
Validated questionnaire [FESFS-2013 validated]	2	01 July 2015
Validated questionnaire [GPTS validated]	2	01 July 2015
Validated questionnaire [PANAS Validated]	2	01 July 2015
Validated questionnaire [PSYRATS-D validated]	2	01 July 2015

Validated questionnaire [RG UK]	1	01 July 2015
Validated questionnaire [SIAS validated]	1	01 July 2015
Validated questionnaire [SNI validated]	2	01 July 2015
Validated questionnaire [SOS validated]	2	01 July 2015
Validated questionnaire [UCLA loneliness validated]	2	01 July 2015
Validated questionnaire [SEAT validated]	1	01 July 2015

#### 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.

#### User Feedback

The Health Research Authority is continually striving to provide a high quality service to all applicants and sponsors. You are invited to give your view of the service you have received 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/>

#### 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/LO/1197	Please quote this number on all correspondence
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With the Committee's best wishes for the success of this project.

Yours sincerely

Pp

**Mr John Richardson**  
Chair

Email: nrescommittee.london-camberwellstgiles@nhs.net

**Enclosures:** *List of names and professions of members who were present at the meeting and those who submitted written comments*

*\*After ethical review – guidance for researchers\**

**Copy to:** *Mr Dave Wilson*  
*Mrs Angela Williams, NoCLOR*

**NRES Committee London - Camberwell St Giles**

**Attendance at Sub-Committee of the REC meeting on 14 August 2015**

**Committee Members:**

Name	Profession	Present	Notes
Mrs Jennifer Bostock	Philosopher of Psychiatry	Yes	
Mr John Richardson (Chair)	Retired Director of COREC: former Ecumenical Officer for Churches Together in South London	Yes	

**Also in attendance:**

Name	Position (or reason for attending)
Miss Claudia Harrison	REC Assistant



## Amendment Categorisation and Implementation Information

Dear Dr. **Fornells-Ambrojo**,

<b>IRAS Project ID:</b>	172018
<b>Short Study Title:</b>	Using Virtual Reality to Investigate Psychological Factors in Paranoia
<b>Date complete amendment submission received:</b>	27 November 2018
<b>Amendment No./ Sponsor Ref:</b>	Non-Substantial Amendment 2
<b>Amendment Date:</b>	25 October 2018
<b>Amendment Type:</b>	Non-substantial
<b>Outcome of HRA and HCRW Assessment</b>	<b>This email also constitutes HRA and HCRW Approval for the amendment</b> , and you should not expect anything further.
<b>Implementation date in NHS organisations in England and Wales</b>	35 days from date amendment information together with this email, is supplied to participating organisations ( <b>providing conditions are met</b> )
<b>For NHS/HSC R&amp;D Office information</b>	
<b>Amendment Category</b>	<b>A</b>

Thank you for submitting an amendment to your project. We have now categorised your amendment and please find this, as well as other relevant information, in the table above.

### What should I do next?

Please read the information in [IRAS](#), which provides you with information on how and when you can implement your amendment at NHS/HSC sites in each nation, and what actions you should take now.

If you have participating NHS/HSC organisations in any other UK nations please note that **we will** forward the amendment submission to the relevant national coordinating function(s).

If not already provided, please email to us any regulatory approvals (where applicable) once available.

### When can I implement this amendment?

You may implement this amendment in line with the information in [IRAS](#). Please note that you may only implement changes described in the amendment notice.

### **Who should I contact if I have further questions about this amendment?**

If you have any questions about this amendment please contact the relevant national coordinating centre for advice:

- England – [hra.amendments@nhs.net](mailto:hra.amendments@nhs.net)
- Northern Ireland – [research.gateway@hscni.net](mailto:research.gateway@hscni.net)
- Scotland – [nhsg.NRSPCC@nhs.net](mailto:nhsg.NRSPCC@nhs.net)
- Wales – [research-permissions@wales.nhs.uk](mailto:research-permissions@wales.nhs.uk)

Additional information on the management of amendments can be found in the [IRAS guidance](#).

### **User Feedback**

The Health Research Authority is continually striving to provide a high quality service to all applicants and sponsors. You are invited to give your view of the service you have received 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/>.

Please do not hesitate to contact me if you require further information.

Kind regards

**Richard Boyd**


**Health Research Authority**

Ground Floor | Skipton House | 80 London Road | London | SE1 6LH

**E.** [hra.amendments@nhs.net](mailto:hra.amendments@nhs.net)

**W.** [www.hra.nhs.uk](http://www.hra.nhs.uk)

## Appendix 4. Participant Information Sheet

Information Sheet Version 5: 16.02.17	<b>Central and North West London</b>  NHS Foundation Trust
<b>PARTICIPANT INFORMATION SHEET</b>	
<b>PROJECT TITLE: UNDERSTANDING SOCIAL INTERACTIONS IN CLINICAL POPULATIONS: AN EVALUATION OF A VIRTUAL FLATMATE</b>	
<p>We would like to invite you to take part in a study looking at people's reactions to virtual environments. This project is part of two Doctoral research projects. Please take time to read the following information carefully and ask us if there is anything that is not clear to you or if you would like more information. Alternatively, one of our team will go through the information sheet with you and answer any questions you have.</p>	
<b>Why have I been invited to take part in the study?</b> You have been invited to take part in the study because we are looking for volunteers who are 18 years old or above. We are specifically looking for individuals who are currently involved with community mental health services. We hope to involve 60 participants for this study.	
<b>Do I have to take part?</b> It is up to you to decide whether or not to take part. We will describe the study and go through this information sheet with you. If you do decide to take part you will be given this information sheet to keep, and be asked to sign a consent form. In this consent form, we will ask to have access your medical notes. This is only because it would be helpful for the research team to look at relevant sections of your medical notes if your care coordinator is not able to access this information on our behalf. This is optional and your participation does not depend on it. If you do consent to take part in the study, you will be free to withdraw at any time, without giving a reason. This will not affect the standard of care you receive.]	
<b>What will happen if I decide to take part?</b> If you decide to take part in this study, we will invite you to visit our virtual reality suite at University College London for a one-off appointment. We expect that this appointment will take a maximum of 2 hours and you will be reimbursed for your time. Our researchers can meet you on any part of your journey to assist you with travelling to the location.	
<p>The main thing you will be asked to do will be to explore a virtual environment. Brief questionnaires will be used to assess how realistic the environment is. You will be asked to complete the following steps:</p>	
<b>Part 1 - Questionnaires:</b> Prior to entering the virtual environment you will be invited to complete a set of measures. These include a brief questionnaire asking about past traumatic experiences and measures asking about your views about other people. You are under no obligation to answer any questions that you do not wish to. Furthermore, the researchers will be on hand to support you with any concerns that may arise for you as you complete the questionnaires.	
Page 1 of 5	

**Part 2 - Virtual Reality:**

- After completion of the questionnaires, you will be given instructions in the use of the virtual reality room.
- We will invite you to wear glasses that produce three-dimensional images so that you can enter the virtual reality room.
- The virtual reality room will represent a flat share. You will be invited to remain in the student flat for 3 minutes and interact with a virtual flatmate character.
- There will be a researcher directly outside the virtual reality suite at all times to ensure that you feel comfortable during the scenario.
- During your time in the virtual environment, your interaction with the virtual flatmate character will be video-recorded by an unobtrusive camera in the ceiling. This camera will help us review how you and the virtual character move around the room. The video footage will not be shown to anyone outside the research team and will be destroyed when the research project has been completed.

**Part 3 – Questionnaires:** Following the virtual reality exercise, we will ask you to complete some final questionnaires about your feelings at that time and to provide feedback on the quality of the virtual interaction with a flat mate avatar.

**Part 4 – Interview:** A researcher will guide you through a brief interview that asks you to imagine future scenarios. Specifically, this interview will ask you to imagine how you might interact with the flatmate avatar if you moved into the flat share you saw in virtual reality (described above in Part 2). As with all the questionnaires in the study, there are no 'right' or 'wrong' answers in this interview.

**Will I be paid for my participation?**

All participants will be paid £12.50 to thank them for their time. Any travel expenses will be reimbursed.

**Are there any disadvantages to taking part?**

There have been various reported side effects of using virtual reality equipment. When people use virtual reality systems they occasionally experience 'flashbacks' or a degree of nausea. If at any time you wish to stop taking part in the study for these or any other reasons, please just say so and we will stop the scenario.

There has been some research that suggests that people using virtual reality might experience some disturbance in their vision afterwards. This research shows that the visual disturbance is sometimes still there after 30 minutes, but no long-term studies are known to our research team. It is advised that you do not drive a car, motorcycle, or operate complicated machinery in the 4 hours following the virtual reality scenario.

With any type of video equipment there is a possibility that an epileptic episode may be generated. This, for example, has been reported for computer video games. **If you have epilepsy, please tell us. We would not want you to take part in study in this case.**

It is important for you to understand that you are not required to discuss anything that you do not want to and you should discuss only the things which you feel are relevant. If at any time

you feel upset, please raise it with one of the researchers immediately. You could ask them to move on to another subject or end the testing altogether. We will help you to manage these feelings by using relaxation strategies commonly used to reduce distress (e.g. involving breathing or muscle relaxation) at the end of the meeting. If necessary, the researcher will seek further support for you through your services and you will be provided with contact details for the researcher and mental health professionals involved in your care.

**What are the possible benefits of taking part?**

We cannot promise the study will help you personally, but the information we get from the research will help improve understanding of social interactions for people under the care of mental health services. This could help inform better practices and treatments for service users in the future.

**What if there is a problem?**

If you wish to complain, or have concerns about any aspect of the way you have been approached or treated by members of staff during your participation in the research, National Health Service or UCL complaints mechanisms are available to you. Please ask your researcher or doctor if you would like more information on this. In the unlikely event that you are harmed by taking part in this study, compensation may be available.

If you suspect that the harm is the result of the Sponsor's (University College London) or the hospital's negligence, then you may be able to claim compensation. After discussing with your research doctor, please make the claim in writing to Dr Miriam Fornells-Ambrojo who is the Chief Investigator for the research and is based at the Department of Clinical, Educational and Health Psychology, University College London. The Chief Investigator will then pass the claim to the Sponsor's Insurers, via the Sponsor's office. You may have to bear the costs of the legal action initially, and you should consult a lawyer about this.

**Will my taking part in the study be kept confidential?**

All the information obtained will be kept strictly confidential and you will not be identified. This is done by allocating you an anonymous participant number under which to collect data in the experiment. All data will be collected and stored in accordance with the Data Protection Act 1998.

**What will happen if I don't want to carry on with the study?**

If you withdraw from the study, we will destroy all your identifiable information e.g. name, contact number, care coordinator etc. However, we may use non-identifiable data that we have collected up until your withdrawal (e.g. data from questionnaires that are assigned an anonymous participant number).

**What will happen to the results of the research study?**

The results of the research will be analysed in order to complete a Doctorate in Clinical Psychology and the findings will be published in a scientific journal and may be presented at conferences. You will not be identified in any report or publication. Please inform the researchers Kate Watchorn or Melissa Hoban if you would like a copy of the study's findings.

**Who is organising this study?**

The research is being organised and funded by UCL.

**Who has reviewed the study?**

All research in the NHS is looked at by an independent group of people, called a Research Ethics Committee, to protect your interests. The study has been reviewed and given favourable opinion by ~~Camberwell~~ St Giles Research Ethics Committee.

**Thank you for considering taking part and taking the time to read this information sheet.**

**Research Team Members:**

Melissa Hoban, Trainee Clinical Psychologist, Department of Clinical, Educational and Health Psychology, University College London. Email: [m.hoban.17@ucl.ac.uk](mailto:m.hoban.17@ucl.ac.uk) Tel: 07538124739

Kate Watchorn, Trainee Clinical Psychologist, Department of Clinical, Educational and Health Psychology, University College London. Email: [kate.watchorn.17@ucl.ac.uk](mailto:kate.watchorn.17@ucl.ac.uk) Tel: 07903242881

Dr Miriam Fornells-Ambrojo, Lecturer in Clinical Psychology, Department of Clinical, Educational and Health Psychology, University College London. Email: [Miriam.fornells-ambrojo@ucl.ac.uk](mailto:Miriam.fornells-ambrojo@ucl.ac.uk)

## Appendix 5. Participant Consent Form

Consent Form  
Version 4: 16.02.17

Central and North West London   
NHS Foundation Trust

THIS STUDY HAS BEEN APPROVED BY  
CAMBERWELL ST-GILES NRES COMMITTEE LONDON  
Project ID 15/LO/1197

Patient Identification Number:  
Date:



### CONSENT FORM

#### PROJECT TITLE: UNDERSTANDING SOCIAL INTERACTIONS IN CLINICAL POPULATIONS: AN EVALUATION OF A VIRTUAL FLATMATE

Name of Researchers: Melissa Hoban & Kate Watchorn

Thank you for your interest in taking part in this research. If you have any questions arising from the Information Sheet or explanation already given to you, please ask the researcher before you decide whether to take part. You will be given a copy of this Consent Form to keep and refer to at any time.

1. I confirm that I have read and understand the information sheet dated 16.02.17 (Version 4) for the above study. I have had the opportunity to ask questions and have had these answered satisfactorily.
2. 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.
3. I understand that if I decide to withdraw from the study, any identifiable data collected up to this point will be destroyed but non-identifiable data may be used for the research.
4. I understand that I must not take part in the study if I have epilepsy.
5. I understand that the information I have submitted will be published as a report and I will be sent a copy if I request this. Confidentiality and anonymity will be maintained and it will not be possible to identify me from any publications.
6. I understand that data collected during the study may be looked at by individuals from University College London, from regulatory authorities such as external auditors checking how the research is being run, or from the NHS Trust where it is relevant to my taking part in the research. I give permission for these individuals to have access to my records.
7. Optional: I understand that relevant sections of my medical notes may be required to be looked at by the research team should my care coordinator not be able to access this information on the researcher's behalf. I give permission for the research to have access to my medical notes, only for the duration that I am involved in the research.
8. I agree that the research project named above has been explained to me to my satisfaction and I agree to take part in this study.

Name of Participant: .....

Signature: .....

Date: .....

Name of researcher taking consent: .....

Signature: .....

Date: .....

If you would like to receive a copy of the research findings once the study is complete please tick here:

When completed: 1 for participant, 1 for researcher, 1 for documenting in medical notes

**Appendix 6. Green et al., Paranoid Thoughts Scale (Green et al., 2008)**

**GPTS**

**Participant no:**

Instructions: Please read each of the statements carefully.

They refer to thoughts and feelings you may have had about others **over the last month**.

Think about the last month and **indicate the extent of these feelings** from 1 (Not at all) to 5 (Totally).

Please complete both **Part A and Part B**.

(N.B. Please do not rate items according to any experiences you may have had under the influence of drugs.)

**Part A**

<b>Statement</b>	<b>Not at all</b>		<b>Somewhat</b>		<b>Extremely</b>
1. I spent time thinking about friends gossiping about me	1	2	3	4	5
2. I often heard people referring to me	1	2	3	4	5
3. I have been upset by friends and colleagues judging me critically	1	2	3	4	5
4. People definitely laughed at me behind my back	1	2	3	4	5
5. I have been thinking a lot about people avoiding me	1	2	3	4	5
6. People have been dropping hints for me	1	2	3	4	5
7. I believed that certain people were not what they seemed	1	2	3	4	5
8. People talking about me behind my back upset me	1	2	3	4	5
9. I was convinced that people were singling me out	1	2	3	4	5
10. I was certain that people have followed me	1	2	3	4	5
11. Certain people were hostile towards me personally	1	2	3	4	5
12. People have been checking up on me	1	2	3	4	5
13. I was stressed out by people watching me	1	2	3	4	5
14. I was frustrated by people laughing at me	1	2	3	4	5
15. I was worried by people's undue interest in me	1	2	3	4	5
16. It was hard to stop thinking about people talking about me behind my back	1	2	3	4	5



**Part B**

<b>Statement</b>	<b>Not at all</b>		<b>Somewhat</b>		<b>Extremely</b>
1. Certain individuals have had it in for me	1	2	3	4	5
2. I have definitely been persecuted	1	2	3	4	5
3. People have intended me harm	1	2	3	4	5
4. People wanted me to feel threatened, so they stared at me	1	2	3	4	5
5. I was sure certain people did things in order to annoy me	1	2	3	4	5
6. I was convinced there was a conspiracy against me	1	2	3	4	5
7. I was sure someone wanted to hurt me	1	2	3	4	5
8. I was distressed by people wanting to harm me in some way	1	2	3	4	5
9. I was preoccupied with thoughts of people trying to upset me deliberately	1	2	3	4	5
10. I couldn't stop thinking about people wanting to confuse me	1	2	3	4	5
11. I was distressed by being persecuted	1	2	3	4	5
12. I was annoyed because others wanted to deliberately upset me	1	2	3	4	5
13. The thought that people were persecuting me played on my mind	1	2	3	4	5
14. It was difficult to stop thinking about people wanting to make me feel bad	1	2	3	4	5
15. People have been hostile towards me on purpose	1	2	3	4	5
16. I was angry that someone wanted to hurt me	1	2	3	4	5

**Appendix 7. Participant demographic details form**

**Participant Information**

Participant name: .....

Participant ID (to be completed by researcher): .....

Age: .....

Gender: .....

Ethnicity: .....

Occupation: .....

History of epilepsy: .....

**Please circle responses to below**

1a) Have you ever had a diagnosed mental health difficulty?

- Yes
- No
- Prefer not to say |

1b) If you answered yes to question 1a), please specify which mental health difficulty you have experienced: .....

- Prefer not to say
- Not applicable

1b) If you answered yes to question 1a), is this mental health difficulty current?

- Yes
- No
- Prefer not to say
- Not applicable

2a) Have you previously lived in a shared flat?

- Yes
- No

2b) If you answered yes to question 2a), overall would you describe this experience as:

- Mainly positive
- Mainly negative
- Neutral

2c) Have you had any previous experience of using Virtual Reality technology?

- Yes
- No

**Appendix 8. Relationship Questionnaire (Bartholomew & Horowitz, 1991)**

**Participant No:**

*Following are four general relationship styles that people often report. Place a checkmark next to the letter corresponding to the style that best describes you or is closest to the way you are.*

\_\_\_ A. It is easy for me to become emotionally close to others. I am comfortable depending on them and having them depend on me. I don't worry about being alone or having others not accept me.

\_\_\_ B. I am uncomfortable getting close to others. I want emotionally close relationships, but I find it difficult to trust others completely, or to depend on them. I worry that I will be hurt if I allow myself to become too close to others.

\_\_\_ C. I want to be completely emotionally intimate with others, but I often find that others are reluctant to get as close as I would like. I am uncomfortable being without close relationships, but I sometimes worry that others don't value me as much as I value them.

\_\_\_ D. I am comfortable without close emotional relationships. It is very important to me to feel independent and self-sufficient, and I prefer not to depend on others or have others depend on me.

*Now please rate each of the relationship styles above to indicate how well or poorly each description corresponds to your general relationship style.*

**Style A**

1 2 3 4 5 6 7  
Disagree Strongly Neutral/Mixed Agree Strongly

**Style B**

1 2 3 4 5 6 7  
Disagree Strongly Neutral/Mixed Agree Strongly

**Style C**

1 2 3 4 5 6 7  
Disagree Strongly Neutral/Mixed Agree Strongly

**Style D**

1 2 3 4 5 6 7  
Disagree Strongly Neutral/Mixed Agree Strongly

**Appendix 9. Paranoia Scale (Fenigstein & Vanable, 1992)**

**Paranoia Scale (Fenigstein and Vanable 1992)**

Please rate how applicable each belief is to you by selecting a number between 1 (not at all applicable to me) and 5 (extremely applicable to me).

	Not at all applicable to me	Extremely applicable to me
1 Someone has it in for me	1 <input type="radio"/>	5 <input type="radio"/>
2 I sometimes feel as if I'm being followed	1 <input type="radio"/>	5 <input type="radio"/>
3 I believe that I have often been punished without cause	1 <input type="radio"/>	5 <input type="radio"/>
4 Some people have tried to steal my ideas and take credit for them	1 <input type="radio"/>	5 <input type="radio"/>
5 My parents and family find more fault with me than they should	1 <input type="radio"/>	5 <input type="radio"/>
6 No one really cares much what happens to you	1 <input type="radio"/>	5 <input type="radio"/>
7 I am sure I get a raw deal from life	1 <input type="radio"/>	5 <input type="radio"/>
8 Most people will use somewhat unfair means to gain profit or advantage, rather than lose it	1 <input type="radio"/>	5 <input type="radio"/>
9 I often wonder what hidden reason another person may have for doing something nice for you	1 <input type="radio"/>	5 <input type="radio"/>
10 It is safer to trust no one	1 <input type="radio"/>	5 <input type="radio"/>
11 I have often felt that strangers were looking at me critically	1 <input type="radio"/>	5 <input type="radio"/>
12 Most people make friends because friends are likely to be useful to them	1 <input type="radio"/>	5 <input type="radio"/>
13 Someone has been trying to influence my mind	1 <input type="radio"/>	5 <input type="radio"/>
14 I am sure I have been talked about behind my back	1 <input type="radio"/>	5 <input type="radio"/>
15 Most people inwardly dislike putting themselves out to help other people	1 <input type="radio"/>	5 <input type="radio"/>
16 I tend to be on my guard with people who are somewhat more friendly than expected	1 <input type="radio"/>	5 <input type="radio"/>
17 People have said insulting and unkind things about me	1 <input type="radio"/>	5 <input type="radio"/>
18 People often disappoint me	1 <input type="radio"/>	5 <input type="radio"/>
19 I am bothered by people outside, in cars, in stores, etc., watching me	1 <input type="radio"/>	5 <input type="radio"/>
20 I have often found people jealous of my good ideas just because they had not thought of them first	1 <input type="radio"/>	5 <input type="radio"/>

**Appendix 10. The Psychotic Symptoms Rating Scale – Delusions (PSYRATS-D; Haddock et al., 1999)**

**(PSYRATS-D; Haddock et al., 1999)**

**1 Amount of preoccupation with delusions**

1. 0 No delusions, or delusions which the subject thinks about less than once a week
2. 1 Subject thinks about beliefs at least once a week
3. 2 Subject thinks about beliefs at least once a day
4. 3 Subject thinks about beliefs at least once an hour
5. 4 Subject thinks about delusions continuously or almost continuously

**2 Duration of preoccupation with delusions**

1. 0 No delusions
2. 1 Thoughts about beliefs last for a few seconds, fleeting thoughts
3. 2 Thoughts about delusions last for several minutes
4. 3 Thoughts about delusions last for at least 1 hour
5. 4 Thoughts about delusions usually last for hours at a time

**3 Conviction**

1. 0 No conviction at all
2. 1 Very little conviction in reality of beliefs, < 10%
3. 2 Some doubts relating to conviction in beliefs, between 10-49%
4. 3 Conviction in belief is very strong, between 50-99 %
5. 4 Conviction is 100 %

**4 Amount of distress**

1. 0 Beliefs never cause distress
2. 1 Beliefs cause distress on the minority of occasions
3. 2 Beliefs cause distress on < 50% of occasions
4. 3 Beliefs cause distress on the majority of occasions when they occur between 50-99% of time
5. 4 Beliefs always cause distress when they occur

**5 Intensity of distress**

- 0 No distress  
1 Beliefs cause slight distress  
2 Beliefs cause moderate distress  
3 Beliefs cause marked distress  
4 Beliefs cause extreme distress, could not be worse

**6 Disruption to life caused by beliefs**

- 0 No disruption to life, able to maintain independent living with no problems in daily living skills. Able to maintain social and family relationships (if present)  
1 Beliefs cause minimal amount of disruption to life, e.g. interferes with concentration although able to maintain daytime activity and social and family relationships and be able to maintain independent living without support  
2 Beliefs cause moderate amount of disruption to life causing some disturbance to daytime activity and/or family or social activities. The patient is not in hospital although may live in supported accommodation or receive additional help with daily living skills  
3 Beliefs cause severe disruption to life so that hospitalisation is usually necessary. The patient is able to maintain some daily activities, self-care and relationships while in hospital. The patient may be also be in supported accommodation but experiencing severe disruption of life in terms of activities, daily living skills and/or relationships  
4 Beliefs cause complete disruption of daily life requiring hospitalization. The patient is unable to maintain any daily activities and social relationships. Self-care is also severely disrupted

**Appendix 11. Positive and Negative Affect Schedule (Watson et al., 1988)**

Participant no:

This scale consists of a number of words that describe different feelings and emotions. Read each item and then tick the appropriate answer next to that word. Indicate to what extent you feel this way right now, that is, at the present moment.

	<b>1</b> Very slightly or not at all	<b>2</b> A little	<b>3</b> Moderately	<b>4</b> Quite a bit	<b>5</b> Extremely
Interested					
Distressed					
Excited					
Upset					
Strong					
Guilty					
Scared					
Hostile					
Enthusiastic					
Proud					
Irritable					
Alert					
Ashamed					
Inspired					
Nervous					
Determined					
Attentive					
Jittery					
Active					
Afraid					

- 1. What do you like about flat sharing?**
- 2. How do you choose flatmates?**
- 3. What makes a good flatmate?**
- 4. What's the best thing about this flat?**

### Appendix 13. Full script of conversation with avatar

A=Avatar

P=Participant

A: Hi my name is Mark thanks for coming. What's your name?"

P: (Tells avatar their name)

A: Thanks, OK I'm ready!

**P: What do you like about flat sharing?**

A: I enjoy meeting new people... I have made new friends this way...its great getting to know them, have a laugh... mhm... and it helps to keep the cost of living low so you can live in a better area!

**P: What do you ask potential flatmates before going ahead?**

A: Well, I always meet them in person and get a sense of what they are like... I ask them what they are looking for in a shared flat, what is a typical day like for them, what music they like, if they smoke, if they are lazy about house chores... mhm.. If they like having friends around ... Oh, yeah it is also good to ask them what has been their best and worse experience of flat sharing!

**P: In your experience... who makes a great flatmate?**

A: Mhm... good question... don't know... I'm trying to think ....someone how is easygoing, friendly and fun but who also can give you space... It is also good to have something in common with them, like love for sport, or music...It's hard to answer because I think it really depends on the person... I've got on with people who were completely different from me, sometimes it just works.

**P: What is the best thing about your flat?**

A: The terrace and the view! Come and have a look! (moves to the window)

A: It's amazing to have all this outside space, in the summer we practically live outside! We have great BBQs...

*(Phone rings – avatar answers and speaks discreetly on the phone)*

A: Hello? Okay..yeah I can be there!okay bye.

A: Oh, sorry but I need to go now... anyway thank you for coming and maybe we can continue the interview some other time?

P: (Answers)

SCENARIO ENDS



**Appendix 14. Subjective Rating of Trust**

**How TRUSTWORTHY did Mark come across?**

Not at  
all

Very  
much

1

2

3

4

5

6

7

**Appendix 15. Attention Checks**

**Please circle whether the following statements are true or false**

1. One reason that Mark the virtual flatmate gave for why he likes flat sharing is that he has made new friends

True

False

2. When asked who makes a good flatmate, Mark mentioned that the most important thing is that they are tidy.

True

False

**Appendix 16. Sense of Presence Questionnaire (Slater et al., 1998)**

**The following questions relate to your recent virtual reality experience. Please read each question and answer as you are instructed in each one.**

1. Please rate the sense of actually being in the flat

Abnormal of being Experience	1	2	3	4	5	6	7	Normal experience in a flat
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2. To what extent were there times during the experience when the virtual flat became "reality" for you, and you almost forgot about the "real world" of the laboratory in which the whole experience was actually taking place?

At no time	1	2	3	4	5	6	7	Almost all the time
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3. When you think back about your experience, do you think of the virtual flat more as "images that you saw", or more as "somewhere you visited"?

Images that I saw	1	2	3	4	5	6	7	Somewhere that I visited
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4. During the experience, which was strongest on the whole, your sense of being in the virtual flat, or being in the real world of the laboratory

Laboratory	1	2	3	4	5	6	7	Virtual flat
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5. Consider your memory of being in the flat. How similar is the memory of the virtual reality experience to other memories of "real places" in terms of: visual quality, size, colour and how realistic and vivid it seems in your imagination?

Not at all Similar	1	2	3	4	5	6	7	Very similar
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6. During the experience, did you think to yourself that you were actually "just standing in a room wearing equipment" or did the virtual flat "overwhelm" you? The virtual flat overwhelmed me...

Not at all	1	2	3	4	5	6	7	All of the time
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