Schizotypy and Contextual Integration

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D.Clin.Psy. Thesis (Volume 1) 2007

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Acknowledgements

I would like to thank my supervisors Oliver Mason and Craig Steel for their availability, support and guidance during the writing of this thesis. I would like to thank Samuel Donaldson, whose computer skills I am greatly indebted to. I would also like to thank Kieran Hayes for his support throughout this process, and to my friends, family and colleagues who have helped me maintain a balance in life during this time.

Overview

This thesis is divided into three parts:

Part 1 is a literature review that summarises some of the cognitive models of schizophrenia. The context based information processing account of Hemsley (2005) is explained and some of the research evidence for the context-deficit hypothesis of schizophrenia is examined. The concept of schizotypy is introduced as a manner of exploring schizophrenia within the non-clinical population. Research investigating context in schizotypy is examined and it is concluded that context memory has not been investigated within schizotypy as it has been in the patient population and that studies in this area would add to the evidence base for Hemsley's (2005) information processing account of schizophrenia.

Part 2 is the empirical paper that investigated Hemsley's (2005) model of context deficits in schizophrenia by examining the impact of high and low levels of schizotypy on a contextual binding task employed by Waters, Maybery, Badcock, and Michie (2004) in their study investigating the differences between patients and non-clinical controls. The hypothesis that participants who were highly schizotypal would have greater difficultly performing the contextual binding task was not supported. These null findings are discussed in relation to other research in schizophrenia and in the context of methodological issues within the study.

Part 3 is a critical review of the process of undertaking the study described above. This includes further reflection on points arising in the discussion of the empirical paper in Part 2.

Part 1: Literature Review

Abstract

This review examines cognitive models of schizophrenia, in particular, Hemsley's (2005) information processing model that implicates a deficit in context memory in people with schizophrenia. Evidence for this model is presented. The concept of schizotypy is introduced as a method of investigating the symptoms of schizophrenia on the continuum into the normal population. Evidence for the context-deficit hypothesis is examined. It is surmised that while there is a growing body of evidence for this hypothesis in the clinical population, the evidence in the healthy volunteer population, as measured by the schizotypy continuum, is currently disparate and further research in this population is required to add support to the hypothesis.

Introduction

This review will examine some of the cognitive models of schizophrenia and the evidence related to contextual integration of information in memory that has been found in experimental studies. It will then outline how schizotypy can be used to research possible underlying vulnerabilities and cognitive processing difficulties that are found in schizophrenia. Evidence of contextual processing difficulties in experimental studies on healthy volunteers will be examined.

A diagnosis of schizophrenia can have a profound impact on a person and their family. It is often seen as having a long term negative prognosis (Jobe & Harrow, 2005). Due to the personal, family and economic burden of schizophrenia, it has been the subject of a great deal of research. This research has focused not only on the disorder as it presents in people who have already been diagnosed, but also how vulnerabilities or underlying predisposing factors may play a role in people making the transition to a diagnosis of schizophrenia.

When researching schizophrenia on a patient population there are a number of confounding factors such as length of illness, level and type of medication/treatment and presenting symptoms. This has provided another rationale for researching the disorder in the healthy population where these confounding factors are not present. Much of the research that has been undertaken in schizophrenia has been replicated in research on schizotypy or psychosis-proneness as an analogue of schizophrenia in the healthy population. By establishing differing patterns of performance between those high and low in aspects of proneness to psychosis, more can be learnt about the processes that may be underlying vulnerability. A promising model both of schizophrenia and vulnerability is often termed the neurodevelopmental model. Whilst there are several versions of this

model differing in the precise nature of the diathesis and developmental process, all share the presupposition that a fundamental impairment in information processing underlies the vulnerability and later manifestation of the disorder. This review outlines a neurocognitive model of schizophrenia, and in particular how this may be related to memory. The following sections of this thesis discuss schizotypy and its usefulness in understanding schizophrenia, before moving on to review the evidence from the research literature as it pertains to memory.

Context-based accounts of Schizophrenia

Schizophrenia, as it is defined by the DSM-IV classification system, has been diagnosed on the basis of positive symptoms, such as hallucinations and delusions, and negative symptoms, such as poverty of speech and flattened affect, of which two are required (American Psychiatric Association, 1994). The diagnostic criterion also requires that the symptoms have an impact on the person's social functioning and have been present for at least six months. However, the nature of this diagnosis results in varied presentations from patient to patient. This heterogeneity can make research difficult. This has resulted in research focusing on individual symptoms, such as delusions or paranoia (e.g. Freeman, Garety, Kuipers, Fowler & Bebbington, 2002), while other research has looked for underlying cognitive deficits that could result in various differing presentations of symptoms (e.g. Hemsley, 2005). There are critics who regard the diagnosis as a delusion itself and argue that it should be consider as a social construct that requires psycho-social interventions (e.g. Boyle, 2002) .

There are a number of models used to explain psychosis which postulate differing pathways and differing outcomes often combining both biological and psychosocial factors. One example of a model is that employed by Robin Murray in

his research (Broome et al., 2005). Murray and colleagues argue that genes playing a role in the developmental process can predispose someone to psychosis later in life (Broome et al., 2005). This model also allows for the possibility of environmental impacts on the brain, postulating that social factors also play a role in the development and onset of psychosis. Murray argues that factors such as location of upbringing, isolation and migration point to an interaction between biological and social factors in the development and onset of psychosis (Boydell, van Os, McKenzie, & Murray, 2004).

Garety and colleagues have focused their research on understanding individual positive symptoms of psychosis, developing cognitive models (Garety, Kuipers, Fowler, Freeman, & Bebbington, 2001), and therapeutic interventions stemming from these models. Taking an example of their model for the formation of persecutory delusions, Garety and colleagues argue that the search to understand anomalous events, both internal and external, plays a role in the development of persecutory delusions, and that this search for understanding interacts with existing personality structures, emotions current at the time and the environment (Freeman, Garety, Kuipers, Fowler, & Bebbington, 2002).

With its starting point in neurocognition, David Hemsley's cognitive model suggests that "the final common pathway to psychosis, in psychological terms, is the failure to relate current sensory input to contextually appropriate stored material" (Hemsley, 2005 p. 980). Hemsley called on a body of research that had begun to indicate the importance of spatial and temporal regularities on perception and how these were related to information that had previously been processed and stored. This model began to highlight the importance of context in understanding schizophrenia. One aspect of context, as Hemsley sees it, is the information that has

already been stored which impacts on behaviours and experience by informing current information processing. Problems in this aspect of processing could produce some of the symptoms that are characteristic of schizophrenia. For instance, if previous information has been stored in a manner that gives too much weight to its importance, and if similar events were then to occur, a person could again place greater importance on otherwise inconsequential events, which could lead to the development of delusional beliefs.

The model, however, does not provide such a clear link to hallucinations, which are important phenomena described in schizophrenia according to the DSM-IV. Hemsley argues that the cognitive dysfunction that is occurring in schizophrenia could also result in ambiguous messages (such as images) reaching awareness which it had failed to inhibit. Information from long-term memory may then, either be required to interpret these messages, or be the content of these messages but not recognised as such. In either situation it could be argued that if there is dysfunction in contextual processing this could be linked with the perceptual experience of hallucinations.

Hemsley has further extended his model to hypothesize about links that could be made between cognitive dysfunction and neural mechanisms that could be supporting this. He argues that the hippocampus has been implicated in studies on animals when investigating context and learning and that this may indicate that areas such as the hippocampus are involved in the cognitive dysfunction observed in schizophrenia.

The Hemsley model of schizophrenia calls on Broadbent's theories of memory in which he described an idea of "pigeon holing" (Broadbent, 1977). This referred to the idea that memories may be placed in "pigeon-holes" when they are

laid down. By this Broadbent meant that as information is attended to and integrated into memory it is organised according to specific topics or situations, and that these topics and situations may contain multiple features (e.g. colour, time and shape). He continued to say that "pigeon holes" are kept "at the ready" and that this can result in biases in perception, as information may enter a pigeon-hole incorrectly.

If Broadbent's idea is expanded further, and the items are not placed in the correct or most appropriate "pigeon-holes" this may have an impact on how the information is later processed. Which "pigeon-hole" information is placed in may be related to both the context in which the information is observed and the context of previous information that is already in memory. Therefore, if something has previously been mistakenly pigeon-holed, there may be carry over effects when processing later information that is related to the first piece of information, or if something that is in current perception is mistakenly added to or believed to be related to a particular pigeon-hole, there could also be errors in attribution and follow-on beliefs.

Within the sphere of psychosis, these processing errors could play a role in the development of paranoid beliefs, and also in the experiencing of hallucinations if memories are experienced not as memories but as new events. There is evidence of the relationship between psychosis and trauma and Steel, Fowler, and Holmes, (2005) have proposed an information processing theory, which builds on Hemsley's model and incorporates Ehlers and Clark's (2000) model of posttraumatic stress disorder. Steel et al., (2005) propose that similar information processing styles may underlie some of the phenomena that are experienced in both arenas.

Ehlers and Clark (2000) postulate two mechanisms by which information is processed during a trauma, data-driven and context-driven. Data-driven processing

is hypothesised to result in memories of the trauma being laid down without full elaboration, without time tags for example, which can result in the trauma memories being triggered by environmental cues and being experienced as flashbacks with an experience of current threat. Whilst context-driven processing allows a fully elaborated memory to be encoded, preventing these memories being triggered as flashbacks as they have information embedded in them such as time tags as well as additional information of the context in which the event occurred.

Steel et al.,'s (2005) theory posits that when a person is under a situation of stress, such as a traumatic event, they may process information in a more data-driven than context-driven manner, and furthermore that those people who are more prone to psychosis may process information in a data-driven manner more often than people who are not prone to psychosis. This could lead to the hypothesis that when context is not employed, there can be flashbacks in trauma reactions and hallucinations in psychotic reactions, if we follow from the ideas of pigeon-holing expounded above. Evidence has been gathered which indicates that there is a link between psychosis and trauma, for many of those who are diagnosed with psychosis also have trauma histories and symptoms of post-traumatic stress disorder (Morrison, Frame, & Larkin, 2003; Morrison, Read, & Turkington, 2005).

However, the concept of data-driven and context-driven processing is a theory and has not been established in information processing research, although the theory has been used to develop successful treatments for people with post-trauma reactions (e.g. Grey, Young and Holmes, 2002) . This would indicate that these two types of processing may be occurring and that it is through the elaboration of the trauma memory that flashbacks and other trauma symptoms are reduced.

Research supporting the context memory hypothesis of schizophrenia has found that there are deficits in perceptual organisation particularly when structure is required to be imposed on the presented stimuli, which indicates a role for current context (Green, Uhlhaas, & Coltheart, 2005). Working memory is implicated in the context hypothesis of schizophrenia, as when information is being processed in working memory context may be required to undertake the task at hand (Green et al., 2005).

Context Memory and Schizophrenia

One of the robust findings in literature is the relationship between psychosis and problems with memory (Aleman, Hijman, de Hann, & Kahn, 1999). This falls under the general rubric of cognitive deficits which occur in schizophrenia, and memory is one area where difficulties with contextual processing have been found in people with a diagnosis of schizophrenia. Memory in people with psychosis has been found to show higher performance for recognition tasks rather than recall tasks (Aleman et al., 1999). Episodic memory in people with a diagnosis of schizophrenia has been shown to be impaired, and may have a genetic component (Toulopoulou, Rabe-Hesketh, King, Murray, & Morris, 2003).

'Context' however, can and has been used in many different ways in the research literature, with both neurological and psychological connotations, as well as variously applying to memory, perception and attention. This literature has been well reviewed by Phillips and Silverstein (2003). They highlight that for some researchers the effect of context is seen to be relevant in working memory, while researchers such as Hemsley are more interested in investigating the impact of context deficits on long term memory. Philips and Silverstein themselves do not make this distinction, but rather see context as impacting both on the way

information is used in "higher order" decisions and also how the information is brought into the system within the existing context. They also take this to a biological level and review how context impacts processing at the neuronal and neurotransmitter level.

Context has been investigated on many differing groups including patients, controls and those assessed as vulnerable including relatives and highly schizotypal individuals. This review is going to focus on those experiments which investigate context in schizophrenia as it is employed by the memory system and how this relates to the current evidence base in schizotypy as the memory system is the common thread between the Hemsley (2005) model and the Ehlers and Clark (2000) model that Steel et al., (2005) have drawn on. The concept of schizotypy as a paradigm for investigating symptoms and processes of psychosis in the healthy volunteer population will be introduced. Research supporting the context deficit model in schizotypy will then be examined.

The literature searches for this review were undertaken on Psych-Info with no date limits. The search terms employed were: schizophrenia, schizotypy, psychosis, memory, context, relational binding, temporal and spatial. From the articles those selected below related most closely to the topic at hand and particularly excluded those that focused more closely on neurological and biological aspects of schizophrenia and schizotypy.

Schizophrenia and Temporal Context

Rizzo, Danion, Van Der Linden, and Grange (1996) investigated temporal context of memory in a patient population by using a recency discrimination task. This compared patients with normal controls who had been matched for gender, age

and education level. To ensure that the groups matched on recall, multiple trials were given until one hundred percent recall was achieved, which resulted in the patient group receiving significantly more trials than the control group. This ensured that the baseline from which the two groups were starting was the same (i.e. both groups had remembered the items and therefore may be able to recognise that they had remembered them). However, the patient group could not recall which items had been recalled in which trial (there were five trials altogether) while the control group mean response was six out of six correct responses for each trial. This result was interpreted by the experimenters as indicating that after a greater number of trials, patients with a diagnosis of schizophrenia were able to remember items, but they were impaired in their judgements of the temporal context of the items that they recalled. This result would provide support for the hypothesised role of context in memory in schizophrenia.

Elevag, Egan, and Goldberg (2000) have also investigated memory for temporal order in patients with schizophrenia. In this study patients were compared to controls on a temporal order task as well as a word recall and recognition task. The patients were significantly impaired on the temporal order task and also on the recall task compared to the controls. While there was also a significant difference between the two groups on the recognition task, the patient group performed closer to the controls than they had done in recall and temporal order tasks. However, when two post-hoc groups were created out of the patients and the controls, who had the same rate of recognition, the difference in the temporal ordering task was below significant, although the difference was still observed in the recall task. From these results the researchers suggest that temporal order may not be impaired in people with schizophrenia as when they were matched for level of recognition there was no

significant result. However, they suggested that there may be a third process that enables precise episodic memory that would facilitate the recall but not the recognition memory. This could be hypothesised to be the greater context information that is required in an episodic memory, which would support the context deficit hypothesis and would explain the differing results that were found in this study.

These two studies have given slightly conflicting results. They both found that there was a deficit in use of temporal information in a memory task. However, one task controlled for memory recall difficulties by increasing exposure to the stimuli until levels of recognition were matched and then found that temporal information was not being employed when coding the memories. The second experiment found that when patients were matched with controls for levels of recognition memory, by using the controls who were performing more poorly, the previously observed difference in temporal information use was diluted. These two ways of matching for memory between the patient and control group cause difficulties when interpreting these results together, although they can both be seen to be supporting the hypothesis that there may be a deficit in context use in memory in patients with a diagnosis of schizophrenia.

Schizophrenia and Spatial Context

Rizzo, Danion, Van Der Linden, Grange, and Rohmer (1996) conducted another study investigating performance by patients with psychosis on a spatial context information task compared to matched controls. The task required the participants to recall lists of French words (three lists of twelve words) but the participants were not informed that they were also going to be asked to recall spatial

information relating to the words. There were two tasks conducted in the recall phase to assess spatial associations in memory. One task required the participants to select one word from three that they believed had been previously presented in a particular location; while the second task required participants to select the location where a particular word had been presented from a selection of three locations. Participants were first tested on their target recognition. The researchers argued that the first spatial task required target recognition and spatial information, while the second task could be achieved by using recognition memory alone, as the participants could answer based on where words had been presented during test phases. The results indicated that there was a significant difference between the patients and the controls in the first location task, indicating that the patient group had difficulty in using spatial information. To match participants further for memory recall a sub-group of 24 matched patients and controls was also compared. This excluded a group of patients who were at least two standard deviations below the mean on the target recognition task. This analysis indicated that patients were performing significantly more poorly than controls on the location task. This study indicates that even when patients who perform particularly poorly on a recognition task are removed from the analysis, a difference is still found between patients and controls in hypothesised use of spatial information. This finding provides further support for the role of context in memory in schizophrenia.

Schizophrenia and Multiple Contexts

Burglen et al., (2004) undertook a study in which context information was required to be used in combination; that is more than one feature was explicitly requested to be remembered. Comparing patients to I.Q. matched controls in three

different conditions (object, location or object and location) Burglen et al., (2004) found that both patients and controls found the binding task more difficult than being asked to recall just the single feature. The patients were impaired compared to the controls on the binding task, and they also responded more slowly. This experiment adds further weight to the hypothesis that there may be a deficit in contextual information processing during memory processes in schizophrenia.

Danion, Rizzo, and Bruant (1999) also investigated explicit binding of context information in patients and controls. They required participants to recall both pairs of items and who had made the pairs (participant or experimenter). A judgement relating to the feeling of remembering or knowing was also required, as the researchers hypothesised that context binding may impact on this type of judgement. When making a judgement regarding remember/know differentiation a person needs to recall a specific event with all the context that this requires, such as location and source of event. Therefore, this could be understood as contextual information and if there has been a deficit in binding this information, a know judgement may be more likely than a remember one.

The results of this experiment supported the hypothesis that there is a deficit in binding information in patients with schizophrenia as they were significantly impaired in recognition of pairs together with the recall of their source (watched or performed). In the remember/know judgements the patients were more likely to produce 'know' judgements rather than 'remember' judgements. This suggests that information is being processed, but without the context around the information the patients are not able to recall exactly why they recognise something - only that they do. Patients may not be able to relate it to the particular episode that is required to provide a know judgement.

Waters, Maybery, Badcock, and Michie (2004) explored the context memory hypothesis by comparing controls and patients on a task based in episodic memory research. This task required the participants to recall information of both a temporal nature (on which trial that pairing of the objects occured) and a source nature (whether they had performed the operation of pairing the objects or if they had observed the objects being paired by the experimenter). Unlike the previous experiments described above which focussed on one aspect of context, this task focused on two-aspects which increased the load that was required of participants. The experimenters postulated that it directly tested the hypothesis that a context binding deficit is linked to psychosis. The participants were either patients with a diagnosis of schizophrenia who were receiving medical treatment or controls who had been screened in case of personal or family history of psychosis. There were no differences in the two groups on the National Adult Reading Test (Nelson, 1982), nor in their ages, or their educational level.

The analysis of the binding task did not directly compare the patients with the controls as the experimenters argued that the difference may be purely due to the difference between the number of pairs that were recalled and not in the recall of the binding of the pairs. Therefore, they compared the patients with a group of 10 controls (out 24 in the original control group) who had a similar level of recognition of the pairs as the patient group. This low-functioning control group was reported to be performing at the same level as the remainder of the control group in terms of recalling the source and the temporal information. However, the low-functioning controls performed more accurately in the recall of this context information than the patient group. This supported the hypothesis that there may be a context binding deficit in people who develop psychosis.

Together this research outlined above provides support for the context deficit model of schizophrenia. While there are variances in the methodologies employed in matching patients with controls for either level of memory or IQ there remains uncertainty in this evidence. Furthermore, these tasks have not been replicated on a normal population comparing high and low schizotypal individuals. Conducting such research would provide converging evidence for the hypothesis that there may be a context binding deficit in psychosis. It would allow researchers to suggest that such a deficit could be seen as a predisposing factor in the development of psychosis which could in turn, aid in the creation of treatments and interventions for those who may be at risk of making the transition to psychosis from an at risk population.

These studies together support Hemsley's (2005) cognitive model of schizophrenia with their emphasis on the deficits that have been found in contextual integration of information in memory tasks among a patient population. The evidence suggests that context in terms of spatial information, temporal information and source information can be found to have deficits in the patient population when compared to healthy volunteers, and particularly when they are compared to control groups who are performing at a similar level of recall. To find further support of the role of this aspect of context in schizophrenia I will now look at the research evidence in the schizotypy literature.

Schizotypy

Research in schizophrenia has a number of drawbacks when comparing patient groups to "normal" controls. Firstly, the controls need to have been screened for proneness to psychosis, to ensure that the researchers are comparing two distinctly different groups. Secondly, the treatments for psychosis, and the experience of psychosis can have an impact on people's functioning, both

cognitively and socially. This can make it difficult to tease out what may be a symptom of the disorder, what may be a function of the treatment and what may have been a pre-disposing factor before the disorder reached a diagnosable level.

To investigate this population, researchers have looked at relatives of people with schizophrenia, who may be a high risk group genetically predisposed to developing the disorder, and they have also used psychometrically defined schizotypal participants and finally people who met criteria for schizotypal personality disorder. These three different groups have similar traits in common, but at a lower level than those found in schizophrenia. High levels schizotypy has been found to be present in between 0.7% and 5% at a population level (Raine, 2006). Schizotypy is understood to have a developmental pathway that is similar to that of schizophrenia, but it is speculated that those who do continue on to make the progression to a diagnosable disorder may have fewer social stressors (Raine, 2006). Schizotypy is conceptualised as a continuum upon which there are differing ranges for the different symptoms observed in schizophrenia, including the unusual experiences and beliefs, cognitive disorganisation, anhedonia and social withdrawal. Each of these can be investigated individually, and as a whole and there are a number of differing scales for exploring these characteristics (e.g. Perceptual Aberration Scale by Chapman, Chapman, & Raulin, 1978; and the Eysenck P scale by Eysenck & Eysenck, 1975). However, these scales have been criticised as being not valid in relation to schizophrenia (Eysenck) and in being biased symptom scales (Chapman) (Mason, Claridge and Jackson, 1995). Scales such as the Schizotypal Personality Questionnaire (Raine, 1991) were designed from the DSM-III-R which overcame some of these problems, however with the publication of DSM-IV there were aspects of the experience of schizophrenia that were missing from this scale – such as

anhedonia. To over come these difficulties scales have been developed that conceptualise schizotypy as a multi dimensional aspect of personality. This conceptualisation of schizotypy as multi dimensional differs from the conceptualisation of schizotypy as only being a precursor to the development of schizophrenia. The multi-dimensional understanding of schizotypy can also allow for the development of bi-polar disorder and sees the traits of schizotypy as possible individual differences which may or may not lead to the development of diagnosable illnesses later in life.

One of these scales for researching schizotypy as a multi-dimensional concept is the Oxford-Liverpool Inventory of Feelings and Experiences (O-LIFE) (Mason et al., 1995). This scale has four subscales: i) Unusual experiences (UnEx), ii) Cognitive Disorganisation (CogDis), iii) Introvertive Anhedonia (InAd) and iv) Impulsive Non-Conformity (ImNon). The UnEx factor covers experiences in the perceptual arena such as magical ideation, and hallucinations and matches onto the positive symptoms of schizophrenia. The CogDis factor attempts to tap any difficulties with concentration, attention and decision making. The InAd factor investigates any lack of pleasure or enjoyment in life from both physical and social inputs. Finally, the ImNon factor refers to any disinhibited and impulsive behaviours that a person may have. These scales have been used widely in research and have been found to have good psychometric properties, being reliable and valid (Mason & Claridge, 2006).

Schizotypy and Context Research

In the research literature which focuses on schizotypy there have been far fewer studies that investigate context aspects of information processing regarding memory than there have been in the literature researching patient populations in

relation to context processing (Uhlhaas, Silverstein, Phillips, & Lovell, 2004). Rather, the research has investigated areas that are related to perceptual context and to established deficits that have been found within the patient population with schizophrenia in other areas of information processing. There have not yet been studies undertaken that map to the studies described above.

Schizotypy and Visual Context

Context of visual processing was investigated by Uhlhaas et al., (2004) in their study on high and low schizotypal individuals as measured by the Schizotypal Personality Questionnaire (SPQ) (Raine, 1991). Context information processing in this experiment is necessary on one of the tasks (a contour integration task) and use of context information would impair performance on the other task (a size perception task). However, while there have been differences found previously in attention and working memory between high and low schizotypy participants, there were not any significant differences found between the two groups on these visual context processing tasks. The researchers hypothesised that cognitive disorganisation may be lower in schizotypal individuals than in patient populations which may result in the lack of significant findings in their study, where they had been found in previous studies on patients. However, the questionnaire employed in this study is based on the DSM-III-R description of Schizotypal personality disorder, as was Claridge's STA (Claridge & Broks, 1984). This may have excluded aspects of schizophrenia that would be found when using a psychometric measure for schizotypy that incorporated all aspects of schizophrenia as outlined in the DSM-IV (American Psychiatric Association, 1994).

Schizotypy and Spatial Context in Working Memory

Park, Holzman, and Lenzenweger (1995) investigated spatial working memory in high and normal schizotypal individuals as measured by the Perceptual Aberration Scale (Chapman et al., 1978). The task required participants to focus on a stimulus and maintain focus there after presentation of a target item in an oculomotor memory task. During a delay a distracter was presented and after this the participants had to move their eye line to the remembered position of the target. To control for the sensory aspects of the memory there was a sensory version of the task that had the target presented through both the delay and the test parts of the task. Executive function was also measured, using the Wisconsin Card Sorting Task. The results indicated that the higher schizotypal participants had a poorer performance on the task, which the researchers inferred to mean that they were less able to hold the spatial information in their memory. There were no differences on the control task between the two groups. As spatial information is required in memory for episodic events it can be seen as part of context, as would be understood by Hemsley's model (2005). It could be extrapolated from this result that context difficulties in working memory could lead to difficulties in context in longer term episodic memory as the information would be required to pass through working memory to be placed in long-term memory. However, this task differentiated the two groups by only using the perceptual aberration sub-scale of Chapman's measures (Chapman et al., 1978). Therefore, there may be different results found if researchers investigated all four aspects of schizophrenia when investigating schizotypy. The relationship with cognitive disorganization could also be hypothesised to be significant in such a situation, which would have not been observed if the groups were divided by using a scale which was looking at perceptual differences.

Schizotypy and Delayed Recall

Gooding and Braun (2004) investigated copy and delay accuracy using the Rey-Osterrieth Complex Figure Task in psychometrically identified schizotypal individuals divided in to three groups – those displaying high levels of anhedonia, those displaying high levels of cognitive/perceptual distortions and, as a control, low scoring schizotypal participants. To do this the researchers employed all four of Chapman's psychosis-proneness scales (Chapman, Chapman, & Raulin, 1976; Chapman et al., 1978; Eckblad & Chapman, 1983). This division of the participants was to explore the hypothesis that there are different presentations of schizotypy related to different cognitive deficit patterns. The aspect of this task that is relevant to this review is the delayed accuracy recall of the figure as this required the participants to combine context information of the relationships of the aspects of the figure to be able to reproduce it. The observed pattern of results indicates that the "negative" schizotypal participants performed significantly worse than both the "positive" schizotypal individuals and the controls. There were no significant differences between the controls and the positive schizotypal participants. However, the decrease in performance from the copy task to the delay recall task was not analysed, but the descriptive data indicates that all groups' mean scores reduced by around eight points, indicating that there may not have been any difference in the ability to use the context information in memory, given the original level of accuracy achieved at the copy stage.

Schizotypy and Incidental Learning

Burch, Hemsley, Corr, and Gwyer (2006) found the level of schizotypy, as measured by the Oxford-Liverpool Inventory of Feelings and Experiences questionnaire (O-LIFE), was related to performance on an incidental learning task. Those who were highly schizotypal also scored more highly on the incidental learning task. However, this was only in relation to the Unusual Experiences subscale of the O-LIFE and this pattern was not repeated in relationship with any of the other sub-scales of the O-LIFE. The researchers suggest that this supports the findings that those who are highly schizotypal are over-inclusive in their associations. When this result is considered in relation to the context hypothesis, one could argue that over-inclusive associations could imply that there is a lack of context being employed to discriminate the information.

Schizotypy and Executive Function

Avons, Nunn, Chan, and Armstrong (2003) investigated memory updating and random generation as measures of executive functioning in schizotypy. The unusual experiences scale of the O-LIFE was employed to group the participants into high and low schizotypal groupings. However, the results indicated that there was no clear pattern of relationship between unusual experiences and executive function, as measured by these tasks. The researchers suggested that in schizotypy, unlike in schizophrenia, executive function deficits may be more selective, as they have been found sometimes, but not always, when using the Wisconsin Card Sorting Task to test executive function. Furthermore, the use of the Unusual Experiences scale of the O-LIFE to divide the participants into two groups may have produced misleading results. Executive function may not be observed in a group split by their propensity

to experience magical ideation or hallucinations, it may be more related to the Cognitive Disorganisation factor of the O-LIFE which measures attention and concentration. Had the researchers investigated all four sub-scales of the O-LIFE in relation to executive function the results may have been more in line with the executive function deficit that is found in schizophrenia. Alternatively, it may be that the executive function deficit observed in schizophrenia is a by-product of medication and treatments, which would explain why there was no deficit found in those with psychometrically defined schizotypy.

Schizotypy and Causal Processing

Causal processing in schizophrenia has been theorised by Hemsley (2005) to be effected by context information processing, for example if judgements are made using temporal contiguity information it is important that other occurrences are accounted for, though this may not be happening in schizophrenia where contiguity may over-ride contingency information, when making judgements of causality. Jolley, Jones, and Hemsley (1999) investigated this hypothesis using a task that had previously been employed by Schlottmann and Shanks (1992) to dissociate between the use of contiguity and contingency cues when making causal inferences. It was hypothesised that participants scoring high in unusual experiences (positive schizotypy) on the O-LIFE would employ contiguity cues over contingency information from Hemsley's causal model (1994). While all sub-scales of the O-LIFE were investigated, it was only on the UnEx scale that there was an interaction between contiguity, contingency and schizotypy scale, where contingency had a greater effect on contiguity in high unusual experience scoring schizotypal individuals. This result did not support the researchers hypothesis and they

considered whether levels of automatic processing that may occur in highly schizotypal individuals may account for the findings. This research is important for the context deficit debate, as contingency and contiguity information could be argued to be part of context under the heading of temporal information.

Summary

The research described above from the schizotypy literature provides evidence for similarities between information processing patterns in schizotypy that have been found in patient populations with schizophrenia and some where it does not. That all areas of information processing have not been matched between the psychometrically defined schizotypal individuals and the patient population in the research could be the result of the scales that have been used to measure schizotypy and also could be affected by the factors that are confounding when studying a patient population, such as medication effects.

This research also provides some evidence for the role of context in perception and social cognition and in causality judgements. While these can be linked to deficits that are observed in the patient population research and to the symptoms that patients experience, they do not directly address the memory aspect of context processing that is described by the research in schizophrenia above or beyond the cognitive model of Hemsley.

Schizophrenia is a diagnosis that has many facets and many outcomes. It can have an enormous impact on people's lives and their families. When researching the disorder there can be many confounding factors which can lead researchers to use psychometrically defined schizotypal participants to overcome some of these difficulties. In the body of research there have been a number of investigations that point to the role of context in memory in schizophrenia as described by Hemsley

(2005). However, in schizotypy the research is currently disparate on the subject of context memory, but this clearly requires further investigation.

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Part 2: Empirical Paper

Abstract

Schizotypy is a personality dimension that maps on to symptom clusters found in schizophrenia. Schizotypy can help in investigating underlying cognitive processes that may be present in schizophrenia or that may indicate a greater vulnerability to schizophrenia. A current theory regarding the underlying information processing in schizophrenia is the context deficit hypothesis (e.g. Hemsley, 2005). Waters et al., (2004) found a difference in context memory between patients with schizophrenia and controls. This study employed an experimental design to investigate the role of context in memory. It compared 38 high scorers (one standard deviation above the mean) and 30 controls (mean and below) using the Schizotypal Personality Scale (Claridge and Broks, 1984) on a modified version of the Waters et al., (2004) task. The task was modified to raise the level of difficulty for the normal population. It also included self-report measures for possible confounding factors such as executive function (Hayling; Burgess & Shallice, 1996), mood (HADS; Zigmond & Snaith, 1983) dissociation and trauma history (Holmes & Steel, 2004). It was hypothesised that people with higher levels of schizotypy would score lower when integrating information in the memory task; however, this was not supported by the results. Nor were there any significant relationships found between the possible confounding factors and the memory task. Several reasons for the lack of significant findings were discussed.

Introduction

Schizophrenia and The Context Hypothesis

Numerous accounts of schizophrenia have proposed that deficient processing of context is a core feature of the disorder (Barch, 2005; Cohen, Barch, Carter, & Servan-Schreiber, 1999; Danion, Rizzo & Bruant., 1999; Green, Uhlhaas & Coltheart, 2005). Context as a deficit in schizophrenia has been understood in a number of ways. Phillips and Silverstein (2003) both reviewed the evidence from a variety of experimental paradigms to arrive at one of the most inclusive views of context as 'a class of interactions that affect the salience or dynamic grouping of neuronal signals without changing what they mean' (p.3). In different ways, both Hemsley (2005) and Cohen et al., (1999) have identified context as the influence of task-relevant information supplied from memory of preceding events to working memory. In these views, schizophrenia involves a weakening in this storage or supply of needed information. This could result in ambiguous internal signals being attributed in an anomalous manner which could play a role in delusions, hallucinations and other unusual experiences. Deficits in working memory, executive function and episodic memory (Barch, 2005) are clearly consistent with these accounts, as is the specific suggestion that an impairment for contextual information underlies the long-term memory difficulties that are associated with the disorder (Schwartz, Deutsch, Cohen, Warden, & Deutsch, 1991).

Context in relation to long-term memory has also been researched in schizophrenia. Hemsley (2005) argues that Broadbent's (1977) idea of "pigeon-holing" information when it is processed can be hypothesised to be related to context processes in long-term memory. Broadbent speculated that when information is processed it is "pigeon-holed" in to a compartment by some or all of it pertinent

attributes, for instance time, place etc. This previously processed information would then be applied when integrating new information, both sensory information and cognitions regarding salient information about events. This previous processing and filing of information would be employed when making judgements and decision about current information that was being processed. If this process was disrupted or information was not fully encoded with all pertinent attributes when processed it could lead to difficulties when making attributions about situations, people and events.

Research evidence has grown supporting the context deficit hypothesis of schizophrenia when comparing patients to normal controls. Context has been examined with relation to single features, such as temporal context (Elevag, Egan, & Goldberg 2000; Rizzo, Danion, Van Der Linden, & Grange, 1996) or spatial context (Rizzo, Danion, Van Der Linden, Grange, & Rohmer, 1999). These studies, although all employed differing experimental methods, provide support for the context hypothesis in schizophrenia by finding that the patients groups are impaired in these tasks.

Waters, Mayberry, Badcock and Michie (2004) found that there were differences between patients with schizophrenia and normal controls on a task that required contextual binding during a memory study. Participants (or the experimenter) were required to create pairs of objects in two trials of the task and then to recall both which trial a pair of objects occurred in and who had undertaken the pairing together of the objects. Patients performed less well on the binding aspect of the task than the normal controls, which indicates that the context of the memory is not necessarily fully elaborated.

Schizotypy and Context

One of several risk factors for the development of schizophrenia comprises pre-morbid personality characteristics which in the normal population are often termed schizotypy, schizoidia or more generally, psychosis proneness (Mason et al., 2004). This personality domain is clearly multi-dimensional, with analogues to both the positive and negative symptoms of schizophrenia (Mason, Claridge & Jackson, 1995). The positive symptoms of schizophrenia are reflected within the factors of unusual experiences (perceptual and cognitive aberrant experiences akin to delusions and hallucinations) and cognitive disorganisation (akin to thought disorder and attentional difficulties); the negative symptoms are mirrored in aspects of social withdrawal and anhedonia, both physical and social. Though not present in every analysis or scale, aspects of impulsive non-conformity reflect eccentric and hypomanic behaviour. Each of these factors are conceptualised as a continuum within psychosis-proneness, the high end of which can be seen as indicating a greater risk of making the transition to psychosis. Similarly to schizophrenia, schizotypy is understood to have a neurodevelopmental element, and genetic predispositions, that interact with psychosocial factors and result in differing levels of expression of schizotypy in the population (Raine, 2006). This variation in the expression of schizotypy and its similar developmental pathway to schizophrenia lends schizotypy as method of studying hypotheses about underlying deficits and difficulties that may influence the transition to psychosis (Raine, 2006).

Schizotypy is investigated either categorically by diagnostically identifying people with schizotypal personality disorder, or dimensionally by employing one of the many psychometric measures that have been designed to study this population such as the Oxford-Liverpool Inventory of Feelings and Experiences questionnaire

(O-LIFE, Mason et al., 1995). Studies have found many similar experimental findings in the general population using schizotypy measures that have also previously been found between patients with schizophrenia and controls (Burch, Hemsley, Corr & Gwyer, 2006; Kopp, 2006; Tsakanikos, Thygenson, & Reed, 2003).

In a now highly developed, if complex area, some research has shown a reduction in latent inhibition associated with schizotypy similar to those found in schizophrenia (Hemsley, 2005) and this can be adduced in general support of the extension of the context hypothesis to a 'vulnerability for' rather than simply an 'expression of' schizophrenia. There has been research into visual context in schizotypy, spatial context and schizotypy and delayed recall and schizotypy (Gooding & Braun, 2004; Park, Holzman, & Lenzenweger, 1995; Uhlhaas, Silverstein, Phillips, & Lovell, 2004). While these areas are disparate, and cannot, alone, support the context deficit hypothesis, they do indicate that further investigation could bring these threads of research together to provide further evidence for the hypothesis. Thus, the direct investigation of context processing in memory in schizotypy would provide further support for this hypothesis.

Trauma and Context

Steel, Fowler and Holmes, (2005) have taken the context deficit hypothesis, as understood by Hemsley (2005) and conceptualised it as an information processing account that could apply to other disorders, in particular trauma. They speculate that the processes that occur under extreme stress during a trauma may be similar to those that are ongoing at a lower level in people with psychosis. Ehlers and Clark (2000) account of Posttraumatic Stress Disorder (PTSD) postulates two separate

mechanisms of processing that may be taking place during a trauma situation – data driven and context driven processing. They hypothesise that it is when people are not processing the entire context that is occurring that they are more vulnerable to flashbacks and other symptoms of PTSD. Holmes and Steel, (2004) have found that people who are highly schizotypal are more prone to intrusions, when employing a stressful film paradigm. Morrison and colleagues (Morrison, Frame & Larkin, 2003; Morrison, Read & Turkington, 2005) have also reviewed the evidence and found links between trauma and psychosis.

Aims and Hypotheses

This study will investigate context aspects of memory in the healthy volunteer population employing an adapted version of the task used by Waters et al., (2004). As this previous experiment was undertaken on patients and controls and the controls performed at a very high level on the memory aspect of the task, it will be modified to increase the level of difficulty and increase the task's sensitivity to any potential individual differences by avoiding any ceiling effect. To increase the difficulty of the task the load will be raised to three trials instead of two, resulting in 36 pairs of items, instead of 24, to recall.

It is hypothesised that with a greater level of task difficulty participants in the highly schizotypal group (according to the STA) when compared to the controls, will have greater difficulty with the context memory task, which would follow the pattern of findings by Waters et al., (2004). Consistent with relationships with positive symptoms, it is hypothesised that those who score highly on the Unusual Experiences subscale of the O-LIFE will have more difficulty with this task than those participants who score in the mid to low range of this subscale.

Potential Confounding Factors

Other measures will be administered to attempt to control for possible confounding factors. These include a 14-time self-report measure of mood (HADS (Zigmond & Snaith, 1983), as mood can impact on memory processing (Lewis & Critchley, 2003). A measure of dissociation will be included as this is a potential confounding factor in any memory binding deficits that may be present in the results. Similarly the Hayling task (Burgess & Shallice, 1996) will be administered as a deficit in executive function is often found in patients with a diagnosis of schizophrenia and may also be a confound in relation to memory performance (Everett, Lavoie, Gagnon, & Gosselin, 2001). A measure of trauma history will also be included (Holmes & Steel, 2004) to assess the suggested links between schizotypy and trauma (Holmes & Steel, 2004; Morrison et al., 2003; Steel et al., 2005)

Method

Participants

The study was advertised on the University College London Subject Pool which is for volunteers to receive information about studies being run in the psychology department. The volunteers come from both from within the university and from outside the university. There are currently 2723 people registered with the subject pool. Eighty one participants agreed to take part in the study. Participants were given an information sheet outlining what the study involved and signed an informed consent sheet after they had asked any questions that they had regarding taking part in the study. Following the use of a screening questionnaire, the Schizotypal Personality Scale (STA) of the Claridge and Broks' (1984) Schizotypy Questionnaire (STQ), participants were included if their score on the STA fell below the mean or 1 standard deviation above the mean to create a control and a high

schizotypy condition. This resulted in 13 participants being excluded from taking part in the study. The remaining 68 participants consisted of 38 females, had a mean age of 26.37 (s.d. 8.59) and a modal educational level of undergraduate. All participants reported that they spoke English fluently.

Ethics

This study received ethical approval from the UCL Research Ethics Committee application number 0606/001 (see Appendix A). This committee approved the participant information sheet (Appendix B), the informed consent form (Appendix C), the advertisement (Appendix D) and the protocol of the experiment. Participants were given an opportunity for a debriefing at the end of the study. During this debrief it was stressed that none of their answers are indicative of a mental health problem.

Research Design

The study is an experimental design with two independent groups, high schizotypy and control schizotypy, and four dependent factors: recognition of pairs, recall of timing of pairing (trial one, two or three), recall of source of pairing (participant or experimenter) and recognition of novel pairings.

Measures

Hospital Anxiety and Depression Scale (HADS)

This is a 14 item self report measure of current levels of depression and anxiety caseness (Zigmond & Snaith, 1983). Each of the scales comprises of seven questions with four levels of response. This instrument has high internal consistencies ($^{a}0.80 - 0.93$ for anxiety and $^{a}0.81 - 0.90$ for depression) and a high correlation for retest reliability after two weeks ($r > 0.80$) (Herrmann, 1997).

Oxford-Liverpool Inventory of Feelings and Experiences (O-LIFE)

This is a 104 item self-report measure of schizotypy (Mason et al., 1995). It covers four factors of schizotypy, unusual experiences, introverted anhedonia, cognitive disorganisation and impulsive non-conformity. Each of the four scales comprises of 24-30 questions with a forced choice yes or no response. This instrument has been found to be a reliable measure in experimental populations (test-retest reliabilities of 0.77 – 0.93, Burch, Steel, & Hemsley, 1998) with high internal consistencies (α= 0.72 – 0.89, Mason et al., 1995).

Hayling Task

This is a sentence completion task in two parts that requires participants to either generate or inhibit responses and is a useful measure for assessing executive function (Burgess & Shallice, 1996). In the first part of the task, participants must complete 15 sentences with the most appropriate word that comes to mind. In the second part of the task, the participant must complete 15 sentences with a word that does not fit at the end. Scores are converted from the raw scores of the time it takes to respond to each sentence and the number of errors made (either not making a sensible completion in the first part of the task, or making a connected completion when an unconnected completion was required in the second part of the task). Burgess & Shallice (1997) reported high test-retest reliability overall (r=0.716). They reported that the split-test reliability was lower than would be liked on a large sample (118) but that on an impaired sample the reliability for the Hayling Time One was r=0.93, Hayling Time Two was r=0.80 and Hayling Errors was 0.93 and that these indicated that it was an adequate measure.

Trait Dissociation

A new dissociative experiences questionnaire, Trait Dissociation Questionnaire (TDQ) that has been developed by Murray, Ehlers, and Mayou, (2002)

was employed. This is a 38 item self-report questionnaire that rates responses as never, rarely, sometimes, often, mostly and always and produces a continuum score of level of trait dissociation. The scale has high internal consistency ($\alpha = .093$) and good test-retest reliability ($r = 0.86$) (Murray et al., 2002). See Appendix F for questionnaire.

Trauma History

This 12 item self-report checklist asks participants to disclose if they have experienced or witnessed one of 12 different traumatic events that would be covered in a routine Posttraumatic Stress Disorder clinical assessment (Holmes & Steel, 2004). This was scored by summing the number of traumas a person endorsed having experienced. See Appendix F for questionnaire.

These questionnaires investigate aspects of a person's life experience or current state that may be impacting on their ability to process and remember information, and therefore may be confounding the experimental data.

Filler Task

To ensure that enough time elapsed between each of the trials of the contextual binding task a cognitively ambiguous filler task was employed that had previously been tested on a patient sample (Emmanuelle Peters, personal communication). This task required participants to watch a series of slides on a computer and then give a response regarding what they had just seen. The slides consisted of a number of cards of which participants were asked to pick one, another slide was then shown with different cards and the participants were asked to explain how the card they had selected had been removed. To explain how the card task worked they were given eight options ('It works because the system is able to read people's minds'; 'It works the same with everybody and is not specific to me'; 'It is

something specific to me and works because the system is able to read my mind'; 'It is a trick and works the same with everybody'; 'It is a trick that I fell for, but not everyone would fall for it'; 'It is something specific to me and works because I projected my thoughts to the system'; 'It works because people project their thoughts to the system'; 'It works the same with everybody and is not specific to me'; 'It is an example of artificial intelligence and is able to predict people's behaviour, for example picking a card'; 'I am good with computers and so I can be tuned in to them, even with out being conscious of it').

Contextual Binding Task

To assess contextual memory and binding, the task employed by Waters et al., (2004) which was developed from the tasks used by Conway & Dewhurst, (1995); Danion et al., (1999); Huppert & Piercy, (1978) was modified to raise the level of difficulty to assess differences between the two populations. The task involved 72 common household objects being arranged into pairs. Either the participant or the experimenter placed the items into the pair as designated by the instruction cards that the participant read out for each pairing. Each pair of objects was required to be placed in a certain relationship to each other, either next to, on top of or in front of the other object. There were three trials each with 12 pairs of items. After the third trial, participants are required to recall if a pairing of objects is one of the original pairings, or a re-arranged pairing, who placed the pairing together and if it came from the first, second or third trial. Twelve re-arranged pairings of items that were in the task were added to the response sheet to measure recall. The response sheet was randomised across all three trials and with the re-arranged pairs included. The order of the trials was randomised across participants for presentation order,

resulting in six groupings of the trials. The instructions for the memory experiment are in Appendix G, as are the instructions for completing the responses for the task.

Procedure

After filling in basic demographic information, participants began the study by reading the instructions for the first trial of the contextual binding task. Following completion of this first trial, participants then completed the O-LIFE questionnaire. The participants then completed the filler task. The second trial of the contextual binding task followed the filler task. The participants then completed the HADS questionnaire, the trait dissociation questionnaire, and the traumatic experiences questionnaire. The third trial of the contextual binding task was then administered. The Hayling Task was given to the participants and finally the participants completed the response sheet for the contextual binding task. All testing took place in UCL rooms.

Results

Firstly the demographic and clinical data will be presented. This will be followed by an analysis of the memory experiment in relation to the two groups with differing levels of schizotypy, first looking at recognition memory, then looking at contextual memory and finally presenting the results of the binding of contextual information in memory. A group of highly schizotypal participants will also be compared to the control group in the same manner as primary analysis. Finally, the clinical measurements will be assessed in relation to the memory task. The data was analysed using SPSS 14 for Windows.

Group differences on Schizotypy and Clinical Features

To account for age and gender differences the O-LIFE data was transformed to z-scores using the norms from Mason and Claridge (2006). The raw means and

standards deviations can be seen in Table 1, while the transformed means and standard deviations are presented in Table 2. The clinical feature data (anxiety, depression, executive function, trauma and dissociation) were tested for normality and both the anxiety and trauma data were significantly skewed. Therefore square root transformations were undertaken on these two variables. The means and standard deviations of the raw clinical feature data can be seen in Table 1 and of the transformed clinical feature data in Table 2.

The STA was employed to screen in two differing groups of participants according to level of Schizotypal personality traits and this was confirmed by the administration of the O-LIFE questionnaire. The means for this study for the STA were taken from Joseph and Peters (1995). The overall mean for the STA was 14.38 (s.d. 7.27), the mean for the control group on the STA was 7.73 (s.d. 3.46) and for the highly schizotypal group the mean was 19.63 (s.d. 4.71). A t-test was carried out on the O-LIFE data between the highly schizotypal participants and the control participants. There were significant differences between the two groups on Unusual Experiences ($t(66) = -6.79$, $p = 0.001$), Cognitive Disorganisation ($t(66) = -4.12$, $p = 0.001$), and Impulsive Non-Conformity ($t(66) = -2.05$, $p = 0.045$) but no significant differences for the Introverted Anhedonia scale. Examining the means for these three variables (as presented in table two) indicates that the high schizotypy group were scoring significantly higher on average on each of these three factors of the O-LIFE scale than the control group. This indicates that employing the STA as means of screening participants in to high and control groups for schizotypy was successful.

There were no significant differences between the two groups, according to schizotypy level (control and high) on measures of executive function and trauma. However, the two groups did differ on anxiety ($t(66) = -2.62$, $p = 0.011$), depression

($t(66) = -2.66$, $p = 0.01$, and dissociation ($t(66) = -5.25$, $p = 0.0001$). Examining the means and the standard deviations as presented in Tables 1 and 2 it can be seen that the high schizotypy group had significantly higher means than the control group for each of these three variables. There were no significant differences between the two groups on level of education or gender.

Table 1

Group Means and Standard Deviations of Untransformed O-LIFE, Demographic and Clinical Feature Data

	Control (n=30) Mean (s.d.)	*High (n=38)* Mean (s.d.)
Age	26.90 (5.91)	25.95 (10.28)
Unusual Experiences	4.36 (4.08)	12.84 (5.37)*
Cognitive Disorganisation	9.50 (5.35)	15.24 (5.38)*
Introverted Anhedonia	5.13 (4.54)	6.82 (4.43)
Impulsive Non-conformity	7.40 (3.07)	9.13 (3.23)*
Depression	5.67 (3.64)	7.82 (3.01)*
Anxiety	2.47 (2.22)	3.97 (2.48)
Dissociation	32.03 (13.77)	53.31 (18.51)*
Trauma	1.63 (1.56)	2.32 (1.82)
Executive Function	7.36 (0.61)	7.21 (0.53)

* = significant difference $p < 0.05$

Table 2

Group Means and Standard Deviations of Transformed O-Life and Clinical Feature Data

	Control (n=30) Mean (s.d.)	*High (n=38)* Mean (s.d.)
Z Unusual Experiences	-0.82 (0.63)	0.52 (0.93)*
Z Cognitive Disorganisation	-0.35 (0.95)	0.63 (0.99)*
Z Introverted Anhedonia	-0.16 (0.98)	0.23 (1.05)
Z Impulsive Non-conformity	-0.46 (0.80)	-0.05 (0.82)*
Transformed Anxiety	1.37 (0.77)	1.86 (0.73) *
Transformed Trauma	1.03 (0.77)	1.34 (0.74)

* = significant difference $p < 0.05$

Recognition Memory

The means and standard deviations for the responses to the memory task by source of pairing action are presented in Table 3. In this table the source of the memory (either created by the person or the experimenter) is tabulated with the responses correctly matched with the source and also where people misattributed the source of a memory. There were 18 pairings made by the participant and 18 pairings made by the experiment alongside 12 novel pairings. Therefore a perfect recognition score would be 18 for the person and the experimenter and 12 for the novel category.

Table 3

Number of Responses (means and standard deviations) for Source Judgements by Schizotypy Group

Control (n=30)			
Response	*Person*	*Experimenter*	*Novel*
Source			
Person	11.10 (3.01)	2.16 (1.88)	4.73 (2.26)
Experimenter	0.33 (0.55)	9.70 (2.64)	7.97 (2.57)
Novel	1.07 (0.94)	2.23 (1.70)	8.70 (2.17)
High (n=38)			
Response	*Person*	*Experimenter*	*Novel*
Source			
Person	11.57 (3.34)	2.11 (2.12)	4.32 (2.58)
Experimenter	0.53 (0.73)	9.63 (3.52)	7.84 (3.48)
Novel	1.47 (0.95)	2.87 (1.56)	7.66 (1.99)

Table 4 shows the means and standard deviations of the responses to the memory task relating to the temporal order of the trials. As in Table 3 this table shows the source of the memory (trial one, two or three) and when participants correctly responded to this and when it was misattributed to another source. There were 12 pairs in each trial, and 12 novel pairs, so a perfect recognition score would be 12.

Table 4

Number of Responses (means and standard deviations) for Temporal Judgements by Schizotypy Group

Control (n=30)				
Response	*Trial One*	*Trial Two*	*Trial Three*	*Novel*
Temporal Source				
Trial One	5.00 (1.96)	2.33 (1.50)	0.80 (1.03)	3.97 (1.65)
Trial Two	1.57 (1.33)	3.73 (2.08)	1.80 (1.24)	4.90 (1.86)
Trial Three	0.60 (0.97)	2.80 (1.49)	4.77 (2.21)	3.83 (2.02)
Novel	1.13 (1.20)	1.30 (1.42)	0.87 (0.90)	8.70 (2.17)
High (n=38)				
Response	*Trial One*	*Trial Two*	*Trial Three*	*Novel*
Temporal Source				
Trial One	4.92 (2.44)	2.44 (1.33)	0.66 (0.78)	3.97 (1.81)
Trial Two	1.74 (1.75)	3.84 (1.73)	2.03 (1.55)	4.39 (2.09)
Trial Three	1.08 (2.08)	3.18 (1.86)	3.95 (2.09)	3.79 (2.34)
Novel	1.47 (1.35)	1.84 (1.46)	1.03 (1.15)	7.66 (1.99)

Novel versus Original Pairings

An ANOVA (sphericity assumed) with STA (control and high) as a between groups factor and with the proportion of correctly recognised novel versus the proportion of correctly recognised original pairings as a within group factor was run to investigate differences in recognition memory between the two groups. Recognition accuracy did not differ for either novel pairings or for original pairings ($F(1,66) = 0.476$, $p = 0.492$). Nor was there a difference in the accuracy of

recognition between the control and the high schizotypy groups ($F(1,66) = 2.187$, $p = 0.144$). There was a trend towards an interaction effect ($F(1,66) = 3.461$, $p = 0.067$). Examination of the means, as displayed in Table 5 indicates that while the controls and the highly schizotypal participants attained similar recognition rates for the original pairings (control M = 0.66, high M = 0.67), the control group recognised the novel pairings more often than the high schizotypy group (control M = 0.73, high M = 0.64).

Table 5

Means and Standard Deviations of (1) proportions of correct responses for object recognition and source and temporal recognition and (2) proportion of correctly recognised intact pairs and the binding data by Schizotypy Group.

	Control (n=30)		High (n=38)	
	Mean	S.D	Mean	S.D.
(1) Content and Context Memory Judgements				
Object Pair Recognition	0.66	0.11	0.67	0.13
Source	0.87	0.12	0.87	0.13
Temporal	0.57	0.13	0.54	0.10
(2) Binding of Source and Temporal Judgements				
Who and When	0.49	0.14	0.47	0.12
Who Only	0.38	0.13	0.40	0.10
When Only	0.08	0.07	0.07	0.08
Neither	0.05	0.08	0.06	0.09

Discrimination accuracy and response bias were investigated by using Signal Detection Theory for normally distributed populations as described by Snodgrass and Corwin (1988), employing the advised correction. *d'*, a measure of discrimination accuracy, and *C*, a measure of bias, were calculated for both original pairings of the data and for the novel pairings of the data. A *d'* indicates how well a participant can identify hits from false alarms and is calculated by estimating the difference between the means of hit rate and the false alarm rate in standard deviation units by subtracting the z score of the false alarm rate from the z score of the hit rate (Snodgrass & Corwin, 1988). A *C* score of greater than zero indicates a more conservative bias while a score of less than zero indicates a more liberal bias. These scores were then t-tested to examine schizotypy group effects. No significant differences were found between the two groups for either measure. The means and standard deviations for the *d'* and *C* estimates for each group can be seen in Table 6.

Table 6

Means and Standard Deviations for d' and C by Schizotypy Group for Recognition Memory

	Control (n=30)		High (n=38)	
	Mean	S.D.	Mean	S.D.
d' original pairing	-0.22	1.34	0.17	1.35
d' novel pairing	-0.21	1.45	0.16	1.32
C original pairing	-0.17	0.71	0.13	0.74
C novel pairing	0.17	0.64	-0.13	0.77

Source and Temporal Context Judgements

For pairs that participants judged to be from the original presentation (that is not novel pairings) they also made judgements regarding the source of the pairing (participant or experimenter) and the temporal occurrence of the event (trial one, two or three). Proportions were calculated for these judgements and an ANVOA was run with schizotypy level as a between subject factor and context (source and temporal) as a within subject factor. There was a significant main effect of context ($F(1,66) = 281.88$, $p = 0.001$), which suggests that judgements regarding the source of the pairing were more accurate than judgements regarding the temporal context of the pairing. There was no main effect of schizotypy level or an interaction effect. Post-hoc testing of the two types of source information was undertaken (with Bonferroni corrections). A repeated measures ANOVA was run to examine the effect of trial time on recognition with schizotypy group as a between subjects factor and trial time as a within subjects factor. There was a significant effect of trial time ($F(2,132) = 5.45$, $p = 0.005$) and examination of the means indicates that the significant difference occurs between trial one and trial two responses (trial one $M = 4.96$, trial two $M = 3.79$). A repeated measures ANOVA was run to examine the effect of source of pairing, person or experimenter, with schizotypy group as a between subjects factor. There was a significant effect of source of pairing ($F(1,66) = 17.68$, $p = 0.001$) but no effect of group and no interaction effect. Examination of the means indicates that participants more often correctly identified pairs that they had made rather than pairs that had been made by the experimenter (person $M = 11.37$, experimenter $M = 9.66$).

As with the recognition memory measures, discrimination accuracy and response bias estimates were calculated for each of the trials and for both the person

created pairs and the experimenter created pairs. These were t-tested to investigate schizotypy group effects and no significant differences were found between the two groups. The means and standard deviations for the *d'* and *C* estimates for each group can be seen in Table 7.

Table 7

Means and Standard Deviations for d' and C by Schizotypy Group for Source and Temporal Judgements

	Control (n=30)		High (n=38)	
	Mean	S.D.	Mean	S.D.
d' trial one	-0.17	1.17	0.14	1.35
d' trial two	-0.18	1.38	0.15	1.12
d' trial three	-0.27	1.29	0.21	1.06
d' person source	-0.17	1.30	0.14	1.64
d' experimenter source	-0.12	1.49	0.10	1.60
C trial one	-0.07	0.51	0.05	0.99
C trial two	-0.12	0.76	0.10	0.80
C trial three	0.08	0.70	-0.60	0.89
C person source	-0.17	0.63	0.13	0.66
C experimenter source	-0.05	0.47	0.04	0.75

Binding of Contextual Information

The ability to bind all the context information together was also investigated by examining how many items of context information were recalled together in a pairing that was recognised as an original pairing. To assess this, a two by four factorial measures ANOVA was performed. The schizotypy level was entered as a

between groups factor and there were four levels of the within groups factor (1) who only, (2) when only, (3) who and when, and (4) neither recalled at all. There was a significant main effect of binding of information ($F(3,198) = 220.28$, $p = 0.001$) but no main effect of group and no interaction effect. Examination of the means shown in Table 5 indicate that the proportions of correct responses to who and when and to who only are both higher for both groups than the proportions for when only and for neither indicating that it was less likely for people to correctly recall only when a pairing occurred or to recognise that a pairing had occurred but not to remember any of the other contextual attributes of that pairing.

Very Highly Schizotypal

In the initial analysis the sample was divided in two groups. The control group scored ten and below on the STA (which is the overall mean in the norms for the STA) and the high group scored 13 and above (one standard deviation above the mean). It is possible that this may not be a big enough difference between the two levels of schizotypal personality traits. As a reasonable sample size had been obtained, analysis was repeated between the control group and a group of very highly schizotypal participants who scored two standard deviations above the mean (Joseph et al., 1995) on the STA. This group gave a sample of 25, losing 13 from the previous high schizotypy group, with 30 remaining in the control group. Unlike the original sample, this new sample differed significantly on all four factors of the O-LIFE. They also, like the original sample, differed significantly on depression, anxiety, and dissociation. The two groups also differed significantly on their recognition of novel pairings. A factorial ANOVA was run to examine the participants recognition memory, the interaction that had been tending towards significance reached significance ($F(1,53) = 4.70$, $p = 0.035$). Examination of the

means indicated that both groups were similar on their recognition of original pairings, the very high schizotypy group did not perform as well as the control group when recognising the novel pairings. The rest of the results replicated those found with the full sample.

Clinical Factors and Memory

Correlations were run between all the clinical factors (anxiety, depression, trauma, dissociation and executive function) that were assessed and the memory task results. There were no relationships of note between any of the clinical factors and the memory task; therefore no further testing was undertaken ($r = -0.192 - r = 0.196$, $p > 0.05$).

Ambiguous Card Task

An ambiguous card task was part of the experiment, which required participants to select an explanation for the way the trick worked (see appendix for possible responses). To compare the responses of the high and control schizotypy groups the correct and most frequent response ('it was a trick and works the same with everyone') was compared to all incorrect responses collapsed to one group and entered in a chi square analysis. No differences were found between the responses of the two groups of according to their schizotypy level ($\chi^2_{(1)} = 1.75$, $p = 0.186$).

Discussion

This study aimed to extend findings of poorer contextual integration in memory in schizophrenia (Waters et al., 2004) to a sample of healthy controls selected according to their hypothetical proneness to psychosis. However, the hypothesis that people who scored highly on schizotypy would have greater difficulty integrating the contextual information of the memory task was not supported. This finding, understood in terms of the links between trauma and

psychosis, and the postulated shared underlying mechanisms (Steel et al., 2005) could suggest that for context binding deficits to be observed in a highly schizotypal population there may need to be increased levels of stress, as would be found in a trauma situation.

The results indicated that everyone, regardless of level of schizotypy found it easier to recall information about who made a pairing of items, compared to when a pairing was made. Within each of the source of context information there were differences as to what was more easily recalled. Participants found it easier to recall the pairings that they had made than pairings the experimenter had made. Differences were also found in recalling which trial a pairing occurred in. These findings concur with established findings repeating the primary and recency effect for the time of trials (Glanzer & Cunitz, 1966).

The lack of significant results in this study could indicate a number of issues with the research, both in relationship to the methodology and in relationship to the theoretical ideas underpinning the study. The previous study by Waters et al., (2004), had found differences between patients and control subjects in their ability to recall contextual information in a memory task. By examining this result in relation to the high and control schizotypy population, one aspect this study was interested in examining was that an information processing difficulty could be a predisposing factor in those who may make the transition to psychosis. The results could suggest that this hypothesis is not supported, however, that may not be the only explanation. Rather than contextual integration difficulties not being a predisposing factor for the transition to psychosis, it is possible that the methodology employed was not sensitive enough to uncover any differences that there may be between the two

groups, given that other studies point to difficulties in this regard (Gooding & Braun, 2004; Park et al., 1995; Uhlhaas et al., 2004).

One area in which the methodology may have played a role was the clarity of instructions for the experiment. It was made clear to the participants what exactly they would have to recall in the memory section of the task. It could be this that fails to differentiate between the two populations as in everyday memory people are not directed to the aspects which they should have to recall. Explicit instruction may have overridden any natural tendency by the highly schizotypal participants to include less contextual integration in their processing style. This weakness could be understood as the task not being ecologically valid, that is not replicating closely the real-life situation, and therefore not tapping the difficulty that is hypothesised to exist in the context deficit hypothesis of schizophrenia.

While the task did not replicate the results that were found in the Waters et al., (2004) study, it did increase the level of difficulty of the task so as to remove the ceiling effects that Waters et al., (2004) found in their control population. This increase in level of difficulty was achieved by increasing the load that was placed on the participants by adding a third trial to the task, which therefore increased the number of pairs that were presented to participants by twelve, effectively an increase of 50%. This resulted in the participants displaying a range of capabilities in their memory judgements, including whether the pair was one that had existed in the task, who made the pairing and in which trial it occurred. Considerable variability on all indices of memory suggests that the absence of effects was not due to ceiling effects, or other issues of restricted variance.

Another possible methodological difficulty in the study is that the two groups were not different enough in terms of levels of schizotypy. The control group were

taken as the mean and below on the STA scale, while the original high schizotypy group were one standard deviation above the mean, and a post hoc group of very highly schizotypal individuals were identified two standard deviations above the mean. It could be postulated that rather than employing the mean and below, it may have been more valid and more sensitive to finding differences between the two groups had the control group also been one standard deviation below the mean. This would have presented practical problems for the study as highly schizotypal participants presented more readily for taking part in the study than those who scored at the mean or below. Nevertheless this may be the necessary comparison group for very high schizotypy that may allow some investigation of what may be a very slight difference in the healthy volunteer population.

The null findings of this study, however, may indicate that deficits in contextual processing are not occuring in individuals who score highly on schizotypy measures, rather than the results may indicating a difficulty with test design, sensitivity or sampling errors. This would be complimentary to the idea that schizophrenia as a diagnosis may not "hang together" as a whole and rather than having a biological basis, may be more social in its origins as suggested by Boyle (2002).

Due to the superior performance of Waters et al., (2004) controls, they utilised a group of low-functioning controls whose recall was more in line with the patient group: this analysis similarly indicated differences in contextual memory. In our task we were able to investigate a group of very highly scoring schizotypal individuals from the already high group which aimed to overcome some of the difficulties described above. The analysis with this higher group, which increased the difference between levels of schizotypy with the control group, did not bring

many significant results. The one result that had been nearing significance in the original analysis did become significant when comparing the controls with the very highly schizotypal individuals. In this analysis the very highly schizotypal participants did not recognise the novel pairings as well as the control group. This suggests that highly schizotypal individuals may have more difficulty identifying pairings they had not seen before which could be understood in terms of the source monitoring literature. This body of research suggests that patients with schizophrenia have greater difficulty recognising the source of a memory as either internally or externally generated (Keefe, Arnold, Bayen, & Harvey, 1999) and that this patient group may rely more on a feeling of knowing than actual remembering (Danion et al., 1999). This evidence could suggest that people with schizophrenia are more likely to recognise novel items as familiar and that this may also apply to those people who are highly schizotypal. However, this gross memory effect is not a result of poor recall of contextual information.

As with the analysis of Waters et al., (2004) results, we did not find any significant differences between the two groups on signal detection analyses. This indicates that both the groups required the same threshold level of signal to make a decision about the memory judgements.

The design employed an ambiguous card task as a filler between the trials of the memory task. This task had been piloted on a patient group with a diagnosis of schizophrenia (Emmanuelle Peters, personal communication) and was added to investigate if there were differences between high and low schizotypal individuals in how they explained what they saw presented in front of them. There were no significant differences in the responses between the two groups, with most people

taking the least unusual and correct option (it was a card trick that works the same with everyone).

In retrospect this option may have been too simple a default response for the majority of participants. Its omission in future may increase alternative responses and allow individual differences to emerge. Alternatively of course, it may be that this task does not tap differences in thinking relevant to schizotypy.

This study comes from a body of research evidence and theoretical hypotheses that suggest that there may be a context deficit in the development of schizophrenia. Much of this research has been undertaken on the patient population compared to healthy controls, while very little research in relation to the context hypothesis has been executed using schizotypy as an analogue in the healthy volunteer population. Those studies that have been published on using the schizotypy continuum as the analogue of schizophrenia in the patient population have been primarily related to perceptual context rather than the context of memory. Therefore, this study is one of the first to investigate this area, and it remains an open question whether this task was sensitive enough to uncover differences or whether another design would have prospered. Other studies have often used a correlational design to investigate relationships between schizotypy and different aspects of perceptual/ information processing and this may be an alternative to pre-screening into groups.

The results indicated that there were significant differences between the two groups on levels of anxiety, dissociation and depression, with the high schizotypy group having higher means for each of these clinical measurements. None of these clinical measures related to the memory task responses, though it may be understandable that people who are higher in levels of schizotypy would be more

likely to exhibit higher levels of these clinical features as they have been found to be common symptoms prior to the onset of schizophrenia (an der Heiden & Häfner, 2000). There was no relationship between trauma and schizotypy which would have lent support to our understanding of the similarities in information processing in psychosis and trauma as is postulated by Steel et al., (2005).

Future research would be required employing other methods of investigating contextual integration in memory to explore the hypothesis that a deficit in this information processing system is related to schizophrenia. As described above it could be that a new task may be designed, or that this task is modified further to increase ecological validity. Alternatively different sampling methods may be employed to ensure that the two groups being compared are more extreme in their differences, or by using a correlational design (albeit sufficiently statistically powered), to investigate throughout the entire continuum of schizotypy on all the factors that the O-LIFE measures.

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Part 3: Critical Review

Introduction

This review will examine some of the issues that arose regarding selection and recruitment, the design and methodology of the experiment and finally the wider implications of the study.

Selection and Recruitment

In retrospect one of the aspects that may have had an impact on the findings in the study was the level of difference in fluency of English in the participants. While the advertisement requested fluent English speakers as a pre-requisite, many who turned up spoke English as a second language and did not know what many of the items were when they were required to read out and pair up items during the memory task, although this did also occur in those who spoke English as a first language occasionally. Particular items seemed to be more incomprehensible than others to many people.

The task employed household items in the pairings, however, some of the items in particular seemed to be more regularly unknown to the participants, and for example the thimble and the golf tee were two that were questioned most. For some participants, it was that they would generally use a different word for the same item in their country, for example people from the United States of America tend to call a spanner a wrench. How this might have impacted on the memory task is unclear. But as the data collection progressed I became more and more aware of it as a possible confounding factor. Did not knowing what an item looked like, or even what it was mean that the participants would pay more attention to it and therefore recall it more fluently or did it mean that they were less likely to recall it as it was too

novel and that items that were more fluent in their vocabulary were also more fluent in their recall?

Reflecting on the process of recruitment also, I had anticipated that recruiting would not be a straightforward process, particularly recruiting people for the high schizotypy group. The availability of the University College London Subject Pool run by the Psychology Department made recruitment very simple. This allowed for participants who were already signed up as willing and interested in taking part in psychological experiments to be notified when new experiments were added to the subject pool and then to sign up in particular time slots for them.

By making available more time slots than I required for participants, which allowed for DNA's, I was easily able to reach the required number of participants in each group. This was surprising as my investigation prior to undertaking the study had left me with the impression that finding highly schizotypal people could be a difficult prospect. As so many of the subject pool are non-psychology students, or not even students at all this may account for the availability of highly schizotypal people that have been more difficult to source in previous studies which have focused on recruiting participants from psychology departments which may not present as many highly schizotypal participants.

Methodological Limitations

Design

One of the choices that was required to be made during the designing of the experiment was to decide whether to use three groups (low, medium and high) or two groups (control and high). Many studies employ the more correlational design of three groups, which also allows greater ease in recruitment as everyone fits in to one or another group. When only two groups are chosen, the control and a high group,

there are a number of people who offer to take part but do not meet the criteria. The study that this research was replicating used a group design which I wished to replicate; however, it was with the awareness that this would make comparison to other schizotypy research difficult, though a group design can increase the power of the study. In retrospect, I think that I would still make the same decision regarding the use of two groups; however, what I may do differently is make a lower level of schizotypy rating for the control group to further increase the difference in personality styles between the two groups.

Finding a suitable control group for a study such as this can be seen as difficult as those who score low on schizotypy could be argued to be being "different" just a those who score highly can be argued to be "different". The use of a group around the mean compared to both high and low scoring schizotypal individuals may therefore be theoretically the more accurate way to compare the way schizotypy personality styles impact on contextual integration or information processing in general. This would also be coherent with a dimensional perspective on personality styles such as schizotypy.

Use of new questionnaires and tasks

The dissociation scale that was employed in this study was a newly developed questionnaire (Murray, Ehlers & Mayou, 2002). Whilst there is data that questions the reliability and validity of more commonly employed dissociation questionnaires and therefore justifying the use of a new questionnaire, there are draw backs. As many other studies use older dissociation measures, this can make comparisons difficult. Nevertheless, the measure was able to discern between the two groups, as would have been expected, which may add to its validity on face value.

A new task was employed in this research - the cognitively ambiguous card task which had been previously used in unpublished studies. It was added to ensure that there were more even timings between the trials of the memory task. The card task responses were also modified to add further variability to the possible answers that participants could give. The original task had been designed for use on inpatients which resulted in the choice of responses being quite extreme and more obviously unusual thinking than was necessarily suitable for the healthy volunteer participants in this study. Therefore we added two more responses to the selection. These were supposed to be not quite as unusual, but still allowed for lower levels of magical ideation or unusual experiences to be considered. However, on reflection, these may not have been sufficient to allow for the variability in lower levels of magical ideation which resulted in most people selecting the response "it was a trick that works the same for everybody". For this to be employed more in experimental situations, it would be helpful to establish some responses that could allow for less obvious magical thinking and that created a forced choice situation, possibly by removing the "it was a trick" answers and replacing with "something else". By using the more ambiguous something else, people may be more inclined to select one of the listed options as these are all spelt out for them. Alternatively, it may be that this task is able to discriminate patient groups from healthy controls, but it is not able to discriminate between high and low schizotypal individuals.

Ecological Validity

The study employed a previously used methodology to research contextual integration ability in memory on people with varying levels of schizotypy personality style. This methodology had been taken from episodic memory research (e.g. Conway & Dewhurst, 1995). While understanding memory in laboratory setting can

be very helpful with uncovering underlying processes that may be taking place, it may not be valid when attempting to replicate the way that memory works in everyday life for people with higher levels of schizotypy.

This experiment gave very clear directions to the participants regarding what they were to remember for the final part of the experiment. This is a very different situation to a person's general use of their memory when they are not necessarily attending to everything that is going on in their world. The memory capabilities that are required to be investigated to examine the context deficit hypothesis for schizophrenia may need to be those that take place in everyday situations, which may be very different from those in this experimental setting. Therefore the question is posed, how would one go about this? One way that may be possible could be the use of vignettes to explore memory, or even the use of video vignettes that people can watch and then answer questions about.

Nevertheless, these methods could also have impediments when considering the necessary controls required in memory testing. It would have to be ensured that the participants were paying attention to the screen at all times and for transparency, given instructions regarding what they were to recall for the testing part of the experiment, which occurred in this experiment as well. The difference, however, could be seen as the increased level of distraction that may be present in a video vignette could come closer to replicating life situations where memory is encoded and then used to make attributions.

Timing the Trials

One of the most difficult aspects of this task was ensuring that the gaps between trials were maintained from participant to participant. In an attempt to do this there were questionnaires placed between each of the trials of the memory task.

These were aiming to be 15 to 20 minutes long. This was not always guaranteed as some people took much longer than expected on the questionnaires and so as filler tasks they were not entirely reliable. This was particularly apparent on the trauma questionnaire where if people answered yes to any of the questions they then had to fill in extra questions. This could mean that the twelve item questionnaire could take as little as two or three minutes but as many as ten. On reflection, I would ensure that there was sufficient time to undertake all questionnaires, but also have a back up cognitive filler task, such as counting backwards in seven's, so that those who finished the questionnaires more quickly were required to wait until it was time to continue.

Task Difficulty

One of the difficulties in the Waters et al., (2004) study was that there was a ceiling effect in the control group, therefore when it came to undertaking this study it was important that the task be modified to ensure that when the entire experimental sample was from the healthy population that a ceiling effect was not impeding the interpretation of the results. The task was made more difficult by increasing the load that would be placed on the memory of the participants to ensure that this did not happen.

During the piloting of the task, the load was increased in two ways. Firstly the number of trials was increased by fifty percent, from two trials to three trials, but each trial still had 12 pairs in it. Secondly the number of pieces of information to be recalled was also increased, from two pieces of context information to three. In the pilot study participants were asked to recall who made a pairing, in which trial it occurred, and how the two items were related to each other (on top of, next to or in front of).

To ensure that the task was at the correct level of difficulty, participants in the pilot had to be scoring above chance. While on average the participants were able to score above chance in each of the three areas of context, they were not able to perform above chance on putting all three pieces of context information together. Therefore, to be able to compare the results with the Waters et al., (2004) paper, it was decided that the load should be reduced by removing the requirement to recall the relationship of the pairs of items to each other, as in the previous study participants were only required to recall 'when' and 'who' context information.

Reassessing this decision in light of the null findings of the study, it may have been worth maintaining the load at the level that was tested in the pilot study as this may have increased our chances of finding areas of difference between the two groups. Future research may investigate this further as a possibility.

Wider context and future directions

Significant findings in this study would have called for discussion on the clinical implications of such findings. Had these been found I would have suggested that a finding of contextual binding difficulties in individuals who score highly on schizotypy scales could be aided in at least two ways. Firstly, this could be an added risk factor that could be employed when investigating those who are at highest risk of making the transition to a diagnosis of psychosis. Secondly, once identified, people who were more at risk could undertake strategies to encourage fuller contextual binding of information, but also reduce other social risk factors that may be more amenable to intervention, such as reducing stress and drug use.

Does this study undermine the context deficit hypothesis for schizophrenia? There is a great deal of evidence for this hypothesis across a number of domains and using multiple methodologies. That one study finds a null result is not enough to

speculate that this entire hypothesis may be false. However, questions that it does raise include, is this deficit one that occurs only after the disorder has developed? The majority of the research investigating the context deficit hypothesis compare patient populations with healthy volunteers, as was evidenced in my literature review, there are very few studies focusing on context in relation to schizotypy. Therefore, until further investigation is carried out, it may be suggested that the differences occur only after the transition to diagnosable disorder are made. This would imply that context deficits are not a predisposing factor on the development of schizophrenia, but are a product of the changes that occur due to the development of the disorder.

Secondly, are the results from the Waters et al., (2004) finding related to medication use? Changes in information processing in patients need to take in to account medication use and all the patients in the Waters et al., (2004) study were on medication. This would be a substantial difference between a study on healthy volunteers, such as this one, and a study comparing patients and non-patient controls. Thirdly, would the difference only be found in those even further up the continuum of the personality dimension of schizotypy? What would be found if low schizotypal participants, highly schizotypal individuals, people identified as at risk of making the transition to psychosis, people in their first episode of psychosis and those who have had a diagnosis of psychosis for a long period of time were compared on such a task? Fourthly, would further investigation with more ecologically valid methodologies uncover a difference in the healthy volunteer population?

However, there are those who argue that the diagnosis of schizophrenia is unreliable and invalid, particularly when it is understood as biological disorder (Boyle, 2002). This argument is given weight by the variety of presentations that can

give rise to the diagnosis and the lack of predictive validity of the diagnosis. For some researchers (e.g. Garety, Kuipers, Fowler, Freeman, & Bebbington, 2001) this has resulted in a focus on individual symptoms rather than the diagnosis as a whole. Studies that investigate information processing styles that may occur in schizophrenia, or in symptoms that can result in a diagnosis of schizophrenia, must be interpreted within a framework that accounts for the social factors that also play a role in the development of psychosis.

Conclusions

This review has examined some of the difficulties regarding selection and recruitment with ideas for how these difficulties may be overcome in the future, as well as how these may need to be accounted for when interpreting the results of this experiment. The design of the experiment was reviewed and possible difficulties regarding the use of new tools and tasks as well as difficulties replicating experimental conditions from one participant to the next. While this review has found areas in this experiment that could be improved on for further research, it has also found that in the area of task difficulty there were improvements from previous research employing the same paradigm. Overall, this research has added to the body of work that investigates the links between information processing context accounts of psychosis and how these may be displayed in the healthy volunteer population. As this was one of the first experiments to directly test this hypothesis with this population, it will be a stepping stone for further research to work from.

References

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Appendices

Appendix A: Ethical Approval

UCL GRADUATE SCHOOL

Dr Oliver Mason
Sub-Department of Clinical Health Psychology
UCL
Gower Street

17 October 2007

Dear Dr Mason

Re: Notification of Ethical Approval

Re: Ethics Application: 0606/001: The relationship between personality style and memory

I am pleased to confirm that following the review of your application by the UCL Research Ethics Committee the above research has been given ethical approval for the duration of the project subject to the following minor amendments. It was suggested that:

1. the word 'memory' should be removed from the title of the Informed Consent Form and Information Sheet and should therefore read: 'Personality and Memory'.
2. the word 'anonymous' should be inserted into the 6th question of the Informed Consent Form to read 'Do you agree with the anonymous publication of the results of this study in an appropriate outlet/s?
3. in the Information Sheet the 2nd para should be amended to read 'This study is about the relationship between personality and memory. The research will help psychologists further understand how different personalities can impact on the way that we organise information in our memories.' In the 3rd para the word 'style' should be removed and the word 'normal' removed from the 4th para. Members also felt that the 4th para needed to be re-written as it was too obscure, in particular the last sentence 'when things are not working correctly.....' Finally, the name of the committee should read 'UCL Research Ethics Committee'.
4. the title of the advert should read 'How does personality affect memory?' 'Help us find out, and EARN £6 in 45 minutes.'

Approval is subject to the following conditions:

1. You must seek Chair's approval for proposed amendments to the research for which this approval has been given. Ethical approval is specific to this project and must not be treated as applicable to research of a similar nature. Each research project is reviewed separately and if there are significant changes to the research protocol you should seek confirmation of continued ethical approval by completing the 'Amendment Approval Request Form'.

The form identified above can be accessed by logging on to the ethics website homepage: http://www.grad.ucl.ac.uk/ethics/ and clicking on the button marked 'Key Responsibilities of the Researcher Following Approval'.

2. It is your responsibility to report to the Committee any unanticipated problems or adverse events involving risks to participants or others. Both non-serious and serious adverse events must be reported.

   Reporting Non-Serious Adverse Events.
   For non-serious adverse events you will need to inform , Ethics Committee Administrator ( ), within ten days of an adverse incident occurring and provide a full written report that should include any amendments to the participant information sheet and study protocol. The Chair or Vice-Chair of the Ethics Committee will confirm that the incident is non-serious and report to the Committee at the next meeting. The final view of the Committee will be communicated to you.

   Reporting Serious Adverse Events
   The Ethics Committee should be notified of all serious adverse events via the Ethics Committee Administrator immediately the incident occurs. Where the adverse incident is unexpected and serious, the Chair or Vice-Chair will decide whether the study should be terminated pending the opinion of an independent expert. The adverse event will be considered at the next Committee meeting and a decision will be made on the need to change the information leaflet and/or study protocol.

On completion of the research you must submit a brief report (a maximum of two sides of A4) of your findings/concluding comments to the Committee, which includes in particular issues relating to the ethical implications of the research.

Yours sincerely

Chair of the UCL Research Ethics Committee

Cc: Anna Saunders, Sub-Department of Clinical Health Psychology, UCL

Appendix B: Information Sheet

SUB-DEPARTMENT OF CLINICAL HEALTH PSYCHOLOGY
UCL PSYCHOLOGY

Participant Information Sheet
Personality and Memory

Anna Saunders and Dr Oliver Mason
Sub-Department of Clinical Health Psychology, UCL,
London

You are being invited to take part in a research study. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it if you wish. Please ask if there is anything that is not clear or that you would like more information. Take time to decide whether or not you wish to take part.

This study is about the relationship between personality and memory. The research will help psychologist further understand how different personalities can impact the way that we organise information in our memories.

The study will take between forty five minutes and an hour to complete. You will be asked to complete a memory task, a sentence finishing task and complete questionnaires about mood, personality, trauma history and some demographic information. For participation in the study you will be paid £6.

All the information you give will be confidential and used only for the purposes of this study. The data will be collected and stored in accordance with the Data Protection Act 1998 and will be disposed of in a secure manner. The information will be used in a way that will not allow you to be identified individually.

This study has been approved by the UCL Research Ethics Committee.

If you have any questions regarding the research please feel free to contact Anna Saunders or Oliver Mason at the above address.

Taking part in this study is voluntary. If you don't want to take part, you do not have to give a reason and no pressure will be put on you to try and change your mind. You can pull out at any time.

You will be required to complete a signed consent form prior to undertaking the study to indicate that you have read this sheet and understood its contents.
THANK YOU FOR AGREEING TO PARTICIPATE.

Appendix C: Informed Consent Form

SUB-DEPARTMENT OF CLINICAL HEALTH PSYCHOLOGY
UCL PSYCHOLOGY

Informed Consent Form

Title of Project:

Personality and Memory

	Yes	No
Have you read the Participant Information Sheet?		
Has the project been explained to you orally?		
Have you received satisfactory answers to all your questions?		
Have you received enough information about the study?		
Do you understand that you are free to withdraw from the study without penalty at any stage?		
Do you agree with the anonymous publication of the results of this study in an appropriate outlet/s?		

Comments or Concerns During the Study:
If you have any comments or concerns you should discuss these with the Principal Research. If you wish to go further and complain about any aspect of the way you have been approached or treated during the course of the study, you should email the Chair of the UCL Ethics Committee ( ) or send a letter to: The Graduate School, North Cloisters, Wilkins Building, UCL, Gower Street, London WC1E 6BT who will take the complaint forward as necessary.

Signed: ..... Date:
.....

Full Name in Capitals:

.....

Appendix D: Advertisement

How does personality affect memory?

Help us find out and EARN £6 in 45 minutes.

This study will involve a memory task and some questionnaires.

All data will be collected and stored in accordance with the Data Protection Act 1998

For more information or to take part please email:

Personality and memory earn £6 email	Personality and memory earn £6 email	Personality and memory earn £6 email	Personality and memory earn £6 email	Personality and memory earn £6 email	Personality and memory earn £6 email	Personality and memory earn £6 email	Personality and memory earn £6 email	Personality and memory earn £6 email

Appendix E: Trait Dissociation Questionnaire

Trait Dissociation Questionnaire

This questionnaire is concerned with how often people have certain experiences. Please read each question carefully, but do not spend too much time on each one. Please circle ONE response in answer to each question (For example, if you OFTEN find yourself doing things without knowing why, circle the '3' (often) on question 1. Remember, there are no right or wrong answers. We are interested in your personal experience.

	Never	Rarely	Sometimes	Often	Mostly	Always
1. I find myself doing things without knowing why.	0	1	2	3	4	5
2. I cannot get angry about the things that should annoy me.	0	1	2	3	4	5
3. I do many things which I regret afterwards.	0	1	2	3	4	5
4. I feel that I am more than one person.	0	1	2	3	4	5
5. I feel as if other people live in a different world.	0	1	2	3	4	5
6. I feel that my mind is divided.	0	1	2	3	4	5
7. I can't understand why I get so cross and grouchy.	0	1	2	3	4	5
8. I feel distant from my own emotions.	0	1	2	3	4	5
9. I don't know how to stop myself from doing something.	0	1	2	3	4	5
10. I have problems remembering important details of stressful events.	0	1	2	3	4	5
11. I have conflicting desires	0	1	2	3	4	5
12. I feel as though I am standing next to myself or watching myself do something and I actually see myself as if I were looking at another person.	0	1	2	3	4	5
13. I feel unable to think straight.	0	1	2	3	4	5
14. I feel emotionally numb (eg. feel sad but can't cry, unable to have loving feelings).	0	1	2	3	4	5

15. I feel that I am floating beside my body, and watching it from "outside". 0 1 2 3 4 5

16. I feel that my personality is split into distinct parts..... 0 1 2 3 4 5

17. I find it difficult to feel real emotions, such as pain, happiness, sadness or anger..... 0 1 2 3 4 5

18. I feel that other people, objects, and the world around me are not real..... 0 1 2 3 4 5

19. I find it difficult to respond to others in a sympathetic way..... 0 1 2 3 4 5

20. Things seem to go by faster or slower than they really do. 0 1 2 3 4 5

21. I find myself dressed in clothes that I don't remember putting on..... 0 1 2 3 4 5

22. I find myself in a place and have no idea how I got there..... 0 1 2 3 4 5

23. I find new things among my belongings that I do not remember buying. 0 1 2 3 4 5

24. My moods can really change..... 0 1 2 3 4 5

25. I find writings, drawings, or notes among my belongings that I must have done but cannot remember doing. 0 1 2 3 4 5

26. I have no memory for some important events in my life (for example, a wedding or graduation). 0 1 2 3 4 5

27. I live in a world of my own where no one can reach me..... 0 1 2 3 4 5

28. I look at my watch and am surprised at the time it shows..... 0 1 2 3 4 5

29. My memory of upsetting events is patchy. 0 1 2 3 4 5

30. I say things without meaning to. 0 1 2 3 4 5

31. I underestimate or overestimate the amount of time that has passed. 0 1 2 3 4 5

32. If something upsetting happens, I find it difficult to remember afterwards. 0 1 2 3 4 5

33. I feel like I don't belong. 0 1 2 3 4 5

34. The world seems unreal or strange. 0 1 2 3 4 5

35. I am able to ignore pain. 0 1 2 3 4 5

36. I feel that there are two of me. 0 1 2 3 4 5

37. I feel distant and cut off from others around. 0 1 2 3 4 5

38. I have difficulty concentrating. 0 1 2 3 4 5

Appendix F: Traumatic Experiences Questionnaire

Traumatic Experiences Questionnaire

Many people have lived through or witnessed a very stressful and traumatic event at some point in their lives. This questionnaire is a sequence of descriptions of traumatic events.

When you see an event that has happened to you, or you have witnessed please circle Y for yes. Otherwise, circle N for no if that event is not relevant to you. If you have experienced or witnessed an event, please respond to the additional questions.

1. Have you experienced or witnessed: Serious accident, fire, or explosion? (For example an industrial, farm, car, plane, or boating accident). Y/N
2. Have you experienced or witnessed: Natural disaster? (For example, tornado, hurricane, flood, or major earthquake). Y/N
3. Have you experienced or witnessed: non-sexual assault by a family member or someone you know? (For example, being mugged, physically attacked, shot, stabbed, or held at gunpoint). Y/N
4. Have you experienced or witnessed: non-sexual assault by a stranger? (For example, being mugged, physically attacked, shot, stabbed, or held at gunpoint). Y/N
5. Have you experienced or witnessed: Sexual assault by a family member or someone you know? (For example, rape or attempted rape). Y/N
6. Have you experienced or witnessed: Sexual assault by a stranger? (For example, rape or attempted rape). Y/N
7. Have you experienced or witnessed: military combat or a war zone? Y/N
8. Have you experienced or witnessed: sexual contact when you were younger than 18 with someone who was 5 or more years older than you? (For example contact with genitals, breasts). Y/N
9. Have you experienced or witnessed: imprisonment? (For example prison inmate, prisoner of war, hostage). Y/N
10. Have you experienced or witnessed: torture? Y/N
11. Have you experienced or witnessed: life threatening illness? Y/N
12. Have you experienced or witnessed: any other traumatic event? Y/N If yes please specify the traumatic event.

How long ago did the traumatic event happen?

1. less than 1 month
2. 1 to 3 months
3. 3 to 6 months
4. 6 months to 3 years
5. 3 to 5 years
6. more than 5 years

Were you physically injured? Y/N

Was someone else physically injured? Y/N

Did you think that your life was in danger? Y/N

Did you think that someone else's life was in danger? Y/N

Did you feel helpless? Y/N

Appendix G: Memory Task Instructions

Instructions for memory task

There are 24 items presented at random on the table. You will be given a series of cards with an instruction for either you (participant) or I (experimenter) to pair together each of the objects in a particular fashion (in front of, next to, or on top of). Please read the instruction on the card out loud and then either you, or the experimenter, should undertake the pairing by moving both objects. Please try to remember which objects went together and who paired them together as you will be asked to recall this information later. There will be two further trials as the experiment progresses and you will also be asked to recall which trial a pair occurred in during the testing section at the end of the tasks. If you have any questions please ask the experimenter now before returning the computer.

Instructions for responding to memory task

This is the last section of the memory task. Earlier you read out and either watched or performed the pairing of objects together. You will now be presented with a series of pairs of objects. Some of these will be pairings that occurred in the task, some will be novel pairings with objects that were involved in the task. You will be asked if this was a pair that was in the experiment. If you think that it was a pair that was in the experiment then you will be asked which trial you think it occurred in (1, 2 or 3) and if you or the experimenter made the pairing. You will not be able to go back and change responses. If you have any questions please ask the experimenter now.