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Trauma-Related Intrusions and Psychosis: An Information Processing Account

Craig Steel

University College London, UK

David Fowler

University of East Anglia, Norwich, UK

Emily A. Holmes

MRC Cognition and Brain Sciences Unit, Cambridge, UK

Abstract. There is active, current speculation about the relationship between trauma and psychosis. However, little is known about the information-processing mechanisms underlying the development of trauma-related intrusions in this area. Our account highlights the role of contextual integration, i.e. the need for experiential information to be effectively integrated into a temporal and spatial context in order to facilitate voluntary recall. Drawing on existing models of both posttraumatic stress disorder (PTSD) and psychosis (Brewin, 2001; Ehlers and Clark, 2000; Garety et al., 2001; Morrison, 2001), we propose a contextual integration account of trauma-related intrusions. It is argued that the strength of contextual integration, which occurs during encoding, influences the frequency and nature of subsequent intrusive experiences. Consequently, individual differences in schizotypal personality traits, which are known to be associated with levels of contextual integration, are also related to the phenomenology of trauma-related intrusions. Whilst intrusions can be seen to occur within a range of disorders, it is argued that contextual integration may be one key variable in understanding the relationship between an experienced trauma and any consequent psychiatric symptomatology. Implications for clinical interventions aimed at trauma-related psychosis are discussed, along with research aimed at developing the empirical basis for such interventions.

Keywords: Posttraumatic stress disorder, psychosis, information processing, trauma, intrusions.

Introduction

There is growing evidence for connections between Posttraumatic Stress Disorder (PTSD) and psychosis. For instance, PTSD symptoms associated with traumatic life events are commonly experienced by people suffering from psychosis (Resnick, Bond and Mueser, 2003), whilst

Reprint requests to Craig Steel, Department of Mental Health Sciences, Royal Free and University College London Medical School, Holborn Union Building, Archway Campus, London N19 5LW, UK. E-mail: c.steel@iop.kcl.ac.uk.

severe threatening and humiliating life events, such as childhood sexual abuse, have been shown to be relatively common precursors to the onset of auditory hallucinations (Ensink, 1992; Hammersley et al., 2003). The rate of developing PTSD following trauma is significantly higher within individuals who have already been diagnosed with a psychotic disorder, when compared to the general population, suggesting that psychosis may convey an elevated risk for developing PTSD (Mueser, Rosenberg, Goodman and Trumbetta, 2002). Indeed, it has been argued that the experience of suffering from a psychotic disorder itself can lead to PTSD symptoms via adverse experiences such as hospitalization, or the level of threat contained within paranoid delusions (McGorry et al., 1991; Shaw, McFarlane and Bookless, 1997; Shaw, McFarlane, Bookless and Air, 2002; Frame and Morrison, 2001). In terms of psychiatric outcome, the co-morbid presence of PTSD and psychosis appears to be a marker of a particularly severe and chronic condition related to more severe symptoms and higher rates of service use (Mueser and Rosenberg, 2001).

There are a variety of ways in which trauma processes may interact with psychotic processes. For example, Mueser et al. (2002) highlight the manner in which PTSD symptoms may exacerbate stress. Specifically, they suggest that the experience of distressing intrusions and hyper-arousal could heighten stress and thus lead to more severe and chronic symptoms of psychotic disorder. Further, secondary reactions to PTSD symptoms, such as avoidance, may lead to non-engagement with services and higher rates of drug abuse. Whilst this model does not clearly specify the exact mechanisms by which PTSD may influence the development and maintenance of psychotic symptoms, recent cognitive models of psychosis do suggest a variety of possible factors (Bentall, Kinderman and Kaney, 1994; Fowler, 2000a; Garety, Kuipers, Fowler, Freeman and Bebbington, 2001; Morrison, 2001). The experience of threat and humiliation, particularly at an interpersonal level, may provide a basis for the emergence of negative beliefs about oneself and others, and the associated patterns of withdrawal, vigilance and anxiety (Fowler, 2000a). Such beliefs and emotions may in turn provide the basis for the emergence of paranoia either as a direct extreme exaggeration of threat related beliefs (Freeman, Garety, Kuipers, Fowler and Bebbington, 2002), or as an attempt to maintain a coherent positive self-image in the context of a perceived threat to that image (Bentall et al., 1994). A potential route to the origin of hostile and critical voices may be through individuals suffering from the unwanted intrusive "reliving" of previous socially threatening or humiliating experiences (Morrison, 2001). Others have argued that there is strong evidence suggesting that the effects of trauma exposure on neural networks could provide a potential common diathesis for both PTSD and psychosis (Read, Perry, Moskowitz and Connolly, 2001; Seedat, Stein, Oosthuizen, Emsley and Stein, 2003).

There are a number of different and potentially competing hypotheses that aim to account for associations and surface similarities between PTSD and psychosis. Investigation of such hypotheses is of considerable importance, particularly as there is a lack of consensus as to how to formulate and manage cases in which there is a co-morbid presentation. In this paper we highlight commonalities within recent theories that attempt to account for the presence of intrusive anomalous experiences within both disorders. This may be helpful in clarifying the different pathways to what appears to be a particularly severe and chronic syndrome. We focus on a particular commonality underpinning both certain psychotic processes and PTSD processes, that is, the manner in which information is processed, stored and subsequently recalled as an intrusive memory. We argue that there are specific aspects of information processing relevant to the development of intrusive memories, and that these occur across

a range of disorders. We suggest a specific aspect of information processing, i.e. contextual processing, may contribute to an understanding of why individuals suffering from psychosis exhibit a greater vulnerability to experiencing intrusions. Preliminary evidence is provided that is consistent with this perspective.

Our account alone is not intended to provide a full explanation of the problems associated with complex disorders involving PTSD and psychosis. Our aim is to focus on one information processing factor, i.e. vulnerability to intrusions, which while providing a fresh "across-disorder" perspective is also consistent with existing models. Complex cases are best understood by taking into account the interactions of a range of underlying psychological processes such as emotions, beliefs, appraisals and behaviours. However, the present approach to understanding vulnerability to intrusions in terms of a common underlying process may have advantages, particularly over previous generic vulnerability-stress models (e.g. Zubin and Spring, 1977). One advantage is that the current approach provides a specific explanation as to how threatening events may be processed so as to give rise to trauma-related intrusions that can occur within a variety of disorders, including PTSD and psychosis.

Trauma, PTSD and psychosis

Individuals who have been involved in traumatic events frequently report experiencing trauma-related, intrusive images of the events. These images often seem to occur spontaneously and are distressing. If maintained, such images may be the key symptom associated with a clinical diagnosis of Posttraumatic Stress Disorder (PTSD). In the context of PTSD, a traumatic event is one in which someone experiences, or witnesses, severe injury to themselves or to others, or a threat to their integrity. The response to the event is required to be extreme fear, helplessness or horror (APA, 1994). The symptoms associated with PTSD comprise: (i) re-experiencing of the traumatic event (e.g. as intrusive thoughts and images); (ii) avoidance of trauma-related stimuli and/or a general numbing of emotional responsiveness; and (iii) increased levels of arousal (APA, 1994). In this paper, we consider both stressful events that are "traumatic" in terms of the strict DSM-IV definition, as well as other events perceived as intensely stressful by an individual. By the term "trauma-related" intrusions, hitherto used in this paper, we are referring to intrusions that are linked to an index stressful/traumatic event, which involve re-experiencing of that event, and whose form includes a sensory component (i.e. take the form of imagery in any modality: visual, auditory, olfactory etc). Rumination per se is not considered to be a trauma-related intrusion. However, certain verbal appraisals made by an individual during a stressful event, or verbal information heard during such an event, may be re-lived afterwards, for example as an auditory image, and thus considered to be a trauma-related intrusion.

Although PTSD is one possible psychopathological outcome when an individual experiences a traumatic event, it is well reported that traumatic and other stressful life events can act as a trigger for a wide range of disorders, including anxiety, depression and psychotic disorders (Brown and Harris, 1989; Zubin and Spring, 1977). Psychotic disturbance has a heterogeneous presentation, with the associated symptoms frequently being referred to as either "positive" or "negative" (e.g. Crow, 1980). The predominant positive symptoms are delusional beliefs and hallucinatory experiences. In contrast, negative symptoms are characterized by a flattening of affect and loss of motivation (APA, 1994). Schizophrenia is a widely diagnosed form of psychotic disturbance, within which the acute phase is predominantly associated with the presentation of delusions and hallucinations.

Given the role of traumatic and stressful events in triggering the onset of both PTSD and psychosis, it is interesting to consider that individuals diagnosed with a severe mental illness are reported to have experienced a high level of traumatic life events. Mueser et al. (1998) report that 98% of their sample ($N = 275$) of people with severe mental illness had experienced at least one traumatic life event, and that 43% had symptoms consistent with a diagnosis of PTSD. Interestingly, less than 1% had been diagnosed with PTSD. From the opposite perspective, there is some evidence of high rates of positive symptoms consistent with a psychotic disorder occurring within individuals diagnosed with PTSD (Kinzie and Boehnlein, 1989; Butler, Mueser, Sprock and Braff, 1996; Sautter et al., 1999). For example, Lindley, Carlson and Sheikh (2000) report that 30% to 40% of combat veterans with PTSD also reported auditory or visual hallucinations and/or delusions.

The phenomenology of PTSD and psychosis

Within clinical assessment, a hallmark of PTSD is the involuntary and highly intrusive memories, and their direct relationship to a traumatic event (Brewin and Holmes, 2003). These intrusions, or "flashbacks", typically take the form of sensory images, are experienced as happening in the present, are associated with high affect and contain a sense of current threat (Ehlers and Clark, 2000; Ehlers, Hackmann and Michaels, 2004; Hackmann, Ehlers, Speckens and Clark, in press). The content of intrusive images appear to be associated with the worst moments experienced within the trauma, as indicated by an individual's cognitive appraisals (Grey, Holmes and Brewin, 2001; Grey, Young and Holmes, 2002). Whilst the majority of these intrusions are associated with a feeling of anxiety, individuals also report intrusive experiences that are accompanied with a variety of other emotions e.g. guilt and sadness (Holmes, Grey and Young, in press).

However, intrusions that are related to stressful and traumatic events have been associated not just with PTSD but with the symptomatology of a range of disorders, including social phobia (Hackmann, Clark and McManus, 2000), bipolar disorder (Mansell and Lam, 2004), depression (Reynolds and Brewin, 1999), psychosis (Morrison et al., 2002) and agoraphobia (Day, Holmes and Hackmann, 2004). In several of these studies, it has been found that patients are able to report a link to an autobiographical account of a specific, stressful, incident with the content of their intrusive images. Also, the "involuntary and highly intrusive" nature of PTSD phenomenology is not specific to PTSD symptomatology; voice hearers report that hallucinations can also occur in such a manner (Nayani and David, 1996). Thus, given that blurred boundaries may occur between symptoms associated with a diagnosis of PTSD and those of other disorders, including psychosis, it may be that it is the patients' and/or the therapists' awareness of the intrusions "direct relationship to a traumatic event" that in part facilitates a diagnosis of PTSD, and the consequent treatment interventions.

Considering the high rate of trauma experienced by people diagnosed with a severe mental illness (Mueser et al., 1998), it is perhaps not surprising that a recent study by Morrison et al. (2002) found this population to report a high prevalence of intrusive images. Further, Morrison et al. suggested that the content of these intrusions e.g. being shouted at, were frequently related to both a previously experienced trauma, e.g. an assault, and the content of current positive symptoms of psychosis, e.g. beliefs about people conspiring to attack. However, what is not understood is why some individuals who have experienced stressful or traumatic events might develop symptoms associated with a diagnosis of PTSD, such

as clear trauma-related intrusions, whilst others may develop psychotic symptoms, such as hallucinations or delusional beliefs, which contain intrusive trauma-related content but where the links may be less clear.

The varied pathways to psychiatric (and non-psychiatric) outcome are likely to involve many psychological processes; however, we consider that it is important to consider basic information-processes so as to further our understanding of the development of trauma-related intrusions (Harvey, Watkins, Mansell and Shafran, 2004). We propose that individual differences in information processing styles may form the basis of individual differences in the frequency and content of trauma-related intrusions, and that these differences may contribute to the varied pathways to psychiatric outcome.

Contextual integration and the hippocampus

A defining feature of an intrusive experience, whether it occurs within PTSD, another anxiety disorder, psychosis, or indeed a non-pathological presentation, is the involuntary nature of the recall of the stored information. The individual does not consciously choose to recall the memory; rather it is thought that recall is triggered involuntarily and directly through stimuli being encountered that correspond to stimuli stored at the time of the trauma (Brewin, Dalgleish and Joseph, 1996; Brewin, 2001; Conway and Pleydell Pearce, 2000; Ehlers and Clark, 2000). The manner in which trauma-related information is encoded, stored and consequently recalled must therefore be central to our understanding of intrusive experiences.

Before expanding on the manner in which trauma-related information is processed, we must first put forward a model of "normal" information processing, i.e. that which occurs whilst an individual is not experiencing a trauma. In doing so, we focus on Broadbent's (1977) concept of "pigeon-holing", which is based on (1) the integration of varied sensory information occurring within the present context with past experience of similar contexts; and (2) the development of individual biases in potential response made on the basis of how the information is initially processed. Within the current paper, we concentrate on the first process, which we refer to as "contextual integration". Thus, "contextual integration" can be considered as the processing and storing of incoming information within a meaningful spatial and temporal context. As a consequence of effective contextual integration, we are able to voluntarily recall our memories with reference to other events that occurred at a similar time, and to place them in a meaningful order. At a neurological level, it has been suggested that the hippocampus serves to bind the individual features of incoming information within a spatial and temporal context, thus forming a coherent whole (Eichenbaum, 1997; Squire, 1992). The contextual integration of this information enables the development of meaningful relationships with reference to events that have occurred previously. It is thought that information is integrated within the hippocampus before being processed by the amygdala, which governs emotional regulation and biological reactions to stress (LeDoux, Iwata, Cicchetti and Reis, 1988).

Contextual integration during a trauma: PTSD and hotspots

Contextual integration is a fundamental aspect of information processing at the time an event is experienced. In line with previous theories (Brewin, 2001; Ehlers and Clark, 2000), we propose that a disruption of contextual integration occurs when an individual experiences a traumatic

event. Disruption to contextual integration can occur during moments of peak intensity and distress during a traumatic event. Within a clinical context, such moments have been described as "hotspots". They are related to both the person's self-defined worst moments of a trauma, and the content of their subsequent intrusive experiences (Ehlers and Clark, 2000; Grey et al., 2001, 2002; Holmes et al., in press; Richards and Lovell, 1999). For example, during a car crash a moment of intense distress may occur at a point when an individual thought "I am going to die" and felt extremely afraid. This traumatic moment (hotspot) may later be "relived" through an intrusive image of glass breaking and a loud crashing noise, that is, those events that were occurring at that particular time of intense fear. A recent meta-analysis of predictors of PTSD indicates that individual's reports of peri-traumatic processing (which can be considered to be shifts in information-processing occurring at the time of the trauma) are a stronger predictor of subsequent PTSD symptomatology than the type of trauma or demographic factors (Ozer, Best, Lipsey and Weiss, 2003).

From a neurobiological perspective, it has been argued that during periods of intense distress (arguably, such as traumatic hotspots) information is processed via a more direct route to the amygdala (LeDoux et al., 1988). This route by-passes the normal pathway through the hippocampus, so as to facilitate a faster release of stress hormones. Such an information processing "short-cut" to the amygdala enables faster processing, but with the drawback being a reduction in the extent to which the hippocampus processes and integrates information within a spatial and temporal context (Brewin, 2001; Layton and Krikorian, 2002). The result of this type of information processing is a memory, for example, of a traumatic hotspot, which is disconnected from the flow of other information occurring at the time of the trauma (Holman and Silver, 1998). This type of memory, which Brewin and colleagues call a "situationally-accessible memory" (SAM) (though see below for other accounts of PTSD), can be difficult to recall voluntarily (Brewin et al., 1996; Brewin, 2001). However, a SAM is vulnerable to being involuntarily triggered into consciousness when stimuli associated with the original trauma are encountered. According to this theory, the triggers of SAM intrusions can be reduced by the formation of "verbally accessible memory" (VAM) of the same event. VAMs can be deliberately recalled by, for example, describing the situation in words.

The "encoding and triggering" argument of Brewin and colleagues has a parallel with Ehlers and Clark's (2000) model of PTSD. Ehlers and Clark (2000) argue that during trauma there is a shift within some individuals from "conceptual-processing" to "data-driven" (perceptual) processing of the events. Data-driven processing is associated with reports of confusion and experiencing overwhelming sensory impressions. Consequently, Ehlers and Clark argue that the "trauma memory is poorly elaborated and inadequately integrated into its context in time, place, subsequent and previous information" (p. 7). Thus, data-driven processing may help explain the often fragmented nature of trauma memories. Further, the weak contextual integration of trauma-related stimuli may contribute to the difficulty individuals encounter when they attempt to place trauma-related events within a chronological order (Foa and Riggs, 1994; van der Kolk and Fisler, 1995).

Information processing, contextual integration and psychosis

Prior to the more recent information-processing models of PTSD discussed above, Hemsley's (1994) information processing model of psychosis made reference to a similar information processing style in which individuals fail to make use of temporal and spatial regularities

of information. Hemsley argued that the efficient processing of regularities of information would normally enable individuals to use previously occurring events in order to facilitate predictions about what events are likely to occur in the future. These predictions take the form of "expectancies", or "response biases". These biases are demonstrated within experimental situations in which individuals respond more quickly to events that they had predicted were likely to happen, based on regularly occurring past events. For example, within the "flanking letter" task (Miller, 1987) individuals are to make a two-choice response as to the identity of a central letter within a three-letter triad, e.g. XCX, YCY, XMX or YMY. The presentation of the trials is biased so that the letter C is predominantly flanked by the letter X, and the letter M is predominantly flanked by the letter Y. Individuals typically pick up on the frequent co-occurring stimuli and make faster response times to the identity of the central letter when it is flanked by the predictable, familiar letter compared to when it is flanked by an unfamiliar letter.

It is these processes that are argued to be relatively weak within people suffering from psychosis. A weak ability to integrate incoming information with co-occurring information, and with previously occurring events, result in individuals being relatively unaware of the significance of each aspect of their current perception and its relationship within a moment-by-moment temporal context. Within the "flanking letter" task, individuals suffering from acute psychosis do not respond more quickly when a central letter is flanked by a predictable, familiar letter, suggesting a weakened ability to integrate the relationships between co-occurring stimuli (Jones, Hemsley and Gray, 1991). Consequently, individuals suffering from psychosis can become overwhelmed by current sensory information, as they are unable to distinguish information that is relevant to the task in hand from "redundant" information. Thus, there is an increased demand on the processing of current incoming stimuli and a reduced ability to integrate this information into a meaningful context. It is argued that this results in a relative breakdown in the continuity of perceptions, which normally underlie the "streamlike" nature of consciousness. The breakdown of these processes may contribute to the deficits in temporal perception exhibited by people suffering from symptoms of psychosis (Davalos, Kisley and Ross, 2002). Further, the relatively unstructured sensory input, and weak temporal associations between stimuli, would leave the individual vulnerable to experiencing intrusions from material stored in long-term memory. It is these ongoing intrusive experiences that Hemsley has argued form the basis of the positive symptoms of psychosis. Clearly, there are interesting similarities between Hemsley's account of intrusion development within psychosis, and Brewin's (2001) account of the development of situationally-accessible memories within PTSD.

The concept of schizotypy and contextual integration

In common with other psychiatric disorders, psychotic experiences have been argued to occur within a continuum throughout the normal population, rather than exist as a categorical construct (e.g. Claridge, 1990). Within this framework, individual differences are reflected in the wide range of reported beliefs, feelings and experiences occurring within the whole population. With reference to psychosis, individuals can be rated as either high or low "schizotypes" on the basis of schizotypal personality questionnaires. Schizotypal questionnaires such as the Oxford-Liverpool Inventory of Feelings and Experiences, or O-LIFE (Mason, Claridge and Jackson, 1995), contain a number of subscales that reflect the number of symptom dimensions associated with schizophrenia (Liddle, 1987). The positive symptom

schizotypy subscale of the O-LIFE, called Unusual Experiences, assesses "diluted" non-pathological forms of hallucinatory and delusionary experiences. Example questions from the Unusual Experiences subscale refer to beliefs in telepathy, hearing one's thoughts in a "loud" manner and experiencing daydreams that seem real. Evidence for the continuum approach to psychosis is gained from a range of experimental studies in which high scoring schizotypes perform in a similar manner to individuals diagnosed with a psychotic disorder (Baruch, Hemsley and Gray, 1988; Steel, Hemsley and Jones, 1996). More specifically, the same weakened contextual integration argued to occur within those suffering from acute psychosis, and demonstrated with the "flanking letter" task (Jones et al., 1991) has also been shown to occur within high scoring positive symptom schizotypes (Steel, Hemsley and Pickering, 2002). Therefore, it would seem that both people suffering from acute schizophrenia and those rated as high positive schizotypes exhibit a "baseline" state of information processing style that is similar to what may occur on a temporary basis during a trauma, i.e. weakened contextual integration.

The temporal context integration continuum in trauma: a hypothesis

On the basis that low schizotypes, high schizotypes and people with acute psychosis can be considered to have psychotic-like experiences that occur on a continuum, we propose that the underlying information-processing style associated with the presence of these experiences also occurs within a continuum. Thus, for example, when people experience traumatic "hotspots", i.e. worst moments during trauma, we propose that there may be a temporary shift in information processing style towards the "psychosis" end of the continuum, in which contextual integration is weakened. That is, there would be a temporary reduction in the hippocampal integration of information within a temporal context. However, this shift along a "temporal context integration continuum" may only occur during the short period of time that comprises the traumatic hotspot, before returning to a "normal" or baseline information-processing style. Thus, only the information processed during this temporary shift in information-processing style would later be vulnerable to being triggered as an intrusion. This would help explain why some moments of a trauma intrude repetitively as images, and not others.

However, high schizotypes (i.e. individuals within the normal population who exhibit a relatively high level of unusual beliefs and experiences) already seem to exhibit a baseline information processing style that is relatively high up the "temporal context integration continuum" (Steel et al., 2002). When compared to low schizotypes, they have a tendency to process information within a relatively weak contextual integration. These individuals are, perhaps, routinely storing information in a manner that makes them vulnerable to having memories triggered as intrusions. Thus, high schizotypes may be particularly vulnerable to significant shifts in information-processing style, such as those argued to occur during a traumatic hotspot. That is, there may be a cumulative effect of an underlying weak ability to contextually integrate information, which is further weakened due to the effects of experiencing a traumatic event. Experiencing a trauma may produce a further shift up the "temporal context integration continuum". This would further decrease the extent to which information can be integrated in a temporal context. It may be that even a relatively mild trauma may impact on the information-processing system of high schizotypes significantly enough to generate intrusions. Thus, it is argued that it is a combination of an individual's level of schizotypy, and

their associated underlying style of information processing, as well as the personal severity of the traumatic event that would contribute to the frequency and nature of any resultant trauma-related intrusions.

Individuals who are currently experiencing psychotic symptoms may be considered to be at the very high end of the "temporal context integration continuum". Consequently, people suffering from a psychotic disorder may be particularly vulnerable to even mild stressful events being processed in a manner that makes even those events vulnerable to being triggered as intrusions. Further, in line with the phenomenology of traumatic "hotspots" (Holmes et al., in press), intrusions may be associated with a wide range of emotional responses, including anxiety, guilt, sadness etc, and not just fear.

Empirical implications

An important implication of the above hypothesis is that individuals scoring high in positive schizotypy would be more vulnerable to experiencing trauma-related intrusions than low scoring schizotypes. Evidence consistent with this proposal was found in a recent study (Holmes and Steel, 2004). In the experiment, individuals were exposed to watching a "stressful-film", which was a short video containing the scenes of the aftermath of road-traffic accidents. Participants subsequently recorded intrusions that related to the content of the video over the following week. Individuals scoring high on the Unusual Experiences Scale, a measure of positive symptom schizotypy, recorded more intrusions than those scoring low. These results are consistent with the idea that the underlying information-processing style associated with high positive schizotypy is one in which relatively mild traumatic information is stored so as to be particularly vulnerable to being triggered as a trauma-related intrusion.

At a clinical level, the hypothesis that high schizotypes are vulnerable to trauma-related intrusions would suggest that individuals diagnosed with a psychotic disorder may also be particularly vulnerable to developing trauma-related intrusions. This proposal is consistent with previous research reporting a high level of intrusive images to occur within a psychotic population (Morrison et al., 2002). It may be that Morrison's findings are in part due (at an information processing level of explanation) to some individuals exhibiting a pre-morbid information processing style that makes them particularly vulnerable to experiencing trauma-related intrusions. However, it may also be that this information-processing style develops in association with the onset of psychosis leaving the individual vulnerable to experiencing intrusions of a wide range of stressful events occurring in their lives. This latter argument is in line with the clinical observation that individuals suffering from psychosis frequently report the content of their intrusive experiences e.g. hallucinations, to reflect day-to-day distressing events.

The contextual integration hypothesis has some immediate research implications that can be conceptualized as a series of hypotheses. We predict that the phenomenology of trauma-related intrusions would differ between people rated as high and low schizotypes within a number of aspects. For example: (1) Range: we would expect that following a traumatic event high schizotypes would exhibit intrusions of a larger number of distinct "hotspots" of the trauma compared to low schizotypes. (2) Frequency: We would predict that the intrusions of high scoring schizotypes compared to low schizotypes to be more easily triggered, thus high schizotypes would experience more frequent intrusions (see Holmes and Steel, 2004). (3) Trauma-intrusion link: we would predict that the larger number of more varied intrusions

experienced by high schizotypes would lead to these individuals having greater difficulty identifying the triggers of their intrusions, and in connecting their intrusive experiences to an actually experienced event, when compared to low schizotypes.

We are keen to emphasize that the temporal context integration hypothesis is considered to be only one of many common underlying information processing mechanisms existing in both PTSD and psychosis. Future research should therefore also seek to link this concept into other key variables in both the trauma and psychosis literatures. One important example to consider is linking the current hypothesis to Ehlers and Clark's (2000) notion of data-driven versus conceptual processing, and to employ a measure of this in future studies. It will also be of importance to further investigate individual differences in the appraisal of stressful or traumatic situations, as it is these appraisals that will determine whether the individual experiences them as sufficiently threatening so as to determine a shift in information processing style (c.f. hotspots, Holmes et al., in press). It is hoped that further developments in our understanding of basic processes, that is information processing mechanisms and trauma-related intrusions, may be integrated within currently existing, more generic, cognitive behavioural models of psychosis (Garety et al., 2001; Morrison, 2001).

Implications for clinical interventions

Experiencing a trauma-related intrusion can have a profound negative impact on an individual. As previously discussed, such intrusions can be accompanied by a sense of current threat (Ehlers and Clark, 2000). The sense of current threat can be both physical, e.g. a threat of physical injury, or psychological, e.g. a threat to one's sense of self. In a sample of patients with PTSD, Holmes et al. (2003) reported that individuals' reports of what they termed "psychological threat" was as common as that of reports of physical threat. Following the temporal-context integration hypothesis, one might expect that if an individual does not link the source of a threatening intrusion to a past trauma (as may be more likely within high schizotypes) there may be an increased likelihood of engaging in a search for meaning as to the contents of consciousness. This search for meaning, combined with a sense of current threat, may lead to increased levels of paranoid ideation and the associated maintenance mechanisms (Freeman et al., 2002). Perhaps of particular clinical concern may be the sense of psychological threat, which may manifest as a threat to self-worth, shame, guilt, abandonment or helplessness. Given these experiences may be represented within an image based form, they may have a particularly powerful impact on the person's sense of self in autobiographical memory (Conway, 2001; Conway and Pleydell-Pearce, 2000; Conway and Holmes, in press).

Whilst the current paper has focused on the presence of trauma-related intrusions with high scoring schizotypes, it has been noted that the high level of trauma experienced by individuals diagnosed with a psychotic disorder is also associated with the presence of intrusive experiences. Clinical experience suggests that this population not only experiences intrusions associated with physical threat, but frequently describes symptoms associated with a sense of psychological threat, and an associated experience of shame. It may be that individuals suffering from psychosis have a particularly high vulnerability to the development of intrusions, possibly leading to experiencing intrusions originating from a wide number of daily stressful events, such as an interpersonal argument. Consequently, it may be especially confusing for these individuals to identify a link between the content of their intrusions and precipitating events.

The approach we have put forward in this paper has implications for clinical interventions when working with people suffering from a psychotic disorder. At the level of assessment, clinicians should consider a history of trauma when working with psychosis, even though the presenting symptoms may seem estranged from reality (Fowler, 2000b; Morrison, Frame and Larkin, 2003). Clinicians should assess the possible presence of potentially "fleeting" intrusive experiences, which may occur in a variety of sensory modalities. The core of the argument that we have put forward is that there may be a continuum of vulnerability to trauma-related intrusions, which in turn may influence both the phenomenology of intrusive experiences and possibly the subsequent appraisals individuals may make as to the origin of their intrusions. Whilst a link between intrusive experiences and a previously experienced traumatic event may be relatively easily established within a PTSD presentation, we would suggest that establishing such a link may be crucial when presented with a case of traumatic psychosis (Morrison et al., 2003). The aim here, as in working with PTSD, would be to formulate intrusive experiences as originating from stressful events, in order to understand them as being memories rather than indicators of current threat (Holmes and Young, 2003). Thus, a careful assessment of previously experienced traumas and stressful events should be interwoven with an assessment of current symptomatology. Where links seem to occur between previously experienced events and current intrusions (within psychosis these may take the form of voices or paranoid thoughts), these can form the basis of a formulation that can be shared with the patient (Fowler, Garety and Kuipers, 1996). The sharing of this formulation may result in a reduction in distress for patients as they begin to incorporate their current intrusive experiences within a re-narrated autobiographical account, and consequently they may be less prone to externalizing the source of their intrusive experiences. Such clinical techniques may provide one of the many steps needed to reduce distress within individuals presenting with traumatic psychosis.

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