Evaluation of latent inhibition and learned irrelevance as assays of attentional abnormalities in schizotypy

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Abstract

The claim that the positive symptoms of schizophrenia are associated with attentional abnormalities was investigated by using naturally occurring individual differences in schizotypic characteristics in a normal population of undergraduate students. Attention was measured using a variety of novel procedures that assessed latent inhibition (Chapters 2 and 3), learned irrelevance (Chapters 4 and 5) and stimulus detection (Chapter 6). The results provide restricted support for the claim that attentional processes are aberrant in groups of participants with high schizotypy scores (in particular high levels of unusual experiences on the Oxford-Liverpool Inventory of Feelings and Experiences).

Chapter 1

1: Introduction and summary:

A core symptom of schizophrenia is held to be abnormal attention (e.g., McGhie & Chapman, 1961). A number of researchers have viewed latent inhibition (retarded conditioned responding after preexposure to the conditioned stimulus, CS) as an index of the ability to screen out irrelevant stimuli and have found this effect to be reduced in acute schizophrenia and high schizotypy (e.g., Baruch, Hemsley, & Gray, 1988a). In addition, latent inhibition has been found to be sensitive to pharmacological manipulations of dopamine in rats and this sensitivity has been proposed to be an animal model of schizophrenia. Close examination of the evidence, however, reveals limitations and inconsistencies that render unconvincing both the suggestion that (1) latent inhibition is an index of the ability to tune out irrelevant stimuli that is deficient in acute schizophrenia and high schizotypy, and (2) the suggestion that latent inhibition/dopamine interaction is an animal model of schizoprenia. This thesis is principally concerned with developing and evaluating novel assays of latent inhibition and learned irrelevance (retarded conditioning after uncorrelated exposure to the CS and the unconditioned stimulus, US) that are then used to assess attentional abnormalities in high schizotypy.

1.1: Schizophrenia

Schizophrenia is a heterogeneous disease characterised by a variety of different symptoms that have been classified into three types: positive symptoms, that are abnormal by their presence (e.g., hallucinations and delusions); negative symptoms, that are abnormal by their absence (e.g., anhedonia and blunted affect); and disorganised symptoms, that are reflected in disordered thought (and manifested by, for example, displays of inappropriate affect and distractability; Liddle, 1987).

At the level of symptomatology and phenomenology, one of the core deficits in schizophrenia seems to be attention (e.g., Weckowicz & Blewett, 1959; McGhie & Chapman, 1961; Anscombe, 1987; Nuechterlein & Dawson, 1984; Braff, 1993) and performance on a number of attentional tasks is impaired in schizophrenia, including the Stroop task (e.g., Wapner & Krus, 1960; Abramczyk, Jordan, & Hegel, 1983; Wysocki & Sweet, 1985), the Wisconsin Card Sorting Task (e.g., Koren, Seidman, Harrison, Lyons, Kremen, Caplan, Goldstein, Faraone, & Tsuang, 1998; for a review see Li, 2004), the intra-extra dimensional shift task (e.g., Jazbec, Pantelis, Robbins, Weickert, Weinberger, & Goldberg, 2007; for review see Robbins, 2000) and the continuous performance task (e.g., Kornetsky, 1972; Nuechterlein, 1984; Cornblatt & Keilp, 1994; Cornblatt, Lenzenweger, & Erlenmeyer-Kimling, 1989). It has been suggested that it is specifically the ability to ignore irrelevant stimuli that is compromised in schizophrenia either by the failure to (1) filter out irrelevant stimuli (Frith, 1979; Weckowicz & Blewett, 1959; McGhie & Chapman, 1961) or (2) use contextual information to guide processing of current perceptual input correctly (Patterson, 1987; Gray, Feldon, Rawlins, Hemsley & Smith, 1991; Hemsley, 1987, 1993, 1994). Hemsley (1987, p. 182) specifically suggested that "It is a weakening of the influences of stored memories of regularities of previous input on current perception which is postulated as basic to the schizophrenic condition". The failure to filter out irrelevant stimuli or to use contextual cues to influence the processing of stimuli are both suggested as the explanation for the development of positive symptoms (such as delusions and hallucinations). This failure to reduce the processing of irrelevant stimuli is taken to result in these stimuli being accorded undue importance. In a related vein, Fleminger (1992, p. 293) suggested that: "Good sensory data, strong links between sense data and memory, and good judgement will all help to prevent misperceptions".

The suggestion that the positive symptoms of schizophrenia reflect a core deficit in attention is attractive for a variety of reasons. One reason concerns the search for schizophrenic endophenotypes. An endophenotype is a "measurable component unseen by the unaided eye along the pathway between disease and distal genotype" (Gottesman & Gould, 2003, page 636). Identifying an endophenotype for positive schizophrenic symptomatology in the form of a behavioural marker is a more well-defined task if the underlying deficit is a unitary rather than a multiple-component construct. Endophenotypes, in general, constitute a tool for identifying relevant genes and disease vulnerabilities that may serve to promote the early detection of schizophrenia, in the case of schizophrenic endophenotypes. A number of different behavioural markers for schizophrenia have been proposed (for a review, see Snitz, MacDonald & Carter, 2006) such as sustained attention, executive function, and selective attention, but none have received unequivocal acceptance. This thesis is primarily concerned with the investigation of potential endophenotypes for schizophrenia, and in particular deficient modulation of attention, that have counterparts in animal models of acute schizophrenia (Gray et al., 1991; Hemsley, 1987, 1993, 1994; Lubow, 1989; Weiner, 2003).

1.2: Schizotypy

In personality research a dimensional view is often taken of personality characteristics which people are considered to display to varying degrees. This dimensional view has been extended to schizophrenia (e.g. Claridge, 1997) with the dimension in question being labelled 'schizotypy'. Adopting a dimensional approach to schizophrenia allows one to circumvent some of the problems inherent in studying schizophrenia patients. For example, schizophrenic patients are often medicated or in institutionalised states; under either of these conditions it is difficult to disentangle processes that are different due to the disease and those that are due to its treatment. The suggestion that the characteristics of schizophrenia can be considered to exist on a continuum, from extremely low levels to extremely high levels (that are manifested in people with schizophrenia as schizophrenic symptoms) allows comparisons to be made between healthy people that display these symptoms or characteristics to varying degrees.

A large number of schizotypy questionnaires have been developed, the majority of which are unidimensional (e.g., Schizophrenism Scale, Nielsen & Petersen, 1976; Psychoticism Scale, Eysenck, & Eysenck, 1975; Schizoidia Scale, Golden & Meehl, 1979; Schizotypal Personality Questionnaire, Raine, 1991; Schizotypal Personality Scale, Claridge & Broks, 1984; Magical Ideation Scale, Eckblad & Chapman, 1983; Launay-Slade Hallucination Scale, Launay & Slade, 1981; Delusions Symptoms States Inventory, Foulds & Bedford, 1975; Borderline Personality Scale, Claridge & Broks, 1984). However, the multi-dimensionality of schizophrenic symptomatology suggests that parallel research in schizotypy would benefit from taking a multi-dimensional approach to schizotypy characteristics. This approach would allow one to gain a more nuanced picture of the effects of schizotypy on a given experimental manipulation. The Oxford-Liverpool Inventory of Feelings and Experiences (O-Life, Mason, Claridge, & Jackson, 1995) has four dimensions that are intended to tap four distinct aspects of schizotypy. These four scales measure the propensity for unusual experiences (e.g., visual or auditory hallucinations), cognitive disorganisation (e.g., anxiety, disordered thought, and general attentional difficulties), introvertive anhedonia (e.g., the ability to experience pleasure through social activities) and impulsive nonconformity (e.g., reckless, rebellious aspects of schizotypy). Broadly speaking, the three symptom groups in schizophrenia can be aligned to the first three dimensions. That is, reality distortion (positive symptoms) in schizophrenia has been aligned with the unusual experiences dimension of the O-life schizotypy questionnaire, disorganisation in schizophrenia has been aligned with the cognitive disorganisation dimension, and psychomotor poverty (negative symptoms) has been aligned to the introvertive anhedonia dimension.

1.3: Attention

When a stimulus has been preexposed (i.e., simply repeatedly presented), the subsequent development of conditioned responding to that stimulus is retarded (Lubow & Moore, 1959). This effect, known as latent inhibition, is a robust and ubiquitous phenomenon that has been studied extensively both in its own right, and as a relatively simple behavioural assay of the process of filtering out irrelevant stimuli in schizophrenia (e.g. Lubow, 1989; Gray, J.A., Feldon, Rawlins, Hemsley, & Smith, 1991). Although the theoretical basis of latent inhibition remains a matter of some debate, for the present purposes, the exact nature of latent inhibition need not be an immediate concern (but see Section 1.3.2). Most, if not all, theories of latent inhibition are consistent with the suggestion that it reflects "the influences of stored memories of regularities of previous input on current perception" (cf. Hemsley, 1987, p. 182) that are considered deficient in schizophrenia.

1.3.1: Two characteristics of latent inhibition

There are two central features of latent inhibition: it is a function of the number of preexposures and it is disrupted by a change in context between the preexposure and test stages. Thus, as the number or amount of preexposure to a CS is increased, so the retardation in learning that is observed also increases (De la Casa, Ruiz & Lubow, 1993; for a review see Lubow, 1989). In fact, limited CS preexposure can result in latent facilitation - more rapid acquisition of conditioned responding - in both human participants (Burch, Hemsley, & Joseph, 2004) and rats (Bennett, Tremain, & Mackintosh, 1996). Human latent inhibition studies typically report statistically significant latent inhibition with between 10 and 30 preexposure trials, although as little as 6 preexposures can induce significant latent inhibition (Allan,Williams, Wellmann, Tonin, Taylor, Feldon, and Rawlins,1995).

Changing the context between the preexposure and test phases has consistently been found to reduce latent inhibition both in animals (e.g., Lubow, Rifkin & Alek, 1976; Channell & Hall, 1983; Hall & Minor, 1984; Lovibond, Preston & Mackintosh, 1984; Honey & Good, 1993, Westbrook, Jones, Bailey, & Harris, 2000) and in humans (e.g., Lubow et al., 1976; Zalstein-Orda & Lubow, 1995; Gray, Williams, Fernandez, Ruddle, Good & Snowden, 2001; Tsakanikos & Reed, 2004). Gray et al. (2001) found that a physical (Experiment 1) and a virtual (Experiment 2) context change between the preexposure and test phases abolished latent inhibition. The physical context change was operationalised by changing testing rooms between preexposure and test. The virtual context change took place in a virtual environment, with the preexposure phase of the latent inhibition task taking place in one virtual room and the participants were then moved to another virtual room for testing.

1.3.2: Theories of latent inhibition

Viewing latent inhibition as a consequence of a reduction in attention to the CS, which has been the main approach in the schizophrenia and schizotypy literature, has a theoretical precedent. It should be acknowledged, however, that existing theories of latent inhibition fall into three broad categories: attentional (Pearce & Hall, 1980; Lubow, Weiner, & Schnur, 1981; see also, McLaren, Kaye and Mackintosh, 1989), associative (e.g., Wagner, 1981) and interference (e.g., Bouton, 1993).

Attentional theories propose that during preexposure attention declines to the CS because it is followed by consistent consequences (Pearce & Hall, 1980) or predicts nothing

(Lubow et al., 1981). This decline in attention to the CS will then retard the rate at which learning involving that stimulus (e.g., during pairings of the CS with an unconditioned stimulus, US) will take place. According to this class of account, latent inhibition reflects an effect on learning and one that should directly reflect the amount of preexposure (cf. De la Casa & Lubow, 1996; De la Casa et al., 1993). However, these theories provide no grounds for supposing that latent inhibition will be context specific (e.g., Lubow et al, 1976; Channell & Hall, 1983; Gray et al., 2001). One way in which these theories could be modified to account for the context specificity of latent inhibition would be to suppose that it is the configuration of the preexposure context and the CS that suffers a decline in attention during preexposure. A change in context would result in a reduction in latent inhibition to the extent that the test context-plus-CS configuration differs from the preexposure context-plus-CS configuration.

There are other theories of CS processing that readily predict that latent inhibition will be context specific. For example, Wagner (1981) supposes that a CS will be fully processed to the extent that it is not predicted (see also McLaren et al., 1989, McLaren & Mackintosh, 2000). According to Wagner's analysis of latent inhibition, stimulus preexposure will allow an association to form between the preexposure context and the CS. This will mean that when the CS is again presented in the preexposure context it will be predicted (or primed) and thereby poorly processed and poorly learnt about. Of course, should the CS be presented in a different context it will no longer be predicted and it will, therefore, be fully processed and learnt about readily. Although this analysis predicts that latent inhibition will be context specific, it also predicts that latent inhibition will be undermined if participants received a period of context extinction placed between preexposure and conditioning. There is little support for this prediction (see Zalstein-Orda & Lubow, 1995; Hall & Minor 1984; but see Baker & Mercier, 1982).

The associative-interference theories (e.g., Bouton, 1993) regard latent inhibition as a consequence of a failure to retrieve or express the CS-US association formed during the test/acquisition stage due to interference from the CS-no event association formed during the preexposure stage. According to this view, the combined influence of the CS and context determines which associate of the CS (no event or US) is most readily retrieved (Bouton, 1993). Support for this account of latent inhibition can be derived from studies showing that if a single presentation of the US is given after CS-US pairings latent inhibition is attenuated (Kasprow, Catterson, Schachtman & Miller, 1984). Given the fact that this "reminder" treatment should not have directly influenced the CS-US association, it has been argued that the deficit in conditioned responding that would otherwise have been observed is a performance deficit as opposed to a learning deficit. Which of these three specific accounts of latent inhibition should be accepted is unclear and some have suggested that latent inhibition might be multiply determined (Pearce, 1997).

1.4: Latent inhibition in humans

The traditional and most widely used latent inhibition task in humans was developed by Ginton, Urca, and Lubow (1975). During preexposure the participants are required to listen to a list of 30 different nonsense syllables that is typically repeated 5 times. The participants are asked to pick a syllable and count how many times it is presented during this (preexposure) phase of the experiment. This syllable-counting requirement constitutes the masking task. During the presentation of the syllables, the CS (a white noise) is preexposed on 25 occasions superimposed on the recordings of the syllables. During the test phase, the participants are played the same recording of nonsense syllables as during preexposure, but now the task is to predict a counter increment on the basis of something that is presented during the recording. In fact, it is the white noise that predicts counter increments. The number of trials required to learn this relationship to a criterion is compared to a control group that has received no presentations of white noise until the test phase. Latent inhibition is evident when the trials taken to learn that the white noise predicts the counter increment is higher in the preexposed than in the nonpreexposed group.

This task produces reliable latent inhibition, but it has a number of drawbacks. First, between-subjects tasks often require a larger pool of participants than do within-subjects procedures and this fact represents a serious constraint given the limited number of participants that either have high levels of schizotypy or are diagnosed with schizophrenia and unmedicated. Although one study has modified the task so that it can be used within-subjects, the resulting latent inhibition effect was found to be very small (Gray, Snowden, Peoples, Hemsley, & Gray, 2003), possibly because there was substantial generalization between the novel and preexposed CSs. Second, the necessity of a masking task during preexposure for the induction of latent inhibition (see Lubow & Gewirtz, 1995) has served to cast doubt on whether the retardation in the development of conditioned responding reflects a genuine latent inhibition effect rather than some other effect whose origin might be quite different (e.g., negative priming; Graham & McLaren, 1998). In addition, the load of the masking task has itself been found to modulate the amount of subsequent latent inhibition observed (Braunstein-Bercovitz & Lubow, 1998; Braunstein-Bercovitz, Hen & Lubow, 2004). Braunstein-Bercovitz and collegues found normal latent inhibition in low schizotypy and reduced latent inhibition in high schizotypy when the masking task had a low load. However, when the masking task had a high load, the reverse pattern of results was found (i.e., reduced latent inhibition in low schizotypy and intact latent inhibition in high schizotypy). This pattern of results raises the issue of whether the influence of schizotypy is on the masking task rather than on the processes that underlie latent inhibition *per se*. Visual versions of this auditory latent inhibition task have also been developed (e.g., Braunstein-Bercovitz & Lubow, 1998;, Zalstein-Orda & Lubow, 1995; Braunstein-Bercovitz, 2000; Gray, Fernandez, Williams, Ruddle, & Snowden, 2002), but are subject to the same limitations. Clearly, the development of a within-subjects latent inhibition task that does not require a masking task would allow one to disentangle these potential influences and the research presented in Chapter 2 of this thesis is directed toward developing such a task.

Recently, a number of within-subjects latent inhibition tasks have been published (Gray et al., 2003; Lubow, Kaplan & De la Casa, 2001; De la Casa & Lubow, 2001; Myers, Oliver, Warren & Gluck, 2000; Swerdlow, Stephany, Wasserman, Talledo, Sharp & Auerbach, 2003; Escobar, Arcediano & Miller, 2003; Pineño, de la Casa, Lubow & Miller, 2006), but with the exception of one (Escobar et al., 2003) all of these tasks also included a masking task during preexposure. Escobar et al. (2003, Experiment 1) presented the participants with an intermixed sequence of 10 presentations of each of cues B and X during preexposure. The subsequent acquisition phase consisted of a single pairing of cue A with an outcome (a white cross), a single cue X→outcome pairing, and a single cue B alone presentation. During the preexposure and conditioning phases the participants were told to observe the stimulus presentations and then were asked to rate the degree to which they thought that the three cues (A, B, and X) predicted the appearance of the outcome. This procedure resulted in higher ratings for the novel/nonpreexposed cue A than for the other two cues, which were statistically indistinguishable from one another. In the following two experiments, Escobar et al. showed that the preexposure to cue X did not result in it passing a summation test (where it was combined with a cue that had independently signalled the outcome; Experiment 2) and that the effect of exposure to X was context specific (Experiment 3). While this task successfully induced unmasked latent inhibition, conditioned responding was measured at only one time point and this procedure is therefore unsuitable for studying the detailed course of acquisition of conditioned responding after stimulus preexposure (see Chapter 2). The only other report of unmasked latent inhibition in human adults comes from Nelson and Sanjuan (2006) who used a Star Trek-inspired task in which participants fired torpedoes at enemy spaceships by clicking the mouse. The CS was a sensor during which the participants were required to learn to suppress mouse clicking. Using this task Nelson and Sanjuan (2006) found significant latent inhibition that was context specific and displayed minimal transfer between conditioned stimuli. This task, however, is also between-subjects and it is unclear whether the general nature of this task would render it unsuitable for use with an abnormal population.

1.5: Latent inhibition as an animal model of schizophrenia

The disruption of latent inhibition by amphetamine administration has been proposed as an animal model of schizophrenia. Here the attenuation of latent inhibition induced by amphetamine is hypothesised to be a consequence of disruptions to selective attentional processes that are presumed to be dysfunctional in acute schizophrenia (Weiner, 1990, 2003; Lubow, 1989, 2005; Gray et al., 1991; Gray, 1998). Evidence cited in support of this model centres around the finding that in rats latent inhibition can be abolished by the dopamine agonists *d-* or *dl*-amphetamine (Solomon, Crider, Winkleman, Turi, Kamer, & Kaplan, 1981; Solomon & Stanton, 1982; Killcross & Robbins, 1993; Killcross, Dickinson, & Robbins, 1994; Weiner, Lubow, & Feldon, 1981; Weiner, Lubow, & Feldon, 1984, Weiner, Israeli-

Telerant, & Feldon, 1987; Weiner, Lubow, & Feldon, 1988) and reinstated or potentiated by dopamine antagonistic antipsychotics such as haloperidol (Christison, Atwater, Dunn, & Kilts, 1988; Feldon & Weiner, 1991; Weiner & Feldon, 1987; Weiner, Feldon & Katz, 1987) and alpha-flupenthixol (Killcross, Dickinson, & Robbins, 1994). These findings have been extended to humans where auditory latent inhibition has been abolished by single *d*-amphetamine doses of either 5.0 mg (N.S. Gray, Pickering, Hemsley, Dawling, & J.A. Gray, 1992; Kumari, Cotter, Mulligan, Checkley, N.S. Gray, Hemsley, Thornton, Corr, Toone, & J.A. Gray, 1999; Thornton, Dawe, Lee, Capstick, Corr, Cotter, Frangou, N.S. Gray, Russell, & J.A. Gray, 1996) or 10 mg (Salgado, Hetem, Vidal, Graeff, Danion, & Sandner, 2000). Surprisingly, Gray et al. (1992) did not find an effect of 10 mg amphetamine on latent inhibition whereas Salgado et al. (2000) found no effect of 5 mg amphetamine; but these inconsistencies may be due to procedural differences between the studies (see Salgado et al., 2000).

Single haloperidol doses of 0.5 mg and 1.0 mg have been found to potentiate visual latent inhibition, although the 1.0 mg dose did so only in people with high schizotypy scores (Williams, Wellman, Geaney, Feldon, Cowen, & Rawlins, 1997). The consistency of these findings is, however, challenged by the results reported by Williams and collegues who found that 0.5 mg of haloperidol had no effect on auditory latent inhibition (Williams, Wellman, Geaney, Cowen, Feldon, Rawlins, 1996) whereas 1.0 mg of haloperidol reduced auditory latent inhibition (Williams, Wellman, Geaney, Cowen, Feldon & Rawlins, 1998). Kumari et al. (1999) also reported reduced auditory latent inhibition after 5.0 mg of haloperidol administration but only in participants with low schizotypy scores whereas 2.0 mg haloperidol was not found to affect auditory latent inhibition.

Furthermore, the dopamine-related variations in latent inhibition reported in rats seems to result from changes in processing during conditioning and not preexposure (Joseph, Peters, & Gray, 1993; Weiner et al., 1988; for a review see Young, Moran, & Joseph, 2005). This is contrary to what one would expect if dopamine influenced the attentional process by which stimuli are tuned out – this process is supposed to take place during stimulus preexposure, not conditioning. More worrying still, amphetamine-induced attenuation of latent inhibition is related to changes in US processing (Killcross, Dickinson & Robbins, 1994), making it unlikely that dopamine affects latent inhibition directly. Instead, it seems that dopamine affects latent inhibition indirectly by increasing the functional effects of the US (Killcross et al., 1994) and that serotonin may be a more fruitful focus for processing changes that occur during preexposure (Killcross, Stanhope, Dourish & Piras, 1997; Barrett, Bell, Watson & King, 2004).

Finally, the latent inhibition-based animal model of acute schizophrenia predicts that latent inhibition will be attenuated in acute schizophrenia, a prediction that has received some support (e.g., Baruch, Hemsley and Gray, 1988a; N.S. Gray, Hemsley, & J.A. Gray, 1992). However, Williams et al. (1998) found latent inhibition is drug-naïve acute schizophrenia participants, but not in drug-treated acute participants, and N.S. Gray, Pilowsky, J.A. Gray and Kerwin (1995) found no differences in latent inhibition between drug-naïve schizophrenia patients and healthy controls although latent inhibition was found to correlate positively with length of illness. The latter result must, however, be interpreted with caution because of the absence of CS counterbalancing in this report. In addition, Swerdlow, Braff, Hartston, Perry, and Geyer (1996) failed to find an effect of acute schizophrenia on latent inhibition beyond a general slowing of learning in acute schizophrenia, using both a variation of the task developed by Ginton et al., (1975) as well as a novel easier-to-acquire task. In summary, the suggestion that reductions in latent inhibition are associated with acute schizophrenia is not persuasive although it may be noted in this respect that it is hard to disentangle all the various influences of extraneous factors such as motivation, institutionalised state and generalised cognitive impairment from the effect of schizopherenia itself on latent inhibition on the basis of the above studies.

1.6: Schizophrenia, schizotypy and latent inhibition

A number of studies have reported attenuated latent inhibition in schizophenia (e.g., Baruch, Hemsley & Gray, 1988b; N. S.Gray, Hemsley & J.A. Gray, 1992; N.S. Gray, Pilowsky, J. A. Gray, & Kerwin, 1995; Guterman, Josiassen, Bashore, Johnson, & Lubow, 1996; Rascle, Mazas, Vaiva, Tournant, Raybois, Goudemand, & Thomas, 2001; Serra, Jones, Toone, & Gray, 2001; Vaitl, Lipp, Bauer, Schüler, Stark, Zimmerman, & Kirsch, 2002) and high schizotypy (e.g., Baruch et al., 1988b; Burch et al., 2004; Allan et al., 1995; Höfer, Casa, Feldon, 1999; Braunstein-Bercovitz, 2000; Lubow, Ingberg-Sachs, Zalstein-Orda, & Gewirtz, 1992; Lipp, Siddle, & Arnold, 1994; Braunstein-Bercovitz & Lubow, 1998; Braunstein-Bercovitz, 2003; Braunstein-Bercovitz et al., 2004; Lubow & De la Casa, 2002; De la Casa, Ruiz & Lubow, 1993; Tsakanikos, Sverdrup-Thygeson, & Reed, 2003; Tsakanikos & Reed, 2004; Tsakanikos, 2004; Wuthrich & Bates, 2001; Gray, Fernandez, Williams, Ruddle & Snowden, 2002). Attenuated latent inhibition in acute schizophrenia and high schizotypy has most often been attributed to an inability to tune out experientially irrelevant stimuli (i.e., an attentional deficit; e.g., Gray, Fernandez, Williams, Ruddle, & Snowden, 2002; Lubow & Gewirtz, 1995; Lubow, 1989, 2005; Braunstein-Bercovitz et al., 2004; Braunstein-Bercovitz & Lubow, 1998). Moreover, this attentional deficit has been associated with positive schizophrenia symptoms (for review, see Gray et al, 1991; Gray, 1998) and the corresponding schizoptypy dimension (e.g., unusual experiences in the O-Life; Burch et al, 2004; Gray et al, 2003).

A substantial number of studies have been conducted on the effect of schizophrenia and schizotypy on latent inhibition. Detailed examination of these studies, however, reveals a number of serious limitations. For example, it is routinely assumed that if latent inhibition is reduced or abolished in acute schizophrenia or high schizotypy, it necessarily reflects an abnormal attentional process (wherein irrelevant stimuli are not successfully tuned out). However, the additional statistical analyses that would allow a claim of this character to be convincing are very rarely performed. Thus, if attenuated latent inhibition in acute schizophrenia and high schizotypy is a manifestation of an inability to tune out the preexposed stimulus, then conditioned responding to the preexposed stimulus would be expected to differ between the control and acute schizophrenia/high schizotypy groups, but there should be no accompanying between-group difference to the nonpreexposed stimulus. However, it important to note in this respect that the frequent presence of some degree of cognitive impairment in patients with schizophrenia (e.g., Keefe, Eesley, & Poe, 2005; Reichenberg, Weiser, Rapp, Rabinowitz, Caspi, Schmeidler, Knobler, Lubin, Nahon, Harvey, & Davidson, 2005) can make it difficult to disentangle if reduced latent inhibition in schizophrenia samples is a result of this cognitive impairment (manifested as inferior responding to the nonpreexposed stimulus) or an effect of the process that leads to latent inhibition (manifested in superior responding to the preexposed stimulus) and this therefore underscores the need for parallel studies in healthy participants whose levels of schizotypy differ.

Inspection of the literature reveals that the majority of studies investigating the effect of schizophrenia or schizotypy on latent inhibition did not statistically examine the locus of the latent inhibition differences found between low and high schizotypy (Baruch et al., 1988a;

Allan et al., 1995; Höfer et al., 1999; Lubow et al., 1992; Braunstein-Bercovitz & Lubow, 1998; Braunstein-Bercovitz, 2003; Braunstein-Bercovitz et al., 2004; Lubow & De la Casa, 2002; De al Casa et al., 1993; Burch et al., 2004; Tsakanikos et al., 2003; Tsakanikos & Reed, 2004; Tsakanikos, 2004; Lipp et al., 1994) or between healthy volunteers and patients with schizophrenia (Guterman et al., 1996; Cohen et al., 2004; Vaitl et al., 2002). Of those studies that did examine the locus of the effect, some reported them to be a result of changes in responding to the preexposed stimulus (Baruch et al., 1988b; Gray et al., 1995; Gray et al., 2002; Braunstein-Bercovitz, 2000), some to changes in responding to the nonpreexposed stimulus (Lipp et al., 1994; Kathmann, Recum, Haag, & Engel, 2000; Serra et al., 2001) and some to changes to both (Gray et al., 1992; Wuthrich et al., 2001).

Visual inspection of the Figures/Tables presented in the studies where the locus of the latent inhibition effect differences were not statistically investigated, suggests that most often the reported differences between low and high schizotypy (Baruch et al., 1988a; Lubow et al., 1992; Braunstein-Bercovitz & Lubow, 1998, Experiment 1; Braunstein-Bercovitz, 2003; Braunstein-Bercovitz et al., 2004; Lubow & De la Casa, 2002; Lubow et al., 2001; Burch et al., 2004; Tsakanikos et al., 2003. Experiment 1; Tsakanikos & Reed, 2004; Tsakanikos, 2004) and between healthy controls and patients with schizophrenia (Vaitl et al., 2002) were a result of changes in responding to both the nonpreexposed and to the preexposed stimuli. The rest of the studies indicate that the differences in latent inhibition result from changes in conditioned responding to the nonpreexposed (Rascle et al., 2001; in this study responding to the preexposed stimulus was not found to differ between the acute schizophrenia and healthy control groups, but no such analysis was conducted for nonpreexposed responding; see also Guterman et al., 1996) or to the preexposed stimuli (Allan et al., 1995; De al Casa et al., 1993; Tsakanikos et al., 2003. Experiment 2; Höfer et al., 1999; Braunstein-Bercovitz & Lubow, 1998, Experiment 2). Finally, a number of studies that did not find a difference in the magnitude of the latent inhibition effects nevertheless found that the schizophrenic patients were slower overall (Leumann, Feldon, Vollenweider, & Ludewig, 2002; Swerdlow et al., 1996; Swerdlow et al., 2003). Consequently, the results to date are, at best, equivocal with regards to pinpointing the source of latent inhibition differences between low and high schizotypy and between healthy and acute schizophrenia samples.

In summary, the variability of this literature in terms of the locus of the difference in latent inhibition between people with acute schizophrenia/high schizotypy and the respective control groups does not make a convincing case for latent inhibition as an adequate measure of the attentional deficit presumed to underlie many of the positive schizophrenia symptoms[1]. In Chapter 3, I further investigated the effect of schizotypy on latent inhibition using the within-subjects procedure developed in Chapter 2 with the aim of clarifying (some of) the reasons for the inconsistent results reported to date.

1.7: Learned irrelevance and schizophrenia

The vast majority of the studies reporting reduced latent inhibition in schizophrenia and high schizotypy have used either variations of the latent inhibition task developed by Ginton et al. (1975) or other latent inhibition tasks that all share the need for a masking task during preexposure. However, the frequent inclusion of a masking task during preexposure make the human latent inhibition tasks appear quite unlike animal latent inhibition tasks, where CS preexposure proceeds with no other explicit stimuli presented and with no response requirement. Another stimulus preexposure effect that is related to latent inhibition is learned irrelevance. Learned irrelevance refers to the retardation of conditioned responding after

[1] Since the completion of the research for this thesis a study has been published that investigated the effect of schizotypy on latent inhibition using the latent inhibition task that I report in Chapter 2 (Evans, Gray, & Snowden, 2007). This study will be considered in detail in Chapter 3.

uncorrelated CS and US preexposure (relative to CS preexposure or US preexposure; e.g., Mackintosh, 1973; Baker & Mackintosh, 1977; Matzel, Schachtman & Miller, 1988; Allen, Chelius, Masand, Gluck, Myers, & Schnirman, 2002). The source of learned irrelevance remain a contentious issue (for an overview see Bonardi & Ong, 2003). The primary issue of contention is whether learned irrelevance is a result of specifically learning that the CS and US are uncorrelated (Baker & Mackintosh, 1977; Baker & Mackintosh, 1979; Matzel et al., 1988; Bennett, Maldonado & Mackintosh, 1995; Bennett, Wills, Oakeshott & Mackintosh, 2000; Baker, Murphy & Mehta, 2003) or whether learned irrelevance simply reflects the sum of the CS and US preexposure effects (Bonardi & Hall, 1996; Bonardi & Ong, 2003). The fact that latent inhibition and learned irrelevance might not be reducible to the operation of the same (attentional or associative) mechanism, suggests that dissociations between the two might be observable, in spite of the fact that they both are manifested in a similar way.

To date latent inhibition has received much more attention in humans than learned irrelevance, but the majority of human learned irrelevance studies have used within-subjects designs (e.g., Orosz, Feldon, Gal, Simon, Cattapan-Ludewig, 2007; Young, Kumari, Mehrotra, Hemsley, Andrew, Sharma, Williams & Gray, 2005; Gal, Mendlovich, Bloch, Beitler, Levkovitz, Young, Feldon & Ratzoni, 2005; Myers, Oliver, Warren & Gluck, 2000, Experiment 3) and some have examined the influence of schizophrenia on learned irrelevance (Young, et al., 2005; Gal, et al., 2005). Young et al. (2005) and Gal et al. (2005) used the same RT-based learned irrelevance task which consisted of pressing a button whenever the letter 'X' was presented. On some of the trials 'X' was cued by a preexposed vowel (PE) and on some trials 'X' was cued by a novel consonant. Both Young et al. (2005, Experiment 2) and Gal et al. (2005) found significant learned irrelevance in their respective healthy control groups and Young et al. reported reversed learned irrelevance (i.e., faster responding to the preexposed CS than to the nonpreexposed CS) in acute schizophrenia while Gal et al. found abolished learned irrelevance (i.e., equal speed of responding to the preexposed and nonpreexposed stimuli) in acute schizophrenia. In addition, Young et al. (Experiment 1) found differential hippocampal formation activation in healthy participants engaged in the task during an fMRI scanning session. However, the consonant and vowel cues were not counter-balanced, that is, the vowels served as the preexposed cue and the consonants as the nonpreexposed cue in all participants. Furthermore, neither of these studies examined the locus of their effect differences between the acute schizophrenia and the respective control groups. Inspection of the relevant figures in both studies indicates that these differences are a result of changes in conditioned responding to the nonpreexposed stimuli and not to the preexposed stimuli. To date, to the best of my knowledge, no studies have been published examining the effect of schizotypy on learned irrelevance. Chapter 4 is concerned with developing and assessing a learned irrelevance procedure that is used in Chapter 5 to investigate attentional abnormalities in schizotypy.

1.8: Summary of rationale for current research

The current research was motivated by the inconsistencies in the literature regarding the influence of schizophrenia and particularly high schizotypy on latent inhibition. To recap, it has been claimed that some of the positive symptoms of schizophrenia reflects an inability to tune out irrelevant stimuli (e.g., Gray et al., 1991; Lubow, 1989). However, support for this suggestion from studies of latent inhibition (and learned irrelevance) in both patients with schizophrenia and participants with high schizotypy scores is less than compelling. In particular, the frequent absence of the relevant statistical analyses, inconsistent results and the methodological limitations of most of the research on this topic to date have made this claim unconvincing (see Sections 1.4 - 1.7). As a first step to investigating this issue, I attempted to develop a latent inhibition task that circumvented the limitations of earlier tasks (see Section 1.4; see also Section 2). The requirements for this novel latent inhibition task were that it should contain no explicit masking task, be within-subjects and yield continuous data of several time points using both correct responses and reaction times. Furthermore, in order to verify that the task did, indeed, measure unmasked latent inhibition, it was necessary to show that it was a function of the amount of CS preexposure as well as being context specific. Chapter 2 reports the results of the development and use of such a latent inhibition task and Chapter 3 examines the effect of variations in schizotypy on the same task. A further aim of this thesis was to examine the effect of schizotypy on learned irrelevance. Two studies have already found abnormal learned irrelevance in acute schizophrenia (but see Section 1.7 for a critique of these studies; Young et al., 2005; Gal et al., 2005), but none have examined the influence of schizotypy on learned irrelevance. In Chapter 4, I develop a learned irrelevance task and in Chapter 5 assess the influence of variations in schizotypy scores on performance in this task. In the final empirical chapter, Chapter 6, the influence of schizotypy on another task with an attentional component is assessed.

Chapter 2

2: Latent inhibition in humans as measured by a within-subjects task: Evaluation of a novel procedure.

If a CS is preexposed without consequence, then the acquisition of conditioned responding to that stimulus is retarded (e.g., Lubow & Moore, 1959). A number of theories have attempted to account for this latent inhibition effect by proposing that it reflects a decline in attention to the CS that occurs during preexposure (e.g., Pearce-Hall, 1980; Wagner, 1981) or a consequence of interference from the CS-noUS association learnt during preexposure (e.g., Bouton, 1993; Kraemer & Spear, 1992). The concern of this chapter is not to directly address whether latent inhibition is a learning or performance deficit, rather this chapter is concerned with the evaluation of a novel latent inhibition procedure that circumvents limitations of existing human latent inhibition tasks (e.g., the requirement of a masking task, e.g., Ginton et al., 1975; ceiling effects, Swerdlow et al., 2003; small latent inhibition effects, Gray et al., 2003; whether the task actually measures latent inhibition and not learned irrelevance, Lubow, Kaplan & De la Casa, 2001; De la Casa & Lubow, 2001; and inconsistency between latent inhibition measures, Swerdlow et al., 2003; Lubow & De la Casa, 2002; De la Casa & Lubow, 2001; that is, Swerdlow et al. (2003) found latent inhibition as measured by correct responses and not by reaction times whereas De la Casa and Lubow (2001) and Lubow and De la Casa (2002) found latent inhibition as measured by reaction times and not correct responses).

The experiments reported here were designed to address these limitations (listed above and discussed in Section 1.4) by developing a novel within-subjects task that measures latent inhibition as a function of more than one dependent measure and results in a large effect. This was accomplished by designing a latent inhibition task that yields both reaction time and correct response measures and then investigating the effects of variables known to modulate latent inhibition, such as the number of CS preexposures (e.g., De la Casa, Ruiz & Lubow, 1993; Allen et al, 1995; Tsakanikos, Sverdrup-Thygeson & Reed, 2003; Wheeler, Chang & Miller, 2003), delay between the task stages (Aguado, Symonds & Hall, 1994; Kraemer, Hoffmann & Spear, 1988; Kraemer & Spear, 1992; Kraemer & Roberts, 1984; Kraemer, Randall & Carbary, 1991; Killcross, Kiernan, Dwyer & Westbrook, 1998) and context change (Lubow et al., 1976; Channell & Hall, 1983; Hall & Minor, 1984; Lovibond et al., 1984; Honey & Good, 1993, Westbrook et al., 2000; Zalstein-Orda & Lubow, 1995; Gray et al., 2001; Tsakanikos & Reed, 2004).

The purpose of Experiment 1a was to verify that latent inhibition could be induced in student participants given 20 CS preexposures. Experiment 1b investigated the generality of the latent inhibition effect in a healthy community sample given 20 CS preexposures thereby establishing the usefulness of the current task for the potential use by others in different (clinical) populations. Experiment 2 reduced the number of CS preexposures to 10 and 5 because latent inhibition is known to be sensitive to the amount of CS preexposure and because this would allow the evaluation of the effect of schizotypy on latent inhibition at different levels of robustness in Chapter 3. In Experiment 3 an interruption between the task phases was inserted (with or without a 15 minute delay) in order to determine the robustness of latent inhibition in preparation for Experiment 4, where the context specificity of latent inhibition was examined by changing the physical context between the task phases.

2.1: Experiment 1

The current series of experiments attempted to demonstrate a latent inhibition effect using a within-subjects procedure. To this end, I explored a novel continuous latent inhibition task very loosely based on the learned irrelevance task of Young et al. (2005) and Gal et al. (2005). The task consisted of two phases (preexposure and test) with no explicit break between those phases. Capital letters were presented at the rate of 1 letter per second with no inter-stimulus interval. During the preexposure phase, the preexposed CS (PE CS; e.g., the letter 'H') and four filler items (the letters 'D','M','T' and 'V') were presented randomly. The filler items were included to "naturally" mask (Lubow & Gewirtz, 1995) the significance of the CS, but are distinct from an explicit masking task as both the filler items and the CS are part of the same task in the current procedure. In addition, the CS is presented centrally in the present task as opposed to peripherally as is the case in the various versions of the Ginton et al. (1975) task (e.g., Braunstein-Bercovitz & Lubow, 1998). During the test phase a novel CS (NPE CS; e.g., the letter 'S') was introduced as well as the event to be predicted (the letter 'X'). The two CSs both predicted the occurrence of the US in the test phase. The participants were given one set of instructions before the task began. They were requested to press the spacebar as fast as possible whenever 'X' was presented, while trying to work out one or more ways of predicting the occurrence of 'X'. Once they thought they knew when 'X' was about to occur, they were told to press the spacebar before 'X' was presented (i.e., when either or both of the CSs appeared). This would result in two dependent measures; reaction time and correct anticipatory responses. A small number of filler item-US pairings were included in the test phase to obscure the relatively simple relationship between the CSs and the US[2].

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[2] After the completion of the experiments in this thesis, a study was published that used a similar latent inhibition task (Evans, Gray, & Snowden, 2007).

The aim of Experiment 1a was to establish that a within-subjects latent inhibition effect can be induced and measured by a novel task without a masking task in a student sample given 20 CS preexposures. The size of the latent inhibition effect was evaluated on the basis of the *partial eta*^{2} effect size which corresponds, in interpretation, to R^2. A *partial eta*^{2} of .01, .06 and .15, constitute a small, medium and large effect, respectively (Keppel & Wickens, 2004). The primary concern of Experiment 1b was to replicate the results of Experiment 1a in a healthy community sample.

2.1.1: Method

Participants

Experiment 1a: Twenty-three university students (22 females, 1 male) took part in the experiment. These participants were primarily psychology undergraduate students who received course credit for participation. The remainder were other students who received £3 for their participation. The mean age was 19.39 years (standard deviation, *SD* = 1.70). The participants in Experiment 1a are referred to as group PE20. Experiment 1b: The community sample was an opportunity sample recruited via advertisements in the local community and consisted of 37 (25 females, 12 males) participants. The participants received £3 for their participation. The mean age was 30.27 years (*SD* = 10.96), and their mean IQ (as measured by the NART-R, see below) was 103.74 (*SD* = 10.51, range = 81-122).

Apparatus

The stimuli used in the latent inhibition task consisted of 7 upper case letters. The letters used for the two CSs were 'S' and 'H', and the US was the letter 'X'. The filler items were the letters 'D', 'M', 'V', and 'T'. The stimuli were presented in Superlab 2.0 (Cedrus

Corporation, San Pedro, CA) on a Fujitsu Siemens Amilo M7400 FB21 laptop. Each stimulus was black, measured 1.2 centimetres in height and was presented in the centre of an otherwise white screen. Each presentation lasted 1000 ms and there was no inter-stimulus interval. In addition, the participants in Experiment 1b were requested to read out the fifty words of the revised National Adult Reading Test (NART-R, Nelson & Willison, 1991). A measure of IQ was included in order to ensure that the community sample was within the normal population range of intelligence.

Procedure

For half of the participants 'S' served as the preexposed CS and 'H' as the nonpreexposed CS and for the remainder the nonpreexposed CS was 'S' and the preexposed CS was 'H'. The latent inhibition task consisted of two stages, preexposure and test, that were presented consecutively. That is, the inter-stimulus interval between the last stimulus in the preexposure phase and the first stimulus in the test phase was identical to that between the stimuli within the preexposure and test phases. The participants were given task instructions at the beginning of the task. The instructions were as follows: *In this task I want you to watch the sequence of letters. Your task is to try to predict when the letter 'X' is going to appear. If you think that you know when the 'X' will appear, then you can press the spacebar early in the sequence. Alternatively, press as quickly as you can when you see the 'X'. There may be more than one rule that predicts the 'X'. Please try to be as accurate as you can, but do not worry about the occasional error. If you understand your task and are ready to start, press the spacebar to begin.* After the participants had read these instructions, the experimenter reiterated the instructions stressing that if the participant knew that the 'X' would appear next on screen, they were allowed to press the spacebar *before* 'X' appeared. In the preexposure stage the filler stimuli as well as the preexposed CS were presented 20 times each and in a pseudo-random order, with the constraints that there were no consecutive presentations of same stimulus. In the test stage, the nonpreexposed CS was introduced and now the 'X' was always presented both after the nonpreexposed CS and after the preexposed CS. The nonpreexposed CS and the preexposed CS were both presented 16 times each in the test stage. The filler items were presented 54 times each. On 4 of the 54 presentations of each filler item the 'X' followed the filler stimulus. It was also the case that in the test phase that there were no consecutive presentations of the same stimulus. The stimuli were presented in a pseudo-random order with the constraints outlined above (see Appendix 1 for a schematic illustration of the task). The task lasted no more than 7 minutes. The only differences between Experiments 1a and 1b were that the participants in Experiment 1b were tested in their homes and after the completion of the latent inhibition task they then completed the NART-R.

2.1.2: Results and Discussion

Participants were excluded if they committed more than 10 errors of omission (i.e., they failed to respond when either 'S','H' or 'X' were presented) or more than 20 errors of commission (i.e., they responded when neither 'S', nor 'H' nor 'X' were presented) in order to ensure that the participants had paid attention to the task and had understood the instructions correctly. Two participants were excluded from Experiment 1a (undergraduate psychology students) and two participants were excluded from Experiment 1b (mean IQ 108.25; *SD* = 6.72) on the basis of these criteria. Table 1 shows the group assignments, mean ages and gender of the excluded participants as well as mean number of total errors of commission and omission both in the preexposure stage and for the whole task. The ages and genders of the final sample of participants are shown in Table 2.

Table 1. Experiments 1-4: The mean age, gender, mean number of total errors of commission and omission as well as mean number of errors of commission in the preexposure stage for the *excluded* participants in Experiments 1a, 1b, 2, 3 and 4. The associated standard deviations (*SD*) are listed in brackets.

Experimental group	Mean age	Female/male ratio	Mean total errors of commission	Mean total errors of omission	Mean errors of commission in PE phase
Experiment 1a:					
PE20	**20.5 (0.71)**	**2/0**	**20 (2.83)**	**15.5 (4.95)**	**0.5 (0.71)**
Experiment 1b:					
Community	**39.5 (3.54)**	**1/1**	**Both were disturbed during testing by telephone**		
Experiment 2:					
PE10	**-**	**0/0**	**-**	**-**	**-**
PE5	**20.5 (0.71)**	**2/0**	**Both failed to understand instructions**		
Experiment 3:					
INT	**19.67 (1.15)**	**3/0**	**19**	**11**	**0**
			Computer crashed during two testing sessions		
Delay	**18.86 (0.83)**	**7/0**	**18 (7.38)**	**16.2 (12.89)**	**0.57 (0.73)**
Experiment 4:					
Control	**20**	**1/0**	**21**	**4**	**1**
Change	**21 (3.61)**	**3/0**	**15.5 (10.61)**	**19 (21.21)**	**0.5 (0.71)**

Note: INT = interruption, Change = context change, PE = preexposure.

Table 2. Experiments 1-4: The mean ages, standard deviations, and gender ratios for the experimental groups in Experiments 1a, 1b, 2, 3, and 4.

Experimental group	Mean age	Female/male ratio
Experiment 1a:		
PE20	**19.29 (1.74)**	**20/1**
Experiment 1b:		
Community	**29.74 (11.02)**	**24/11**
Experiment 2:		
PE10	**19.58 (3.41)**	**39/9**
PE5	**20.05 (4.16)**	**49/8**
Experiment 3:		
INT	**19.45 (1)**	**14/6**
Delay	**19.1 (0.79)**	**16/4**
Experiment 4:		
Control	**19.9 (3.14)**	**18/2**
Change	**20.05 (3.66)**	**17/3**

Note: INT = interruption, Change = context change, PE = preexposure.

The 16 NPE and the 16 PE conditioning trials were split into four blocks of four trials. The number of correct anticipatory responses to each CS within each block were recorded along with the mean reaction time of the four trials in each block. Correct responses were defined as responses made during the presentation of either of the CSs. Reaction times could take values between -1000 milliseconds (indicating that the participant had responded at the onset of the CS) and +1000 milliseconds (indicating that the participant had responded at the very end of the US). Reaction times close to 0 indicated that the response was at the offset of the CS and the onset of the US. In addition, in order to reduce the variability of the data, ratio scores were calculated for correct anticipatory responses according to the following formula: nonpreexposed score / (nonpreexposed score + preexposed score). Consequently, the ratio scores varied between 0 and 1 with scores of 0.5 signifying no difference between responses to the nonpreexposed and preexposed stimuli (i.e., no latent inhibition) and with scores between 0.5 and 1 signifying increasing amounts of latent inhibition. Scores less than 0.5 signified more correct responding to preexposed compared to nonpreexposed stimuli (i.e., latent facilitation). Correspondence between these three measures of latent inhibition will serve to make the findings more convincing whereas inconsistency between the measures will make the results less compelling (cf. De la Casa & Lubow, 2001; Lubow & De la Casa, 2002; Swerdlow et al., 2003) although the latter may reflect a speed-accuracy trade-off.

Experiment 1a

Correct anticipatory responses

Figure 1 shows the mean number of correct reponses for the PE CS and the NPE CS. Inspection of Figure 1 indicates that correct anticipatory responding increased as conditioning progressed and that there was more correct anticipatory responding to the NPE CS than to the

PE CS in all four blocks. Analysis of variance (ANOVA) confirmed effects of exposure, $F(1, 20) = 13.20$, $MSE = 4.07$, $p < .01$, block, $F(3, 60) = 15.22$, $MSE = .9$, $p < .001$, and no interaction between these factors, $F(3, 60) = 1.87$, $MSE = .78$, $p = .14$. The fact that latent inhibition is evident during block 1 is a result of rapid learning within this block (see Panel B of Figure 2). None of the participants correctly anticipated the appearance of 'X' on either the first NPE or PE trial. The *partial eta*^{2} for exposure was .40, indicating a large latent inhibition effect. The ratio scores of Experiment 1a are presented in Section 2.2.2 for the purpose of comparison with the ratio scores found in Experiment 2.

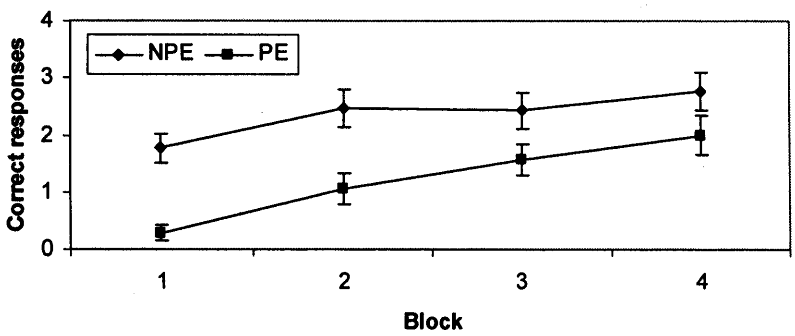


Figure 1. Experiment 1a: Mean number of correct anticipatory responses (±standard error of the mean; *SEM*) during the nonpreexposed CS (NPE) and the preexposed CS (PE) for the student sample given 20 CS preexposures.

Reaction times

The mean reaction times in the four blocks on the NPE and PE CS trials are shown in Panel A of Figure 2. Inspection of Panel A indicates that the reaction times became shorter as conditioning progressed, with faster reaction times on the NPE trials than on the PE trials in all four blocks. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi 2(5) = 13.67$, $p < .05$, and for the interaction between exposure and block, $\chi 2(5) =$

16.94, $p < .01$; therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .68$, and for the interaction between exposure and block, $\varepsilon = .68$. ANOVA confirmed that there were effects of exposure, $F(1, 20) = 16.79$, MSE = 191,262.99, $p < .01$, and block, $F(2.02, 40.48) = 16.81$, MSE = 43,390.42, $p < .001$, but no interaction between exposure and block, $F(2.03, 40.61) = 1.18$, MSE = 53,094.76, $p = .32$. Panel B of Figure 2 shows the reaction times on the 16 NPE and 16 PE trials. Inspection of Panel B confirms that the latent inhibition effect was not present on the first trial, $F(1, 20)$ = 2.47, MSE = 12236.95, $p = .13$. The *partial* eta^2 for exposure was .46, again indicating a large latent inhibition effect.

In summary, Experiment 1a showed that the novel within-subjects latent inhibition task was successful in inducing latent inhibition both in terms of correct anticipatory responses and reaction time. In addition, the size of the latent inhibition effect was large for both of these measures. Moreover, these results were all obtained without a masking task.

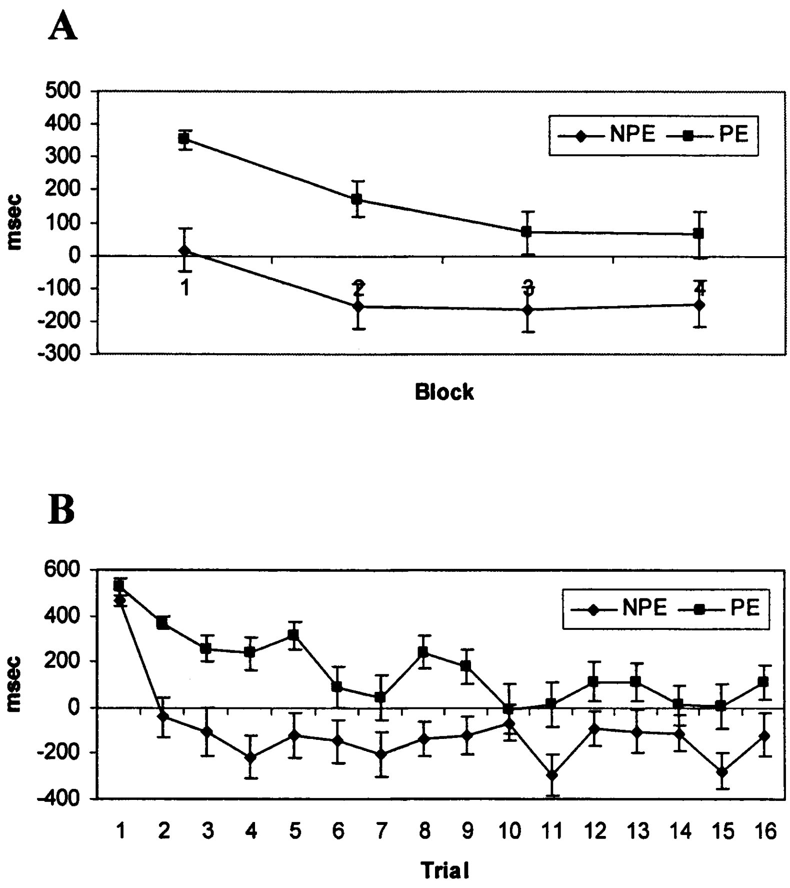


Figure 2. Experiment 1a: Panel A: The mean reaction times (±*SEM*) on the nonpreexposed (NPE) and preexposed (PE) trials across the four blocks for the student sample given 20 CS preexposures. Panel B: The mean reaction times (±*SEM*) on the nonpreexposed (NPE) and preexposed (PE) trials across the 16 trials for the student sample given 20 CS preexposures. A negative reaction time signifies that the response was made during the presentation of the CS.

Experiment 1b

Correct anticipatory responses

Figure 3 shows the mean numbers of correct reponses for the NPE and PE CSs. Although the difference appears to be smaller than in Experiment 1a, inspection of Figure 3 indicates more conditioned responding as conditioning progressed and more correct anticipatory responding to the NPE CS than to the PE CS. ANOVA confirmed that there were effects of exposure, $F(1, 34) = 8.44$, $MSE = 1.84$, $p < .01$, and block, $F(3, 102) = 13.86$, MSE

=.68, $p < .001$, but no interaction between these factors, $F(3, 102) = 1.50$, $MSE = .62$, $p = .22$.

The *partial* eta^2 for exposure was .20 indicating a large latent inhibition effect.

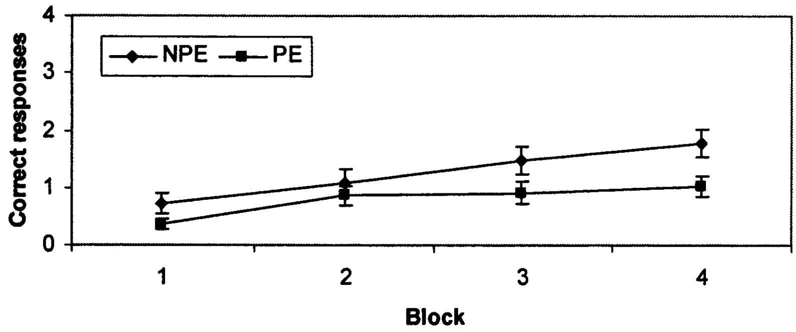


Figure 3. Experiment 1b: The mean number of correct anticipatory responses (±*SEM*) during the nonpreexposed CS (NPE) and the preexposed CS (PE) for the community sample given 20 CS preexposures.

Reaction times

The mean reaction times on the PE and NPE CS trials are shown in Figure 4. Although the difference appears smaller than in Experiment 1a, inspection of Figure 4 indicates reaction times that declined as conditioning progressed and shorter reaction times on the NPE than the PE trials. ANOVA confirmed effects of exposure, $F(1, 34) = 9.3$, $MSE = 104970.51$, $p < .01$, block, $F(3, 102) = 13.84$, $MSE = 32714.88$, $p < .001$, but no interaction between these factors, $F(3, 102) = .37$, $MSE = 36372.74$, $p = .78$. The *partial* eta^2 for exposure was .22, again indicating a large latent inhibition effect.

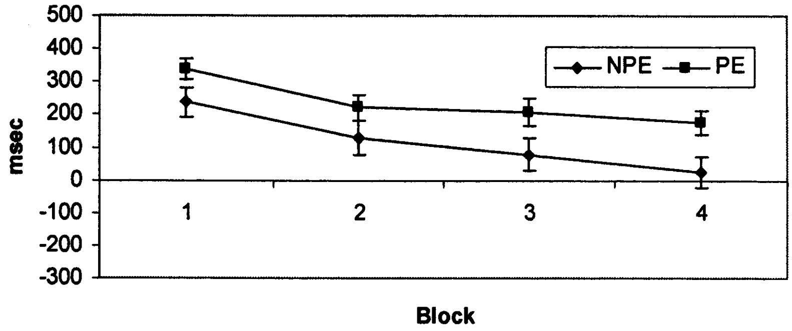


Figure 4. Experiment 1b: The mean reaction times (±*SEM*) on the nonpreexposed (NPE) CS and preexposed (PE) CS trials for the community sample given 20 CS preexposures. A negative reaction time signifies that the response was made during the presentation of the CS.

In summary, Experiment 1b replicated the results of Experiment 1a in a healthy community sample. In addition, the latent inhibition effect obtained was large both as measured by correct anticipatory responses and reaction time. The latent inhibition effect obtained in the community sample (Experiment 1b) appears to be smaller than the effect obtained in the student sample (Experiment 1a). These two samples differ in a number of ways that may influence the results, one of which is familiarity with psychological testing. Familiarity with psychological testing is likely to moderate the amount of anxiety that a participant experiences by simply taking part in a psychological experiment. The student sample (although the majority were tested during their first semester at university) are likely to be more familiar (and therefore experience less associated anxiety) with psychological testing than the community participants because the student participants would already have been introduced to the concept of psychological testing both through lectures and through the requirement of research participation that constitutes an inherent part of their psychology course. Elevated levels of anxiety in the community sample can explain why the latent inhibition effect seems to be smaller in this group of participants than in the student sample as high levels of anxiety have been found to be associated with reduced latent inhibition (Braunstein-Bercovitz, 2000). In this respect, it is, however, important to remember that the latent inhibition effects obtained in the community sample were still large.

2.2: Experiment 2

One of the hallmarks of latent inhibition is that it is a function of the amount of CS preexposure given (De la Casa et al., 1993; for a review see Lubow, 1989). However, a minimum amount of CS preexposure is necessary to induce measurable latent inhibition. Statistically significant latent inhibition is usually found after between 10-30 preexposures in human studies, although latent inhibition has also been reported after 6 preexposures (Allen et al., 1995). The primary concern of Experiment 2 was to establish that the current latent inhibition task is sensitive to the number of CS preexposures presented. As Experiments 1a and 1b established large and robust latent inhibition effects after 20 preexposures, Experiment 2 reduced the number of preexposures to 10 and 5 with the aim of reducing the difference between the preexposed and the nonpreexposed groups and to enable the effect of schizotypy on latent inhibition to be evaluated at different levels of latent inhibition in Chapter 3.

2.2.1: Method

Participants and apparatus

One-hundred and seven university students (90 females, 17 males) took part in the experiment. These participants were primarily psychology undergraduate students who received course credit for participation. The remainder were other students who received £3 for their participation. The mean age was 19.85 years (*SD* = 3.79). The apparatus was the same as in Experiment 1a.

Procedure

The procedure was the same as in Experiment 1a with the following exceptions: One group (PE5) received 5 CS preexposures and another group (PE10) received 10 CS preexposures. The number of each filler item in the preexposure stage matched the number of CS preexposures given; that is, each filler item was presented 5 times in the preexposure phase in group PE5 and 10 times in group PE10. The participants were randomly allocated to receive either 5 CS preexposures or 10 CS preexposures.

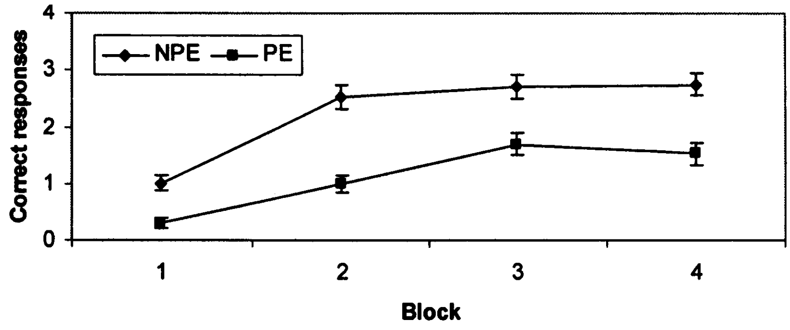
2.2.2: Results and Discussion

Two participants were excluded on the basis of criteria employed in Experiment 1. Table 1 shows the group assignments, mean ages and gender of the excluded participants. The ages and genders of the final sample of participants in the experimental groups are shown in Table 2. The student sample given 20 CS preexposures in Experiment 1a (group PE20) has been included in the analyses throughout this section to enable comparisons with Experiment 2. The groups did not differ in age, $F < 1$.

Correct anticipatory responses

Panels A and B of Figure 5 show the mean numbers of correct reponses to the NPE and PE CSs for the groups given 10 and 5 preexposures, respectively. Inspection of both panels indicates more overall correct responding as conditioning progressed, with more correct responding to the NPE CS than to the PE CS in both groups PE10 and PE5; although the difference between the exposure conditions appears to be less marked in group PE5 than in group PE10. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi^2(5) = 26.66, p < .001$; therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity, $\varepsilon = .86$. ANOVA revealed that there were effects of exposure, $F(1, 123) = 60.18$, $MSE = 2.46$, $p < .001$, block, $F(2.59, 318.61) = 85.93$, $MSE = 1$, $p < .001$, and preexposure number, $F(2, 123) = 4.5$, $MSE = 6.66$, $p < .05$. The interactions between block and preexposure number, $F(5.18, 318.61) = 1.97$, $MSE = 1$, $p = .08$, and between exposure and block, $F(3, 369) = 2.5$, $MSE = .65$, $p = .059$, approached significance, and the interactions between exposure and preexposure number, $F(2, 123) = 9.03$, $MSE = 2.46$, $p < .001$, and between exposure, block and preexposure number were significant, $F(6, 369) = 2.45$, $MSE = .65$, $p < .05$. The interaction between exposure, block and preexposure number reflected significant latent inhibition in blocks 1-4 in both group PE20 and group PE10, all *ps* < .05, and significant latent inhibition in block 1, $p < .05$, but not blocks 2-4, all *ps* > .2, in group PE5. Responding on the preexposed trials was not found to differ in any of the four blocks between the three groups, all p > .12, whereas responding on the nonpreexposed trials differed between group PE20 and PE10, $p < .01$, and between group PE20 and PE5, $p < .001$, but not between groups PE10 and PE5, $p = .09$, on block 1, and between groups PE10 and PE5, $p < 001$, and groups PE20 and PE5, $p < .01$, but not between groups PE10 and PE20, $p = .91$, on block 2. Responding on the nonpreexposed trials was also found to differ between groups PE5 and PE10, $p < .01$, but not between groups PE10 and PE20 or between groups PE5 and PE20, both *ps* > .08, on block 3, and between groups PE5 and PE20, $p < .01$, and between groups PE5 and PE10, $p < .001$, but not between groups PE10 and PE20, $p = .98$, on block 4. In group PE10 *Partial* eta^2 was .52 indicating a large effect size. In group PE5 *Partial* eta^2 was .07 indicating a medium effect size.

A



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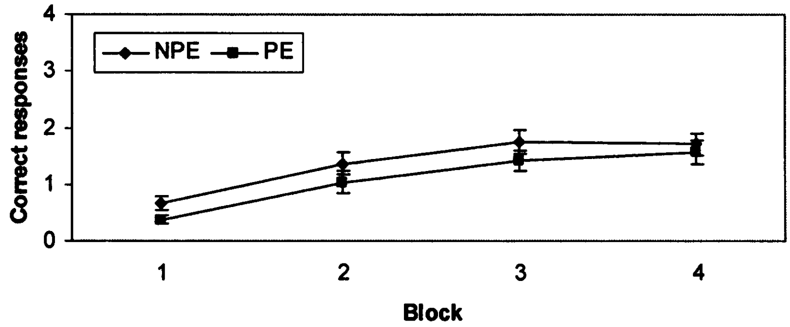


Figure 5. Experiment 2: Panel A: The mean number of correct anticipatory responses (±*SEM*) to the nonpreexposed CS (NPE) and the preexposed CS (PE) for group PE10. Panel B: The mean number of correct anticipatory responses to the nonpreexposed CS (NPE) and the preexposed CS (PE) for group PE5.

Correct anticipatory ratio responses

The mean ratios for the three groups given 20, 10 and 5 preexposures, respectively, are illustrated in Figure 6. Inspection of Figure 6 suggests that the latent inhibition ratios for groups PE20 and PE10 do not differ from each other, but that they both are higher than in group PE5. ANOVA confirmed that there were effects of preexposure number, $F(2, 123) = 7.17$, $MSE = .15$, $p < .01$, and block, $F(3, 369) = 5.58$, $MSE = .052$, $p < .01$, but no interaction between block and preexposure number, $F(6, 369) = 1.36$, $MSE = .052$, $p = .23$. Bonferroni adjusted pairwise comparisons showed that groups PE20 and PE10 did not differ from each other, $p = 1$, but they both differed from group PE5, all $ps < .05$. One sample t-tests performed on the ratios pooled over all four blocks confirmed that there was significant latent inhibition in groups PE20, $t(20)=3.45$, $p < .01$, and PE10, $t(47)=6.81$, $p < .001$, but not in group PE5, $t(56)=1.63$, $p = .11$. The absence of latent inhibition in group PE5 as measured by the ratio scores reflects the fact that these were pooled over all four blocks for the purposes of analysis of the basic effect and latent inhibition was only found in block 1 as measured by raw correct anticipatory responses.

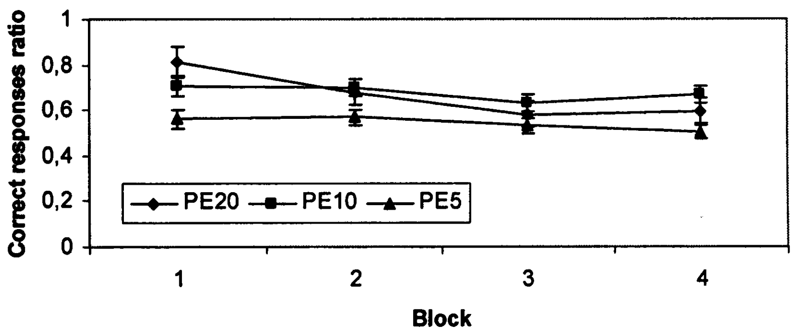


Figure 6. Experiment 2: The correct anticipatory ratio scores (±*SEM*) for the student samples given 20, 10 and 5 preexposures, respectively.

Reaction times

Panels A and B of Figure 7 show the mean reaction times on the NPE and PE CS trials for the groups given 10 and 5 preexposures, respectively. Inspection of both panels indicates that the reaction times became shorter as conditioning progressed with faster responding on NPE than on PE trials in both group PE10 and group PE5, although the difference in reaction times on NPE trials compared to PE CS trials appears to be less in group PE5 than in group PE10. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi_2(5) = 34.84$, $p < .001$, and for the interaction between exposure and block, $\chi_2(5) = 14.14$, $p <$

.05. Therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block , $\varepsilon = .83$, and for the interaction between exposure and block, $\varepsilon = .94$. ANOVA revealed effects of exposure, $F(1, 123) = 64.53$, $MSE = 115493.2$, $p < .001$, block, $F(2.49, 306.59) = 102.44$, $MSE = 42187.79$, $p < .001$, and preexposure number, $F(2, 123) = 3.55$, $MSE = 312625.24$, $p < .05$. The interaction between exposure and preexposure number was significant, $F(2, 123) = 8.7$, $MSE = 115493.2$, $p < .001$, and the interaction between block and preexposure number approached significance, $F(4.99, 306.59) = 2.07$, $MSE = 42187.79$, $p = .07$. The interactions between exposure and block, $F(2.8, 345.14) = 1.12$, $MSE = 37053.25$, $p = .34$, and between exposure, block and preexposure number, $F(5.61, 345.14) = 1.51$, $MSE = 37053.25$, $p = .18$, were not significant. Pairwise comparisons showed significant latent inhibition in groups PE20 and PE10, both *ps* < .001, as well as in group PE5, $p < .05$. Responding on the preexposed trials did not differ between any of the three groups, all *ps* > .85, whereas responding on the nonpreexposed trials did not differ between groups PE20 and PE10, $p = .5$, but both groups PE20 and PE10 differed from group PE5, both *ps* < .01. *Partial* eta^2 for group PE10 was .46 indicating a large effect size and *partial* eta^2 for group PE5 was .1 indicating a medium effect size.

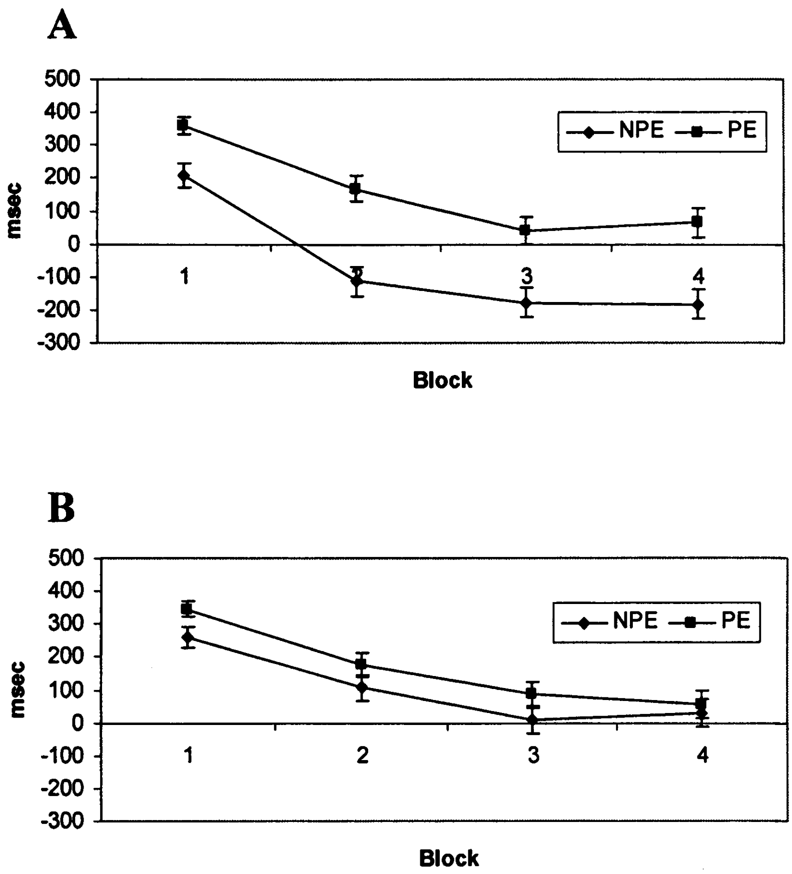


Figure 7. Experiment 2: Panel A: The mean reaction times (±*SEM*) on the nonpreexposed (NPE) CS and preexposed (PE) CS trials for group PE10. Panel B: The mean reaction times (±*SEM*) on the nonpreexposed (NPE) CS and the preexposed (PE) CS trials for group PE5. A negative reaction time signifies that the response was made during the presentation of the CS.

In summary, Experiment 2 showed that latent inhibition, as measured by the present novel within-subjects task, is a function of the number of CS preexposures. Latent inhibition was evident in all four blocks after 20 and 10 preexposures, but only in block 1 after 5 preexposures as measured by correct responses whereas latent inhibition was observed after 20, 10 and 5 CS preexposures as measured by reaction times. It was the case with both measures that the effect sizes were large after both 20 and 10 preexposures and of medium size after 5 CS preexposures. These results therefore indicate that the novel latent inhibition task used in the current experiments is sensitive to the amount of CS preexposure.

The finding that the difference in latent inhibition as a function of CS preexposure was due to differences in responding on the nonpreexposed trials between the groups needs to be addressed. The absence of differences in responding on the preexposed trials between the groups suggests that the effect of preexposure is maximal after 5 preexposures and further preexposures does not affect performance as evaluated by the current procedure. The differences in responding on the nonpreexposed trials between the groups, on the other hand, is likely to, at least partly, reflect the fact that the participants in group PE5 are less familiar with the task by the time the test stage commences than the participants in groups PE10 and PE20 as the participants in group PE5 have only been engaged in the task for 25% / 50% of the time that the participants in group PE20/PE10 have been engaged in the task by the time the test stage commences as the preexposure stage in group PE20 is four/two times as long as in group PE5. This differential familiarity during the early stages of the task may have subsequent knock-on effects on performance during the later stages of the task and explain why performance in group PE5 did not ever reach the performance levels of groups PE10 and PE20 during the 16 test trials.

2.3: Experiment 3

Sensitivity to the number of times the CS is preexposed represents one of the hallmarks of latent inhibition. Experiment 2 established that the current latent inhibition task fulfilled this criterion. A second hallmark of latent inhibition is its context dependence. However, as a prelude to investigating the context specificity of latent inhibition, I examined whether either an interruption or a delay in and of itself reduces latent inhibition. If they did, then it would be difficult to assess the context specificity of latent inhibition which also involves an interruption or delay.

Experiment 3 investigated the effects of interrupting the latent inhibition task between the preexposure and test stages and of imposing a 15-minute delay between the two task phases. In most of the latent inhibition research in humans to date, that have used between-subjects designs, interruptions have had to be imposed between the phases of the task. Indeed, in most cases the participants have been lead to believe they were taking part in two different tasks, not in two stages of the same task. However, despite the breaks between the stages of the task robust latent inhibition has consistently been reported with these human between-subjects tasks. Therefore it was expected that latent inhibition would still be evident after a brief break between the task phases. The group who experienced a 15-minute delay between the preexposure and test stages was included in order to examine the temporal robustness of the latent inhibition effect. In addition to being of theoretical interest (e.g., demonstrating that the effect does not reflect short-term letter adaptation), this would also be practically informative when conducting the planned context change experiment (Experiment 4) in terms of how much time to allow for the context change to take place.

2.3.1: Method

Participants and Apparatus

Fifty university students (40 females, 10 males) took part in the experiment. These participants were mainly psychology undergraduate students who received course credit for participation. The remainder were other students who received £3 for their participation. The mean age of the participants was 19.24 years (*SD* = .92). The apparatus was the same as that used in Experiment 1a.

Procedure

The procedure was the same as that used in Experiment 1a with the following exceptions: there were two experimental groups (interruption and delay) for each task, and in this experiment there was a break between the preexposure stage and the test stage in the latent inhibition task. When the preexposure stage had finished, the participants were given the following information: *There will now be a short interval before the task is resumed.* The participants in the 15-minute delay group then spent the 15-minute delay filling out the Oxford-Liverpool Inventory of Feelings and Experiences (O-LIFE) questionnaire (Mason et al., 1995). When the 15 minutes had elapsed, the experimenter collected the questionnaire regardless of whether or not the participants had completed it and the following instructions were displayed: *The task will now resume. Remember that you are required to try to predict when the letter X will appear, and recall that you may press the spacebar early in the sequence if you think you know when X will appear. Alternatively, press the spacebar as quickly as possible when you see X, and remember that there may be more than one rule that predicts the X. Don't worry about the occasional error, but do try to be as accurate as possible. Press the spacebar to resume the task.* These latter instructions were presented immediately after the former instructions for the interruption group. The participants were randomly assigned to either the interruption (group INT) or the delay (group DELAY) group.

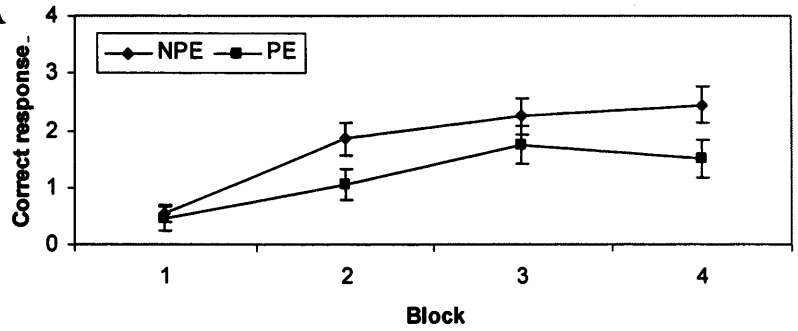
2.3.2: Results and Discussion

The same exclusion criteria were used as in Experiment 1. Ten participants were excluded on the basis of these criteria. It is not clear why there was a higher number of exclusions in this experiment than in Experiments 1a and 1b. In any event, Table 1 (in Section 2.1.2) shows the group assignments, mean ages and gender of the excluded participants as well as mean number of errors of commission and omission both in the preexposure and test phases along with all the associated standard deviations. The ages and genders of the final sample of participants in the experimental groups are shown in Table 2 (also in Section 2.1.2). The mean ages of the groups were not significantly different, $F(1, 38) = 1.51$, $MSE = .81$, $p = .23$.

Correct anticipatory raw responses

Panels A and B of Figure 8 show the mean numbers of correct reponses to the PE and NPE CSs for groups INT and DELAY, respectively. Inspection of both panels indicates more overall correct responding as conditioning progressed with more correct responding to the NPE CS than the PE CS. ANOVA confirmed that there were effects of exposure, $F(1, 38) = 12.31$, $MSE = 2.44$, $p < .01$, and block, $F(3, 144) = 37.78$, $MSE = 1.12$, $p < .001$. The main effect of group, $F < 1$, and the interactions between exposure and block, $F(3, 114) = 1.70$, $MSE = .62$, $p = .17$, exposure and group, block and group, and between exposure, block and group were not significant, all $Fs < 1$.

A



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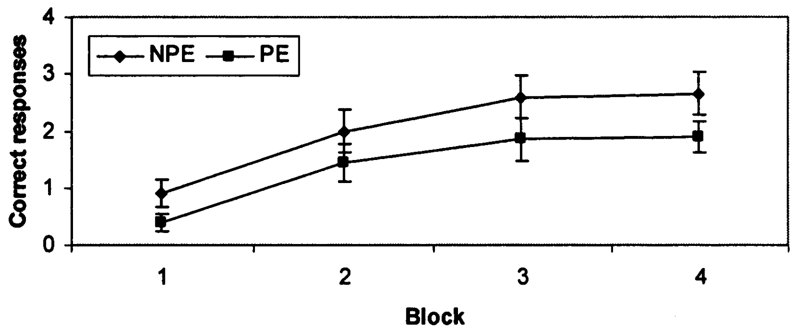


Figure 8. Experiment 3: Panel A: The mean number of correct anticipatory responses (±*SEM*) to the nonpreexposed CS (NPE) and the preexposed CS (PE) in group INT. Panel B: The mean number of correct anticipatory responses (±*SEM*) to the nonpreexposed CS (NPE) and the preexposed CS (PE) in group DELAY.

Correct anticipatory ratio responses

Figure 9 illustrates the mean ratios for groups PE20, INT and DELAY, respectively. For illustrative purposes the correct responses ratios for group PE20 (from Experiment 1a) were also included in Figure 9. Inspection of Figure 9 suggests that the correct response ratios for the three groups do not differ apart from in block 1 where more latent inhibition is evident in group PE20 than in groups INT and DELAY. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi 2(5) = 18.74$, $p < .01$. Therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block , $\varepsilon = .81$.

ANOVA revealed that neither of the main effects, both *Fs* < 1, nor the interaction, $F(2.42, 92.1) = 1.7$, $MSE = .06$, $p = .18$, were significant. One sample t-tests indicated significant latent inhibition in group INT, $t(19) = 2.45$, $p < .05$, but latent inhibition in group DELAY failed to reach significance in this analysis, $t(19) = 1.69$, $p = .11$.

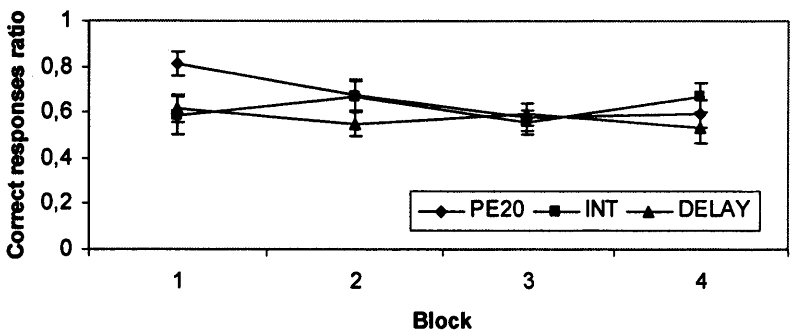


Figure 9. Experiment 3: The correct anticipatory ratio scores (±*SEM*) for groups PE20, INT and DELAY, respectively.

Reaction times

Panels A and B of Figure 10 show the mean reaction times on the PE and NPE CS trials for group INT and DELAY, respectively. Inspection of both panels indicates that the reaction times became shorter as training progressed with faster reaction times on the NPE CS trials than on the PE CS trials in both groups. ANOVA confirmed these observations, revealing effects of exposure, $F(1, 38) = 12.08$, $MSE = 117583.04$, $p < .01$, block, $F(3, 114) = 38.54$, $MSE = 48655.69$, $p < .001$, but no effect of group, $F < 1$. None of the interactions were significant (largest $F(3, 114) = 1.28$, $MSE = 26566.21$, $p = .29$).

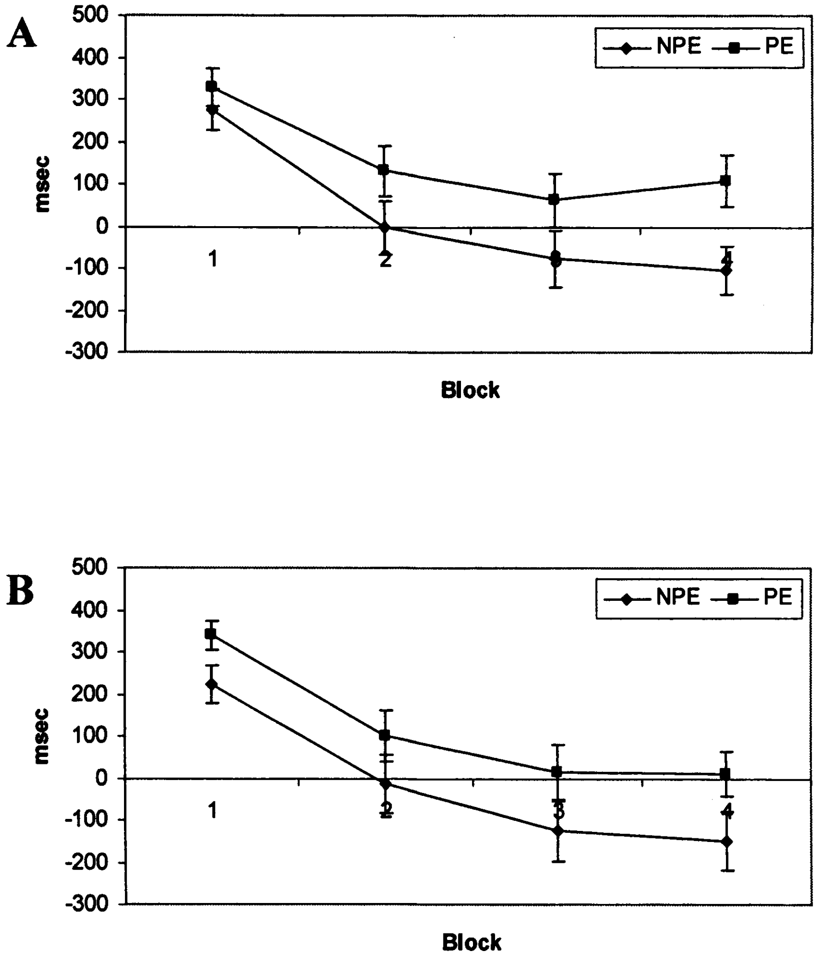


Figure 10. Experiment 3: Panel A: The mean reaction times (±*SEM*) on the nonpreexposed (NPE) CS and on the preexposed (PE) CS trials in group INT. Panel B: The mean reaction times (±*SEM*) on the nonpreexposed (NPE) CS and on the preexposed (PE) CS trials in group DELAY. A negative reaction time signifies that the response was made during the presentation of the CS.

Experiment 3 thus found significant latent inhibition after both an interruption and after a 15-minute delay as measured by both correct responses and reaction times. Experiment 4 proceeded to investigate whether a change of context between the preexposure and test phases would disrupt latent inhibition in this task.

2.4: Experiment 4

Experiment 4 was designed to establish if changing the context between the two test phases would abolish latent inhibition. The context specificity of latent inhibition is well-established (see Section 1.3.1), but it is notable that only one major theory of associative learning predicts this effect (namely Wagner's SOP model; Wagner, 1981). In Experiment 4 context was manipulated by using two different testing laboratories that varied in size and contents. Preexposing the participants in one laboratory and testing them in the other laboratory served to make the context change very marked.

2.4.1: Method

Participants and Apparatus

Thirty-nine female and five male university students took part in the experiment. These participants were mostly psychology undergraduate students who received course credit for participation, with the remainder being other students who received £3 for their participation. The mean age was 20.06 years (*SD* = 3.31). The apparatus was the same as that used in Experiment 1.

Procedure

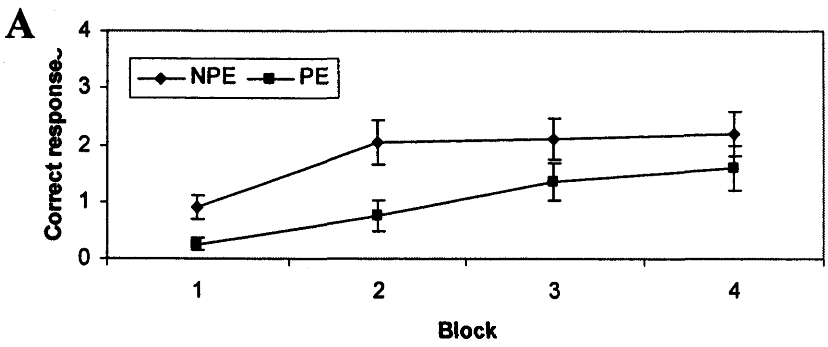
The procedure was the same as that used in Experiment 1a with the following exceptions: The context change was created using two laboratories (contexts A and B) situated adjacently on a corridor of six laboratories. Context A (2 by 3 metres) was slightly bigger than context B (2.5 by 2 metres). Context A contained two desks, two chairs, and a set of shelves with various vision science equipment. Context B contained two chairs and one desk with a stationary PC that was turned off. In addition, a number of computer screens were placed in one corner of context B on the floor. Half of the participants in the same context condition were preexposed and tested in context A, while the other half of those participants were preexposed and tested in context B. Half of the participants in the different context condition were preexposed in context A and tested in context B. The other half were preexposed in context B and tested in context A. For all of the participants the preexposure stage was terminated with the same instructions as those terminating the preexposure stage in Experiment 3. Immediately following those instructions, the participants were taken either to the other context (different context) or simply walked out of the preexposure context and back into it again (same context). The second set of instructions (the same as those resuming the test in Experiment 3) was then displayed on screen and the participants completed the test stage. The participants were randomly assigned to either the control (CONTROL) group or the context change (CHANGE) group.

2.4.2: Results and Discussion

Four participants were excluded using the same criteria as in Experiment 1a. Table 1 (see Section 2.1.2) shows the group assignments, mean ages and gender of the excluded participants as well as mean number of total errors of commission and omission both in the preexposure stage and overall along with all the associated standard deviations. The ages and genders of the final sample of participants in the experimental groups are shown in Table 2 (in Section 2.1.2). The mean ages of the groups were not significantly different, $F < 1$.

Correct anticipatory responses

Panels A and B of Figure 11 show the mean numbers of PE and NPE correct reponses for group CONTROL and CHANGE, respectively. Inspection of Panel A suggests more correct responding to the NPE CS than to the PE CS, especially in blocks 1 and 2, whereas inspection of Panel B indicates no difference in correct responding to the NPE and PE CSs in blocks 1, 2 and 4 in group CHANGE. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi^2(5) = 20.63, p < .01$; therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block , $\varepsilon = .80$. ANOVA showed that there were effects of exposure, $F(1, 38) = 14.70$, $MSE = 2.13$, $p < .001$, block, $F(2.40, 91.18) = 23.60$, $MSE = 1.25$, $p < .001$, but not of group, $F < 1$. None of the interactions were significant (largest $F(1, 38) = 1.51$, $MSE = 2.13$, $p = .23$). Consequently, with a full analysis of all four blocks of trials no evidence of an effect of context change on latent inhibition was found. However, as is illustrated in Figure 11, the effect of context change on latent inhibition appears to be evident primarily in blocks 1 and 2 and is not apparent on blocks 3 and 4. Therefore a second ANOVA was performed on the results from blocks 1 and 2. This revealed effects of exposure, $F(1, 38) = 14.82$, $MSE = 1.01$, $p < .001$, block, $F(1, 38) = 31.54$, $MSE = .79$, $p < .001$, but not of group, $F < 1$. The interaction between exposure and group was significant, $F(1, 38) = 5.19$, $MSE = 1.01$, $p < .05$, but the interactions between block and group, $F < 1$, exposure and block, $F(1, 38) = 1.95$, $MSE = .54$, $p = .17$, and between exposure, block and group, $F(1, 38) = 1.95$, $MSE = .54$, $p = .17$, were not significant. Bonferroni adjusted simple main effects tests showed that significant latent inhibition was found in both blocks 1 and 2 in the control group, both $ps < .01$, whereas no latent inhibition was evident in either of the two blocks in the context change group, both $ps > .17$.



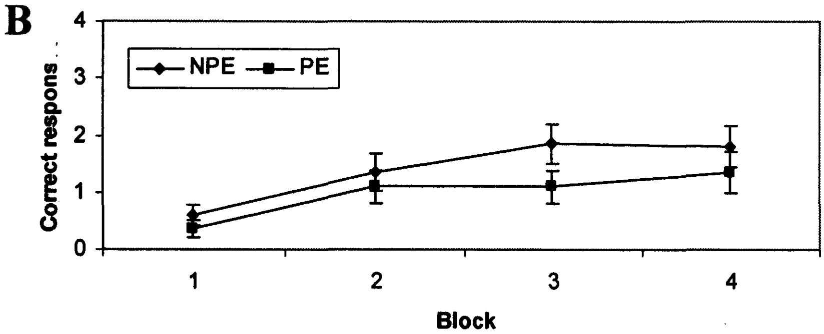


Figure 11. Experiment 4: Panel A: The mean number of correct anticipatory responses (±*SEM*) to the nonpreexposed CS (NPE) and the preexposed CS (PE) in group CONTROL. Panel B: The mean number of correct anticipatory responses (±*SEM*) to the nonpreexposed CS and the preexposed CS in group CHANGE.

Correct anticipatory ratio responses

The mean ratios for the control and context change groups, respectively, are illustrated in Figure 12. Inspection of Figure 12 suggests that the effect of a context change on the latent inhibition ratios is primarily evident in blocks 1 and 2 as the groups do not appear to differ in blocks 3 and 4. ANOVA revealed no effects of block or group, both $Fs < 1$, nor an interaction between block and group, $F(3, 114) = 1.41$, $MSE = .04$, $p = .24$. However, as the effect of context change appears to be evident only in blocks 1 and 2 an additional ANOVA was performed on the results from blocks 1 and 2, but revealed no effects of block, $F(1, 38) =$

1.59, $MSE = .05, p = .22$, or group, $F(1, 38) = 2.40$, $MSE = .11, p = .13$, nor an interaction between these factors, $F < 1$. In line with these results, one sample t-tests revealed significant latent inhibition in both the CONTROL, $t(19) = 3.23, p < .01$, and CHANGE, $t(19) = 2.35, p < .05$, groups. However, latent inhibition was only found in group CONTROL, $t(19) = 3.66, p < .01$, and not in group CHANGE, $t(19) = 1.39, p = .18$, when the analysis was confined to the results of blocks 1 and 2.

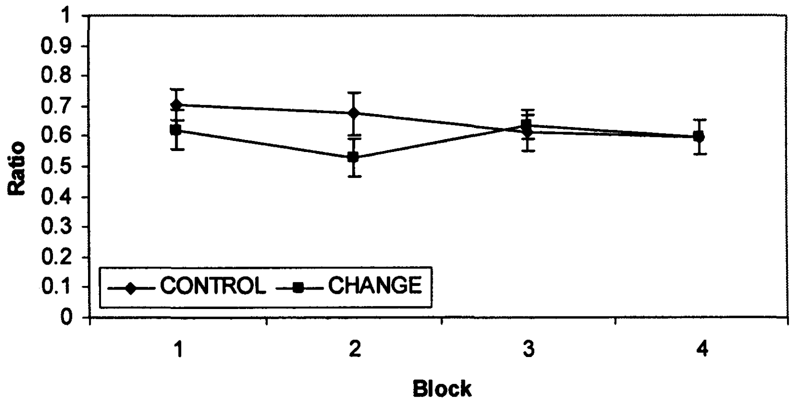


Figure 12. Experiment 4: The correct anticipatory response ratio scores (±*SEM*) for groups CONTROL and CHANGE.

Reaction times

Panels A and B of Figure 13 show the mean reaction times on the PE and NPE CS trials for group CONTROL and CHANGE, respectively. Inspection of Panel A suggests that the reaction times became shorter as training progressed with faster reaction times on the NPE CS trials than on thePE CS trials, especially in blocks 1 and 2. Inspection of Panel B indicates that the reaction times became shorter as training progressed with no difference in speed of responding on the NPE and PE CS trials in blocks 1 and 2. However, in blocks 3 and 4 reaction times on the NPE CS trials appeared to be faster than on the PE CS trials. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi^2(5) = 20.34$, $p < .01$. Therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block , $\varepsilon = .77$. ANOVA revealed effects of exposure, $F(1, 38) = 16.07$, $MSE = 87208.76$, $p < .001$, block, $F(2.30, 87.44) = 25.94$, $MSE = 59199.91$, $p < .001$, but not group, $F < 1$. The interaction between exposure and group was not significant although there was an apparent trend, $F(1, 38) = 3.89$, $MSE = 87208.76$, $p = .056$. The interactions between block and group, exposure and block, both $Fs < 1$, and between exposure, block and group, $F(3, 114) = 1.69$, $MSE = 28179.47$, $p = .17$, were not significant either. Inspection of Figure 13 suggests, as was the case above, that the effect of a context change on latent inhibition is primarily evident in the first two blocks. Consequently, a second set of analyses identical to those conducted above were calculated on the first two blocks. ANOVA revealed effects of exposure, $F(1, 38) = 11.57$, $MSE = 62713.35$, $p < .01$, block, $F(1, 38) = 33.67$, $MSE = 40758.73$, $p < .001$, but not group, $F < 1$. The interaction between exposure and group was significant, $F(1, 38) = 6.82$, $MSE = 62713.35$, $p < .05$, but the interactions between block and group, $F < 1$, exposure and block, $F(1, 38) = 2.95$, $MSE = 23781.39$, $p = .09$, and between exposure, block and group, $F < 1$, were not significant. Bonferroni adjusted simple main effects tests showed that in group CONTROL significant latent inhibition was evident in both blocks 1 and 2, all $ps < .01$, whereas in the group CHANGE no significant latent inhibition was found, all $ps > .54$.

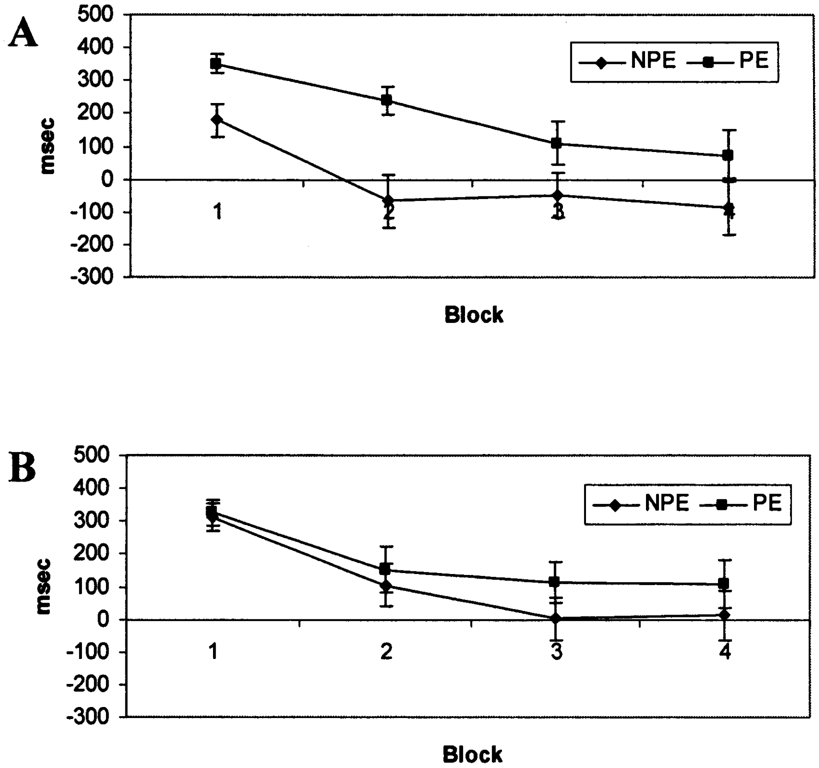


Figure 13. Experiment 4: Panel A: The mean reaction times (±*SEM*) on the nonpreexposed (NPE) CS and the preexposed (PE) CS trials in group CONTROL. Panel B: The mean reaction times (±*SEM*) on the nonpreexposed (NPE) CS and the preexposed (PE) CS trials in group CHANGE. A negative reaction time signifies that the response was made during the presentation of the CS.

In summary, Experiment 4 found reduced latent inhibition when the preexposure and test contexts differed using both correct anticipatory responses and reaction time measures (at least on the first two blocks of conditioning). The current task is sensitive to the second hallmark of latent inhibition which provides additional grounds for supposing that this novel task does indeed measure latent inhibition.

<u>2.5: General discussion</u>

The key findings of this series of experiments were as follows: Experiment 1a and 1b established large latent inhibition effects in both a student and healthy community sample. Experiment 2 found that latent inhibition, as measured by the current task, was a function of the number of CS preexposures. Experiment 3 found intact latent inhibition both after interrupting the task and after a delay between the task stages, and Experiment 4 found attenuated latent inhibition after a context change between the task stages. These effects were evident both as measured by correct anticipatory responses and reaction time. By contrast, other studies of within-subjects latent inhibition (e.g. Swerdlow et al., 2003; De la Casa & Lubow, 2001; Lubow & De la Casa, 2002b) have only found latent inhibition as a function of either trials to criterion/correct responses (Swerdlow et al., 2003) or reaction time (De la Casa & Lubow, 2001; Lubow & De la Casa, 2002). An advantage of using reaction time instead of trials to criterion, and in addition to correct anticipatory responses, concerns the absence of obvious ceiling effects in reaction time measures.

The results reported in Experiments 1-4 were all obtained without an explicit masking task. This is of interest because it provides additional grounds for considering human and animal latent inhibition to be similar. It is, however, notable that although no explicit masking task was used, the present latent inhibition task may be considered naturally masked due to the presence of the filler items (Lubow & Gerwirtz, 1995). The only other unmasked instrumental latent inhibition tasks (Escobar et al., 2003; Nelson & Sanjuan, 2006) to my knowledge also included filler items and may therefore also be regarded as naturally masked.

In the present latent inhibition task, the participants are told that they need to respond when the letter 'X' appears or when they think 'X' is about to appear. In the preexposure phase, no 'X's appear, thus none of the presented stimuli predict 'X' and these stimuli may therefore be regarded as predicting the absence of 'X'. This leaves open the possibility that the preexposed stimulus became a conditioned inhibitor of 'X' and that the task consequently measures conditioned inhibition rather than latent inhibition. Conditioned inhibition is most often assessed by summation and retardation tests (Rescorla, 1969) and while a latently inhibited stimulus passes the retardation test, it does not pass the summation test (e.g. Rescorla, 1971; Reiss & Wagner, 1972). Although I did not include a summation test in these experiments, there is some (albeit indirect) evidence presented in Chapters 4 and 5 in terms of dissociations between latent inhibition and learned irrelevance that suggests that it is unlikely that the current task induces conditioned and not latent inhibition.

In conclusion, in general the current latent inhibition task addresses a number of limitations that so far have hampered human latent inhibition research. The research reported in Chapter 3 takes advantage of the fact that schizotypy scores were available for the majority of participants in Experiments 1-4. This allowed me to examine the effect of schizotypy on this novel latent inhibition procedure.

Chapter 3

3: Latent inhibition and multi-dimensional schizotypy.

A substantial number of studies have reported attenuated latent inhibition in acute schizophrenia and high schizotypy (see Chapter 1). Acute schizophrenia is associated with florid positive symptomatology which, in turn, is associated with a hyperdopaminergic state. The reports of abolished latent inhibition after dopamine agonist administration and potentiated latent inhibition after dopamine antagonist administration have further served to suggest that the process which results in latent inhibition is deficient in acute schizophrenia (because of the dopamine imbalance of this disease state). Moreover, this deficit is assumed to be in an attentional process that filters out (experientially) irrelevant stimuli from awareness. However, as already mentioned in Chapter 1, both the acute schizophrenia patient-based literature and the pharmacologically-based literature are inconsistent and often methodologically and analytically limited.

Chapter 3 examined the effect of multi-dimensional schizotypy on latent inhibition by dividing the participants from Experiments 1-4 (in Chapter 2) into four groups. The four groups mirror the structure of this chapter. Experiment 5 examined the effect of schizotypy on latent inhibition after 20 CS preexposures. To this end all the conditions with 20 CS preexposures were combined with two exceptions: the control group in Experiment 4 (which was included in Experiment 8, see below), and the community participants in Experiment 1b (as no pre-test schizotypy data were available for them, see also below). Consequently, the data from the student participant group in Experiment 1a as well as the interruption and delay groups from Experiment 3 were analysed together in Experiment 5. Experiments 6 and 7 examined the effect of schizotypy on latent inhibition after 10 and 5 preexposures, respectively (i.e., using the participants from Experiment 2), and Experiment 8 investigated the effect of schizotypy on latent inhibition after a context change had taken place (by examining the effect of schizotypy on the data obtained in Experiment 4).

It was the case for all the experiments reported in this chapter that the schizotypy data were primarily obtained from a customary general pre-test session that the majority of psychology first-year undergraduate students complete within their first week at Cardiff university. The 3-6 months test-retest reliability of the O-Life is high with correlations ranging between .93 and .77 for the four scales (Burch, Steel & Hemsley, 1998) and since the majority of the participants were tested within their first semester at university (where the general pre-test session also took place), the reliability of the pre-test scores was considered to be adequate for the purposes of the following analyses.

3.1: Experiment 5

Experiment 5 investigated the effect of multi-dimensional schizotypy on latent inhibition after 20 CS preexposures. As outlined in Chapter 1, the symptom group most often found to affect latent inhibition is the positive symptoms. The corresponding schizotypy dimension, unusual experiences, has also been reported to be the primary schizotypy dimension of the O-life schizotypy dimensions that influences latent inhibition (Gray et al., 2003; see also Burch et al., 2004). A very recent paper by Evans, Gray and Snowden (2007) investigated the effect of multi-dimensional schizotypy on latent inhibition by employing an almost identical latent inhibition task to the present task. The minor differences between the Evans et al. task and mine relate to the smaller number of filler item presentations during preexposure in the Evans et al. task (15 versus 20 presentations for each filler items in my task) and to the number of trials that are reported in the test phase in the Evans et al. task (10 NPE/PE CS-US pairings versus 16 NPE/PE-US pairings in my task). Evans et al. gave their participants 20 CS preexposures and using regression analyses found a marginally significant negative relationship between unusual experiences and total reaction time to the preexposed CS (p = .08), indicating more rapid responding to the preexposed CS in high compared to low schizotypy as well as a marginally significant positive relationship between total number of correct responses to the preexposed CS and unusual experiences (p = .1). It was therefore expected that the relevant schizotypy dimension to latent inhibition in Experiment 5 would be the unusual experiences dimension. If the hypothesised attenuation of latent inhibition is found in high (unusual experiences) schizotypy, the analyses will extend to the examination of the source of the effect by comparing responding to the preexposed CS between the low and high schizotypy groups as well as comparing responding to the nonpreexposed CS between the low and high groups.

3.1.1: Results

Descriptive schizotypy statistics

Not all of the first-year undergraduate students completed the pre-test sessions that provided the majority of the schizotypy data for the current experiments, therefore schizotypy data was not available for all the participants from Experiments 1-4. Schizotypy data were available for 18 out of a possible 21 participants (18/21) from the student group given 20 preexposures (Experiment 1a), 12/20 participants in the interruption group (Experiment 3), and for 20/20 participants in the delay group (Experiment 3). A mixed three-way ANOVA with group (PE20, INT and DELAY) as the between-subjects factor and exposure (NPE, PE) and block (1-4) as the within-subjects factors confirmed that these three groups did not differ (all $ps > .08$), therefore the three groups were combined into one group for the purposes of

Experiment 5. Tables 3 and 4 show the means, standard deviations (*SD*) and inter-correlations of the schizotypy scales for the 50 participants from whom schizotypy data were available (mean age = 19.2 (*SD* = 1.31), 43 females, 7 males). In addition, Tables 3 and 4 include the corresponding norms reported by Mason et al. (1995) for comparison. Mason et al. provided the standard deviations and not the standard errors of the means for their participants. For ease of comparison, the standard deviations found in the current study are therefore listed instead of the standard error of the means. Inspection of Table 3 indicates that, in general, the schizotypy scores of the current sample are lower than the norms. This is especially the case for the unusual experiences scale. Inspection of Table 4 indicates that the inter-relationships found between the scales in the present study are, broadly speaking, in accordance with those reported by Mason et al. (1995), although fewer of the correlations in the present study were significant compared to Mason et al.

Table 3. Experiment 5: The means and standard deviations (*SD*) for the schizotypy dimensions from the current study (centre column) and the norms reported in Mason et al. (1995; right column).

Schizotypy dimension	Schizotypy mean (*SD*) N=50	Norm mean (Mason et al. 1995)
Full scale	32.88 (11.26)	not calculated
Unusual experiences	6.84 (5.48)	11.5 (6.9)
Cognitive disorganisation	12.54 (4.79)	13.4 (5.3)
Introvertive anhedonia	4.78 (3.46)	5.0 (4.5)
Impulsive nonconformity	8.72 (3.31)	9.7 (4.1)

Note: Mason et al. (1995) provided 5 different norms: 1) overall (females and males, N = 508), 2) males between 16-25 years (N = 76), 3) females between 16-25 years (N = 175), 4) males above 25 years (N = 143), and 5) females above 25 years (N = 114). The norms included in this table are those from group 3), i.e. females between 16-25 years as the vast majority of this sample were females between the ages of 16 and 25 years.

Table 4. Experiment 5: The inter-correlations between the schizotypy scales from the present study (four left-hand data columns) and the correlations reported by Mason et al. (1995; four right-hand columns)

	This study (N=50)			Mason et al. (1995)		
	CD	IA	IN	CD	IA	IN
Unusual experiences (UE)	**.39***	**-.04**	**.19**	**.42***	**-.08**	**.46***
Cognitive disorganisation (CD)		**.44***	**.25**		**.25***	**.33***
Introvertive anhedonia (IA)			**.12**			**-.1***
Impulsive nonconformity (IN)						

*Significant (*p* < .05 or less)

Inferential statistics and sampling

The participants were split into two groups (LOW, HIGH) on the basis of their schizotypy score. However, given the reduced variation of the present schizotypy scores (i.e., the lower means) as compared to Mason et al. (1995), a simple median split would not have ensured that the high group did indeed consist of participants with a high schizotypy score (a proportion of those in the high group would have scores in the region of the norm means instead). Consequently, the groups were formed on the basis of the most extreme scores obtained. The 10 participants with the most extreme scores were selected from each extreme and assigned to the LOW and HIGH groups. However, the cut-off occurred after the score of the 10th most extreme scoring participant, so in order to avoid losing participants with equally extreme scores, the participants scoring the same as the 10^{th} most extreme participant were also included in the relevant (LOW, HIGH) extreme group. This sometimes resulted in groups with more than 10 participants. For example, if 8 participants were found to score 16 or above on the cognitive disorganisation subscale and 4 participants scored 15, then all 12 participants scoring 15 or above were included in the HIGH group. This grouping method is clearly dependent on sample size, with a larger sample size being more likely to contain a relatively larger number of extreme scores than a smaller sample size. This therefore means that the cut-off scores used in the experiments in this chapter (and in Chapter 5) may vary between experiments with different sample sizes. The current sample was divided into LOW/HIGH groups for each subscale on the basis of the relevant schizotypy score, in order to investigate which schizotypy dimension primarily affected latent inhibition. Correlational analyses of the current data would have entailed a large number of comparisons due to the number of blocks within each experiment and given the already substantial number of analyses contained in this thesis, that was considered undesirable. More importantly, the data were analysed in terms of

LOW/HIGH groups because a relationship between variations in schizotypy and latent inhibition is most likely to be revealed in the most extreme scoring participants, especially given the restricted range of schizotypy scores in the present experiments.

Full scale schizotypy: Groups

The 10 participants scoring 24 or below on the full schizotypy scale were assigned to the LOW group and the 10 participants scoring 40 or above on the full schizotypy scale were assigned to the HIGH group. The mean schizotypy score in the LOW group was 19 (SD = 4.88) and the mean score in the HIGH group was 50.5 (SD = 6.74). The LOW and HIGH groups did not differ in age, $F < 1$.

Full scale schizotypy: Correct responses

Panel A of Figure 14 illustrates the mean number of correct responses to the NPE (denoted by triangles) and the PE (denoted by squares) CS for the participants in the LOW (full lines) and HIGH (dotted lines) schizotypy groups. Inspection of Panel A indicates more correct responding as conditioning progressed with greater correct responding to the NPE CS than to the PE CS for both the LOW and HIGH schizotypy groups. There is some indication of more latent inhibition in block 1 in the HIGH than in the LOW group. ANOVA confirmed effects of exposure, $F(1, 18) = 21.97$, $MSE = 3.14$, $p < .001$, and block, $F(3, 54) = 21.02$, $MSE = .88$, $p < .001$. However, there was no effect of schizotypy group and no interaction between any of the factors (largest $F(3, 54) = 1.64$, $MSE = .65$, $p = .19$).

Full scale schizotypy: Correct responses ratio

Panel B of Figure 14 illustrates the mean number of correct responses ratios for the participants in the LOW and HIGH groups. Inspection of Panel B indicates no difference in latent inhibition ratios between the LOW and HIGH group apart from in block 1 where there appears to be, if anything, more latent inhibition in HIGH than in LOW schizotypy. ANOVA did not find any differences in latent inhibition between the LOW and HIGH groups, all *Fs* < 1. One-sample t-tests confirmed latent inhibition in both the LOW, $t(9) = 3.13$, $p < .05$, and the HIGH schizotypy groups, $t(9) = 2.84$, $p < .05$.

Full scale schizotypy: Reaction times

Panel C of Figure 14 illustrates the mean reaction times on the NPE CS and the PE CS trials across the four conditioning blocks for the participants in the LOW and HIGH groups. Inspection of Panel C indicates that the reaction times became faster as conditioning progressed with faster responding on the NPE CS trials than on the PE CS trials. The amount of latent inhibition in the LOW and HIGH groups did not appear to differ apart from in block 1 where, if anything, there was more latent inhibition in the HIGH than in the LOW group. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi_2(5) = 11.16$, $p < .05$. Therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .73$. ANOVA confirmed effects of exposure, $F(1, 18) = 23.36$, $MSE = 136294.62$, $p < .001$, and block, $F(2.1, 37.83) = 22.53$, $MSE = 48001.26$, $p < .001$. There was no effect of schizotypy group and no interactions between the factors (largest $F(2.1, 37.83) = 1.77$, $MSE = 48001.26$, $p = .18$).

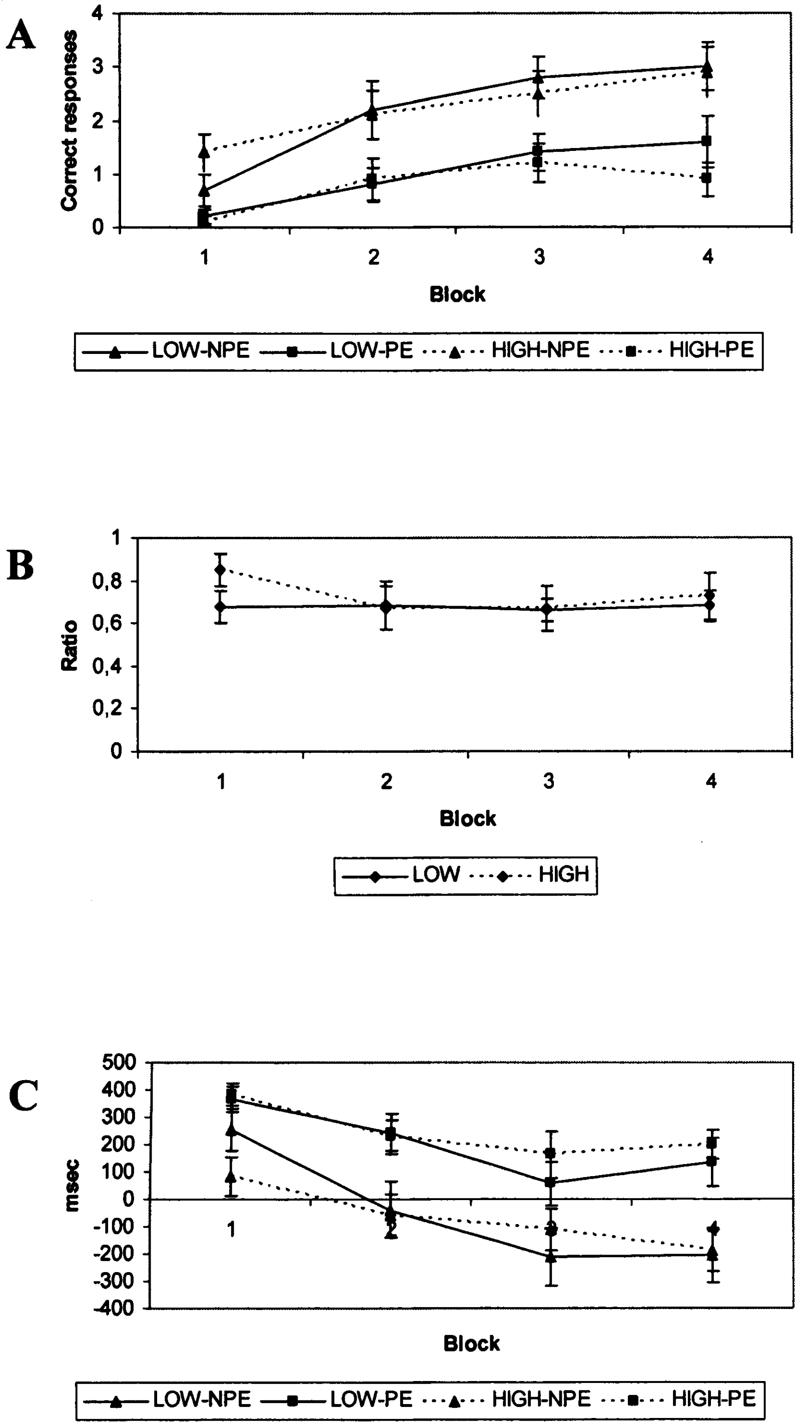


Figure 14. Experiment 5; Panel A: The mean number of correct responses (±*SEM*) to the nonpreexposed (NPE) and the preexposed (PE) stimuli in each block for the participants in the LOW (0-24, N = 10) and HIGH (40+, N = 10) full scale schizotypy groups. Panel B: The correct response ratios (±*SEM*) in each block for the participants in the LOW and HIGH full scale schizotypy groups. Panel C: The mean reaction times (±*SEM*) on the nonpreexposed CS and preexposed CS trials in each block for the participants in the LOW and HIGH full schizotypy scale groups.

Unusual experiences: Groups

The 12 participants scoring 2 or below on the unusual experiences subscale were assigned to the LOW group and the 10 participants scoring 12 or above on the unusual experiences subscale were assigned to the HIGH group. The mean schizotypy score in the LOW group was 1.42 (SD = .90) and the mean score in the HIGH group was 16 (SD = 2.94). The LOW and HIGH groups did not differ in age, $F(1, 20) = 1.29$, $MSE = 3.06$, $p = .27$.

Unusual Experiences: Correct responses

Panel 1A of Figure 15 illustrates the mean number of correct responses to the NPE and the PE CSs for the participants in the LOW and HIGH unusual experiences groups. Inspection of Panel 1A indicates more correct responding as conditioning progressed and more correct responding to the NPE than to the PE CS for both the LOW and HIGH unusual experiences groups. There were no clear differences in latent inhibition between the LOW and HIGH groups. ANOVA revealed effects of exposure, $F(1, 20) = 36.48$, $MSE = 2.49$, $p < .001$, and block, $F(3, 60) = 17.26$, $MSE = 1.18$, $p < .001$, but neither the effect of unusual experiences group nor any of the interactions were significant (largest $F(3, 60) = 1.59$, $MSE = .63$, $p = .2$).

Unusual Experiences: Correct responses ratio

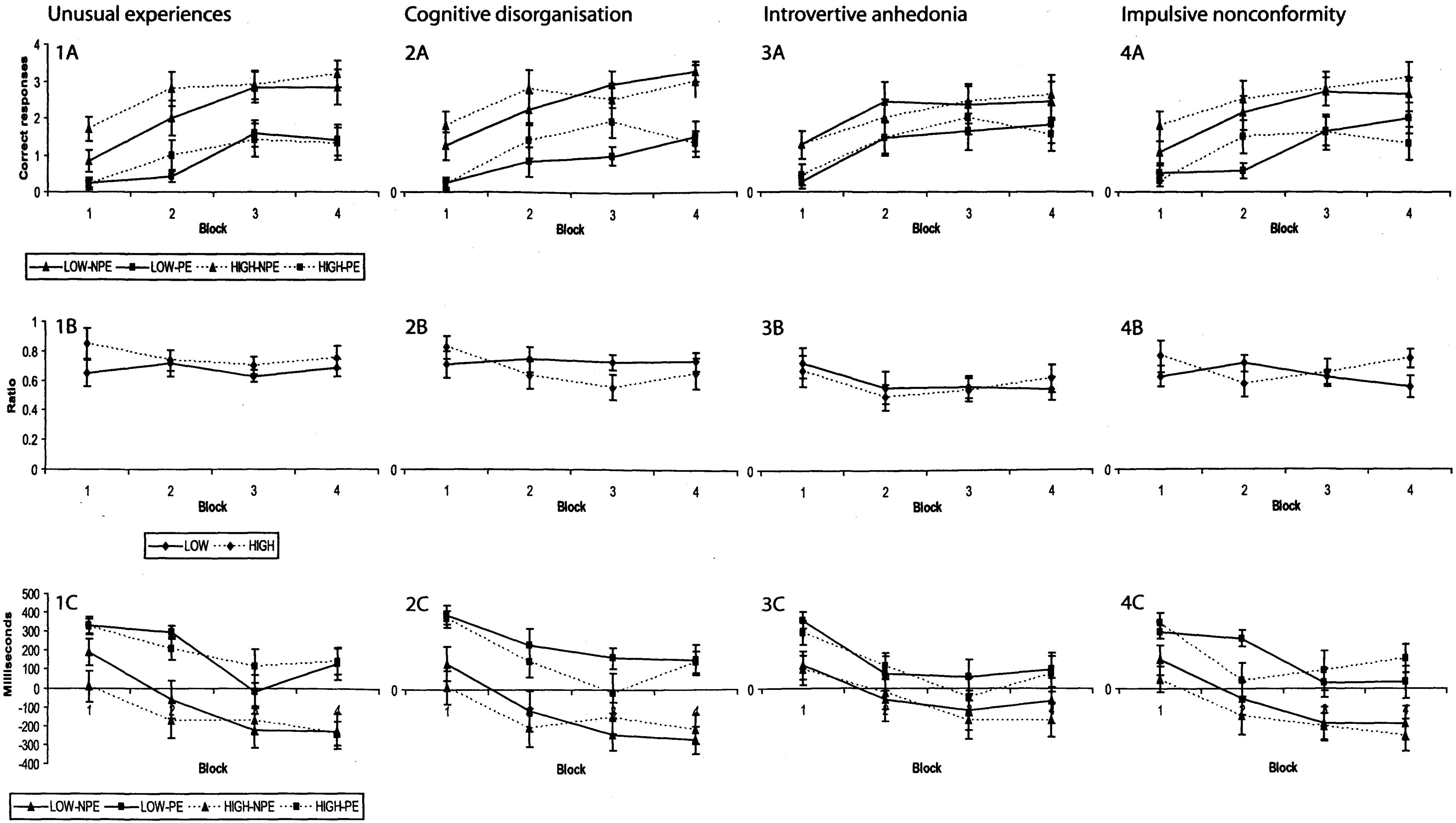
Panel 1B of Figure 15 illustrates the mean number of correct responses ratios for the participants in the LOW and HIGH groups. Inspection of Panel 1B indicates no difference in latent inhibition ratios between the LOW and HIGH group apart from in block 1 where more latent inhibition seems to be evident in HIGH unusual experiences. ANOVA did not find any differences in latent inhibition between the LOW and HIGH groups (largest $F(1, 20) = 1.5$, *MSE* = .12, $p = .23$). One-sample t-tests confirmed that there was latent inhibition in both the LOW, $t(11) = 3.43$, $p < .01$, and the HIGH unusual experiences groups, $t(9) = 4.59$, $p < .01$.

Unusual Experiences: Reaction times

Panel 1C of Figure 15 illustrates the mean reaction times on the NPE CS trials and the PE CS trials for the participants in the LOW and HIGH unusual experiences groups. Inspection of Panel 1C indicates shorter reaction times as conditioning progressed and faster responding on the NPE CS trials than on the PE CS trials. The amount of latent inhibition in the LOW and HIGH groups did not appear to differ apart from in block 1 where there appeared to be more latent inhibition in the HIGH than in the LOW unusual experiences group. ANOVA confirmed that there were effects of exposure, $F(1, 20) = 28.83$, *MSE* = 140722.69, $p < .001$, and block, $F(3, 60) = 17.7$, *MSE* = 43493.89, $p < .001$, but not unusual experiences, $F < 1$. The interaction between exposure and block approached significance, $F(3, 60) = 2.56$, *MSE* = 13605.24, $p = .064$. None of the remaining interactions were significant, (largest $F(3, 60) = 2.06$, *MSE* = 43493.89, $p = .12$).

Cognitive disorganisation: Groups

The 12 participants scoring 8 or below on the cognitive disorganisation subscale were assigned to the LOW group and the 10 participants scoring 18 or above on the cognitive disorganisation subscale were assigned to the HIGH group. The mean schizotypy score in the LOW group was 6.33 (*SD* = 1.44) and the mean score in the HIGH group was 19.2 (*SD* = 1.23). The LOW and HIGH groups did not differ in age, $F(1, 20) = 1.08$, *MSE* = 2.73, $p = .32$.



Unusual experiences
Cognitive disorganisation
Introvertive anhedonia
Impulsive nonconformity
1A
2A
3A
4A
Correct responses
Block
LOW-NPE
LOW-PE
HIGH-NPE
HIGH-PE
1B
2B
3B
4B
Ratio
Block
LOW
HIGH
1C
2C
3C
4C
Milliseconds
Block
LOW-NPE
LOW-PE
HIGH-NPE
HIGH-PE

Figure 15. Experiment 5: The twelve panels 1A-4C are organised into the three rows (A, B and C) that show the mean (±*SEM*) correct responses to the nonpreexposed (NPE) and preexposed (PE) CS, mean ratios (±*SEM*), and mean reaction times (±*SEM*) on the NPE CS trials and PE CS trials for the LOW and HIGH schizotypy groups that were given 20 preexposures, respectively; and into four columns that illustrate the results of the low (0-2, N = 12) and high (12+, N = 10) unusual experiences, the low (0-8, N = 12) and high (18+, N = 10) cognitive disorganisation, the low (0-1, N = 11) and high (8+, N = 11) introvertive anhedonia, and the low (0-6, N = 14) and high (12+, N = 10) impulsive nonconformity groups, respectively.

Cognitive disorganisation: Correct responses

Panel 2A of Figure 15 illustrates the mean number of correct responses to the NPE and PE CSs for the participants in the LOW and HIGH cognitive disorganisation groups. Inspection of Panel 2A indicates greater correct responding as conditioning progressed and more correct responding to the NPE than to the PE CS for both the LOW and HIGH cognitive disorganisation groups, but no clear differences in latent inhibition between the LOW and HIGH groups were apparent apart from in block 1 where there was more latent inhibition in the HIGH than LOW group. ANOVA confirmed that there were effects of exposure, $F(1, 20) = 29.89$, $MSE = 2.96$, $p < .001$, and block, $F(3, 60) = 15.16$, $MSE = 1.1$, $p < .001$, but not of cognitive disorganisation group, $F < 1$. No two-way interactions were found (largest $F(3, 60) = 1.04$, $MSE = 1.1$, $p = .38$), but the interaction between block, exposure and cognitive disorganisation approached significance, $F(3, 60) = 2.43$, $MSE = .08$, $p = .074$.

Cognitive disorganisation: Correct responses ratios

Panel 2B of Figure 15 illustrates the mean number of correct response ratios for the participants in the LOW and HIGH cognitive disorganisation groups. Inspection of Panel 2B indicates no difference in latent inhibition between the HIGH and LOW groups apart from in block 3 where more latent inhibition appears to be present in the LOW than in the HIGH cognitive disorganisation group. ANOVA revealed no group differences in latent inhibition (largest $F(3, 60) = 1.95$, $MSE = .04$, $p = .13$). One sample t-tests confirmed significant latent inhibition in both the LOW, $t(11) = 4.31$, $p < .01$, and HIGH cognitive disorganisation groups, $t(9) = 2.46$, $p < .05$.

Cognitive disorganisation: Reaction times

Panel 2C of Figure 15 illustrates the mean reaction times on the NPE CS trials and PE CS trials for the participants in the LOW and HIGH cognitive disorganisation groups. Inspection of Panel 2C suggests shorter reaction times as the course of conditioning proceeded and faster responding on the NPE CS trials than on the PE CS trials. The HIGH and LOW cognitive disorganisation groups do not appear to differ markedly. ANOVA confirmed that there were effects of exposure, $F(1, 20) = 30.76$, $MSE = 154473.27$, $p < .001$, and block, $F(3, 60) = 18.66$, $MSE = 41364.1$, $p < .001$. There was no effect of cognitive disorganisation, no two-way interactions, all $Fs < 1$, and no three-way interaction between exposure, block and cognitive disorganisation, $F(3, 60) = 1.93$, $MSE = 36788.7$, $p = .13$.

Introvertive anhedonia: Groups

The 11 participants scoring 1 or below on the introvertive anhedonia subscale were assigned to the LOW group and the 11 participants scoring 8 or above on the introvertive anhedonia subscale were assigned to the HIGH group. The mean schizotypy score in the LOW group was .45 ($SD = .52$) and the mean score in the HIGH group was 9.73 ($SD = 1.68$). The LOW and HIGH groups did not differ in age, $F(1, 20) = 1.69$, $MSE = .67$, $p = .21$.

Introvertive anhedonia: Correct responses

Panel 3A of Figure 15 illustrates the mean number of correct responses to the NPE and PE CSs for the participants in the LOW and HIGH introvertive anhedonia groups. Inspection of Panel 3A suggests increased performance as conditioning progressed and more correct responding to the nonpreexposed than to the preexposed CS in both LOW and HIGH groups, but with no clear differences in latent inhibition between the LOW and HIGH groups. ANOVA confirmed effects of exposure, $F(1, 20) = 8.36$, $MSE = 3.23$, $p < .01$, and block, $F(3, 60) = 15.94$, $MSE = 1.05$, $p < .001$, but no effect of introvertive anhedonia and no interactions, all $Fs < 1$.

Introvertive anhedonia: Correct responses ratios

Panel 3B of Figure 15 illustrates the mean number of correct responses ratios for the participants in the LOW and HIGH groups. Inspection of Panel 3B does not indicate that there are any differences between the LOW and HIGH groups. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi^2(5) = 13.64$, $p < .05$. Therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .67$. ANOVA revealed no effects of block, $F(2.02, 40.31) = 2.48$, $MSE = .07$, $p = .1$, or introvertive anhedonia, and no interaction between the factors, both $Fs < 1$. One sample t-tests indicated no significant latent inhibition in either the LOW, $t(10) = 1.34$, $p = .21$, or the HIGH introvertive anhedonia group, $t(10) = 1.29$, $p = .23$.

Introvertive anhedonia: Reaction times

Panel 3C of Figure 15 illustrates the mean reaction times on the NPE CS trials and PE CS trials for the participants in the LOW and HIGH introvertive anhedonia groups. Inspection of Panel 3C indicates increasingly faster reaction times as conditioning progressed and faster responding on the NPE CS trials than on the PE CS trials in both the LOW and HIGH introvertive anhedonia groups, but no differences in latent inhibition between the two groups are apparent. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi^2(5) = 13.79$, $p < .05$. Therefore the degrees of freedom were corrected using

Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .66$. ANOVA revealed effects of exposure, $F(1, 20) = 9.29$, $MSE = 151313.76$, $p < .01$, and block, $F(1.98, 39.61) = 16.53$, $MSE = 63758.08$, $p < .001$, but not of introvertive anhedonia, nor any interactions between the factors, all $Fs < 1$.

Impulsive nonconformity: Groups

The 14 participants scoring 6 or below on the impulsive nonconformity subscale were assigned to the LOW group and the 10 participants scoring 12 or above on the impulsive nonconformity subscale were assigned to the HIGH group. The mean schizotypy score in the LOW group was 4.86 ($SD = 1.35$) and the mean score in the HIGH group was 13.4 ($SD = 1.84$). The LOW and HIGH groups did not differ in age, $F(1, 22) = 4.16$, $MSE = .61$, $p = .054$, although the analysis approached significance. However, as the mean age in the LOW group was 18.64 ($SD = .63$) years and the mean age in the HIGH group was 19.3 ($SD = .95$) years, this was considered an unfortunate anomaly that, however, did not constitute a major concern.

Impulsive nonconformity: Correct responses

Panel 4A of Figure 15 illustrates the mean number of correct responses to the NPE and PE CSs for the participants in the LOW and HIGH impulsive nonconformity groups. Inspection of Panel 4C indicates increasing levels of correct responding as conditioning progressed and more correct responding to the NPE than to the PE CS in both the LOW and HIGH impulsive nonconformity groups. However, less latent inhibition seemed apparent in blocks 1 and 4 in the LOW than in the HIGH group and there appeared to be more latent inhibition in the LOW than in the HIGH group in block 2. ANOVA confirmed that there were effects of exposure, $F(1, 22) = 18.72$, $MSE = 3.41$ $p < .001$, and block, $F(3, 66) = 14.54$, $MSE = 1.23$, $p < .001$. There was no effect of impulsive nonconformity and no two-way interactions (largest $F(3, 66) = 1.06$, $MSE = 1.23$, $p = .37$), but there was a three-way interaction between exposure, block and impulsive nonconformity, $F(3, 66) = 3.21$, $MSE = .57$, $p < .05$, which reflected latent inhibition in the LOW group in blocks 2 and 3, both *ps* < .05, but not in blocks 1 and 4, both *ps* > .12, and latent inhibition in the HIGH group in blocks 1, 3 and 4, all *ps* < .05, but not in block 2, $p = .06$.

Impulsive nonconformity: Correct responses ratios

Panel 4B of Figure 15 illustrates the mean number of correct responses ratios for the participants in the LOW and HIGH groups. Inspection of Panel 4B suggests more latent inhibition in the HIGH than in the LOW group in block 4. ANOVA revealed no effects of block or impulsive nonconformity, both *Fs* < 1. There was, however, an interaction between block and impulsive nonconformity, $F(3, 66) = 4.83$, $MSE = .03$, $p < .01$. Bonferroni adjusted pairwise comparisons showed that the impulsive nonconformity groups did not differ in any of blocks 1-3, all *ps* > .16. In block 4, the difference between the groups approached significance, $p = .073$. One sample t-tests confirmed significant latent inhibition in both the LOW impulsive nonconformity group, $t(13) = 2.62$, $p < .05$, and the HIGH impulsive nonconformity group, $t(9) = 2.57$, $p < .05$.

Impulsive nonconformity: Reaction times

Panel 4C of Figure 15 illustrates the mean reaction times on the NPE CS trials and PE CS trials for the participants in the LOW and HIGH impulsive nonconformity groups. Inspection of Panel 4C indicates shorter reaction times as conditioning proceeded and faster responding on the NPE CS than on the PE CS trials in both the LOW and HIGH impulsive nonconformity groups. More latent inhibition was evident in the HIGH than in the LOW group in blocks 1 and 4, whereas there seemed to be more latent inhibition in block 2 in the

LOW than in the HIGH group. ANOVA revealed effects of exposure, $F(1, 22) = 18.51$, $MSE = 171943.08$, $p < .001$, and block, $F(3, 66) = 17.94$, $MSE = 43841.43$, $p < .001$, but not of impulsive nonconformity, $F < 1$. There were no interactions between exposure and block, exposure and impulsive nonconformity, both $Fs < 1$, block and impulsive nonconformity, $F(3, 66) = 2.02$, $MSE = 43841.43$, $p = .12$, or between exposure, block and impulsive nonconformity, $F(3, 66) = 2.19$, $MSE = 27735.85$, $p = .1$.

3.1.2: Discussion

The schizotypy dimension hypothesised to exert the primary effect on latent inhibition is the unusual experiences dimension. Latent inhibition was therefore predicted to be reduced in high unusual experiences schizotypy. However, no such effect was observed in Experiment 5. Evans et al. (2007) using a task that was very similar to the present experiments reported marginally significant reduced latent inhibition in high unusual experiences schizotypy. Evans et al. entered data from 73 participants into their analyses, substantially more than in the current investigation. However, when I subsequently split the participants into low and high schizotypy according to slightly different criteria, where the emphasis still was to split the group into genuinely low and high schizotypy groups but with minimal loss of power, the hypothesised reduction in latent inhibition in the high unusual experiences schizotypy group was not found in the current experiment. Instead the opposite result was found; that is, significantly increased latent inhibition in the *high* unusual experiences group compared to the low group (see Appendix 2 for details of the low/high split and for the analyses and results). It remains possible that the sample of participants in this study did not have scores that were sufficiently extreme to detect robust differences in latent inhibition as a function of schizotypy. This is particularly an issue with the high unusual experiences group where the mean still was well within one standard deviation of the Mason et al. (1995) norm mean. All the other low and high group means were at least around one standard deviation away from the corresponding norm means. The lack of extremely high unusual experiences scores may go some way in explaining the absence of an effect of this schizotypy dimension on latent inhibition. Alternative explanations will be considered in Section 3.4.

The introvertive anhedonia and cognitive disorganisation schizotypy dimension were not expected nor found to affect latent inhibition. The impulsive nonconformity schizotypy dimension, however, was found to interact with latent inhibition, but in a manner contrary to the overall expectation of less latent inhibition in high schizotypy. If anything, more latent inhibition was evident in high than in low schizotypy. This finding is in accordance with the marginally significantly enhanced latent inhibition reported in high impulsive nonconformity by Evans et al. (2007).

Experiment 6 and 7 investigated of the effect of the schizotypy dimensions on latent inhibition after 10 and 5 CS preexposures on the grounds that less robust latent inhibition may be more sensitive to the effects of schizotypy.

3.2: Experiments 6 and 7

Chapter 2 established that 20 CS preexposures induced large and robust latent inhibition that survived both an interruption and a delay between the preexposure and test phases. This suggests that 20 preexposures constitute a relatively large amount of preexposure and this may be one reason why high levels of schizotypy did not attenuate latent inhibition in Experiment 5. Experiments 6 and 7, therefore, examined the effect of multi-dimensional schizotypy on latent inhibition after relatively less CS preexposure than in Experiment 5. Experiment 6 investigated the effect of schizotypy on latent inhibition after 10 CS preexposures and Experiment 7 investigated the effect of schizotypy on latent inhibition after

5 preexposures. This investigation was conducted in an analogous way to Experiment 5. That is, the latent inhibition data from the participants in Experiment 2 (for whom schizotypy scores were available) were analysed in the same manner as in Experiment 5. The data from the participants given 10 and 5 CS preexposures were analysed separately because although latent inhibition was found after both amounts of preexposure, the amount of latent inhibition differed between the groups.

3.2.1: Results and discussion

Descriptive schizotypy statistics

Table 5 show the means and standard deviations (*SD*), and Table 6 shows the inter-correlations of the schizotypy scales for the 43 participants in Experiment 6 (mean age = 19.42 (*SD* = 3.4), 36 females, 7 males) and for the 53 participants in Experiment 7 (mean age = 20.09 (*SD* = 4.3), 46 females, 7 males).

Table 5. Experiments 6 and 7: The means and standard deviations (*SD*) for the schizotypy dimensions from the PE10 group (centre column) and the PE5 group (right column).

Schizotypy dimension	PE10 (N=43)	PE5 (N=53)
Full scale	32.3 (14.37)	36.09 (12.81)
Unusual experiences	8.53 (5.96)	9.04 (5.97)
Cognitive disorganisation	11.19 (6.04)	13.53 (5.52)
Introvertive anhedonia	3.95 (2.88)	5.19 (4.02)
Impulsive nonconformity	8.63 (3.92)	8.34 (3.6)

Table 6. Experiments 6 and 7: The inter-correlations between the schizotypy scales from group PE10 (four left-hand data columns) and group PE5 (four right-hand columns).

	PE10 (N=43)			PE5 (N=53)		
	CD	IA	IN	CD	IA	IN
Unusual experiences (UE)	**.72***	**.09**	**.5***	**.38***	**-.18**	**.49***
Cognitive disorganisation (CD)		**.2**	**.47***		**.18**	**.51***
Introvertive anhedonia (IA)			**.17**			**.14**
Impulsive nonconformity (IN)						

*Significant (*p* < .05 or less)

The participants were split into LOW and HIGH schizotypy groups according to the same criteria as Experiment 5.

Experiment 6: 10 preexposures

Full scale schizotypy: Groups

The 10 participants scoring 20 or below on the full schizotypy scale were assigned to the LOW group and the 11 participants scoring 44 or above on the full schizotypy scale were assigned to the HIGH group. The mean schizotypy score in the LOW group was 13.7 (SD = 4.97) and the mean score in the HIGH group was 49.72 (SD = 6.89). The LOW and HIGH groups did not differ in age, $F(1, 19) = 3.19$, $MSE = 19.16$, $p = .09$.

Full scale schizotypy: Correct responses

Panel A of Figure 16 illustrates the mean number of correct responses to the NPE and the PE CSs for the participants in the LOW and HIGH schizotypy groups. Inspection of Panel A indicates more correct responding as conditioning progressed and more correct responding to the NPE than to the PE CS for both the LOW and HIGH schizotypy groups. In fact, more latent inhibition is apparent in block 1 in the HIGH than in the LOW group. ANOVA revealed effects of exposure, $F(1, 19) = 38.4$, $MSE = 2.15$, $p < .001$, and block, $F(3, 57) = 27.81$, $MSE = .84$, $p < .001$, but no effect of schizotypy, $F < 1$. There was also an interaction between exposure and block, $F(3, 57) = 3.28$, $MSE = .53$, $p < .05$, but not between exposure and schizotypy or block and schizotypy. Three-way interaction between exposure, block and schizotypy was not significant although there was an apparent trend, $F(3, 57) = 2.76$, $MSE = .53$, $p = .051$.

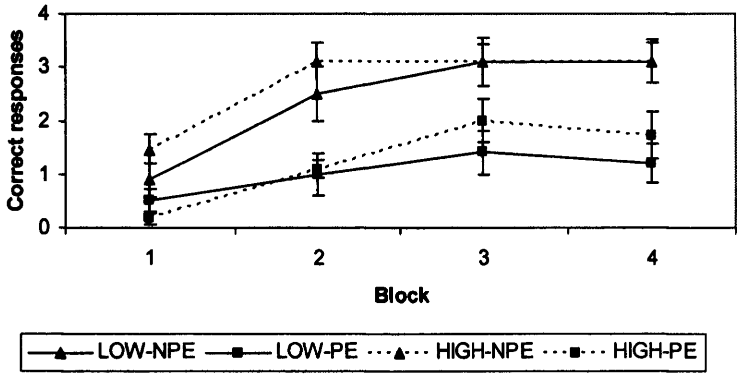
Full scale schizotypy: Correct responses ratio

Panel B of Figure 16 illustrates the mean number of correct responses ratios for the participants in the LOW and HIGH groups. Inspection of Panel B indicates no difference in latent inhibition ratios between the LOW and HIGH group apart from in block 1 where there seems to be more latent inhibition in the HIGH than in the LOW schizotypy group. A mixed two-way ANOVA did not, however, find any differences in latent inhibition between the LOW and HIGH groups (largest $F(3, 57) = 1.76$, $MSE = .05$, $p = .17$). One-sample t-tests confirmed latent inhibition in both the LOW, $t(9) = 2.96$, $p < .05$, and the HIGH schizotypy groups, $t(10) = 5.47$, $p < .001$.

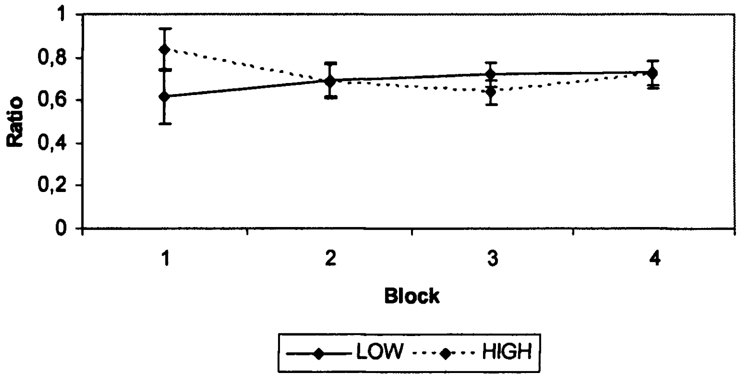
Full scale schizotypy: Reaction times

Panel C of Figure 16 illustrates the mean reaction times on the NPE CS and the PE CS trials for the participants in the LOW and HIGH schizotypy groups. Inspection of Panel C indicates shorter reaction times as conditioning progressed and faster responding on the NPE CS trials than on the PE CS trials. The amount of latent inhibition in the LOW and HIGH groups did not appear to differ apart from in block 1 where more latent inhibition in the HIGH than in the LOW schizotypy group seems apparent. ANOVA confirmed effects of exposure, $F(1, 19) = 33.18$, $MSE = 108806.29$, $p < .001$, block, $F(3, 57) = 38.37$, $MSE = 34558.47$, $p < .001$, but not schizotypy group, $F(1, 19) = 1.93$, $MSE = 265018.26$, $p = .18$. There were no two-way interactions (largest $F(3, 57) = 1.74$, $MSE = 30908.83$, $p = .17$), but there was a three-way interaction between exposure, block and schizotypy, $F(3, 57) = 3.8$, $MSE = 30908.83$, $p < .05$. The three-way interaction reflected latent inhibition in the LOW group in blocks 2-4, all $ps < .01$, but not in block 1, $p = .76$, and latent inhibition in the HIGH group in blocks 1-4, all $ps < .05$.

A



B



C

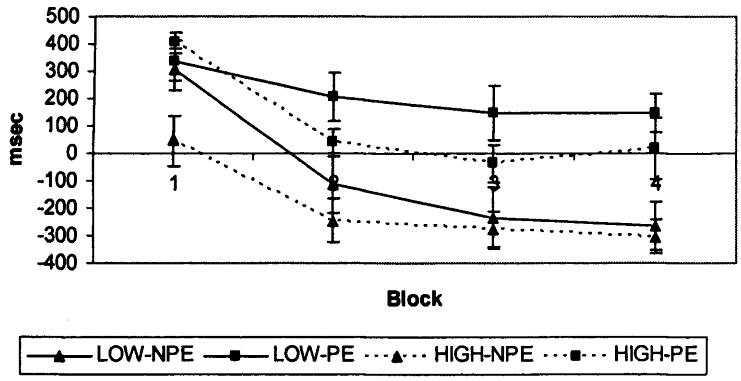


Figure 16. Experiment 6; Panel A: The mean number of correct responses (±*SEM*) to the nonpreexposed (NPE) and the preexposed (PE) stimuli in each block for the participants given 10 CS preexposures in the LOW (0-20, N = 10) and HIGH (44+, N = 11) full scale schizotypy groups. Panel B: The correct response ratios (±*SEM*) in each block for the participants given 10 CS preexposures in the LOW and HIGH full scale schizotypy groups. Panel C: The mean reaction times (±*SEM*) on the NPE CS trials and PE CS trials in each block for the participants given 10 CS preexposures in the LOW and HIGH full schizotypy scale groups.

Unusual experiences: Groups

The 11 participants scoring 3 or below on the unusual experiences subscale were assigned to the LOW group and the 11 participants scoring 14 or above on the unusual experiences subscale were assigned to the HIGH group. The mean schizotypy score in the LOW group was 1.64 (SD = 1.12) and the mean score in the HIGH group was 16.27 (SD = 3.47). The LOW and HIGH groups did not differ in age, $F(1, 20) = 1.59$, $MSE = 12.63$, $p = .22$.

Unusual Experiences: Correct responses

Panel 1A of Figure 17 illustrates the mean number of correct responses to the NPE and the PE CSs for the participants in the LOW and HIGH unusual experiences groups. Inspection of Panel 1A indicates more correct responding as conditioning progressed and more correct responding to the NPE than to the PE CS for both the LOW and HIGH unusual experiences groups. However, there appears to be more latent inhibition in the HIGH than in the LOW unusual experiences group in block 1, and the reverse in block 3. ANOVA supported these observations, revealing effects of exposure, $F(1, 20) = 25.13$, $MSE = 2.54$, $p < .001$, block, $F(3, 60) = 41.19$, $MSE = .72$, $p < .001$, but not unusual experiences group, $F(1, 20) = 2.53$, $MSE = 4.36$, $p = .13$. There were no two-way interactions (largest $F(3, 60) = 2.12$, $MSE = .53$, $p = .11$, < 1), but there was a three-way interaction between unusual experiences, exposure and block, $F(3, 60) = 4.36$, $MSE = .53$, $p < .01$. The three-way interaction reflected latent inhibition in the LOW group in blocks 2-4, all $ps < .05$, but not in block 1, $p = .37$, and latent inhibition in the HIGH group in blocks 1 and 2, both $ps < .01$, but not in blocks 3, p = 11, or 4, $p = .06$.

Unusual Experiences: Correct responses ratio

Panel 1B of Figure 17 illustrates the mean number of correct responses ratios for the participants in the LOW and HIGH groups. Inspection of Panel 1B indicates no difference in latent inhibition ratios between the LOW and HIGH groups apart from in block 1 where more latent inhibition seems to be evident in the HIGH than the LOW unusual experiences group and in block 3 where the reverse is the case. However, ANOVA revealed no effects of block or unusual experiences, both $Fs < 1$, and nor was there an interaction between these factors, $F(3, 60) = 2.15$, $MSE = .05$, $p = .1$. One-sample t-tests confirmed latent inhibition in both the LOW, $t(10) = 2.99$, $p < .05$, and the HIGH unusual experiences groups, $t(10) = 2.2$, $p < .05$.

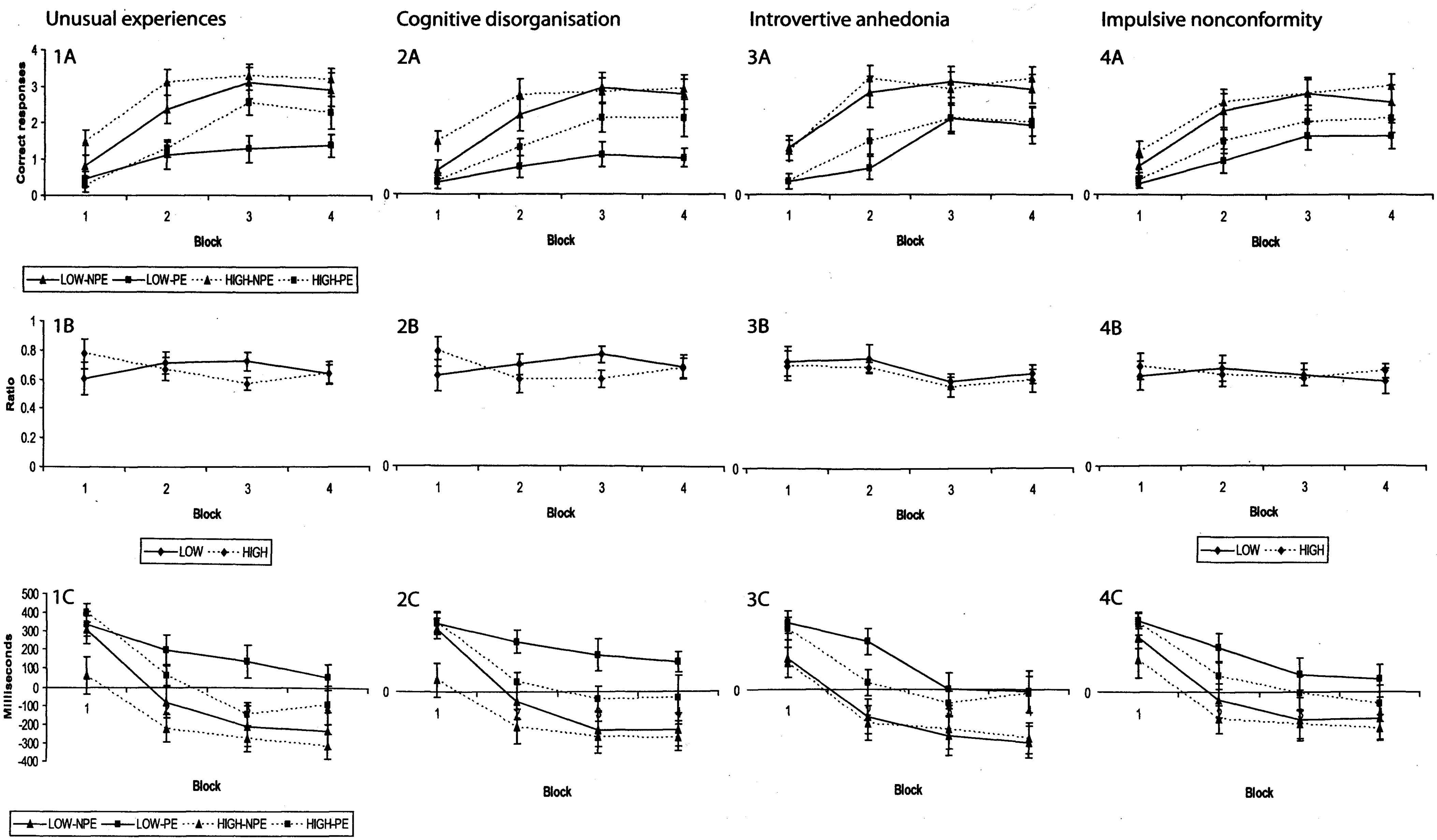

Unusual experiences
Cognitive disorganisation
Introvertive anhedonia
Impulsive nonconformity
1A
2A
3A
4A
Correct responses
0
1
2
3
4
Block
1
2
3
4
LOW-NPE
LOW-PE
HIGH-NPE
HIGH-PE
1B
2B
3B
4B
Ratio
0
0.2
0.4
0.6
0.8
1
LOW
HIGH
1C
2C
3C
4C
Milliseconds
500
400
300
200
100
0
-100
-200
-300
-400

Figure 17. Experiment 6: The twelve panels 1A-4C are organised into the three rows (A, B and C) that show the mean (±*SEM*) correct responses to the nonpreexposed (NPE) and preexposed (PE) CS, mean ratios (±*SEM*), and mean reaction times (±*SEM*) on the NPE CS trials and PE CS trials for the LOW and HIGH schizotypy groups that were given 10 preexposures, respectively; and into four columns that illustrate the results of the low (0-3, N = 11) and high (14+, N = 11) unusual experiences, the low (0-6, N = 12) and high (16+, N = 11) cognitive disorganisation, the low (0-1, N = 11) and high (6+, N = 11) introvertive anhedonia, and the low (0-6, N = 13) and high (11+, N = 13) impulsive nonconformity groups, respectively.

Unusual Experiences: Reaction times

Panel 1C of Figure 17 illustrates the mean reaction times on the NPE CS and the PE CS trials for the participants in the LOW and HIGH unusual experiences groups. Inspection of Panel 1C indicates increasingly shorter reaction times as training proceeded and faster responding on the NPE CS trials than to the PE CS trials. The amount of latent inhibition in the LOW and HIGH groups did not appear to differ, again, apart from in block 1 where there appeared to be more latent inhibition in the HIGH than in the LOW unusual experiences group and in block 3 where the reversed appeared to be the case. Mauchly's test indicated that the assumption of sphericity had been violated for the interaction between exposure and block, $\chi^2(5) = 12.12, p < .05$. Therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for the interaction between exposure and block, $\varepsilon = .72$. ANOVA confirmed that there were effects of exposure, $F(1, 20) = 19.04$, $MSE = 134566.33$, $p < .001$, and block, $F(3, 60) = 59.34$, $MSE = 28318.07$, $p < .001$, but not of unusual experiences, $F(1, 20) = 3.03$, $MSE = 245764.83$, $p = .1$. There were no two-way interactions, all $Fs < 1$, but there was a three-way interaction between exposure, block and unusual experiences, $F(3, 60) = 3.84$, $MSE = 34852.76$, $p < .05$. The three-way interaction reflected latent inhibition in the LOW group in blocks 2-4, all $ps < .05$, but not in block 1, $p = .78$, and latent inhibition in the HIGH group in blocks 1 and 2, $p < .01$, but not in blocks 3, $p = .2$, or 4, $p = .088$.

Cognitive disorganisation: Groups

The 12 participants scoring 6 or below on the cognitive disorganisation subscale were assigned to the LOW group and the 11 participants scoring 16 or above on the cognitive disorganisation subscale were assigned to the HIGH group. The mean schizotypy score in the LOW group was 3.08 (SD = 2.02) and the mean score in the HIGH group was 18.18 (SD = 1.72). The LOW and HIGH groups did not differ in age, $F(1, 21) = 3.61$, $MSE = 18.33$, p = .07. This result apporached significance, but as the mean age was 21.67 (SD = 6.7) years in the HIGH group and 18.22 (SD = .47) years in the LOW group, this was considered an anomaly rather than constituting a serious problem.

Cognitive disorganisation: Correct responses

Panel 2A of Figure 17 illustrates the mean number of correct responses to the NPE and PE CSs for the participants in the LOW and HIGH cognitive disorganisation groups. Inspection of Panel 2A indicates more correct responding as conditioning progressed and more correct responding to the NPE than to the PE CS for both the LOW and HIGH cognitive disorganisation groups. In addition, there appears to be more latent inhibition in the HIGH than in the LOW group in block 1 whereas in blocks 3 and 4 there appears to be more latent inhibition in the LOW than in the HIGH cognitive disorganisation group. ANOVA confirmed that there were effects of exposure, $F(1, 21) = 26.92$, $MSE = 2.37$, $p < .001$, and block, $F(3, 63) = 31.08$, $MSE = .74$, $p < .001$, but not of cognitive disorganisation, $F(1, 21) = 2.36$, MSE = 5.01, $p = .14$. There were no two-way interactions (largest $F(3, 63) = 2.18$, $MSE = .54$, $p = .1$), but there was a three-way interaction between block, exposure and cognitive disorganisation, $F(3, 63) = 4.07$, $MSE = .54$, $p < .05$. The three-way interaction reflected latent inhibition in the

LOW group in blocks 2-4, all $ps < .01$, but not in block 1, $p = .34$, and latent inhibition in the HIGH group in blocks 1-2, both $ps < .01$, but not in block 3, $p = .1$, or block 4, $p = .062$.

Cognitive disorganisation: Correct responses ratios

Panel 2B of Figure 17 illustrates the mean number of correct response ratios for the participants in the LOW and HIGH cognitive disorganisation groups. Inspection of Panel 2B indicates no difference in latent inhibition between the HIGH and LOW groups apart from in block 1 where there appears to be more latent inhibition in the HIGH than the LOW group and in block 3 where there seems to be more latent inhibition in the LOW than in the HIGH cognitive disorganisation group. ANOVA revealed no effects of block or cognitive disorganisation nor an interaction between these factors (largest $F(3, 63) = 2.15$, $MSE = .06$, $p = .1$). One sample t-tests confirmed that there was latent inhibition in both the LOW, $t(11) = 3.44$, $p < .01$, and HIGH cognitive disorganisation groups, $t(9) = 2.98$, $p < .05$.

Cognitive disorganisation: Reaction times

Panel 2C of Figure 17 illustrates the mean reaction times on the NPE and PE CS trials for the participants in the LOW and HIGH cognitive disorganisation groups. Inspection of Panel 2C suggests increasingly short reaction times over the course of conditioning and faster reaction times on the NPE than on the PE CS trials. The HIGH and LOW cognitive disorganisation groups do not appear to differ markedly apart from in block 1 where more latent inhibition is apparent in the HIGH than in the LOW group. ANOVA revealed effects of exposure, $F(1, 21) = 24.25$, $MSE = 125887.9$, $p < .001$, and block, $F(3, 63) = 40.9$, $MSE = 32326.12$, $p < .001$, and marginally of cognitive disorganisation, $F(1, 21) = 3.72$, $MSE = 242667.05$, $p = .067$. There were no two-way interactions, all $Fs < 1$, but there was a three-way interaction between exposure, block and cognitive disorganisation, $F(3, 63) = 4.03$, MSE

= 32552.24, $p < .05$. The three-way interaction reflected latent inhibition in the LOW group in blocks 2-4, all $ps < .01$, but not in block 1, $p = .76$, and latent inhibition in the HIGH group in blocks 1-3, all $ps < .05$, but not in block 4, $p = .062$.

Introvertive anhedonia: Groups

The 11 participants scoring 1 or below on the introvertive anhedonia subscale were assigned to the LOW group and the 11 participants scoring 6 or above on the introvertive anhedonia subscale were assigned to the HIGH group. The mean schizotypy score in the LOW group was .64 (SD = .51) and the mean score in the HIGH group was 7.82 (SD = 1.89). The LOW and HIGH groups did not differ in age, $F < 1$.

Introvertive anhedonia: Correct responses

Panel 3A of Figure 17 illustrates the mean number of correct responses to the NPE and PE CSs for the participants in the LOW and HIGH introvertive anhedonia groups. Inspection of Panel 3A suggests that correct responding increased as conditioning progressed and more correct responding to the NPE than to the PE CS in both LOW and HIGH groups, but with no clear differences in latent inhibition between the LOW and HIGH groups. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi_2(5)$ = 11.42, $p < .05$. Therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .7$. ANOVA revealed effects of exposure, $F(1, 20)$ = 22.54, MSE = 2.78, $p < .001$, and block, $F(2.09, 41.79) = 36.67$, MSE = 1.09, $p < .001$, but not of introvertive anhedonia, $F < 1$. There was an interaction between exposure and block, $F(3, 60) = 5.62$, MSE = .46, $p < .01$, but no other interactions (largest $F(2.09, 41.79) = 1.23$, MSE = 1.09, p = .31).

Introvertive anhedonia: Correct responses ratios

Panel 3B of Figure 17 illustrates the mean number of correct responses ratios for the participants in the LOW and HIGH groups. Inspection of Panel 3B does not indicate any differences in latent inhibition between the LOW and HIGH groups. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi^2(5) = 12.4$, $p < .05$. Therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .71$. A two-way mixed ANOVA revealed no effects of block, $F(2.12, 42.47) = 2.63$, $MSE = .05$, $p = .08$, or introvertive anhedonia nor an interaction between these factors, both *Fs* < 1. One sample t-tests indicated significant latent inhibition in both the LOW, $t(10) = 2.82$, $p < .05$, and the HIGH introvertive anhedonia group, $t(10) = 2.56$, $p < .05$.

Introvertive anhedonia: Reaction times

Panel 3C of Figure 17 illustrates the mean reaction times on the NPE and PE CS trials for the participants in the LOW and HIGH introvertive anhedonia groups. Inspection of Panel 3C indicates shorter reaction times as conditioning progressed and faster reaction times on the NPE than on the PE CS trials in both the LOW and HIGH introvertive anhedonia groups, but no differences in latent inhibition between the two groups are apparent apart from in block 2 where there appears to be more latent inhibition in the LOW than in the HIGH group. ANOVA confirmed that there were effects of exposure, $F(1, 20) = 16$, $MSE = 148119.88$, $p < .01$, and block, $F(3, 60) = 47.24$, $MSE = 30842.36$, $p < .001$, but no effect of introvertive anhedonia and no interactions (largest $F(3, 60) = 1.16$, $MSE = 30842.36$, $p = .33$).

Impulsive nonconformity: Groups

The 13 participants scoring 6 or below on the impulsive nonconformity subscale were assigned to the LOW group and the 13 participants scoring 11 or above on the impulsive nonconformity subscale were assigned to the HIGH group. The mean schizotypy score in the LOW group was 4.46 ($SD = 1.56$) and the mean score in the HIGH group was 13.38 ($SD = 2.47$). The LOW and HIGH groups did not differ in age, $F < 1$.

Impulsive nonconformity: Correct responses

Panel 4A of Figure 17 illustrates the mean number of correct responses to the NPE and PE CSs for the participants in the LOW and HIGH impulsive nonconformity groups. Inspection of Panel 4C indicates that correct responding increased as conditioning progressed and more correct responding to the NPE than to the PE CS in both the LOW and HIGH impulsive nonconformity groups with no difference in latent inhibition apparent between the LOW and HIGH impulsive nonconformity groups. ANOVA confirmed that there were effects of exposure, $F(1, 24) = 16.2$, $MSE = 2.79$ $p < .001$, and block, $F(3, 72) = 49.36$, $MSE = .63$, $p < .001$, but no effect of impulsive nonconformity nor any interactions (largest $F(3, 72) = 1.3$, $MSE = .63$, $p = .28$).

Impulsive nonconformity: Correct responses ratios

Panel 4B of Figure 17 illustrates the mean correct responses ratios for the participants in the LOW and HIGH groups. Inspection of Panel 4B indicates that the latent inhibition ratios do not differ between the groups. ANOVA revealed no effects or interaction, all $Fs < 1$. One sample t-tests showed marginally significant latent inhibition in the LOW impulsive nonconformity group, $t(12) = 1.97$, $p = .073$, and significant latent inhibition in the HIGH impulsive nonconformity group, $t(12) = 3.89$, $p < .01$.

Impulsive nonconformity: Reaction times

Panel 4C of Figure 17 illustrates the mean reaction times on the NPE and PE CS trials for the participants in the LOW and HIGH impulsive nonconformity groups. Inspection of

Panel 4C indicates increasingly short reaction times as conditioning progressed and faster reaction times on the NPE than on the PE CS trials in both the LOW and HIGH impulsive nonconformity groups. The LOW and HIGH groups do not appear to differ markedly in terms of latent inhibition, however, the HIGH group appears to be faster than the LOW group overall. ANOVA revealed effects of exposure, $F(1, 24) = 12.25$, $MSE = 157194.85$, $p < .01$, and block, $F(3, 72) = 64.54$, $MSE = 24074.74$, $p < .001$, but not of impulsive nonconformity, $F(1, 24) = 1.09$, $MSE = 347539.07$, $p = .31$. There were no interactions, all $Fs < 1$.

In summary, latent inhibition after 10 CS preexposure was not reduced in high schizotypy as a function of any of the individual schizotypy dimensions or of overall schizotypy. A number of significant three-way interactions between block, exposure and schizotypy (notably the 3 most highly correlated of the scales; full scale, unusual experiences and cognitive disorganisations) suggested that latent inhbition is influenced by schizotypy. However, the investigations of these interactions revealed no evidence of reduced latent inhibition in high schizotypy. If anything, the results of Experiment 6 seem to indicate that latent inhibition is increased in high schizotypy after 10 CS preexposures by being evident sooner than in low schizotypy (block 1).

Experiment 7: 5 preexposures

Full scale schizotypy: Groups

The 12 participants scoring 25 or below on the full schizotypy scale were assigned to the LOW group and the 11 participants scoring 47 or above on the full schizotypy scale were assigned to the HIGH group. The mean schizotypy score in the LOW group was 18.92 (SD = 5.82) and the mean score in the HIGH group was 52.73 (SD = 6.31). The LOW and HIGH groups did not differ in age, $F(1, 21) = 1.96$, $MSE = 31.44$, $p = .18$.

Full scale schizotypy: Correct responses

Panel A of Figure 18 illustrates the mean number of correct responses to the NPE and the PE CS for the participants in the LOW and HIGH schizotypy groups. Inspection of Panel A indicates that there were more correct responding as conditioning progressed and that in the LOW group there was more correct responding to the NPE than to the PE CS, whereas in the HIGH group more correct responding to the PE than to the NPE CS is suggested in block 4. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi^2(5) = 11.3, p < .05$. Therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .76$. ANOVA revealed an effect of block, $F(2.29, 48.04) = 14.97$, $MSE = 1.3$, $p < .001$, but not of exposure or schizotypy, both $Fs < 1$. There was an interaction between exposure and schizotypy, $F(1, 21) = 7.41$, $MSE = .99$, $p < .05$, but the interaction between exposure and block was not significant although there was an apparent trend, $F(3, 63) = 2.5$, $MSE = .8$, $p = .07$. There were no interactions between block and schizotypy or between exposure, block and schizotypy (largest $F(3, 63) = 1.45$, $MSE = .55$, $p = .24$). The interaction between schizotypy and exposure was followed up by Bonferroni adjusted simple main effects test which showed significant latent inhibition in the LOW group, $p < .05$, but not in the HIGH group, $p = .1$. However, responding to neither the NPE, $p = .38$, nor the PE, $p = .41$, CS differed between the LOW and HIGH groups.

Full scale schizotypy: Correct responses ratio

Panel B of Figure 18 illustrates the mean number of correct responses ratios for the participants in the LOW and HIGH groups. Inspection of Panel B indicates no marked difference in latent inhibition ratios between the LOW and HIGH group apart from in block 4 where latent facilitation seems to be evident in HIGH and not in LOW group. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi^2(5) = 13.43, p < .05$.

Therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .68$. ANOVA revealed an effect of schizotypy, $F(1, 21) = 6.14$, $MSE = .1$, $p < .05$, but not of block and there was no interaction between block and schizotypy (largest $F(2.05, 43.07) = 1.45$, $MSE = .04$, $p = .24$). One-sample t-tests revealed marginally significant latent inhibition in the LOW, $t(11) = 2.06$, $p = .064$, but not in the HIGH schizotypy group, $t(10) = -1.59$, $p = .14$.

Full scale schizotypy: Reaction times

Panel C of Figure 18 illustrates the mean reaction times on the NPE and the PE CS trials for the participants in the LOW and HIGH schizotypy groups. Inspection of Panel C indicates shorter reaction times as conditioning proceeded in both groups with faster reaction times on the NPE than on the PE CS trials in the LOW group, whereas in the HIGH group the reaction times appeared to be faster on the PE than on the NPE CS trials in block 4. ANOVA revealed an effect block, $F(3, 63) = 14.56$, $MSE = 48970.43$, $p < .001$, but not of exposure or schizotypy, both $Fs < 1$. There was an interaction between exposure and schizotypy, $F(1, 21) = 5.59$, $MSE = 44494.38$, $p < .05$, but although there was an apparent trend of an interaction between exposure and block, $F(3, 63) = 2.45$, $MSE = 32110.04$, $p = .07$, there were no other interactions, both $Fs < 1$. The interaction between schizotypy and exposure was followed up by Bonferroni-adjusted simple main effects test which showed a non-significant trend of latent inhibition in the LOW, $p = .08$, but not in the HIGH, $p = .15$, group. However, responding to neither the NPE CS, $p = .61$, nor the PE CS, $p = .32$, was found to differ between the LOW and HIGH groups.

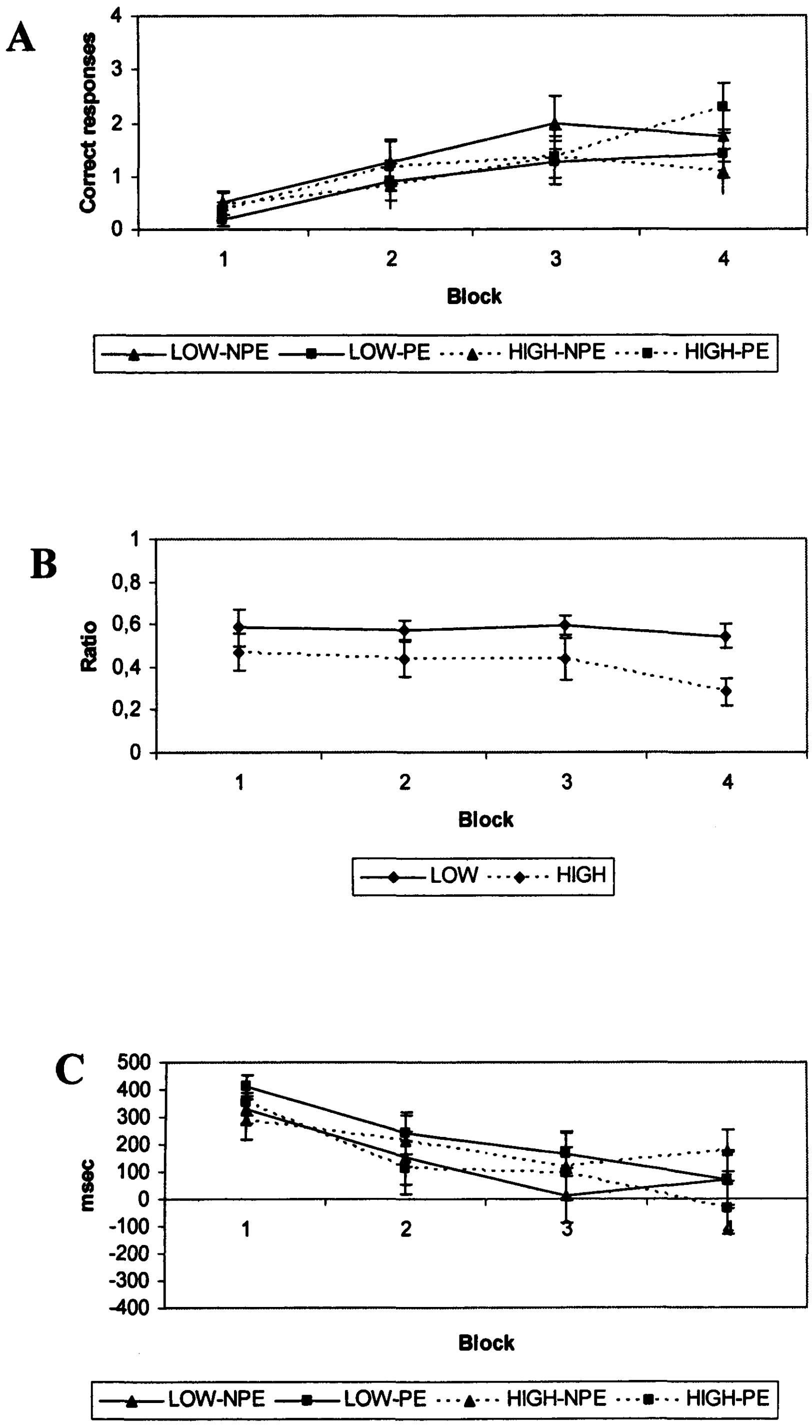


Figure 18. Experiment 7; Panel A: The mean number of correct responses (±*SEM*) to the nonpreexposed (NPE) and the preexposed (PE) stimuli in each block for the participants in the LOW (0-25, N = 12) and HIGH (47+, N = 11) full scale schizotypy groups given 5 CS preexposures. Panel B: The correct response ratios (±*SEM*) in each block for the participants in the LOW and HIGH full scale schizotypy groups given 5 CS preexposures. Panel C: The mean reaction times (±*SEM*) on the nonpreexposed CS trials and preexposed CS trials in each block for the participants in the LOW and HIGH full schizotypy scale groups given 5 CS preexposures.

Unusual experiences: Groups

The 11 participants scoring 3 or below on the unusual experiences subscale were assigned to the LOW group and the 14 participants scoring 14 or above on the unusual experiences subscale were assigned to the HIGH group. The mean schizotypy score in the LOW group was 1.45 ($SD = 1.04$) and the mean score in the HIGH group was 16.71 ($SD = 3.43$). The LOW and HIGH groups differed marginally in age, $F(1, 23) = 3.92$, $MSE = 27.29$, $p = .06$. However, as the mean age was 23.45 (7.23) years in the LOW group and 19.29 (2.84) years in the HIGH group, the mean ages of the groups were relatively similar.

Unusual Experiences: Correct responses

Panel 1A of Figure 19 illustrates the mean number of correct responses to the NPE and the PE CS for the participants in the LOW and HIGH unusual experiences groups. Inspection of Panel 1A indicates that correct responding increased as conditioning progressed, but that there was no clear evidence of latent inhibition. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi 2(5) = 18.68$, $p < .01$. Therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .64$. ANOVA revealed an effect of block, $F(1.9, 43.8) = 9.75$, $MSE = 1.46$, $p < .001$, but not of exposure, $F(1, 23) = 2.8$, $MSE = 1.5$, $p = .1$, or unusual experiences nor any interactions (largest $F(1.9, 43.8) = 1.2$, $MSE = 1.46$, $p = .31$).

Unusual Experiences: Correct responses ratio

Panel 1B of Figure 19 illustrates the mean correct response ratios for the participants in the LOW and HIGH groups. Inspection of Panel 1B indicates no differences between the LOW and HIGH groups. ANOVA did not find any differences between the LOW and HIGH groups (largest $F(3, 69) = 1.73$, $MSE = .07$, $p = .17$). One-sample t-tests found no latent inhibition in the LOW, $t(10) = 1.15, p = .28$, or the HIGH unusual experiences groups, $t(13) = .4, p = .69$.

Unusual Experiences: Reaction times

Panel 1C of Figure 19 illustrates the mean reaction times on the NPE and the PE CS trials for the participants in the LOW and HIGH unusual experiences groups. Inspection of Panel 1C indicates faster reaction times as conditioning progressed and faster reaction times on the NPE than on the PE CS trials in particular in the LOW group, however the LOW and HIGH groups did not appear to differ markedly. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi 2(5) = 19.59, p < .01$, and for the interaction between exposure and block, $\chi 2(5) = 16.6, p < .01$. Therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .64$, and for the interaction between exposure and block, $\varepsilon = .71$. ANOVA confirmed that there was an effect of block, $F(1.92, 44.13) = 9.7$, $MSE = 68515.71$, $p < .001$, and a non-significant trend of an effect of exposure, $F(1, 23) = 4.23$, $MSE = 54760.81$, $p = .051$. There was no effect of unusual experiences nor any interactions (largest $F(1.92, 44.13) = 1.29$, $MSE = 68515.71$, $p = .29$).

Cognitive disorganisation: Groups

The 13 participants scoring 9 or below on the cognitive disorganisation subscale were assigned to the LOW group and the 10 participants scoring 19 or above on the cognitive disorganisation subscale were assigned to the HIGH group. The mean schizotypy score in the LOW group was 6.15 ($SD = 2.73$) and the mean score in the HIGH group was 20.9 ($SD = 1.91$). The LOW and HIGH groups did not differ in age, $F(1, 21) = 1.8$, $MSE = 31.36$, $p = .19$.

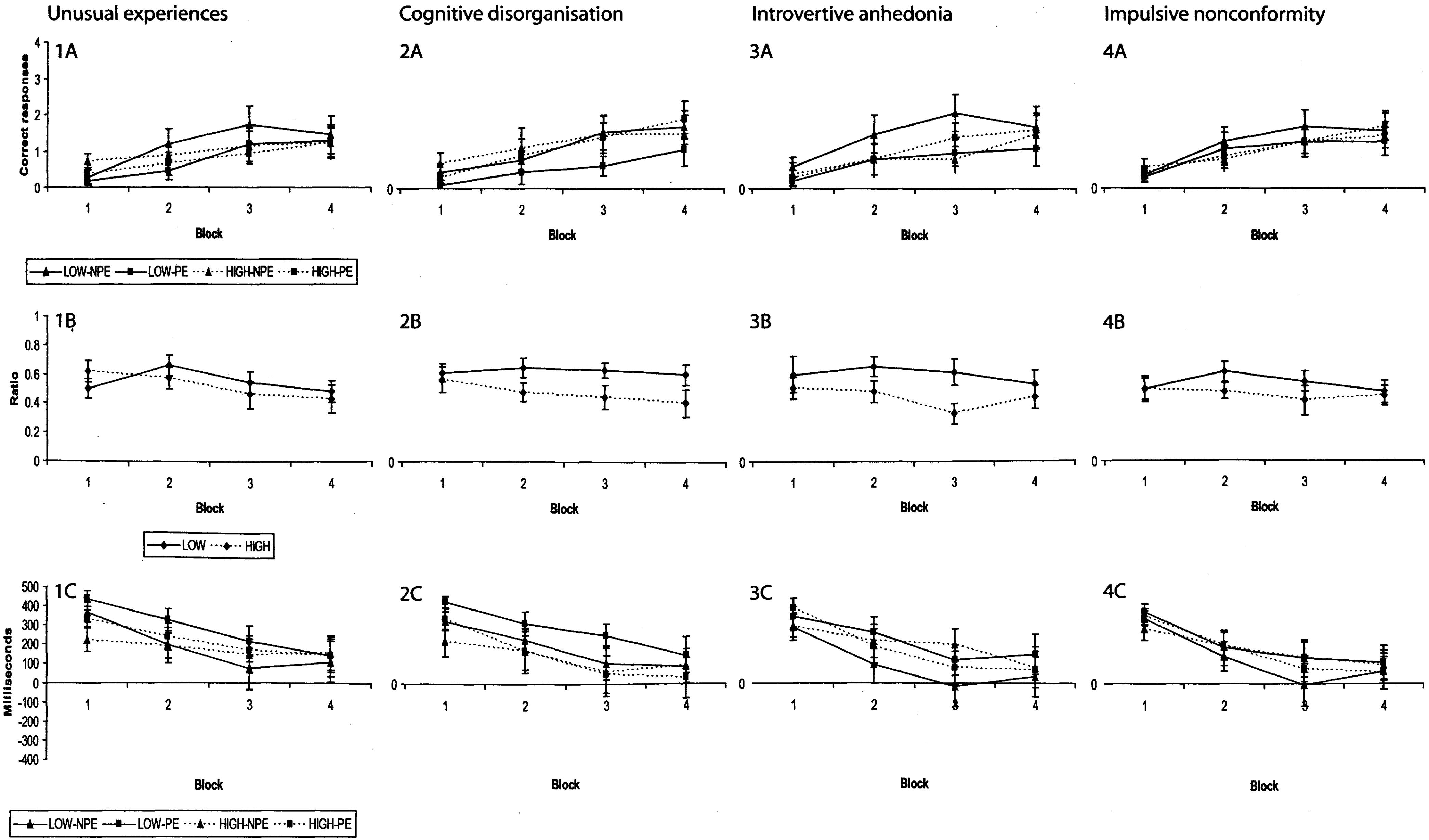

Unusual experiences
Cognitive disorganisation
Introvertive anhedonia
Impulsive nonconformity
1A
2A
3A
4A
Correct responses
Block
LOW-NPE LOW-PE HIGH-NPE HIGH-PE
1B
2B
3B
4B
Ratio
LOW HIGH
1C
2C
3C
4C
Milliseconds
LOW-NPE LOW-PE HIGH-NPE HIGH-PE

Figure 19. Experiment 7: The twelve panels 1A-4C are organised into the three rows (A, B and C) that show the mean (±*SEM*) correct responses to the nonpreexposed (NPE) and preexposed (PE) CS, mean ratios (±*SEM*), and mean reaction times (±*SEM*) on the NPE CS trials and PE CS trials for the LOW and HIGH schizotypy groups that were given 5 preexposures, respectively; and into four columns that illustrate the results of the low (0-3, N = 11) and high (14+, N = 14) unusual experiences, the low (0-9, N = 13) and high (19+, N = 10) cognitive disorganisation, the low (0-1, N = 10) and high (9+, N = 10) introvertive anhedonia, and the low (0-5, N = 14) and high (11+, N = 14) impulsive nonconformity groups, respectively.

Cognitive disorganisation: Correct responses

Panel 2A of Figure 19 illustrates the mean number of correct responses to the NPE and PE CS for the participants in the LOW and HIGH cognitive disorganisation groups. Inspection of Panel 2A indicates that correct responding increased as conditioning progressed and that there appeared to be more correct responding to the NPE than to the PE CS especially in the LOW cognitive disorganisation group. Mauchly's test indicated that the assumption of sphericity had been violated for the interaction between exposure and block, $\chi_2(5) = 13.14, p < .05$. Therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for the interaction between exposure and block, $\varepsilon = .7$. ANOVA only confirmed that there was an effect of block, $F(3, 63) = 12.27$, $MSE = .96, p < .001$. There was no effect of exposure, $F(1, 21) = 2.94$, $MSE = 1.54, p = .1$, nor cognitive disorganisation, nor were there any interactions between the factors (largest $F(1, 21) = 1.71$, $MSE = 1.54, p = .21$).

Cognitive disorganisation: Correct responses ratios

Panel 2B of Figure 19 illustrates the mean correct response ratios for the participants in the LOW and HIGH cognitive disorganisation groups. Inspection of Panel 2B suggests that there was latent inhibition in the LOW but not in the HIGH group. ANOVA revealed a marginally significant effect of cognitive disorganisation, $F(1, 21) = 4.2$, $MSE = .12, p = .053$, but no effect of block and there was no interaction between block and cognitive disorganisation, both *Fs* < 1. One sample t-tests confirmed that there was significant latent inhibition in the LOW, $t(12) = 2.88, p < .05$, but not in the HIGH cognitive disorganisation group, $t(9) = -.4, p = .7$.

Cognitive disorganisation: Reaction times

Panel 2C of Figure 19 illustrates the mean reaction times on the NPE and PE CS trials for the participants in the LOW and HIGH cognitive disorganisation groups. Inspection of Panel 2C suggests increasingly short reaction times over the course of conditioning and faster reaction times on the NPE than on the PE CS trials, especially in the LOW cognitive disorganisation group. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi_2(5) = 12.14, p < .05$. Therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .71$. ANOVA only revealed an effect of block, $F(2.13, 44.67) = 11.66$, $MSE = 47437.93, p < .001$. There was no effect of exposure, $F(1, 21) = 2.34$, $MSE = 58032.07, p = .14$, or cognitive disorganisation, $F(1, 21) = 1.16$, $MSE = 357733.82, p = .29$, and no interactions between the factors (largest $F(1, 21) = 1.6$, $MSE = 58032.07, p = .22$).

Introvertive anhedonia: Groups

The 10 participants scoring 1 or below on the introvertive anhedonia subscale were assigned to the LOW group and the 10 participants scoring 9 or above on the introvertive anhedonia subscale were assigned to the HIGH group. The mean schizotypy score in the LOW group was .8 ($SD = .42$) and the mean score in the HIGH group was 12 ($SD = 2.87$). The LOW and HIGH groups did not differ in age, $F < 1$.

Introvertive anhedonia: Correct responses

Panel 3A of Figure 19 illustrates the mean number of correct responses to the NPE and PE CS for the participants in the LOW and HIGH introvertive anhedonia groups. Inspection of Panel 3A suggests that there is more correct responding as conditioning proceeded and more correct responding to the NPE than to the PE CS in the LOW group. ANOVA confirmed an effect of block, $F(3, 54) = 8.85$, $MSE = 1.08$, $p < .001$, but not of exposure, $F(1, 18) = 1.98$, $MSE = 1.53$, $p = .18$, or introvertive anhedonia, $F < 1$. There was an interaction between exposure and introvertive anhedonia, $F(1, 18) = 4.73$, $MSE = 1.53$, $p < .05$, but no other interactions (largest $F(3, 54) = 1.22$, $MSE = .73$, $p = .31$). Bonferroni adjusted simple effects test followed up the interaction between introvertive anhedonia and exposure and confirmed that there was latent inhibition in the LOW group, $p < .05$, but not in the HIGH group, $p = .59$. Responding to neither the NPE CS, $p = .51$, nor the PE CS, $p = .42$, differed between the LOW and HIGH introvertive anhedonia groups.

Introvertive anhedonia: Correct responses ratios

Panel 3B of Figure 19 illustrates the mean correct responses ratios for the participants in the LOW and HIGH groups. Inspection of Panel 3B appears to reveal latent inhibition in the LOW, but not in the HIGH introvertive anhedonia group. However, ANOVA revealed only a non-significant trend of an effect of introvertive anhedonia, $F(1, 18) = 3.94$, $MSE = .13$, $p = .063$, but not of block nor an interaction between block and introvertive anhedonia, both $Fs < 1$. One sample t-tests found no significant latent inhibition in the LOW, $t(9) = 1.78$, $p = .11$, or the HIGH, $t(9) = -1.26$, $p = .3$ introvertive anhedonia groups.

Introvertive anhedonia: Reaction times

Panel 3C of Figure 19 illustrates the mean reaction times on the NPE and PE CS trials for the participants in the LOW and HIGH introvertive anhedonia groups. Inspection of Panel 3C indicates increasingly short reaction times as training progressed in both the LOW and HIGH introvertive anhedonia groups and faster reaction times on the NPE than on the PE CS trials, especially in the LOW group. ANOVA confirmed an effect of block, $F(3, 54) = 10.81$, $MSE = 51999.13$, $p < .001$, but not of exposure, $F(1, 18) = 1.97$, $MSE = 55114.73$, $p = .18$, or introvertive anhedonia, $F < 1$. There was no interaction between introvertive anhedonia and exposure, $F(1, 18) = 3.32$, $MSE = 55114.73$, $p = .09$, nor any other interactions (largest $F(3, 54) = 1.48$, $MSE = 28778.16$, $p = .23$).

Impulsive nonconformity: Groups

The 14 participants scoring 5 or below on the impulsive nonconformity subscale were assigned to the LOW group and the 14 participants scoring 11 or above on the impulsive nonconformity subscale were assigned to the HIGH group. The mean schizotypy score in the LOW group was 4.43 ($SD = 1.09$) and the mean score in the HIGH group was 13.14 ($SD = 2.38$). The LOW and HIGH groups differed in age, $F(1, 26) = 5.13$, MSE = 25.92, p < .05, and the mean ages of 23.07 (7.11) years in the LOW group and 18.71 (1.14) years in the HIGH group were quite different. For this reason, the following results must be interpreted with some caution.

Impulsive nonconformity: Correct responses

Panel 4A of Figure 19 illustrates the mean number of correct responses to the NPE and PE CS blocks for the participants in the LOW and HIGH impulsive nonconformity groups. Inspection of Panel 4C indicates increasing rates of correct responding as conditioning proceeded but with no indication of latent inhibition or any difference between the LOW and HIGH impulsive nonconformity groups. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi_2(5) = 19.26, p < .01$. Therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .71$. ANOVA confirmed these observations revealing only an effect of block, $F(2.13, 55.41) = 12.61$, $MSE = 1.52, p < .001$. All the other $Fs < 1$.

Impulsive nonconformity: Correct responses ratios

Panel 4B of Figure 19 illustrates the mean correct response ratios for the participants in the LOW and HIGH groups. Inspection of Panel 4B indicates that the ratios do not differ between the groups and that no latent inhibition is apparent in either group. ANOVA revealed no effects or interaction (largest $F(1, 26) = 1.1$, $MSE = .14, p = .3$). One sample t-tests showed no significant latent inhibition in the LOW, $t(13) = .74, p = .47$, or HIGH impulsive nonconformity group, $t(13) = -.74, p = .47$.

Impulsive nonconformity: Reaction times

Panel 4C of Figure 19 illustrates the mean reaction times on the NPE and PE CS trials for the participants in the LOW and HIGH impulsive nonconformity groups. Inspection of Panel 4C indicates increasingly short reaction times as training proceeded and no differences between responding on the NPE and on the PE CS trials in either the LOW or the HIGH impulsive nonconformity group. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi_2(5) = 12.02, p < .05$. Therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .74$. ANOVA revealed that there was only an effect of block, $F(2.23, 57.93) = 15.98$, $MSE = 65294.46, p <$

.001. There were no other main effects or interactions (largest $F(3, 78) = 1.02$, $MSE = 30577.91$, $p = .91$).

In summary, latent inhibition after 5 CS preexposure was reduced in high schizotypy as a function of overall schizotypy and introvertive anhedonia. The unusual experiences and impulsive nonconformity schizotypy dimensions were not found to affect latent inhibition after 5 CS preexposures at all and the cognitive disorganisation schizotypy dimension was only marginally found to influence latent inhibition and only as measured by the correct response ratio. It therefore appears that the reduced latent inhibition found in high overall schizotypy is primarily carried by the introvertive anhedonia schizotypy dimension, which is related to the negative symptoms of schizophrenia. If this characterization of the results is accurate, then this finding constrasts with previous reports in the literature of increased latent inhibition in schizophrenia patients with a primarily negative symptom profile (Rascle et al., 2001) and a theoretical analysis that links negative schizophrenia symptoms to increased latent inhibition (Weiner, 2003). This finding is therefore perturbing and it is not clear how it fits into the literature. This is especially so, as it is clear that the introvertive anhedonia schizotypy dimension is the only dimension of the four O-Life dimensions that appears to be unrelated to positive schizophrenia symptoms (for a review, see Mason, Claridge & Williams, 1997; Mason et al., 1995) and therefore acute schizoprenia, which are both believed to influence latent inhibition according to much of the literature on latent inhibition in schizotypy and schizophrenia (e.g., Gray et al., 1991; Lubow & Gewirtz, 1995).

3.3: Experiment 8

Abnormal latent inhibition may be expressed in two ways; either as absent under circumstances when latent inhibition would usually be present or as present under circumstances when normally latent inhibition would be absent. Experiment 8 investigated the effect of schizotypy on latent inhibition under circumstances where latent inhibition was not expected to be evident; that is, after a context change between the preexposure and test stages. If latent inhibition was intact after a context change in participants with high levels of schizotypy, then it would suggest that schizotypy affects either the manner in which the context is processed and/or the manner/speed in which the CS and context are associated with each other. More generally, it might also suggest that in the absence of externally modulated latent inhibition, other sources of the effect remain (Pearce, 1997).

Several theories of schizophrenia posit that the influence of the context on perceptual processing is reduced in schizophrenia (although the theories vary in the exact manner by which this occurs: e.g. Hemsley, 1987, 1993; Patterson, 1987; Frith, 1979; Fleminger, 1992; Cohen & Servan-Schreiber, 1992), especially if context is liberally defined as information provided by preceding events (Cohen & Servan-Schreiber, 1992) and concurrent stimuli (Uhlhaas, Silverstein, Phillips, & Lovell, 2004). A number of studies have reported deficient context processing in schizophrenia (e.g. Cohen & Servan-Schreiber, 1992; Silverstein, Knight, Schwarzkopf, West, Osborn, & Kamin, 1996; Cohen, Barch, Carter, & Servan-Schreiber, 1999; Silverstein, Kovács, Corry, & Valone, 2000) using a variety of different tasks, such as target detection (Silverstein et al., 1996), Stroop (Cohen & Servan-Schreiber, 1992; Cohen et al., 1999), A-X continuous performance (Cohen & Servan-Schreiber, 1992; Cohen et al., 1999), lexical disambiguation (Cohen & Servan-Schreiber, 1992; Cohen et al., 1999), and contour integration (Silverstein et al., 2000). Parallel studies investigating context processing in schizotypy have found no effect of physical anhedonia, perceptual aberration or magical ideation schizotypy on context processing in any of the tasks under study (target detection, visual suffix, and configural superiority; Silverstein, Raulin, Pristach, & Pomerantz, 1992), but have found that thought disorder schizotypy is associated with impairments in visual context processing (Uhlhaas et al., 2004). This pattern of results is in accordance with the finding that contextual processing deficits in schizophrenia is particularly associated with the disorganised symptoms (Silverstein, Bakshi, Chapman, & Nowlis, 1998; Silverstein et al., 2000) and thought disordered symptoms (Kuperberg, McGuire, & David, 1998). Although Cohen and Servan-Schreiber (1992) have linked negative schizophrenia symptoms, in particular, to a weakened internal representation of context (see also Section 3.4).

I am only aware of one study that has examined the effect of schizotypy on latent inhibition after a context change between the preexposure and test stages (Tsakanikos & Reed, 2004), and of none that examined the same question in schizophrenia. Tsakanikos and Reed (2004) found abolished latent inhibition after a context change in low but not high schizotypy in a visual search task. Schizotypy was measured using the STA (Claridge & Broks, 1984) which has been found to correlate with both unusual experiences schizotypy ($r = .87, p < .01$) and cognitive disorganisation schizotypy ($r = .69, p < .01$) as measured by the O-Life (Mason et al., 1995).

Experiment 8 examined the effect of multi-dimensional schizotypy on latent inhibition after a physical context change between the preexposure and test phases by examining the latent inhibition data from the participants in Experiment 4 for whom schizotypy scores were available. The analyses conducted in this experiment are limited to blocks 1 and 2 because it was in these blocks the effect of a context change on latent inhibition was evident.

3.3.1: Results

Descriptive schizotypy statistics.

Tables 7 and 8 show the means, standard deviations and inter-correlations of the schizotypy scales for the 19 participants in the CONTROL group (mean age = 19.84 (*SD* =

3.22), 17 females, 2 males) and the 20 participants in the context CHANGE group (mean age = 20.05 (SD = 1.15), 17 females, 3 males). The CONTROL and CHANGE groups did not differ in age, $F(1, 37) = .04$, $MSE = 11.93$, $p = .85$. The participants were split into two groups (LOW, HIGH) on the basis of their schizotypy score according to slightly different criteria to those employed in Experiments 5-7 because the sample size in this experiment is substantially smaller than in Experiments 5-7. With the aim of having around 10 participants in each LOW and HIGH group the sampling method used in Experiments 5-7 would essentially be a median split. However, as is clear from Table 7, some of the schizotypy dimension means are quite a lot lower than the Mason et al. (1995) means and if the participants are just divided into the LOW and HIGH groups on the basis of a median split, then the HIGH group will contain a number of participants whose scores will be in the region of the norm mean (Mason et al., 1995). The participants were therefore divided into LOW and HIGH groups on the basis of the Mason et al. (1995) norm means in order to ensure that the respective LOW and HIGH groups did indeed consist of participants with scores below and above the norm mean provided by Mason et al. (1995). As Mason et al., gave no mean for the full scale, all the dimensional means were added together to obtain that measure (= 39.6).

Table 7. Experiment 8: The means and standard deviations (*SD*) for the schizotypy dimensions from the CONTROL group (centre column) and the CHANGE group (right column).

Schizotypy dimension	CONTROL (N=19)	CHANGE (N=20)
Full scale	36.42 (11.36)	36.25 (12.81)
Unusual experiences	7.74 (6.02)	9.7 (4.73)
Cognitive disorganisation	13.63 (4.34)	13.85 (4.99)
Introvertive anhedonia	5 (3.32)	2.9 (2.17)
Impulsive nonconformity	10.05 (3.33)	9.8 (4.9)

Table 8. Experiment 8: The inter-correlations between the schizotypy scales in group CONTROL (four left-hand data columns) and group CHANGE (four right-hand columns).

	CONTROL (N=19)			CHANGE (N=20)		
	CD	IA	IN	CD	IA	IN
Unusual experiences (UE)	**.29**	**.22**	**.24**	**.18**	**-.1**	**.72***
Cognitive disorganisation (CD)		**.27**	**.14**		**-.01**	**.43**
Introvertive anhedonia (IA)			**.32**			**-.09**
Impulsive nonconformity (IN)						

*Significant ($p < .05$ or less)

Full scale schizotypy: Groups

The 13 participants in the CONTROL group (mean = 31.31, *SD* = 4.77) and the 11 participants in the CHANGE group (mean = 27.22, *SD* = 6.44) scoring 39 or below on the full schizotypy scale were assigned to the LOW groups and the 6 participants in the CONTROL group (mean = 47.5, *SD* = 13.97) and the 9 participants in the CHANGE group (mean = 47.22, *SD* = 4.74) scoring 40 or above on the full schizotypy scale were assigned to the HIGH groups. The four groups did not differ in age (largest $F(1, 35) = 1.16$, $MSE = 12.2$, $p = .29$). It should be acknowledged that the group sizes, particularly in the HIGH CONTROL group, are unfortunately small.

Full scale schizotypy: Correct responses

Panel A of Figure 20 illustrates the mean number of correct responses to the NPE and the PE CS across conditioning blocks 1 and 2 for the participants in the LOW and HIGH schizotypy CONTROL and CHANGE groups. Inspection of Panel A indicates more correct responding as conditioning progressed and more correct responding to the NPE than to the PE CS for both the LOW and HIGH schizotypy CONTROL and CHANGE groups. ANOVA revealed effects of exposure, $F(1, 35) = 12.15$, $MSE = .97$, $p < .01$, and block, $F(1, 35) = 33.73$, $MSE = .77$, $p < .001$, but not of group (CONTROL and CHANGE) or schizotypy, both $Fs < 1$. The interactions between exposure and schizotypy, $F(1, 35) = 3.56$, $MSE = .97$, $p = .068$, and between block, schizotypy and condition, $F(1, 35) = 3$, $MSE = .77$, $p = .09$, were not sognificant although there were apparent trends. There were no other interactions (largest $F(1, 35) = 1.48$, $MSE = .55$, $p = .23$).

Full scale schizotypy: Correct responses ratio

Panel B of Figure 20 illustrates the mean correct responses ratios across the two conditioning blocks for the four groups. Inspection of Panel B indicates equal amounts of latent inhibition in the LOW and HIGH CONTROL groups, whereas latent inhibition appears to be evident in the HIGH and not in the LOW CHANGE group. ANOVA did not, however, reveal any effects of block, schizotypy or group nor any interactions between these factors (largest $F(1, 35) = 2.02$, $MSE = .05$, $p = .16$). One-sample t-tests confirmed latent inhibition in both the LOW, $t(12) = 2.31$, $p < .05$, and the HIGH schizotypy CONTROL groups, $t(5) = 2.9$, $p < .05$, and also in the HIGH, $t(8) = 3.24$, $p < .05$, but not in the LOW, $t(10) = .16$, $p = .87$, CHANGE group.

Full scale schizotypy: Reaction times

Panel C of Figure 20 illustrates the mean reaction times on the NPE and the PE CS trials across the two conditioning blocks for the four groups. Inspection of Panel C indicates shorter reaction times as conditioning progressed and faster reaction times on the NPE than on the PE CS trials, especially in the CONTROL groups. The amount of latent inhibition in the LOW and HIGH groups did not appear to differ in either the CONTROL groups or the CHANGE groups. ANOVA confirmed that there were effects of exposure, $F(1, 35) = 10.23$, $MSE = 57054.46$, $p < .01$, and block, $F(1, 35) = 32.22$, $MSE = 42642.79$, $p < .001$, but not of schizotypy or group, both $Fs < 1$. There was an interaction between exposure and group, $F(1, 35) = 5.39$, $MSE = 57054.46$, $p < .05$, but no other two-way interactions (largest $F(1, 35) = 1.42$, $MSE = 22765.09$, $p = .24$). There was no interaction between exposure, block and schizotypy, $F(1, 35) = 2.57$, $MSE = 22765.09$, $p = .12$, nor any other three-way or four-way interactions, all $Fs < 1$. Bonferroni-adjusted simple effects test followed up the interaction between exposure and group and confirmed that there was latent inhibition in the CONTROL groups, $p < .05$, but not in the CHANGE groups, $p = .52$.

Unusual experiences: Groups

The 14 participants in the CONTROL group (mean = 4.64, $SD = 2.41$) and the 14 participants in the CHANGE group (mean = 7.36, $SD = 3.25$) scoring 11 or below on the unusual experiences schizotypy scale were assigned to the LOW groups and the 5 participants in the CONTROL group (mean = 16.4, $SD = 4.1$) and the 6 participants in the CHANGE group (mean = 15.17, $SD = 2.48$) scoring 12 or above on the unusual experiences scale were assigned to the HIGH groups. The four groups did not differ in age, all $Fs < 1$.

Unusual experiences: Correct responses

Panel 1A of Figure 21 illustrates the mean number of correct responses to the NPE and the PE CS across conditioning blocks 1 and 2 for the four groups. Inspection of Panel 1A indicates that correct responding increased as conditioning progressed and that there was more correct responding to the NPE than to the PE CS for both the LOW and HIGH schizotypy CONTROL groups whereas latent inhibition seems to have been abolished in the LOW and HIGH CHANGE groups. However, ANOVA revealed effects of exposure, $F(1, 35) = 8.31$, $MSE = .96$, $p < .01$, and block, $F(1, 35) = 23.69$, $MSE = .79$, $p < .001$, but not of group or unusual experiences, both $Fs < 1$. There was no interaction between exposure and condition, $F(1, 35) = 2.53$, $MSE = .96$, $p = .12$, nor any other two- or three-way interactions between the factors (largest $F(1, 35) = 1.18$, MSE = .79, p = .23). The four-way interaction between exposure, block, schizotypy and condition approached significance, $F(1, 35) = 3.06$, $MSE = .52$, $p = .09$.

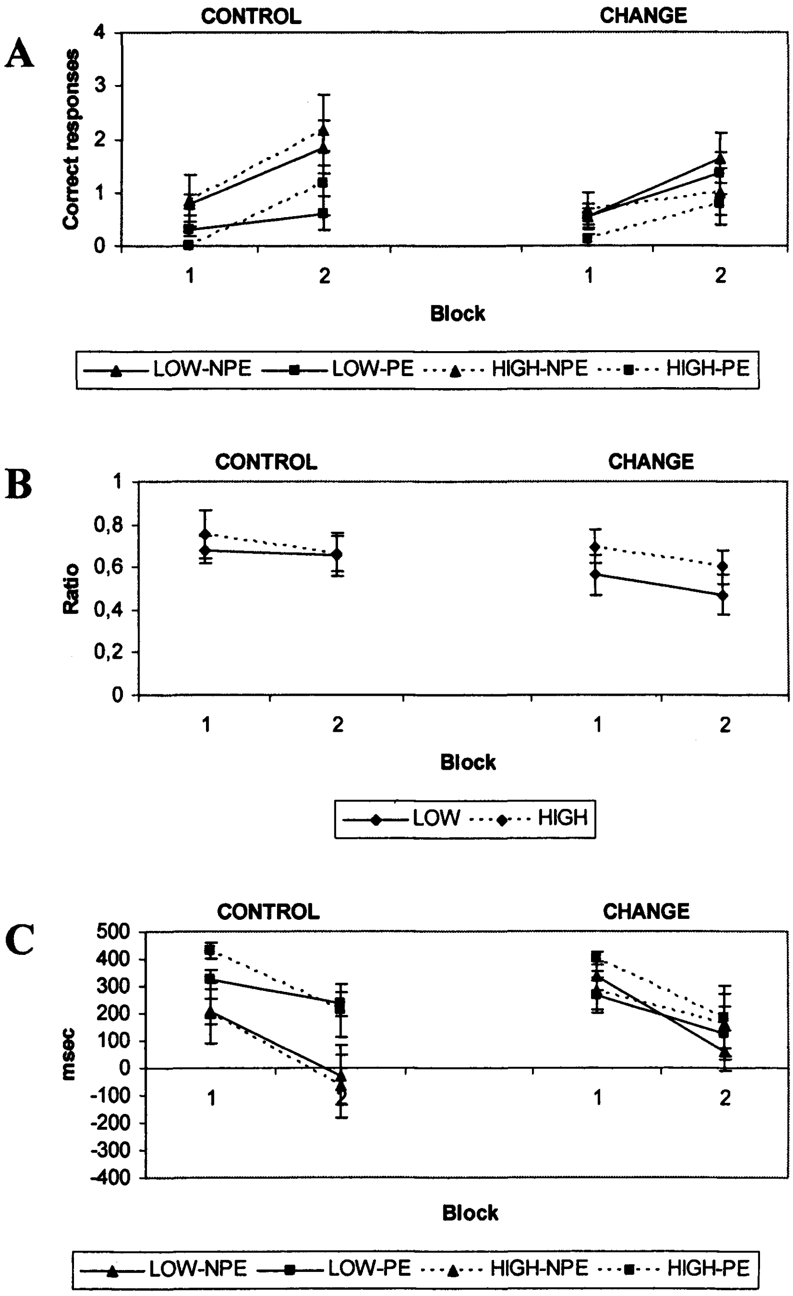
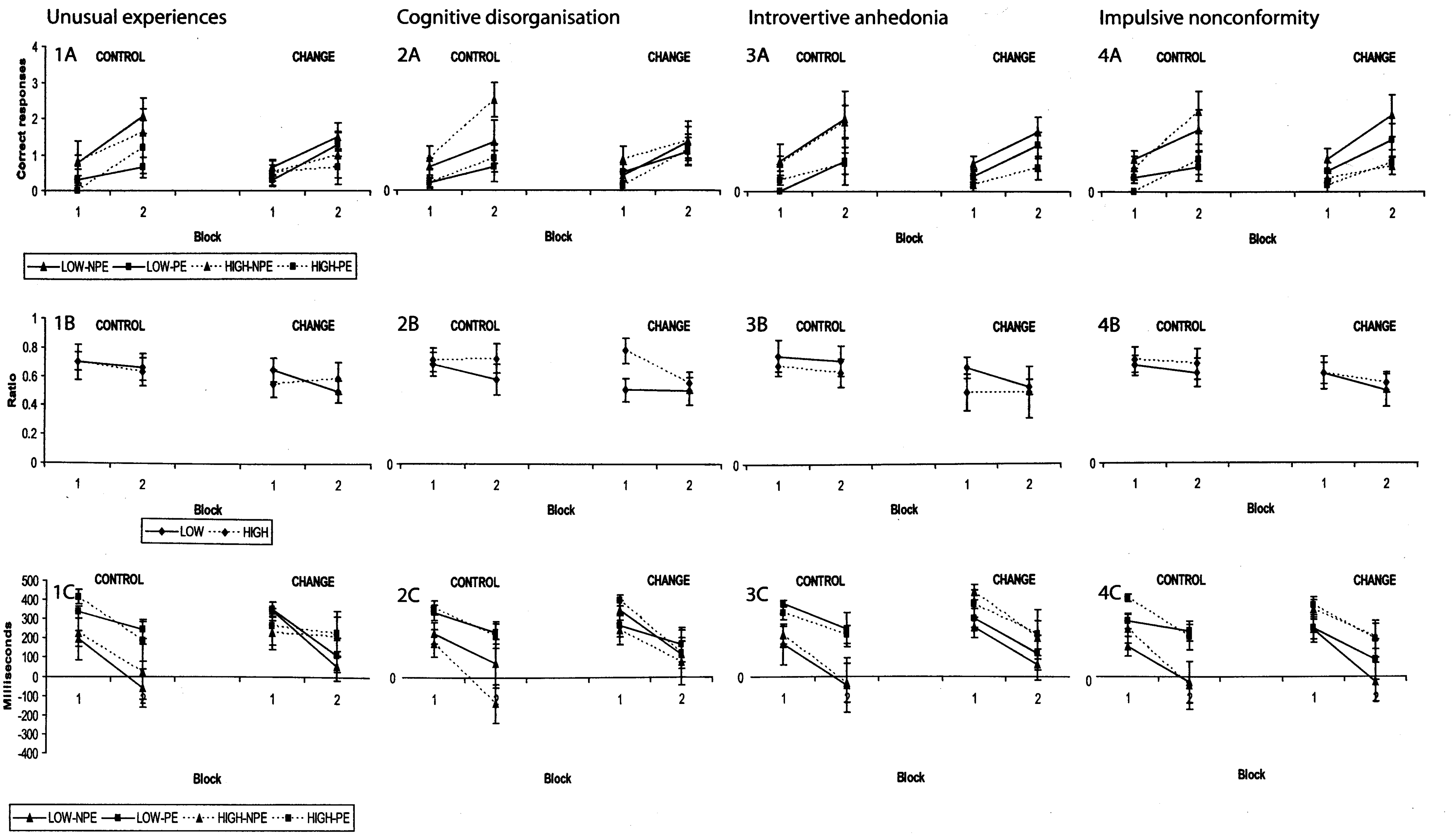


Figure 20. Experiment 8; Panel A: The mean number (±*SEM*) of correct responses to the nonpreexposed (NPE) and the preexposed (PE) stimuli in blocks 1 and 2 for the participants in the LOW (0-39, N = 13) and HIGH (40+, N = 6) full scale schizotypy CONTROL and LOW (0-39, N = 11) and HIGH (40+, N = 9) full scale schizotypy context CHANGE groups. Panel B: The correct response ratios (±*SEM*) in each block for the participants in the LOW and HIGH full scale schizotypy CONTROL and context CHANGE groups. Panel C: The mean reaction times (±*SEM*) on the NPE and PE CS trials in each block for the participants in the LOW and HIGH full scale schizotypy CONTROL and context CHANGE groups.



Unusual experiences
Cognitive disorganisation
Introvertive anhedonia
Impulsive nonconformity
1A CONTROL CHANGE
2A CONTROL CHANGE
3A CONTROL CHANGE
4A CONTROL CHANGE
Correct responses
Block
LOW-NPE LOW-PE HIGH-NPE HIGH-PE
1B CONTROL CHANGE
2B CONTROL CHANGE
3B CONTROL CHANGE
4B CONTROL CHANGE
Ratio
Block
LOW HIGH
1C CONTROL CHANGE
2C CONTROL CHANGE
3C CONTROL CHANGE
4C CONTROL CHANGE
Milliseconds
Block
LOW-NPE LOW-PE HIGH-NPE HIGH-PE

Figure 21. Experiment 8: The twelve panels 1A-4C are organised into three rows (A, B and C) that show the mean (±*SEM*) correct responses to the nonpreexposed (NPE) and preexposed (PE) CS, mean ratios (±*SEM*), and mean reaction times (±*SEM*) on the NPE and PE CS trials in blocks 1 and 2 for the LOW and HIGH CONTROL and CHANGE schizotypy groups, respectively; and into four columns that illustrate the results of the low (0-11, N = 14) and high (12+, N = 5) unusual experiences CONTROL and the low (0-11, N = 14) and high (12+, N = 6) unusual experiences CHANGE groups; the low (0-13, N = 9) and high (14+, N = 10) cognitive disorganisation CONTROL and the low (0-13, N = 12) and high (14+, N = 8) cognitive disorganisation CHANGE groups; the low (0-4, N = 6) and high (5+, N = 13) introvertive anhedonia CONTROL and the low (0-4, N = 14) and high (5+, N = 6) introvertive anhedonia CHANGE groups; and the low (0-9, N = 10) and high (10+, N = 9) impulsive nonconformity CONTROL and the low (0-9, N = 9) and high (10+, N = 11) impulsive nonconformity CHANGE groups, respectively. *Note.* In Panel 3A the mean number of correct responses to the NPE and PE CS were identical in the HIGH CHANGE group.

Unusual experiences: Correct responses ratio

Panel 1B of Figure 21 illustrates the mean correct responses ratios across conditioning blocks 1 and 2 for the four groups. Inspection of Panel 1B indicates that the latent inhibition ratios do not appear to differ markedly between the four groups. ANOVA revealed no effects of block, group or unusual experiences, nor any interactions between these factors (largest $F(1, 35) = 1.37$, $MSE = .12$, $p = .25$). One-sample t-tests, however, found latent inhibition in both the LOW, $t(13) = 2.59$, $p < .05$, and the HIGH schizotypy CONTROL groups, $t(4) = 3.16$, $p < .05$, and but not in the LOW, $t(13) = 1.04$, $p = .32$, or HIGH, $t(5) = 1.01$, $p = .36$, CHANGE groups.

Unusual experiences: Reaction times

Panel 1C of Figure 21 illustrates the mean reaction times on the NPE and the PE CS trials for the participants in the LOW and HIGH unusual experiences CONTROL and CHANGE groups. Inspection of Panel 1C indicates shorter reaction times as conditioning progressed with faster reaction times on the NPE than the PE CS trials in the CONTROL groups. In the CHANGE groups no latent inhibition is apparent in either the LOW or the HIGH group, however, responding in the LOW group became faster as conditioning progressed whereas this was not the case in the HIGH group where the speed of responding stayed the same across the conditioning blocks. ANOVA confirmed that there were effects of exposure, $F(1, 35) = 7$, $MSE = 58134.89$, $p < .05$, and block, $F(1, 35) = 24.69$, $MSE = 36671.62$, $p < .001$, but not group or unusual experiences, both $Fs < 1$. There was a non-significant trend of an interaction between exposure and group, $F(1, 35) = 3.83$, $MSE = 58134.89$, $p = .058$, and a significant interaction between group, block and unusual experiences, $F(1, 35) = 4.17$, $MSE = 36671.62$, $p < .05$, but no other interactions (largest $F(1, 35) = 2.1$, MSE = 36671.62, $p = .16$). The three-way interaction between block, unusual experiences and group reflected that in the CONTROL LOW, CONTROL HIGH and CHANGE LOW groups, responding was faster in block 2 than in block 1, all $ps < .05$, whereas in the HIGH unusual experiences CHANGE group, speed of responding did not differ between blocks 1 and 2, $p = .75$. It is difficult to know what to make of this as, in reducing the sample, there was no effect of a context change.

Cognitive disorganisation: Groups

The 9 participants in the CONTROL group (mean = 10.11, $SD = 2.89$) and the 12 participants in the CHANGE group (mean = 10.17, $SD = 1.9$) scoring 13 or below on the cognitive disorganisation schizotypy scale were assigned to the LOW groups and the 10 participants in the CONTROL group (mean = 16.8, $SD = 2.57$) and the 8 participants in the CHANGE group (mean = 19.38, $SD = 1.92$) scoring 14 or above on the cognitive disorganisation scale were assigned to the HIGH groups. The four groups did not differ in age (largest $F(1, 35) = 2.58$, MSE = 11.71, $p = .12$).

Cognitive disorganisation: Correct responses

Panel 2A of Figure 21 illustrates the mean number of correct responses to the NPE and the PE CS in conditioning blocks 1 and 2 for the four groups. Inspection of Panel 2A indicates that correct responding increased as conditioning progressed and that there was more correct responding to the NPE than to the PE CS for both the LOW and HIGH cognitive disorganisation CONTROL groups whereas latent inhibition seems to be attenuated in the LOW and HIGH CHANGE groups. ANOVA revealed effects of exposure, $F(1, 35) = 13.81$, $MSE = .91, p < .01$, and block, $F(1, 35) = 31.18$, $MSE = .79, p < .001$, but not of cognitive disorganisation or group, both $Fs < 1$. There was a non-significant trend of an interaction between exposure and condition $F(1, 35) = 3.32$, $MSE = .91, p = .077$, but no other interactions, (largest $F(1, 35) = 2.69$, $MSE = .91, p = .11$).

Cognitive disorganisation: Correct responses ratio

Panel 2B of Figure 21 illustrates the mean correct responses ratios across conditioning blocks 1 and 2 for the four groups. Inspection of Panel 2B indicates that the latent inhibition ratios do not appear to differed markedly between the four groups, although there is a tendency for more latent inhibition to be evident in the HIGH cognitive disorganisation groups. ANOVA did not reveal any effects of block, cognitive disorganisation or group, nor any interactions between these factors (largest $F(1, 35) = 2.73$, MSE $= .11, p = .11$). One-sample t-tests showed latent inhibition in the HIGH CONTROL, $t(9) = 2.89, p < .05$, and the HIGH CHANGE groups, $t(7) = 3.5, p < .05$, and but not in the LOW CONTROL, $t(8) = 1.75$, $p = .12$, or LOW CHANGE groups, $t(11) = .11, p = .91$.

Cognitive disorganisation: Reaction times

Panel 2C of Figure 21 illustrates the mean reaction times to the NPE and the PE CS for the four groups. Inspection of Panel 2C indicates faster responding as conditioning progressed and faster responding to the NPE than to the PE CS in the LOW and HIGH CONTROL groups. Latent inhibition appeared to be attenuated in the LOW and HIGH CHANGE groups. ANOVA confirmed that there were effects of exposure, $F(1, 35) = 10.79$, $MSE = 53976.29, p < .01$, block, $F(1, 35) = 33.05$, $MSE = 41831.24, p < .001$, but not cognitive disorganisation or group, both $Fs < 1$. There was an interaction between exposure and group, $F(1, 35) = 4.63$, $MSE = 53976.29, p < .05$, and a non-significant trend of an interaction between group, block, exposure and cognitive disorganisation, $F(1, 35) = 3.54$, $MSE = 22301.04, p = .068$, but no other interactions (largest $F(1, 35) = 2.8$, $MSE = 53976.29$, $p = .1$). Bonferroni adjusted simple effects tests that followed up the interaction between exposure and group revealed latent inhibition in the CONTROL groups, $p < .01$, but not in the CHANGE groups, $p = .43$.

Introvertive anhedonia: Groups

The Mason et al. (1995) mean for introvertive anhedonia is 5. The participants scoring 5 should therefore ideally be excluded from the analyses. However, due to the low number of partcipants scoring above 5 in the context CHANGE group (N = 2), the participants scoring 5 were included in the HIGH groups. The 6 participants in the CONTROL group (mean = 1.5, $SD = 1.52$) and the 14 participants in the CHANGE group (mean = 1.79, $SD = 1.48$) scoring 4 or below on the introvertive anhedonia schizotypy scale were assigned to the LOW groups and the 13 participants in the CONTROL group (mean = 6.62, $SD = 2.57$) and the 6 participants in the CHANGE group (mean = 5.5, $SD = .84$) scoring 5 or above on the introvertive anhedonia scale were assigned to the HIGH groups. The four groups did not differ in age (largest $F(1, 35) = 1.76$, $MSE = 11.98$, $p = .19$).

Introvertive anhedonia: Correct responses

Panel 3A of Figure 21 illustrates the mean number of correct responses to the NPE and the PE CS across conditioning blocks 1 and 2 for the four groups. Inspection of Panel 3A indicates that there was more correct responding as training proceeded and that there was more correct responding to the NPE than to the PE CS for both the LOW and HIGH CONTROL groups whereas latent inhibition seems to have been attenuated in the LOW and HIGH CHANGE groups. ANOVA confirmed that there were effects of exposure, $F(1, 35) = 10.17$, $MSE = .96$, $p < .01$, and block, $F(1, 35) = 25.55$, $MSE = .81$, $p < .001$, but no other effects (largest $F(1, 35) = 1.06$, $MSE = 2.75$, $p = .31$). There was an interaction between exposure and group, $F(1, 35) = 4.57$, $MSE = .96$, $p < .05$, but no other interactions (largest $F(1, 35) = 1.26$, $MSE = 2.75$, $p = .27$). Bonferroni adjusted simple effects test revealed latent inhibition in the CONTROL groups, $p < .01$, but not in the CHANGE groups, $p = .46$.

Introvertive anhedonia: Correct responses ratio

Panel 3B of Figure 21 illustrates the mean correct responses ratios across the two conditioning blocks for the four groups. Inspection of Panel 3B indicates latent inhibition in the CONTROL groups, but not in the CHANGE groups. ANOVA did not, however, reveal any effects of block, group or introvertive anhedonia nor any interactions between these factors (largest $F(1, 35) = 2.9$, $MSE = .12$, $p = .1$). One-sample t-tests confirmed that there was latent inhibition in the LOW CONTROL group, $t(5) = 3.5$, $p < .05$, and a non-significant trend of latent inhibition in the HIGH CONTROL, $t(12) = 2.13$, $p = .054$, and in the LOW

CHANGE, $t(13) = 1.94$, $p = .074$, groups, but not in the HIGH CHANGE group, $t(5) = 0$, $p = 1$.

Introvertive anhedonia: Reaction times

Panel 3C of Figure 21 illustrates the mean reaction times on the NPE and the PE CS trials across conditioning blocks 1 and 2 in the four groups. Inspection of Panel 3C indicates shorter reaction times as training progressed and faster responding on the NPE than on the PE CS trials in the LOW and HIGH CONTROL groups. Latent inhibition appeared to be attenuated in both the LOW CHANGE and HIGH CHANGE groups. ANOVA revealed effects of exposure, $F(1, 35) = 8.23$, $MSE = 57066.76$, $p < .01$, and block, $F(1, 35) = 27.35$, $MSE = 43645.73$, $p < .001$, but no other effects (largest $F(1, 35) = 1.06$, $MSE = 115995.95$, $p = .31$). There was an interaction between exposure and group, $F(1, 35) = 6.11$, $MSE = 57066.76$, $p < .05$, but no other interactions (largest $F(1, 35) = 1.96$, MSE = 24606.21, $p = .17$). Bonferroni adjusted simple effects tests that followed up the interaction between exposure and group revealed latent inhibition in the CONTROL groups, $p < .01$, but not in the CHANGE groups, $p = .78$.

Impulsive nonconformity: Groups

The 10 participants in the CONTROL group (mean = 7.4, $SD = 1.35$) and the 9 participants in the CHANGE group (mean = 5.44, $SD = 3.01$) scoring 9 or below on the impulsive nonconformity schizotypy scale were assigned to the LOW groups and the 9 participants in the CONTROL group (mean = 13, $SD = 2.06$) and the 11 participants in the CHANGE group (mean = 13.36, $SD = 2.69$) scoring 10 or above on the impulsive nonconformity scale were assigned to the HIGH groups. The LOW (mean age = 18.9, $SD = 1.1$) and HIGH (mean age = 20.89, $SD = 4.43$) CONTROL and the LOW (mean age = 21.33,

$SD = 5.07$) and HIGH (mean age = 19, $SD = 1.48$) CHANGE groups marginally differed in age, $F(1, 35) = 4$, $MSE = 11.31$, $p = .053$. This was unexpected, but given the similar mean ages in each group, this was not considered to be of major concern.

Impulsive nonconformity: Correct responses

Panel 4A of Figure 21 illustrates the mean number of correct responses to the NPE and the PE CS in conditioning blocks 1 and 2 in the four groups. Inspection of Panel 4A indicates increasing levels of correct responding as conditioning progressed and more correct responding to the NPE than to the PE CS for both the LOW CONTROL and HIGH CONTROL groups whereas latent inhibition seems to have been attenuated in the LOW CHANGE and HIGH CHANGE groups. ANOVA supported these observations, revealing effects of exposure, $F(1, 35) = 13.59$, $MSE = .94$, $p < .01$, and block, $F(1, 35) = 36.79$, $MSE = .73$, $p < .001$, but not of impulsive nonconformity or group (largest $F(1, 35) = 1.84$, $MSE = 2.63$, $p = .18$). There was a non-significant trend of an interaction between exposure and group $F(1, 35) = 3.74$, $MSE = .94$, $p = .061$, and an interaction between between block, impulsive nonconformity and group, $F(1, 35) = 5.01$, $MSE = .73$, $p < .05$. There were no other interactions between the factors (largest $F(1, 35) = 2.05$, $MSE = 2.63$, $p = .16$). Bonferroni adjusted simple effects test indicated that the interaction between block, impulsive nonconformity and group reflects that the CONTROL LOW and HIGH impulsive nonconformity groups do not differ in either block 1, $p = .27$, or in block 2, $p = 51$. whereas in the LOW and HIGH CHANGE groups there were non-significant trends that responding differed in both block 1, $p = .08$, and block 2, $p = .065$.

Impulsive nonconformity: Correct responses ratio

Panel 4B of Figure 21 illustrates the mean correct responses ratios across the two conditioning blocks in the four groups. Inspection of Panel 4B indicates more latent inhibition in the CONTROL groups than in the CHANGE groups. However, ANOVA did not reveal any effects or interactions between the factors (largest $F(1, 35) = 1.94$, $MSE = .12$, $p < .17$). One-sample t-tests confirmed that there was latent inhibition in the HIGH CONTROL group, $t(8) = 2.55$, $p < .05$, and marginally significant latent inhibition in the LOW CONTROL group, $t(9) = 2.1$, $p = .066$, but not in the LOW CHANGE, $t(8) = .55$, $p = .6$, groups, or in the HIGH CHANGE, $t(10) = 1.73$, $p = .12$, groups.

Impulsive nonconformity: Reaction times

Panel 4C of Figure 21 illustrates the mean reaction times on the NPE and the PE CS trials in the two conditioning blocks in the four groups. Inspection of Panel 4C indicates shorter reaction times as training progressed and faster responding on the NPE than on the PE CS trials in the LOW and HIGH CONTROL groups. Latent inhibition was attenuated in both the LOW CHANGE and HIGH CHANGE groups. ANOVA revealed effects of exposure, $F(1, 35) = 9.86$, $MSE = 57819.28$, $p < .01$, and block, $F(1, 35) = 35.2$, $MSE = 40662.81$, $p < .001$, but not of impulsive nonconformity, $F(1, 35) = 3.14$, $MSE = 110269.39$, $p = .09$, or group, $F < 1$. There was an interaction between exposure and group, $F(1, 35) = 5.08$, $MSE = 57819.28$, $p < .05$, but no other interactions (largest $F(1, 35) = 2.42$, $MSE = 24028.87$, $p = .13$). Bonferroni adjusted simple effects tests revealed that the interaction between exposure and condition reflected latent inhibition in the CONTROL groups, $p < .01$, but not in the CHANGE groups, $p = .53$.

3.3.2: Discussion

In summary, none of the individual four schizotypy dimensions nor their combination into an overall schizotypy scale were found to affect latent inhibition either with or without a context change between the preexposure and test phases in this experiment. This is in contrast to the report by Tsakanikos and Reed (2004) of abolished latent inhibition in low but not high schizotypy after a context change. However, it is difficult to know what to make of the inconsistency between the results of Experiment 8 and those of Tsakanikos and Reed (2004). One the one hand, the number of extreme schizotypy scorers in the current experiment was low and this severely limits the confidence with which to come to clear conclusions about the current results. On the other hand, Tsakanikos and Reed (2004) in two experiments found abolished latent inhibition in participants with high schizotypy scores and intact latent inhibition in participants with low levels of schizotypy when the contexts of the preexposure and test phases were identical (Experiment 1) and the reverse pattern of results (i.e., abolished latent inhibition in participants with low levels of schizotypy and intact latent inhibition in participants with high schizotypy scores) when the contexts differed between the preexposure and test phases (Experiment 2). However, this description of Tsakanikos and Reed's results is based both upon a cross-experiment comparison involving the critical manipulation of context and separate analyses conducted upon each schizotypy group within each experiment, and this render these findings less compelling.

Although the lack of extreme schizotypy scorers in this experiment must temper the current findings, Experiment 8 does suggest that the contextual manipulation of the current study was not diffentially affected by schizotypy status. It may therefore be that the context processing deficits reported in schizophrenia (e.g., Cohen & Servan-Schreiber, 1992; Kuperberg et al., 1998; Silverstein et al., 1996, 1998, 2000; Cohen et al., 1999) and schizotypy (e.g., Silverstein, Raulin, Pristach, & Pomerantz, 1992; Uhlhaas et al., 2004) are specific deficits that do not impair all context processing and seemingly spare the processing of the context in Experiment 8.

3.4: General discussion

The key findings of Experiments 5-8, summarised in Table 9, are as follows: Experiments 5 and 6 found no indication of reduced latent inhibition in high schizotypy whether it was assessed after 20 or 10 CS preexposures; on the contrary, if anything the tendency was for more latent inhibition to be evident in high compared to low schizotypy. Experiment 7 found reduced latent inhibition after 5 CS preexposures in high introvertive anhedonia, and Experiment 8 found no effect of schizotypy on latent inhibition before or after a context change.

Table 9. Experiments 5-8: A summary of the results of Experiment 5-8.

	Full scale Schizotypy	Unusual experiences	Cognitive disorganisation	Introvertive anhedonia	Impulsive nonconformity
Experiment 5					
Correct responses	N	N	N	N	Y (H >L)
Ratios	N	N	N	N	Y (H > L)
Reaction times	N	N	N	N	N
Experiment 6					
Correct responses	(Y; H >L)	Y (H≠L)	Y (H≠L)	N	N
Ratios	N	N	N	N	N
Reaction times	Y (H >L)	Y (H≠L)	Y (H≠L)	N	N
Experiment 7					
Correct responses	Y (L >H)	N	N	Y (L >H)	N
Ratios	Y (L >H)	N	(Y; L >H)	(Y; L >H)	N
Reaction times	Y (L >H)	N	N	N	N
Experiment 8					
Correct responses	N	N	N	N	N
Ratios	N	N	N	N	N
Reaction times	N	N	N	N	N

Note: (Y) indicates a maginally significant effect of schizotypy. 'N' indicates no effect of schizotypy, 'Y' indicates an effect of schizotypy on latent inhibition. 'L' = LOW, 'H' = HIGH.

Evans et al. (2007) used a similar task to that employed in Experiments 1-8 and found trends of reduced latent inhibition in participants with high unusual experiences scores. However, firstly, the trends (correct responses: $p = .1$ and reaction times $p = .08$) were not significant according to conventional levels of statistical significance and, secondly, the (non-significant) trends towards reduced latent inhibition were not found on the basis of the latent inhibition indices (the difference between the PE and NPE scores), but on the basis of associations with responding to the preexposed stimulus. The absence of an association between the latent inhibition index and unusual experiences suggests that it is not latent inhibition *per se* that is (non-significantly) related to unusual experiences, but rather something else that is nevertheless limited to responding to the preexposed CS. It might be concluded, therefore, that the absence of an effect of unusual experiences on latent inhibition in Experiments 5-8 is in broad agreement with the results of Evans et al. (2007).

Before moving on to consider the finding of reduced latent inhibition in participants with high levels of introvertive anhedonia reported in Experiment 7, the effect of gender will be considered. Lubow and De la Casa (2002) found that the effect of gender on latent inhibition interacted with schizotypy as latent inhibition was observed in low schizotypal females and high schizotypal males whereas no latent inhibition was evident in low schizotypal males and high schizotypal females. Lubow, Kaplan and De la Casa (2001) observed a similar pattern of results for females. Both these studies used the Claridge and Broks (1984) schizotypal scale (STA) which correlates highly with both the unusual experiences (.65 and .57; Claridge, McCreery, Mason, Bentall, Boyle, Slade, & Popplewell, 1996) and cognitive disorganisation scales (.44 and .48; Claridge et al., 1996) of the O-Life. Evans et al. (2007) found no effect of gender on latent inhibition, but did not specifically examine whether gender interacted with schizotypy. In Experiments 5-8 (and in the subsequent Experiment 13) the numbers of male participants were too low (e.g., N = 3-4) to examine whether gender interacted with latent inhibition (and learned irrelevance in Experiment 13). However, as the majority of participants in Experiments 5-8 were female and Lubow and collegues found latent inhibition to be modulated by schizotypy in females, in particular, using a task that employed an explicit masking task, the absence of an effect of the aspects of schizotypy that are specifically related to positive schizoprenic symptomatology on latent inhibition in Experiments 5-8 does not weaken the validity of the current findings, but rather suggests that both the effect of gender and schizotypy on latent inhibition is due to an interaction between these factors and the masking task.

Reduced latent inhibition in introvertive anhedonia after 5 preexposures is contrary to any predictions and findings of the existing literature on latent inhibition in schizophrenia and schizotypy because latent inhibition is supposed to be sensitive to the positive schizophrenic symptomatology (e.g., J.A. Gray et al., 1991) and the corresponding schizotypy dimension (s; N.S. Gray et al., 2003). To the extent that latent inhibition has been found to be related to the negative symptomatology then it is reportedly in the opposite direction to that found in Experiment 7. That is, enhanced latent inhibition has been found in people displaying high levels of negative schizophrenic/schizotypic symptoms/characteristics (Weiner, 2003; Rascle et al., 2001; Cohen et al., 2004). Cohen and Servan-Schreiber (1992), however, hypothesised that the primary deficit in schizophrenia that leads to the negative symptoms is an inability to maintain an internal representation of context; "By an *internal representation of context* we mean information held in mind in such a form that it can be used to mediate an appropriate behavioral response" (Cohen & Servan-Schreiber, 1992, p. 46). A deficit in the internal representation of context as defined by these authors can explain why latent inhibition was reduced in people with high levels of introvertive anhedonia. Firstly, the introvertive anhedonia schizotypy dimension taps the characteristics of negative symptoms in schizophrenia. Secondly, the context during preexposure leads to a subsequent retardation of conditioned responding to the preexposed CS. Reduced latent inhibition in high introvertive anhedonia may therefore have come about because of a failure to keep the internal representation of the preexposure context in mind in such a form that it could be used to mediate a response during conditioning (e.g., do not press spacebar when PE CS is presented). The fact that the effect of introvertive anhedonia on latent inhibition was restricted to Experiment 7 might reflect that the latent inhibition effect was too marked in Experiments 5 and 6 (where preexposure was more extensive). However, this analysis is inconsistent with the finding that introvertive anhedonia did not influence the extent to which latent inhibition was context-specific in Experiment 8; where one might have anticipated greater latent inhibition in the high change group than in the low change group.

Experiments 5-8 employed a latent inhibition task that addressed a number of problems of earlier human latent inhibition tasks, including the absence of an explicit masking task. This task, however, revealed no attenuating effects of positive schizotypy on latent inhibition. Given the variability (which may partly be a result of the influence of factors that have not been taken into account in most of the published studies such as motivation level, anxiety, cognitive impairment, and an institutionalised state) in the human literature that has examined the effect of schizophrenia and schizotypy on latent inhibition and the results reported in this chapter, it is becoming increasingly more difficult to accept the general suggestion that latent inhibition is (1) an index of the attentional process that serves to tune out experientially irrelevant stimuli that is (2) deficient in acute schizophrenia and high positive schizotypy. Relatedly, the issue of latent inhibition as an attentional construct needs to be addressed. It is a core assumption of much of the human latent inhibition literature that latent inhibition is attentional and most of the findings appear to be interpreted on this basis without really questioning this assumption. However, the learning theories that are specifically attentional (e.g., Pearce & Hall, 1980; Lubow et al., 1981) are not able to account for certain aspects of latent inhibition such as its context specificity (although Lubow (1989) later added to his theory the idea that the context might serve as an occasion-setter for the CS-noUS association hypothesised to be formed during preexposure). The theories of learning that are best able to account for the context specificity of latent inhibition (or other preexposure effects such as perceptual learning) are those that emphasise the influence of associations between elements within (McLaren et al., 1989) and between the CS and the context (e.g., Wagner, 1981; McLaren et al., 1989) or view latent inhibition as a consequence of associative interference (e.g., Bouton, 1993). This implies that when latent inhibition is abnormal in certain human sub-groups, then the process that is abnormal may not be attentional.

Chapters 4 and 5 examined the influence of schizotypy on a stimulus preexposure effect that is related to latent inhibition, namely learned irrelevance. As already mentioned, many theories suggest that latent inhibition is an associative effect (e.g., Wagner, 1981; McLaren et al., 1989), whereas the theory of learning that is most successful at accounting for retarded conditioned responding after uncorrelated CS and US preexposure is the attentional theory proposed by Mackintosh (1975). This theory states that when a stimulus is a no better predictor of an outcome than other stimuli with which it is presented, then attention to it will decline. Although application of this theory to latent inhibition is troublesome, it provides a ready account of learned irrelevance (where the CS is a no better predictor of the US than the context in which it is presented). Mackintosh's theory accounts less well for latent inhibition because there is no US during preexposure for the CS to be a poor predictor of. It is possible to suppose, that the CS is a poorer predictor of no outcome than is the context and that this difference results in a reduction in attention to the CS. However, once one construes latent inhibition as the CS coming to predict no outcome, then there is no requirement for an attentional process; an account based on associative interference will suffice (see Section 1.3.2). Chapters 4 and 5 thus examined if learned irrelevance is a better index of the attentional deficit(s) evident in schizophrenia and high schizotypy than latent inhibition, at least in my hands, has proven to be.

Chapter 4

4: Learned irrelevance in humans as measured by a within-subjects task: Evaluation of a novel procedure.

Learned irrelevance refers to the retardation in the development of conditioned responding to a CS after uncorrelated CS and US preexposure (Mackintosh, 1973; Baker, 1976; Baker & Mackintosh, 1977). The acquisition of conditioned responding is usually reported to be retarded more after uncorrelated CS and US preexposure than after only CS or US preexposure (e.g., Mackintosh, 1973; Baker & Mackintosh, 1977; Matzel et al., 1988; Allen et al, 2002). As already mentioned (in Section 1.7) it is unclear whether learned irrelevance constitutes something (special) over and above the well-established retardation in conditioned responding induced by simple CS or US preexposure. The concern of this thesis is not to directly address the exact nature of learned irrelevance, rather to use a procedure analogous to learned irrelevance to study abnormalities in schizotypy.

A learned irrelevance procedure was developed to study abnormalities in schizotypy for the following reasons: Although obvious parallels exist between latent inhibition and learned irrelevance, different processes may underlie these effects (e.g., Mackintosh, 1975) and these processes may be differentially affected by schizotypy; which allow that while latent inhibition might not (always) be influenced by schizotypy, learned irrelevance might be so influenced. Furthermore, existing latent inhibition tasks appear to be very similar to learned irrelevance tasks (e.g., Lubow & De la Casa, 2002), which might be why these tasks are sensitive to schizotypy. In addition, learned irrelevance has been shown to be a robust effect that may generalise to other CSs than the preexposed CS (Dess & Overmier, 1989; Linden, Savage & Overmier, 1997) and to contexts other than the context of preexposure (Matzel et al., 1988; Dess & Overmier, 1989; Linden et al., 1997). Learned irrelevance therefore seems to be a more pervasive effect than latent inhibition. Moreover, learned irrelevance (if it is more than the sum of the retardation in conditioned responding induced by US and CS alone preexposure) seems to be about learning that events are unrelated (e.g., Baker & Mackintosh, 1977). One of the bases of a delusion might be failing to realise that events are unrelated and therefore treating them as if they were related.

The current experiments (9-12) were conducted as a prelude to Experiment 13 that investigated the effect of schizotypy on learned irrelevance. Experiments 9-12 parallel those described in Chapter 2 and were conducted for the same general reasons. Thus, the purpose of Experiment 9a was to verify that learned irrelevance could be induced in student participants given 20 uncorrelated CS and US preexposures. Experiment 9b investigated if the learned irrelevance effect was also evident in a healthy community sample given 20 uncorrelated CS and US preexposures. Experiment 10 addressed the effect of reducing the number of uncorrelated CS and US preexposures to 10 and 5 on learned irrelevance. In Experiment 11 an interruption between the task phases was inserted (with or without a 15 minute delay), and in Experiment 12 the effect on learned irrelevance of changing the context between the task phases was investigated. Responding to a CS after uncorrelated CS and US preexposure was compared to responding to a CS after US alone preexposure and the difference in responding between these two conditions is referred to as learned irrelevance throughout Chapters 4-7. It is important to note that the experiments reported in Chapters 4 and 5 did not include conditions that had been preexposed to the CS alone or not preexposed to any of the stimuli. That is, a nonpreexposed condition such as was employed in Chapters 2 and 3. However, for ease of comparison, the experimental (uncorrelated CS and US preexposure) and the control

(US only preexposure) conditions in Chapters 4 and 5 are referred to as PE and NPE, respectively, throughout Chapters 4 and 5.

4.1: Experiment 9

The aim of Experiment 9a was to establish that a within-subjects learned irrelevance effect can be induced and measured by a novel continuous task without an explicit masking task in a student sample given 20 CS and 20 US preexposures in an uncorrelated manner. The size of the learned irrelevance effect was, again, evaluated on the basis of the *partial eta*^{2} effect size. The primary aim of Experiment 9b was to replicate the results of Experiment 9a in a healthy community sample.

4.1.1: Method

Participants

Experiment 9a: The 42 university students (38 females, 4 males) who took part in the experiment were primarily psychology undergraduate students who received course credit for participation. The remainder were other students who received £3 for their participation. The mean age was 20.26 years (standard deviation, *SD* = 2.36). The participants in Experiment 9a are referred to as group PE20. Experiment 9b: The community sample was an opportunity sample recruited via advertisements in the local community and consisted of 28 (16 females, 12 males) participants. The participants received £3 for their participation. The mean age was 35.75 years (*SD* = 7.24) and their mean IQ was 113.41 (*SD* = 7.34, range = 92-124).

Apparatus and Procedure

The apparatus and procedures of Experiments 9a and 9b were identical to those of Experiments 1a and 1b, respectively, with the following expection: Twenty 'X' presentations were included in the preexposure phase. The sequence of trials was arranged with the following constraints: The presentations of 'X' were uncorrelated with both the CS and all the filler items. This was achieved by each of the filler items and the preexposed CS preceding 'X' on 4 occasions. These pairings with 'X' were intermixed with the remainder of the trials such that no consecutive presentations of a stimulus occurred.

4.1.2: Results and Discussion

The exclusion criteria were identical to those of Experiments 1a with the following exception: Due to the additional response requirement during preexposure in the learned irrelevance task, 15 errors of omission and 30 errors of commission were allowed before exclusion, provided it was the case that no more than 5 errors of omission and 10 errors of commission were committted during the preexposure phase. Twelve participants were excluded from Experiment 9a (undergraduate psychology students) and two participants were excluded from Experiment 9b (mean IQ 112.25 (SD = 1.77) on the basis of these criteria. Table 10 shows the group assignments, mean ages and gender of the excluded participants and the mean number of total errors of commission and omission both in the preexposure stage and for the whole task. The ages and genders of the final sample of participants are shown in Table 11.

Table 10. Experiments 9-12: The mean age, gender, mean number of total errors of commission and omission as well as mean number of errors of commission in the preexposure stage for the *excluded* participants in Experiments 9a, 9b, 10, 11 and 12. The associated standard deviations (*SD*) are listed in brackets.

Experimental group	Mean age	Female/male ratio	Mean total errors of commission	Mean total errors of omission	Mean errors of commission in PE phase	Mean errors of omission in PE phase
Experiment 9a:						
PE20	20.64 (1.93)	12/0	27.36 (16.73)	18.91 (8.44)	12.64 (7.41)	7.27 (4.34)
Experiment 9b:						
Community	40.5 (4.95)	1/1	20 (7.07)	30 (24.04)	8 (4.24)	14.5 (6.36)
Experiment 10:						
PE10	19.13 (1.73)	8/0	27.75 (18.71)	12.5 (11.43)	6.25 (3.58)	2.38 (2.97)
PE5	21.67 (2.89)	3/0	20.33 (15.53)	11 (8.72)	1.33 (1.15)	0 (0)
Experiment 11:						
INT	20 (1)	3/0	Computer crashed on all three participants			
Delay	-	0/0	-	-	-	-
Experiment 12:						
Control	19 (0)	2/0	21.5 (2.12)	10 (7.07)	8 (8.49)	4.5 (4.95)
Change	22 (2.65)	3/0	24 (15)	15.33 (13.2)	9 (10.58)	3 (3.46)

Note: INT = interruption, Change = context change, PE = preexposure

Table 11. Experiments 9-12: The mean ages, standard deviations and gender ratios for the experimental groups in Experiments 9a, 9b, 10, 11, and 12.

Experimental group		Mean age	Female/male ratio
Experiment 9a:	PE20	20.2 (2.54)	26/4
Experiment 9b:	Community	35.38 (7.33)	15/11
Experiment 10:	PE10	19.77 (4.18)	57/4
	PE5	19.55 (3.79)	48/7
Experiment 11:	INT	19.15 (1.27)	17/3
	Delay	19.95 (2.35)	15/5
Experiment 12:	Control	18.95 (1.79)	19/1
	Change	18.8 (0.83)	19/1

Note: INT = interruption, Change = context change, PE = preexposure

Experiment 9a

Correct anticipatory responses

Figure 22 shows the mean number of correct reponses to the NPE and PE CS. Inspection of Figure 22 indicates that correct anticipatory responding increased as conditioning progressed and that there was more correct responding to the NPE CS than to the PE CS in each of the four blocks. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi_2(5) = 11.2, p < .05$; therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .81$. ANOVA confirmed that there were effects of exposure, $F(1, 29) = 17.07$, $MSE = 2.34$, $p < .001$, and block, $F(2.42, 70.14) = 22.19$, $MSE = 1.04$, $p < .001$. The interaction between exposure and block was not significant although there was an apparent trend, $F(3, 87) = 2.5$, $MSE = .73$, $p = .064$. The *partial eta*^{2} for exposure was .37 indicating a large learned irrelevance effect. The mean correct response ratios are presented in Experiment 10 where they are compared with the ratios after 10 and 5 preexposures.

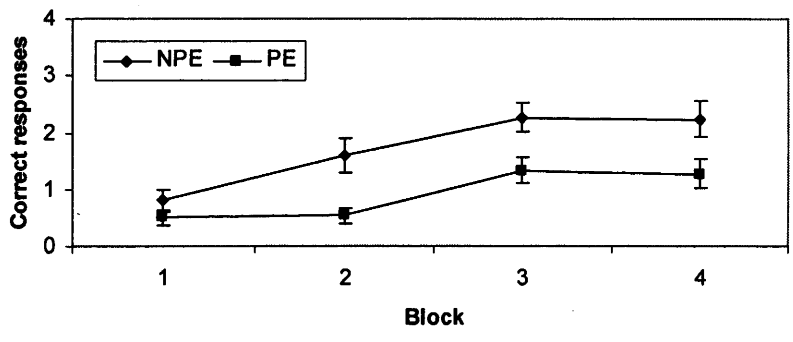


Figure 22. Experiment 9a: Mean number of correct anticipatory responses (±*SEM*) to the nonpreexposed CS (NPE) and the preexposed CS (PE) for the student sample given 20 uncorrelated CS and US preexposures.

Reaction times

Figure 23 shows the mean reaction times on the NPE and PE CS trials. Inspection of Figure 23 indicates shorter reaction times as conditioning progressed and faster responding on the NPE than on the PE CS trials in each of the four blocks. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi^2(5) = 16.15, p < .01$, and for the interaction between exposure and block, $\chi^2(5) = 12.32, p < .05$; therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .75$, and for interaction between exposure and block, $\varepsilon = .81$. ANOVA revealed effects of exposure, $F(1, 29) = 12.9$, $MSE = 107187.44$, $p < .01$, and block, $F(2.25, 65.1) = 20.08$, $MSE = 45264.72$, $p < .001$. There was no interaction between exposure and block, $F(2.43, 70.38) = 2.34$, $MSE = 47578.79$, $p = .09$. The *partial eta*^{2} for exposure was .31 indicating a large learned irrelevance effect.

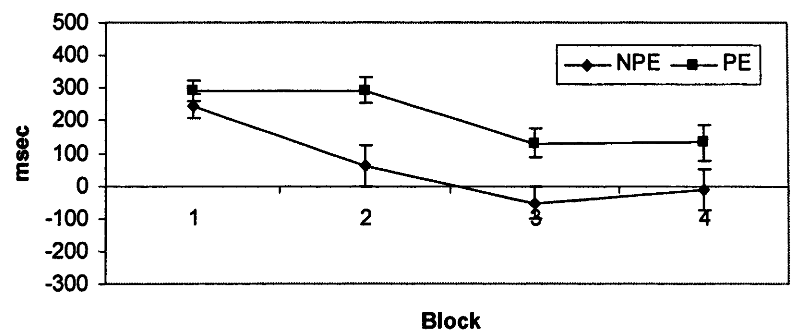


Figure 23. Experiment 9a: The mean reaction times (±*SEM*) on the nonpreexposed (NPE) CS and the preexposed (PE) CS trials for the student sample given 20 uncorrelated CS and US preexposures. A negative reaction time signifies that the response was made during the presentation of the CS.

In summary, Experiment 9a showed that the novel within-subjects learned irrelevance task was successful in inducing a retardation in conditioned responding both in terms of correct anticipatory responses and reaction time. In addition, the size of this effect was large, both as a function of correct responses and reaction time. These results were, again, all obtained without an explicit masking task.

Experiment 9b

Correct anticipatory responses

Figure 24 shows the mean numbers of correct reponses to the NPE and PE CS. Inspection of Figure 24 indicates that correct responding increased as conditioning progressed and, although the difference appears smaller than in Experiment 9a, there was more correct responding to the NPE than to the PE CS. ANOVA confirmed that there were effects of exposure, $F(1, 25) = 7.82$, $MSE = 1.93$, $p < .05$, and block, $F(3, 75) = 6.28$, $MSE = 1.19$, $p < .01$, but no interaction between these factors, $F(3, 75) = 1.57$, $MSE = .55$, $p = .21$. The *partial* eta^2 for exposure was .24 indicating a large learned irrelevance effect.

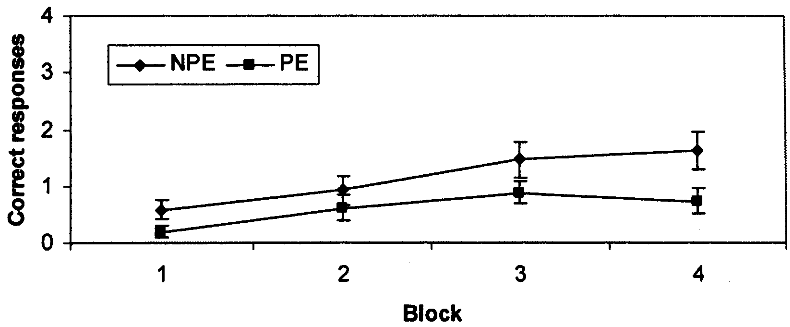


Figure 24. Experiment 9b: The mean number of correct anticipatory responses (±*SEM*) to the nonpreexposed CS (NPE) and the preexposed CS (PE) for the community sample given 20 uncorrelated CS and US preexposures.

Reaction times

Figure 25 shows the mean reaction times on the NPE CS trials and on the PE CS trials. Inspection of Figure 25 indicates faster responding as training progressed and, although the difference appears smaller than in Experiment 9a, there was faster responding on the NPE than on the PE CS trials. ANOVA confirmed these observations, revealing effects of exposure, $F(1, 25) = 7.45$, $MSE = 108349.34$, $p < .05$, and block, $F(3, 75) = 6.72$, $MSE = 52073$, $p < .001$, but no interaction between exposure and block, $F(3, 75) = 1.28$, $MSE = 34927.33$, $p = .29$. The *partial eta*^{2} for exposure was .23 indicating a large learned irrelevance effect.

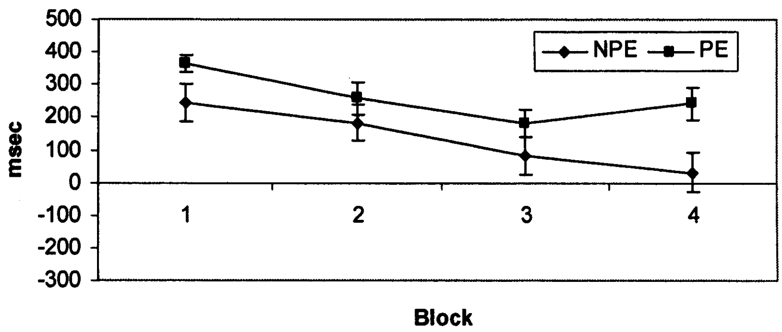


Figure 25. Experiment 9b: The mean reaction times (±*SEM*) on the nonpreexposed CS trials (NPE) and the preexposed CS trials (PE) for the community sample given 20 uncorrelated CS and US preexposures. A negative reaction time signifies that the response was made during the presentation of the CS.

In summary, Experiment 9b replicated the results of Experiment 9a in a healthy community sample using the present novel learned irrelevance task. The effect of uncorrelated preexposure was evident both using correct anticipatory responses and reaction times. In addition, the learned irrelevance effect obtained was large both as measured by correct anticipatory responses and reaction times.

4.2: Experiment 10

Experiment 10 examined the effect of varying the number of uncorrelated CS and US preexposures. I am unaware of any studies directly examining the effect of manipulating the amount of uncorrelated CS and US preexposure on learned irrelevance. However, learning theory (e.g., Mackintosh, 1975) predicts that the extent of retardation in conditioned responding to the CS after uncorrelated preexposure to the CS and the US is a direct function of the amount of uncorrelated CS and US preexposure, and this is of interest for the same reasons as were outlined in the context of latent inibition. That is, to enable the examination of the effect of schizotypy on learned irrelevance at different levels of robustness. Thus, the primary concern of Experiment 10 was to establish that the current learned irrelevance task is sensitive to the number of CS preexposures presented. As Experiments 9a and 9b established large and robust learned irrelevance effects after 20 preexposures, Experiment 10 reduced the number of preexposures with the aim of reducing the difference between the preexposed and the nonpreexposed groups.

4.2.1: Method

Participants and apparatus

The 127 university students (116 females, 11 males) that took part in the experiment were primarily psychology undergraduate students who received course credit for participation. The remainder were other students who received £3 for their participation. The mean age was 19.68 years (*SD* = 3.86). The apparatus was the same as in Experiment 9a.

Procedure

The procedure was the same as in Experiment 9a with the following exceptions. One group (PE10) received 10 CS and 10 US preexposures. The other group (PE5) received 5 CS and 5 US preexposures. The number of filler items in both groups were matched to the number of CS preexposures given: Each filler item was presented 5 times in the preexposure phase for group PE5, and 10 times for group PE10. The participants were randomly allocated to group PE5 or group PE10.

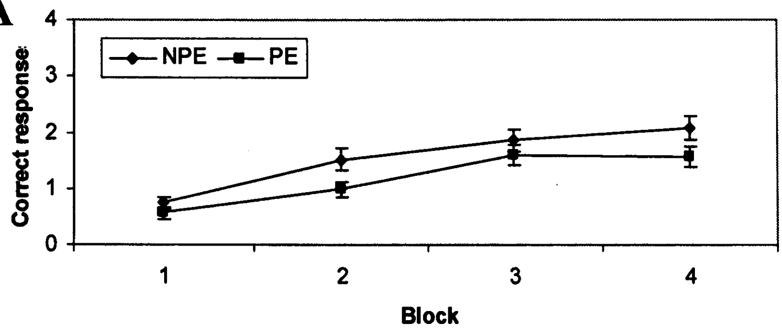
4.2.2: Results and Discussion

Eleven participants were excluded on the basis of scaled versions of the criteria employed in Experiment 9. That is, for the participants in the PE10 group, no more than 5 errors of commission and 3 errors of omission were allowed during preexposure, and for the participants in group PE5, no more than 3 errors of commision and 1 error of omission were allowed. In the test phase the usual maximum (of 20 errors of commission and 10 errors of omission) was allowed. Table 10 (in Section 4.1.2) shows the group assignments, mean ages and gender of the excluded participants. The ages and genders of the final sample of participants in the experimental groups are shown in Table 11 (also in Section 4.1.2). The student sample given 20 uncorrelated CS and US preexposures in Experiment 9a (group PE20) was included in the analyses throughout this section to enable comparisons with the manipulations of Experiment 10. The groups did not differ in age, $F < 1$.

Correct anticipatory responses

Panels A and B of Figure 26 show the mean numbers of correct reponses to the NPE and PE CS for the groups given 10 and 5 preexposures, respectively. Inspection of Panels A and B indicates that correct responding increased as conditioning progressed and that there was more correct responding to the NPE than to the PE CS; although this difference appeared to be smaller in group PE5 than in group PE10. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi_2(5) = 43.86, p < .001$. Therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity, $\varepsilon = .82$. ANOVA confirmed effects of exposure, $F(1, 143) = 31.48$, $MSE = 1.85$, $p < .001$, and block, $F(2.47, 353.49) = 75.74$, $MSE = 1.21$, $p < .001$, but not of preexposure number, $F < 1$. There were interactions between exposure and preexposure number, $F(2, 143) = 3.81$, $MSE = 1.85$, $p < .05$, and between exposure and block, $F(3, 429) = 6.21$, $MSE = .71$, $p < .001$, but not between block and preexposure number or between exposure, block and preexposure number, both $Fs < 1$. The interaction between exposure and preexposure number reflected that learned irrelevance was evident in groups PE20, $p < .001$, and PE10, $p < .01$, but not in group PE5, $p = .1$. Responding on neither the nonpreexposed, all $ps > .12$, nor the preexposed, all $ps > .2$, trials differed between the three groups. In group PE10 the *partial* eta^2 for exposure was .12 indicating a medium learned irrelevance effect after 10 CS+US preexposures. In group PE5 the *partial* eta^2 for exposure was .06 indicating a medium learned irrelevance effect after 5 CS+US preexposures.

A



B

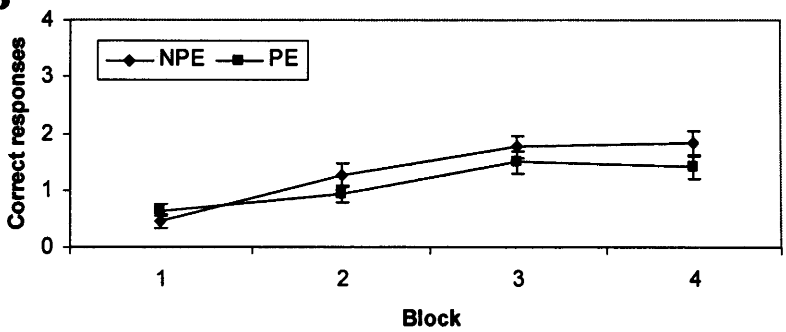


Figure 26. Experiment 10: Panel A: The mean number (±*SEM*) of correct anticipatory responses to the nonpreexposed CS (NPE) and the preexposed CS (PE) for group PE10. Panel B: The mean number (±*SEM*) of correct anticipatory responses to the nonpreexposed CS (NPE) and the preexposed CS (PE) for group PE5.

Correct anticipatory ratio responses

Figure 27 illustrates the mean correct responses learned irrelevance ratios for the three groups PE20, PE10 and PE5. Inspection of Figure 27 suggests that the learned irrelevance ratios for groups PE10 and PE5 do not differ from each other, but that they both appear to be slightly smaller than group PE20. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi^2(5) = 23.72, p < .001$; therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity, $\varepsilon = .9$. ANOVA revealed no effects of preexposure number, $F(2, 143) = 1.84$, $MSE = .14$, $p = .16$, or block, $F(2.69, 384.97) = 2.01$, $MSE = .08$, $p = .12$, and no interaction between these factors, $F < 1$. One-sample t-tests revealed learned irrelevance in group PE20, $t(29) = 2.07$, $p < .05$, but not in group PE10 although there was an apparent trend, $t(60) = 2$, $p = .05$, nor in group PE5, $t(54) = 1.7$, $p = .1$.

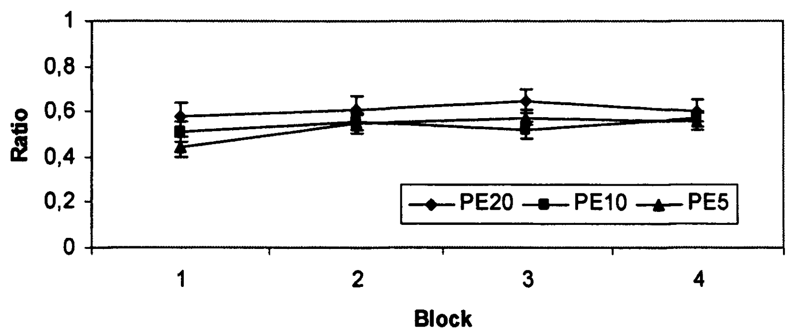


Figure 27. Experiment 10: The correct anticipatory response learned irrelevance ratios (±*SEM*) for the student samples in groups PE20, PE10 and PE5.

Reaction times

Panels A and B of Figure 28 illustrate the mean reation times on the NPE and PE CS trials across the four blocks for the groups given 10 and 5 preexposures, respectively. Inspection of both Panels A and B indicates that the speed of responding increased as conditioning progressed and shorter reaction times on the NPE CS than on the PE CS trials in both groups PE10 and PE5. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi 2(5) = 33.88$, $p < .001$, and for the interaction between exposure and block, $\chi 2(5) = 14.49$, $p < .05$. Therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block , $\varepsilon = .85$, and for the interaction between exposure and block, $\varepsilon = .94$. ANOVA confirmed that there were effects of exposure, $F(1, 143) = 18.99$, $MSE = 86445.61$, $p < .001$, and block, $F(2.55, 365.02) = 62.42$, $MSE = 50589.89$, $p <$

.001, but not preexposure number, $F < 1$. There were interactions between exposure and preexposure number, $F(2, 143) = 3.41$, $MSE = 86445.61$, $p < .05$, and between exposure and block, $F(2.81, 402) = 5.64$, $MSE = 40581.19$, $p < .01$, but no other interactions, both $Fs < 1$. The interaction between exposure and preexposure number reflected that learned irrelevance was evident in groups PE20, $p < .001$, but not in PE10 although there is an apparent trend, $p = .05$, or group PE5, $p = .25$. Responding on neither the nonpreexposed, all $ps > .22$, nor the preexposed, all $ps > .1$, trials differed between the three groups. In group PE10 the *partial eta*^{2} for exposure was .06 indicating a medium learned irrelevance effect after 10 CS+US preexposures. In group PE5 the *partial eta*^{2} for exposure was .03 indicating a medium learned irrelevance effect after 5 CS+US preexposures.

In summary, Experiment 10 suggested that learned irrelevance, as assessed by the present novel within-subjects task, is a function of number of uncorrelated CS and US preexposures both in terms of correct responses and reaction time. Learned irrelevance was observed after 20 and 10, but not after 5 CS and US preexposures as measured by correct anticipatory responses whereas learned irrelevance was only observed after 20 preexposures as measured by reaction times although there was a trend of learned irrelevance in group PE10. In line with these results, the effect size of the learned irrelevance effect declined as a function of the amount of preexposure given.

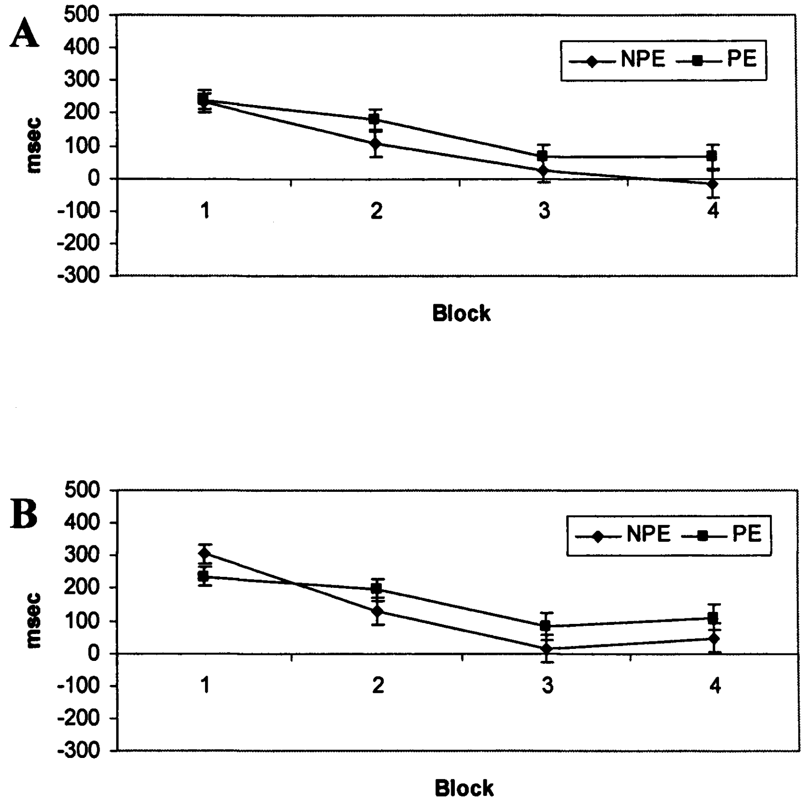


Figure 28. Experiment 10: Panel A: The mean reaction times (±*SEM*) on the nonpreexposed CS trials (NPE) and the preexposed CS trials (PE) for group PE10. Panel B: The mean reaction times (±*SEM*) to the nonpreexposed CS trials (NPE) and the preexposed CS trials (PE) for group PE5. A negative reaction time signifies that the response was made during the presentation of the CS.

4.3: Experiment 11

Experiment 11 investigated the effects of interrupting the learned irrelevance task between the preexposure and test stages and of imposing a 15-minute delay between the two task phases. Experiment 11 was conducted for the same reasons as Experiment 3. That is, as a prelude to the investigation (in Experiment 12) of the context specificity of the learned irrelevance effect. The effect of a context change on learned irrelevance is less well-established than the effect of a context change on latent inhibition, and this manipulation is of theoretical interest because if learned irrelevance is merely a special case of latent inhibition, it might be anticipated that learned irrelevance will also be context specific (but see Bonardi & Hall, 1996). The group who experienced a 15-minute delay between the preexposure and test stages was included in order to examine the temporal robustness of the learned irrelevance effect, which, as far as I am aware, has not been studied before.

4.3.1: Method

Participants, Apparatus and Procedure

The 43 university students (35 females, 8 males) who took part in the experiment were mostly psychology undergraduate students who received course credit for participation. The remainder were other students who received £3 for their participation. The mean age was 19.58 years ($SD = 1.85$). The apparatus was the same as that used in Experiment 9a, and the procedure was identical to Experiment 3.

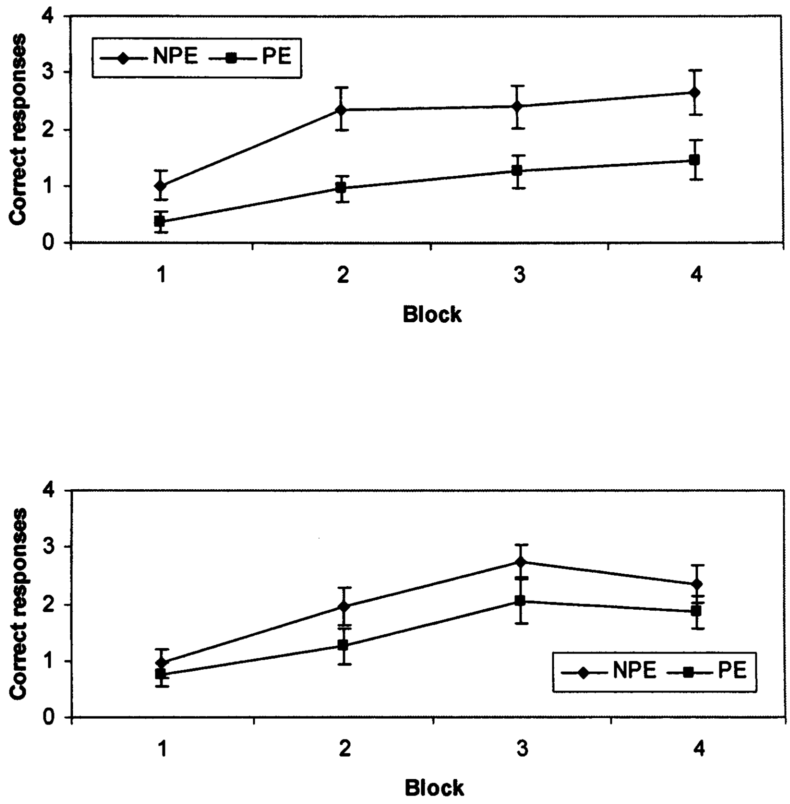
4.3.2: Results and Discussion

The same exclusion criteria were used as Experiment 9a. Three participants were excluded. The group assignments, mean ages and gender of the excluded participants as well as mean number of errors of commission and omission both in the preexposure and test phases are shown in Table 10 (in Section 4.1.2). Table 11 (also in Section 4.1.2) shows the mean ages and genders of the final sample of participants in the experimental groups. The mean ages of the groups were not significantly different, $F(1, 38) = 1.8$, $MSE = 3.57$, $p = .19$.

Correct anticipatory responses

Panels A and B of Figure 29 illustrate the mean numbers of correct reponses to the PE and NPE CS across the four blocks for groups INT and DELAY. Inspection of Panels A and B indicates increasing rates of correct responding as conditioning progressed, but that there was more correct responding to the NPE than the PE CS in both groups. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi^2(5) = 22.19, p < .001$. Therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block , $\varepsilon = .7$. ANOVA revealed effects of exposure, $F(1, 38) = 16.58$, $MSE = 3.19$, $p < .001$, and block, $F(2.11, 80.28) = 33.33$, $MSE = 1.34$, $p < .001$, but not group, $F < 1$. There was a non-significant trend of an interaction between exposure and block, $F(3, 114) = 2.44$, $MSE = .6$, $p = .068$, but no interactions between exposure and group, $F(1, 38) = 2.08$, $MSE = 3.19$, $p = .16$, between block and group, $F(2.11, 80.28) = 1.59$, $MSE = 1.34$, $p = .21$, or between exposure, block and group, $F < 1$.

A



B

Figure 29. Experiment 11: Panel A: The mean number (±*SEM*) of correct anticipatory responses to the nonpreexposed CS (NPE) and the preexposed CS (PE) in group INT. Panel B: The mean number (±*SEM*) of correct anticipatory responses to the nonpreexposed CS (NPE) and the preexposed CS (PE) in group DELAY.

Correct anticipatory ratio responses

Figure 30 illustrates the mean learned irrelevance ratios for groups PE20 (from Experiment 9a included for illustrative purposes only), INT and DELAY. Inspection of Figure 30 suggests that the correct response ratios for the three groups do not differ markedly. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi 2(5) = 19.78, p < .01$. Therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block , $\varepsilon = .73$. ANOVA confirmed that the response ratios did not differ between the groups INT or DELAY (largest $F(1, 38) = 1.47$, $MSE = .18$, $p = .23$). One-sample t-tests showed that in group INT learned irrelevance was observed, $t(19) = 2.87, p <$ $.05$, whereas in group DELAY no learned irrelevance was evident, $t(19) = 1.64, p = .12$.

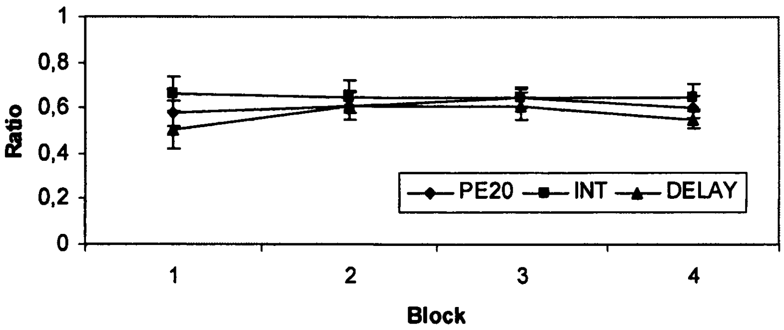


Figure 30. Experiment 11: The correct anticipatory responses learned irrelevance ratios (±*SEM*) for groups PE20, INT and DELAY.

Reaction times

The mean reaction times on the PE and NPE CS trials across the four blocks are shown in Panels A and B of Figure 31 for group INT and DELAY, respectively. Inspection of Panels A and B indicates shorter reaction times as conditioning proceeded and faster responding on the NPE than on the PE CS trials in both groups. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi^2(5) = 33.88, p < .001$. Therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block , $\varepsilon = .63$. ANOVA confirmed that there were effects of exposure, $F(1, 38) = 13.46$, $MSE = 159889.74$, $p < .01$, and block, $F(1.9, 72.11) = 33.54$, $MSE = 63800.68$, $p < .001$, but not group, $F < 1$. There was an interaction between exposure and block, $F(3, 114) = 2.85$, $MSE = 32168.92$, $p < .05$, but no other interactions, all $Fs < 1$.

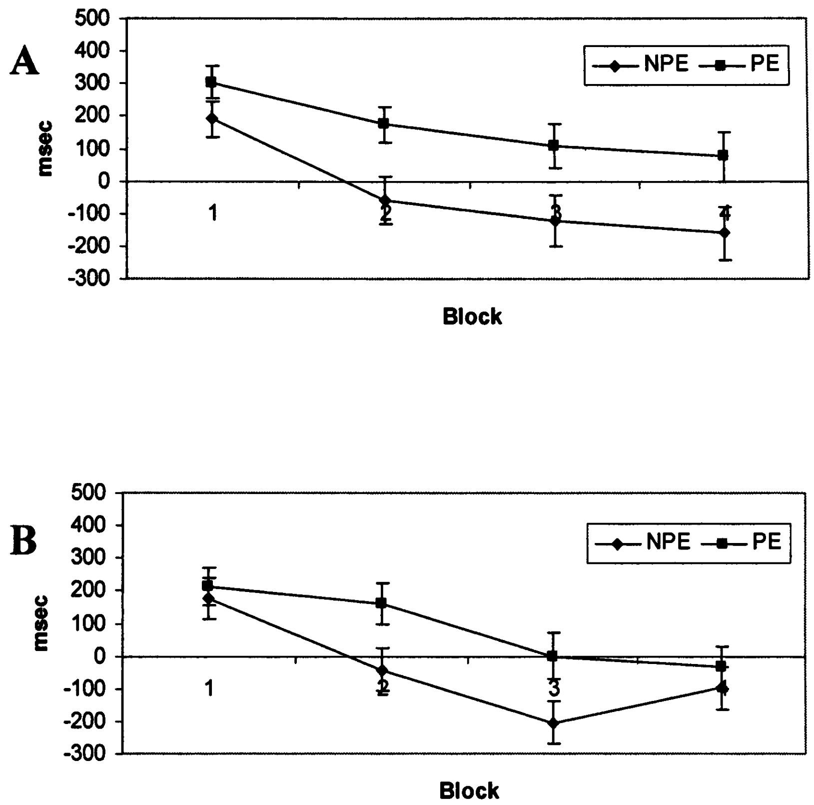


Figure 31. Experiment 11: Panel A: The mean reaction times (±*SEM*) on the nonpreexposed CS trials (NPE) and on the preexposed CS trials (PE) in group INT. Panel B: The mean reaction times (±*SEM*) on the nonpreexposed CS trials (NPE) and on the preexposed CS trials (PE) in group DELAY. A negative reaction time signifies that the response was made during the presentation of the CS.

Experiment 11 thus found a significant learned irrelevance effect after both an interruption and a 15-minute delay between preexposure and conditioning as a function of both correct responses and reaction time. These results suggest that the current task is capable of inducing robust retardation of conditioned responding that remains after both an interruption and a 15-minute delay. This, in turn, means that the context specificity of learned irrelevance, as measured by the current task, can be examined in Experiment 12.

4.4: Experiment 12

Experiment 12 was designed to establish if changing the context between the two test phases would abolish learned irrelevance. Matzel et al. (1988) reported attenuated, but still significant learned irrelevance after a context change using the same CS during preexposure and conditioning while Dess and Overmier (1989) and Linden et al. (1997) found retarded conditioned responding to a novel CS in a novel context after uncorrelated nontarget CS and US preexposure. Both simple and general learned irrelevance therefore seems to be evident in a novel context.

Experiments 9 and 11 found robust learned irrelevance after 20 uncorrelated CS and US preexposures whether or not the task was interrupted between the test phases and whether or not conditioning was delayed. Experiment 12 examined whether the learned irrelevance effect would also survive a physical context change between the test phases where context was manipulated in a similar manner to Experiment 4.

4.4.1: Method

Participants, Apparatus and Procedure

The 45 university students (43 females, 2 males) who participated in the experiment were for the most part psychology undergraduate students who received course credit for participation, and the remainder were other students who received £3 for their participation. The mean age of the participants was 19.09 years (*SD* = 1.62). The apparatus and general procedure were the same as Experiment 9a. The contextual manipulation was identical to Experiment 4.

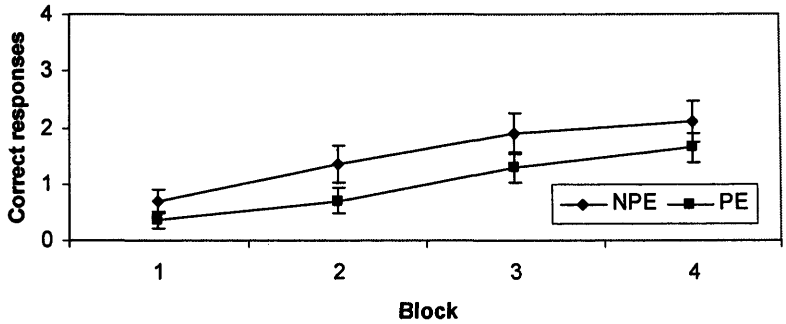
4.4.2: Results and Discussion

Five participants were excluded using the exclusion criteria of Experiment 9a. Table 10 (in Section 4.1.2) shows the group assignments, mean ages and gender of the excluded participants as well as mean number of total errors of commission and omission both in the preexposure stage and in total. The ages and genders of the final sample of participants in the experimental groups are shown in Table 11 (also in Section 4.1.2). The mean ages of the groups were not significantly different, $F < 1$.

Correct anticipatory responses

The mean numbers of correct reponses to the PE and NPE CS across the four blocks are shown in Panels A and B of Figure 32 for group CONTROL and CHANGE, respectively. Inspection of both Panels A and B suggests that there was more correct responding as conditioning progressed in both groups and that there was greater correct responding to the NPE than to the PE CS; although this difference appeared to be marginally smaller in group CHANGE than in group CONTROL. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi 2(5) = 11.79, p < .05$; therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block , $\varepsilon = .81$. ANOVA confirmed that there were effects of exposure, $F(1, 38) = 10.81$, $MSE = 1.26, p < .01$, and block, $F(2.43, 92.22) = 25.58$, $MSE =1.15, p < .001$. There was no effect of group nor any interactions, all $Fs < 1$.

A



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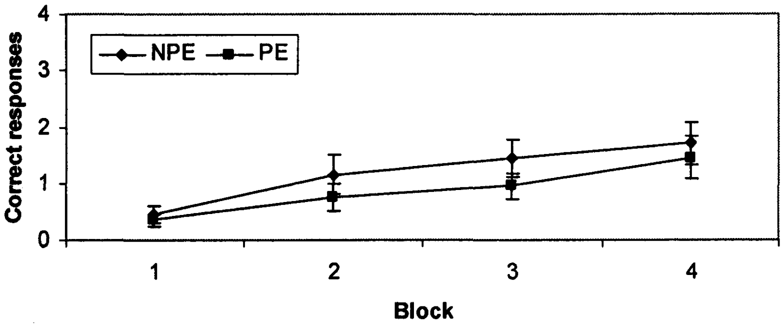

Figure 32. Experiment 12: Panel A: The mean number (±*SEM*) of correct anticipatory responses to the nonpreexposed CS (NPE) and the preexposed CS (PE) in group CONTROL. Panel B: The mean number (±*SEM*) of correct anticipatory responses to the nonpreexposed CS and the preexposed CS in group CHANGE.

Correct anticipatory ratio responses

The mean correct responses learned irrelevance ratios for the CONTROL and CHANGE groups are illustrated in Figure 33. Inspection of Figure 33 suggests no real effect of a context change on the ratio scores. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi_2(5) = 15.17, p < .05$; therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block , $\varepsilon = .79$. ANOVA confirmed that there was no effects of block or group nor an interaction between these factors (largest $F(2.37, 90.06) = 1.08$, $MSE = .08$, $p = .35$). One-sample t-tests showed no learned irrelevance in groups CONTROL, $t(19) = 1.51, p = .15$, or CHANGE, $t(19) = 1.35, p = .19$. It appears that this measure was not sensitive to the learned irrelevance pre-treatment.

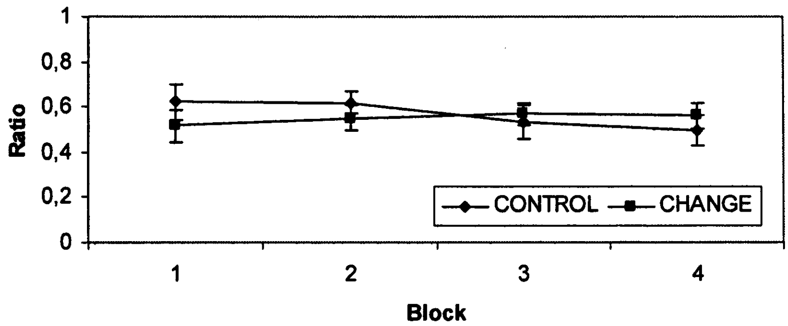

Figure 33. Experiment 12: The correct anticipatory response learned irrelevance ratios (±*SEM*) for group CONTROL and CHANGE.

Reaction times

The mean reaction times on the PE and NPE CS trials are shown in Panels A and B of Figure 34 for group CONTROL and CHANGE, respectively. Inspection of Panels A and B indicates shorter reaction times as conditioning progressed in both groups and faster responding on the NPE than on the PE CS trials although this difference appears to be smaller in group CHANGE than in group CONTROL, especially in blocks 1 and 2. However, ANOVA confirmed that there were effects of exposure, $F(1, 38) = 9.76$, $MSE = 73047.3$, $p < .01$, and block, $F(3, 114) = 16.41$, $MSE = 48898.61$, $p < .001$, but indicated that there was no effect of group, $F(1, 38) = 1.09$, $MSE = 318019.14$, $p = .3$. There was no interaction between exposure and group, $F(1, 38) = 2.57$, $MSE = 73047.3$, $p = .12$, nor any other interactions (largest $F(3, 114) = 1.32$, $MSE = 26256.1$, $p = .27$). Consequently, with the full analysis of the four blocks, a context change did not appear to affect learned irrelevance, However, as already mentioned, inspection of Figure 34 suggests that the effect of a context change on learned irrelevance is primarily evident in the first two blocks. Consequently, a second set of analyses identical to those conducted above were calculated on the first two blocks. ANOVA showed effects of exposure, $F(1, 38) = 11.43$, $MSE = 39556.66$, $p < .01$, and block, $F(1, 38) = 12.01$, $MSE = 38851.1$, $p < .01$, but not group, $F < 1$. There was an interaction between exposure and group, $F(1, 38) = 4.46$, $MSE = 39556.66$, $p < .05$, and a non-significant trend of an interaction between exposure and block, $F(1, 38) = 3.47$, $MSE = 22464.1$, $p = .07$, but no other interactions, both $F < 1$. Bonferroni adjusted simple main effects tests showed that in group CONTROL learned irrelevance was evident in both blocks 1 and 2, all $ps < .05$, whereas in the group CHANGE no learned irrelevance was found in any of the blocks, both $ps > .23$.

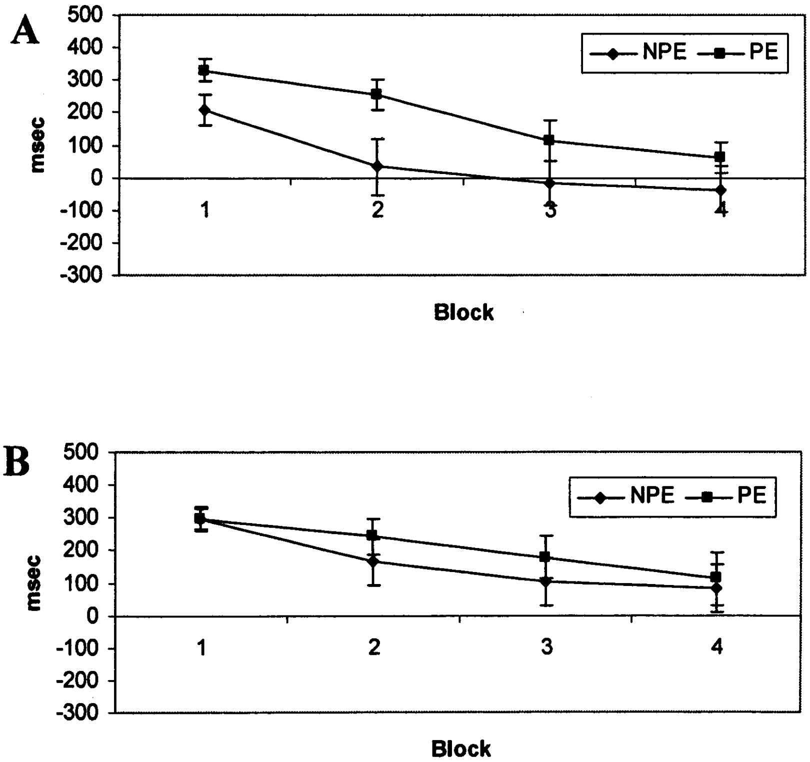

Figure 34. Experiment 12: Panel A: The mean reaction times (±*SEM*) on the nonpreexposed CS trials (NPE) and the preexposed CS trials (PE) in group CONTROL. Panel B: The mean reaction times (±*SEM*) on the nonpreexposed CS trials and the preexposed CS trials in group CHANGE. A negative reaction time signifies that the response was made during the presentation of the CS.

In summary, Experiment 12 found reduced learned irrelevance in blocks 1 and 2 when the preexposure and test contexts differed as a function of only reaction time and not correct anticipatory responses. Consequently, the learned irrelevance effect obtained did not appear to be as influenced by a change of context as the latent inhibition effect was in Experiment 4.

4.5: General discussion

The key findings of this series of experiments were as follows; Experiment 9a and 9b established robust and large learned irrelevance in both a student and healthy community sample. Experiment 10 found that this effect as measured by the current task was a function of the number of CS preexposures. Experiment 11 found intact learned irrelevance both after interrupting the task and after delaying conditioning, and Experiment 12 found attenuated, but not abolished learned irrelevance after a context change between the task stages. All the results were evident without a masking task and both as measured by correct anticipatory responses and reaction time, with the exception of Experiment 12 where the two dependent measures were more inconsistent.

Before moving to Chapter 5, where I investigate the effect of schizotypy on learned irrelevance, I will comment on the apparent inconsistence between the results of De la Casa and Lubow (2001) and those reported in this chapter. De la Casa and Lubow (2001) used a task that appears to be more akin to learned irrelevance than latent inhibition (due to the presence of the US during preexposure) and found the effect to be abolished by a 15-minute delay between the two task stages and by a context change. However, these results were only obtained as a function of reaction times and not correct responses which suggests that the effects obtained by their task were smaller and less robust than those obtained by the task reported in this thesis. Consequently, it is likely that the effects obtained by De la Casa and

Lubow (2001) will be more easily disrupted than those reported here, where a context change reduced learned irrelevance, but only as a function of reaction times. I will now move onto Chapter 5 where the effect of schizotypy on learned irrelevance was investigated.

Chapter 5

5: Learned irrelevance and multi-dimensional schizotypy.

5.1: Experiment 13

Chapter 3 found no evidence of reduced latent inhibition in any of the schizotypy dimensions putatively related to the positive symptoms of schizophrenia. The results of Chapter 3 were obtained using a latent inhibition task that circumvents a number of limitations of previous tasks that have been used in several studies which have reported reduced latent inhibition in high positive schizotypy (e.g., Gray et al., 2003; Braunstein-Bercovitz & Lubow, 1998). In this chapter the effect of multi-dimensional schizotypy on learned irrelevance is examined.

Abnormally attenuated learned irrelevance in acute schizophrenia has been reported on two occasions, both using the same learned irrelevance task (Gal et al., 2005; Young et al., 2005). However, in addition to not counterbalancing the letter stimuli employed in their task, Gal et al. and Young et al. did not statistically examine the locus of the differences in learned irrelevance between the control and acute schizophrenia groups. Visual inspection of the data indicates that the differences in learned irrelevance seemed to be more due to differences in responding to the nonpreexposed stimulus than to differences in responding to the preexposed stimulus, which suggests that it may not be learned irrelevance *per se* that is disrupted but rather some other effect on general responding. However, the lack of counterbalancing in these two reports make it difficult to assess the impact of acute schizophrenia on learned irrelevance. No studies exist, to the best of my knowledge, that have examined the effect of schizotypy on learned irrelevance.

In Experiment 13 the effect of multi-dimensional schizotypy on learned irrelevance was examined after 20 uncorrelated CS and US preexposures. This was achieved in the same way as in Experiments 5, that examined the effect of schizotypy on latent inhibition in groups PE20, INT and DELAY. That is, by obtaining the schizotypy data for the participants in Experiments 9a and 11 from the customary pre-test sessions that take place at the beginning of semester 1 for all undergraduate psychology students in the School of Psychology of Cardiff University.[3] If it is assumed that variations in the retardation of conditioned responding after learned irrelevance pre-treatment reflect differences in attention that are themseleves related to the positive symptoms of schizophrenia, then the schizotypy dimension hypothesised to exert an attenuating influence on learned irrelevance would be unusual experiences due to its alignment with acute schizophrenia that is characterised by a primarily positive symptom profile.

5.2: Results

Descriptive schizotypy statistics

Not all of the first year undergraduate students completed the pre-test sessions that provided the majority of the schizotypy data for the current experiment, therefore schizotypy data was not available for all the participants from Experiments 9a and 11. Schizotypy data were available for 24 out of a possible 30 participants (24/30) from the student group given 20 preexposures (Experiment 9a), 16/20 participants in the interruption group (Experiment 11), and for 20/20 participants in the delay group (Experiment 11). ANOVAs confirmed that these three groups did not differ (largest $F(2, 57) = 2.09$, $MSE = 299265.64$, $p = .13$), therefore the three groups were combined into one group for the purposes of Experiment 13. Tables 12 and

[3] Examination of the influence of schizotypy on the results of Experiment 12 was precluded because of the extremely small and unequal number of partipicants in groups CONTROL and CHANGE in the high schizotypy condition.

13 show the means, standard deviations and inter-correlations of the schizotypy scales for the 60 participants from whom schizotypy data were available (mean age = 19.62 (*SD* = 2.03), 50 females, 10 males). Inspection of Table 12 indicates that, in general, the schizotypy scores of the current sample are lower than existing norms. This is especially the case for the unusual experiences scale. Inspection of Table 13 indicates that the inter-relationships found between the scales in the present study differ in some ways from those those reported by Mason et al. (1995).

Table 12. Experiment 13: The means and standard deviations (*SD*) for the schizotypy dimensions from the current study (centre column) and the norms reported in Mason et al. (1995; right column).

Schizotypy dimension	Schizotypy mean (*SD*) N=60	Norm mean (Mason et al. 1995)
Full scale	32.07 (10.06)	not calculated
Unusual experiences	6.9 (4.99)	11.5 (6.9)
Cognitive disorganisation	11.83 (4.67)	13.4 (5.3)
Introvertive anhedonia	4.83 (3.53)	5.0 (4.5)
Impulsive nonconformity	9 (3.19)	9.7 (4.1)

Note: Mason et al. (1995) provided 5 different norms: 1) overall (females and males, N = 508), 2) males between 16-25 years (N = 76), 3) females between 16-25 years (N = 175), 4) males above 25 years (N = 143), and 5) females above 25 years (N = 114). The norms included in this table are those from group 3), i.e. females between 16-25 years as the vast majority of this sample were females between the ages of 16 and 25 years.

Table 13. Experiment 13: The inter-correlations between the schizotypy scales from the present study (four left-hand data columns) and the correlations reported by Mason et al. (1995; four right-hand columns).

	This study (N=60)			Mason et al. (1995)		
	CD	IA	IN	CD	IA	IN
Unusual experiences (UE)	**.5***	**-.27***	**.33***	**.42***	**-.08**	**.46***
Cognitive disorganisation (CD)		**.1**	**.1**		**.25***	**.33***
Introvertive anhedonia (IA)			**.06**			**-.1***
Impulsive nonconformity (IN)						

*Significant ($p < .05$ or less)

Inferential statistics and sampling

The participants were split into two groups (LOW, HIGH) on the basis of each schizotypy dimension according to the application of the same criteria as in Experiment 5[4]. The analyses were also identical to those of Experiment 5.

Full scale schizotypy: Groups

The 13 participants scoring 22 or below on the full schizotypy scale were assigned to the LOW group and the 10 participants scoring 44 or above on the full schizotypy scale were assigned to the HIGH group. The mean schizotypy score in the LOW group was 19.31 (SD = 2.93) and the mean score in the HIGH group was 48.5 (SD = 3.1). The LOW and HIGH groups did not differ in age, $F < 1$.

Full scale schizotypy: Correct responses

Panel A of Figure 35 illustrates the mean number of correct responses to the NPE and the PE CS for the participants in the LOW and HIGH schizotypy groups. Inspection of Panel A indicates that correct responding increased as conditioning progressed and that there was more correct responding to the NPE than to the PE CS for both the LOW and HIGH schizotypy groups. There is, however an indication of more learned irrelevance in block 3 in the LOW than in the HIGH group. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi2(5) = 15.92, p < .01$. Therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .68$. ANOVA revealed effects of exposure, $F(1, 21) = 7.66, MSE = 3.9, p < .05$, and block, $F(2.04, 42.83) = 13.15, MSE = 1.36, p < .001$, but not of schizotypy, $F < 1$. There was an interaction between exposure and block, $F(3, 63) = 3.34, MSE = .53, p < .05$, and a non-significant trend of an

[4] See Appendix 3 for alternative method of splitting the participants into high and low schizotypy groups. Appendix 3 presents the same analyses for the effect of schizotypy on learned irrelevance after 20 CS and US preexposures as Appendix 2 did for the effect of schizotypy on latent inhibition after 20 CS preexposures.

interaction between block and schizotypy $F(2.04, 42.83) = 3.09$, $MSE = 1.36$, $p = .055$, but no other interactions (largest $F(3, 63) = 1.19$, $MSE = .55$, $p = .32$).

Full scale schizotypy: Correct responses ratio

Panel B of Figure 35 illustrates the mean correct response ratios across the four conditioning blocks for the participants in the LOW and HIGH groups. Inspection of Panel B indicates no difference in these ratios between the LOW and HIGH group apart from in block 3 where more learned irrelevance seems to be evident in LOW than in HIGH schizotypy. ANOVA revealed no effects of block or schizotypy nor an interaction between these factors (largest $F(3, 63) = 2.13$, $MSE = .04$, $p = .11$). One-sample t-tests found a non-significant trend of learned irrelevance in the LOW group, $t(12) = 2.13$, $p = .055$, but not in the HIGH schizotypy group, $t(9) = .87$, $p = .41$.

Full scale schizotypy: Reaction times

Panel C of Figure 35 illustrates the mean reaction times on the NPE and the PE CS trials for the participants in the LOW and HIGH schizotypy groups. Inspection of Panel C indicates faster rates of responding as conditioning progressed and shorter reaction times on the NPE than on the PE CS trials. Inspection of Panel C suggests that the amount of learned irrelevance in the LOW and HIGH groups did not appear to differ apart from in block 3 where there seems to be more learned irrelevance in the LOW than in the HIGH schizotypy group. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi 2(5) = 22.15$, $p < .01$. Therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .57$. ANOVA confirmed that there were effects of block, $F(1.7, 35.74) = 10.71$, $MSE = 63047.66$, $p < .001$, and exposure, $F(1, 21) = 4.75$, $MSE = 196723.58$, $p < .05$, but not of schizotypy, F < 1. There was an interaction between exposure and block, $F(3, 63) = 2.92$, $MSE = 36281.32$, $p < .05$, but no other interactions were significant (largest $F(1.7, 35.74) = 1.29$, $MSE = 63047.66$, $p = .29$).

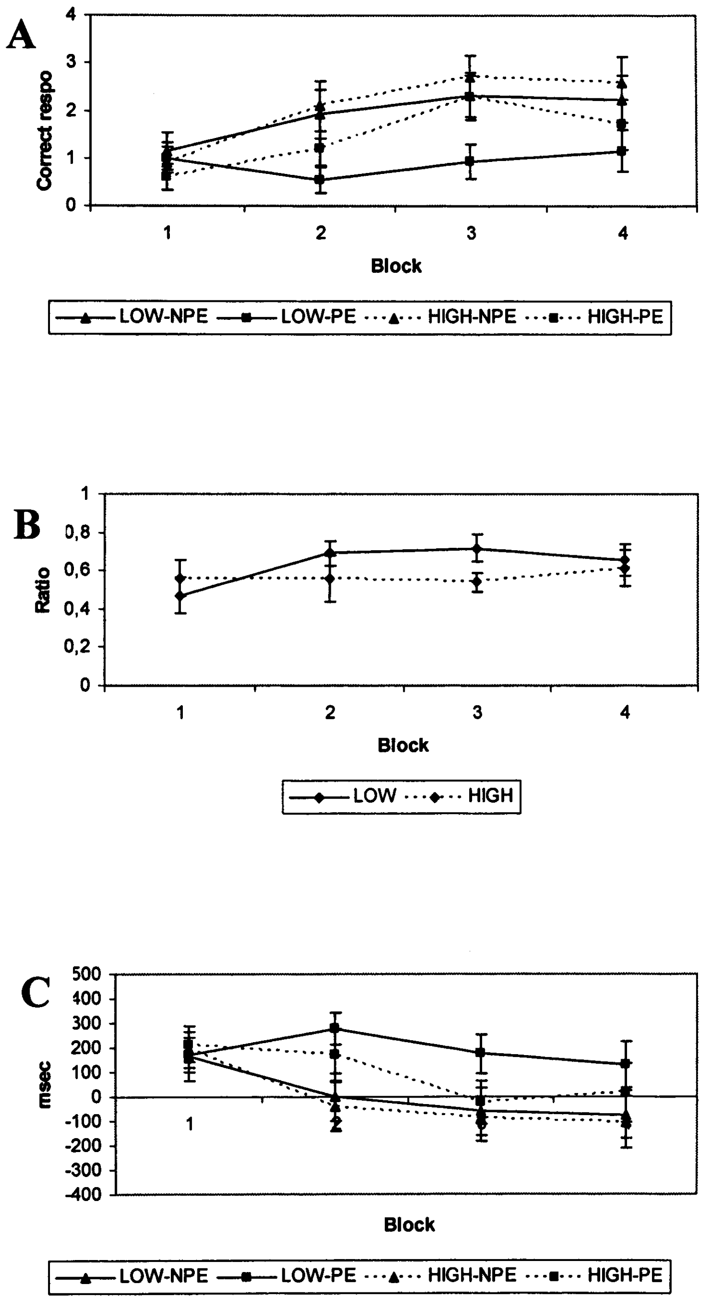

Figure 35. Experiment 13; Panel A: The mean number of correct responses (±*SEM*) to the nonpreexposed (NPE) and the preexposed (PE) stimuli in each block for the participants in the LOW (0-22, N = 13) and HIGH (44+, N = 10) full scale schizotypy groups. Panel B: The correct response ratios (±*SEM*) in each block for the participants in the LOW and HIGH full scale schizotypy groups. Panel C: The mean reaction times (±*SEM*) on the nonpreexposed and preexposed CS trials in each block for the participants in the LOW and HIGH full schizotypy scale groups.

Unusual experiences: Groups

The 10 participants scoring 1 or 0 on the unusual experiences subscale were assigned to the LOW group and the 13 participants scoring 12 or above on the unusual experiences subscale were assigned to the HIGH group. The mean schizotypy score in the LOW group was .6 (SD = .52) and the mean score in the HIGH group was 14.08 (SD = 2.66). The LOW and HIGH groups did not differ in age, $F < 1$.

Unusual Experiences: Correct responses

Panel 1A of Figure 36 Panel shows the mean number of correct responses to the NPE and the PE CS across the four conditioning blocks for the participants in the LOW and HIGH unusual experiences groups. Inspection of Panel 1A indicates that there was more correct responding as conditioning progressed and more correct responding to the NPE than to the PE CS for both the LOW and HIGH unusual experiences groups; but with less learned irrelevance apparent in the HIGH than in the LOW group. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi_2(5) = 13.73, p < .05$; therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .73$. ANOVA comfirmed that there were effects of exposure, $F(1, 21) = 8.73$, $MSE = 2.57, p < .01$, and block, $F(2.19, 45.92) = 19$, $MSE = .95, p < .001$, but not of unusual experiences, $F < 1$. There was an interaction between exposure and block, $F(3, 63) = 2.75$, $MSE = .61, p = .05$, but no other interactions were significant (largst $F(1, 21) = 1.8$, $MSE = 2.57, p = .19$). Closer inspection of Panel 1A suggests that the effect of unusual experiences on learned irrelevance was manifested in blocks 3 and 4 in particular. Consequently, ANOVA calculated on the data from blocks 3 and 4 only revealed an effect of exposure, $F(1, 21) = 9.47$, $MSE = 1.93, p < .01$, but not of block or unusual experiences, both $Fs < 1$. There was a non-significant trend of an interaction between unusual experiences and exposure, $F(1, 21) = 3.58$, $MSE = 1.93$, $p = .072$, but no other interactions, all $Fs < 1$.

Unusual Experiences: Correct responses ratio

Panel 1B of Figure 36 illustrates the mean correct response ratios across the four conditioning blocks for the participants in the LOW and HIGH groups. Inspection of Panel 1B indicates more learned irrelevance in the LOW than HIGH group apart from in block 1 where no learned irrelevance seems to be evident in either of the unusual experiences groups. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi^2(5) = 11.76$, $p < .05$; therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .71$. ANOVA calculated on all four blocks did not, however, reveal effects of block or unusual experiences nor an interaction between the factors (largest $F(2.14, 44.95) = 1.76$, $MSE = .07$, $p < .18$). This is in contrast to one-sample t-tests which confirmed that there was learned irrelevance in the LOW, $t(9) = 2.3$, $p < .05$, but not the HIGH unusual experiences groups, $t(12) = .74$, $p = .48$. However, as inspection of Panel 1B indicates that the effect of unusual experiences on the ratios appear particularly in blocks 3 and 4, a two-way ANOVA was conducted on blocks 3 and 4 only, and revealed an effect of unusual experiences, $F(1, 21) = 4.75$, $MSE = .08$, $p < .05$, but no effect of block nor an interaction between these factors, both $Fs < 1$. One-sample t-tests confirmed learned irrelevance in blocks 3 and 4 in the LOW group, $t(9) = 3.14$, $p < .05$, but not in the HIGH unusual experiences groups, $t(12) = .3$, $p = .77$. In order to examine whether reduced learned irrelevance in the HIGH group was due to a difference in responding to the NPE CS, to a difference in responding to the PE CS or both, ANOVAs were calculated on the NPE data in blocks 3 and 4 as well as on the PE data in blocks 3 and 4. The NPE data did not differ between the LOW and HIGH unusual experiences groups, all $Fs < 1$, and neither did the PE data (largest $F(1, 21) = 2.71$, $MSE = 3.68$, $p = .12$). Consequently, reduced learned irrelevance in the HIGH unusual experiences group seems to be due to both differences in responding to the NPE and to the PE CS.

Unusual Experiences: Reaction times

Panel 1C of Figure 36 illustrates the mean reaction times on the NPE and the PE CS trials across the four conditioning blocks for the participants in the LOW and HIGH unusual experiences groups. Inspection of Panel 1C indicates that the reaction times reduce as conditioning progressed and that the reaction times were shorter on the NPE than on the PE CS trials. In addition, there seems to be more learned irrelevance in the LOW than in the HIGH group, especially in blocks 3 and 4. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi_2(5) = 12.04$, $p < .05$; therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .71$. ANOVA revealed effects of exposure, $F(1, 21) = 6.43$, $MSE = 138188.92$, $p < .05$, and block, $F(2.14, 44.98) = 23.05$, $MSE = 43289.23$, $p < .001$, but not of unusual experiences, $F < 1$, nor were there any interactions between the factors (largest $F(1, 21) = 2.49$, $MSE = 138188.92$, $p = .13$). However, the effect of unusual experiences seems again to be most pronounced in blocks 3 and 4, and ANOVA, calculated on the data from blocks 3 and 4 only, revealed effects of exposure, $F(1, 21) = 7.39$, $MSE = 89117.75$, $p < .05$, but not of block or unusual experiences, both $Fs < 1$. There was an interaction between exposure and unusual experiences, $F(1, 21) = 5.32$, $MSE = 89117.75$, $p < .05$, but no other interactions, all $Fs < 1$. Bonferroni adjusted simple effects tests revealed significant learned irrelevance in the LOW, $p < .01$, but not in the HIGH groups, $p = .76$. In order to examine whether the absence of learned irrelevance in the HIGH unusual experiences groups was due to differences in responding to the NPE CS , to the PE CS or both, ANOVAs were calculated on the NPE data from blocks 3 and 4 and on the PE data from blocks 3 and 4, respectively. Responding to the NPE CS was not found to differ between the LOW and HIGH unusual experiences groups, all $Fs < 1$, and neither was responding to the PE CS (largest $F(1, 21) = 1.98$, $MSE = 138188.92$, $p = .17$). Consequently, it seems that reduced learned irrelevance in high unusual experiences is a result of differences in responding to both the NPE and the PE CS between the LOW and HIGH groups. In this respect, it should, however, be remembered that the effect of unusual experiences on learned irrelevance was obtained in the absence of an interaction between these factors in a full analysis of all four blocks.

Cognitive disorganisation: Groups

The 12 participants scoring 7 or below on the cognitive disorganisation subscale were assigned to the LOW group and the 10 participants scoring 17 or above on the cognitive disorganisation subscale were assigned to the HIGH group. The mean schizotypy score in the LOW group was 5.67 ($SD = 1.78$) and the mean score in the HIGH group was 18.7 ($SD = 2.06$). The LOW and HIGH groups did not differ in age, $F < 1$.

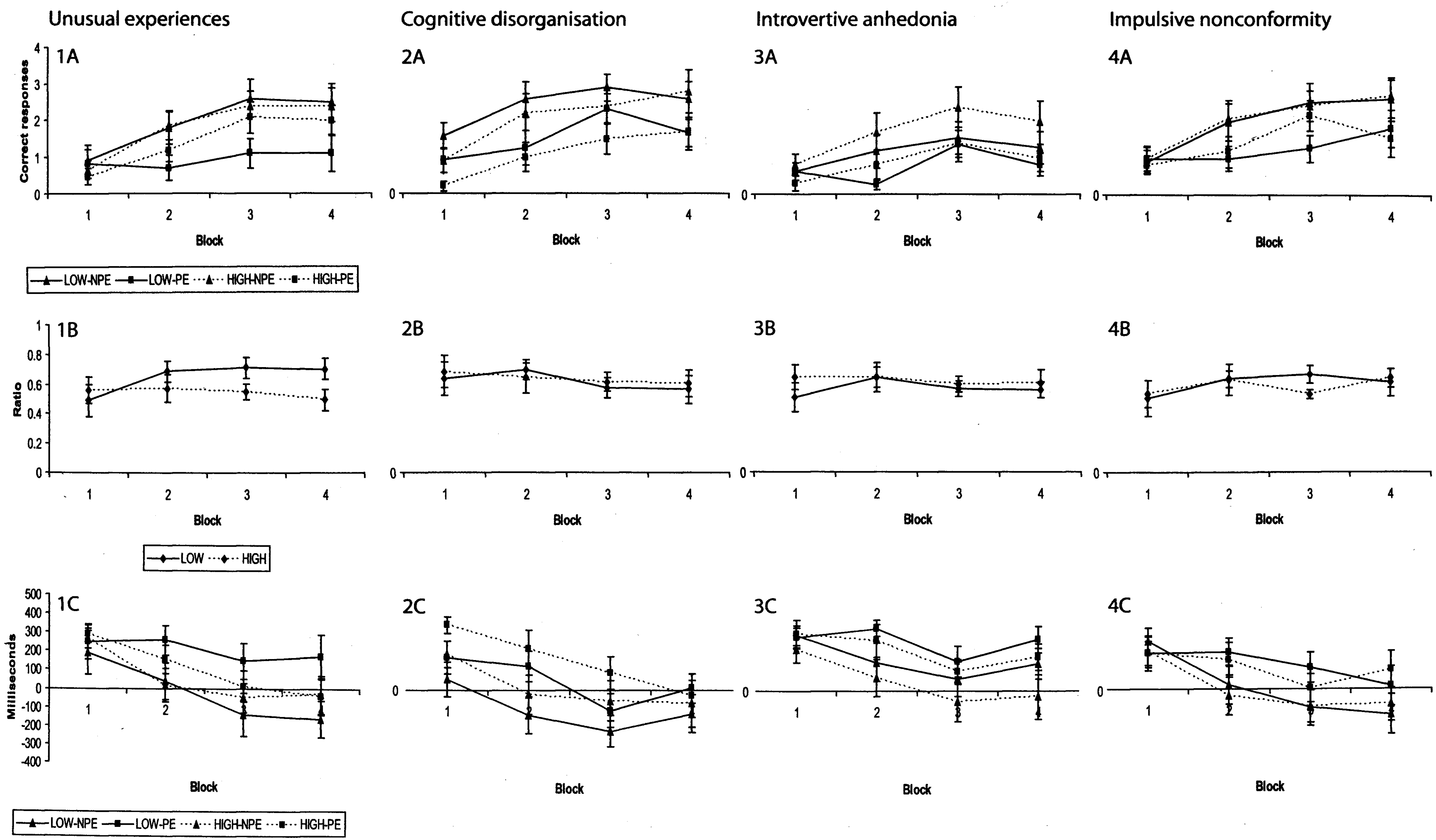
Unusual experiences
Cognitive disorganisation
Introvertive anhedonia
Impulsive nonconformity
1A
2A
3A
4A
Correct responses
Block
LOW-NPE LOW-PE HIGH-NPE HIGH-PE
1B
2B
3B
4B
Ratio
Block
LOW HIGH
1C
2C
3C
4C
Milliseconds
Block
LOW-NPE LOW-PE HIGH-NPE HIGH-PE

Figure 36. Experiment 13: The twelve panels 1A-4C are organised into three rows (A, B and C) that show the mean (±*SEM*) correct responses to the nonpreexposed (NPE) and preexposed (PE) CS, mean ratios (±*SEM*), and mean reaction times (±*SEM*) on the NPE and PE CS trials for the LOW and HIGH schizotypy groups that were given 20 CS and 20 US preexposures, respectively; and into four columns that illustrate the results of the low (0-1, N = 10) and high (12+, N = 13) unusual experiences, the low (0-7, N = 12) and high (17+, N = 10) cognitive disorganisation, the low (0-1, N = 11) and high (9+, N = 10) introvertive anhedonia, and the low (0-5, N = 11) and high (13+, N = 11) impulsive nonconformity groups, respectively.

Cognitive disorganisation: Correct responses

Panel 2A of Figure 36 illustrates the mean number of correct responses to the NPE and PE CS for the participants in the LOW and HIGH cognitive disorganisation groups. Inspection of Panel 2A indicates that there was greater correct responding with traning and more correct responding to the NPE than to the PE CS for both the LOW and HIGH groups; but there was no clear difference in learned irrelevance between the LOW and HIGH groups. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi^2(5) = 14.88$, $p < .05$; therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .64$. ANOVA revealed effects of exposure, $F(1, 20) = 8.58$, $MSE = 4.35$, $p < .01$, block, $F(1.92, 38.35) = 22.34$, $MSE = 1.22$, $p < .001$, but not cognitive disorganisation, $F < 1$. There were no interactions between the factors (largest $F(1.92, 38.35) = 2.09$, $MSE = 1.22$, $p = .11$).

Cognitive disorganisation: Correct responses ratios

Panel 2B of Figure 36 illustrates the mean correct response ratios across the four conditioning blocks for the participants in the LOW and HIGH cognitive disorganisation groups. Inspection of Panel 2B indicates no differences in these ratios between the HIGH and LOW group. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi^2(5) = 14.94$, $p < .05$; therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .65$. ANOVA revealed no effects of cognitive disorganisation or block nor an interaction between these factors (largest $F(1.94, 38.75) = 1.05$, $MSE = .04$, $p = .38$). One sample t-tests, however, found no learned irrelevance in neither the LOW, $t(11) = 1.58$, $p = .14$, nor the HIGH cognitive disorganisation groups, $t(9) = 1.66$, $p = .13$. It is therefore difficult to know what to make of the ANOVA, because the effect of interest was not significant using the correct response ratio scores.

Cognitive disorganisation: Reaction times

Panel 2C of Figure 36 illustrates the mean reaction times on the NPE and PE CS trials for the participants in the LOW and HIGH cognitive disorganisation groups. Inspection of Panel 2C suggests increasingly rapid responding over the course of conditioning and shorter reaction times on the NPE than on the PE CS trials. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi 2(5) = 18.87$, $p < .01$, and for the interaction between block and exposure, $\chi 2(5) = 15.53$, $p < .01$; therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .64$, and for the block and exposure interaction, $\varepsilon = .71$. ANOVA confirmed effects of exposure, $F(1, 20) = 4.9$, $MSE = 207969.33$, $p < .05$, and of block, $F(1.91, 38.28) = 19.22$, $MSE = 53340.93$, $p < .001$, but not of cognitive disorganisation nor were there any interactions between the factors (largest $F(1.91, 38.28) = 1.92$, $MSE = 53340.93$, $p = .16$).

Introvertive anhedonia: Groups

The 11 participants scoring 1 or below on the introvertive anhedonia subscale were assigned to the LOW group and the 10 participants scoring 9 or above on the introvertive anhedonia subscale were assigned to the HIGH group. The mean schizotypy score in the LOW group was .36 ($SD = .51$) and the mean score in the HIGH group was 10.9 ($SD = 2.23$). The

LOW (mean age = 18.64, SD = .67) and HIGH (mean age = 19.2, SD = .79) groups did not differ in age, $F(1, 19) = 3.12$, $MSE = .53$, $p = .09$.

Introvertive anhedonia: Correct responses

Panel 3A of Figure 36 illustrates the mean number of correct responses to the NPE and PE CS for the participants in the LOW and HIGH introvertive anhedonia groups. Inspection of Panel 3A suggests that correct responding increased with training and more correct responding to the NPE than to the PE CS in both LOW and HIGH groups; there was some indication that learned irrelevance was reduced in the LOW compared to the HIGH group in blocks 3 and 4. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi 2(5) = 13.16$, $p < .05$; therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .69$. ANOVA confirmed effects of exposure, $F(1, 19) = 7.14$, $MSE = 2.24$, $p < .05$, and block, $F(2.06, 39.19) = 10.57$, $MSE = 1.21$, $p < .001$, but not of introvertive anhedonia, $F < 1$. Again, there no interactions between the factors (largest $F(3, 57) = 1.78$, MSE = .45, p = .16). As already mentioned, inspection of Panel 3A suggests reduced learned irrelevance in the LOW introvertive anhedonia group in blocks 3 and 4. Therefore a separate ANOVA was conducted on the data from blocks 3 and 4 only. This analysis did, however, not reveal any effect of introvertive anhedonia on learned irrelevance: There was only an effect of exposure, $F(1, 19) = 6.62$, $MSE = 1.37$, $p < .05$, and of block, $F(1, 19) = 7.4$, $MSE = .46$, $p < .05$, but no effect of introvertive anhedonia nor any interactions between the factors (largest $F(1, 19) = 1.77$, $MSE = 1.37$, $p = .2$).

Introvertive anhedonia: Correct responses ratios

Panel 3B of Figure 36 illustrates the mean number of correct response ratios across the four conditioning blocks for the participants in the LOW and HIGH groups. Inspection of

Panel 3B does not indicate any differences between the LOW and HIGH groups. ANOVA revealed no effects of block or introvertive anhedonia nor an interaction between these factors, all *Fs* < 1. One sample t-tests showed no learned irrelevance in the LOW introvertive anhedonia group, $t(10) = 1.33$, $p = .21$, and only a non-significant trend of learned irrelevance in the HIGH introvertive anhedonia group, $t(9) = 1.93$, $p = .086$. As before, it is therefore difficult to know what to make of the ANOVA as the effect of uncorrelated CS and US preexposure is not significant using the correct response ratios.

Introvertive anhedonia: Reaction times

Panel 3C of Figure 36 illustrates the mean reaction times on the NPE and PE CS trials for the participants in the LOW and HIGH introvertive anhedonia groups. Inspection of Panel 3C indicates shorter reaction times as training proceeded and faster responding on the NPE than on the PE CS trials in both the LOW and HIGH introvertive anhedonia groups. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi_2(5) = 22.88$, $p < .001$. Therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .56$. ANOVA confirmed that there were effects of exposure, $F(1, 19) = 6.6$, $MSE = 109518.54$, $p < .05$, and block, $F(1.69, 32.05) = 9.38$, $MSE = 64212.56$, $p < .01$, but not of introvertive anhedonia, nor any interactions between the factors (largest $F(3, 57) = 2.39$, $MSE = 21197.39$, $p = .1$).

Impulsive nonconformity: Groups

The 11 participants scoring 5 or below on the impulsive nonconformity subscale were assigned to the LOW group and the 11 participants scoring 13 or above on the impulsive nonconformity subscale were assigned to the HIGH group. The mean schizotypy score in the LOW group was 4.55 (*SD* = .52) and the mean score in the HIGH group was 14 (*SD* = 1.34).

The LOW (mean age = 20, $SD = .94$) and HIGH (mean age = 18.91, $SD = 1.41$) groups did not differ significantly in age, $F(1, 20) = 3.75$, $MSE = 1.75$, $p = .067$.

Impulsive nonconformity: Correct responses

Panel 4A of Figure 36 shows the mean number of correct responses to the NPE and PE CS across the four conditioning blocks for the participants in the LOW and HIGH impulsive nonconformity groups. Inspection of Panel 4A indicates there were increasing levels of correct responding as conditioning progressed and that there was more correct responding to the NPE than to the PE CS in both the LOW and HIGH impulsive nonconformity groups. However, there appears to be less learned irrelevance in block 3 in the HIGH than in the LOW group. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi2(5) = 13.34$, $p < .05$. Therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .67$. ANOVA confirmed the existence of effects of exposure, $F(1, 20) = 7.85$, $MSE = 2.69$ $p < .05$, and block, $F(2.01, 40.11) = 12.76$, $MSE = 1.74$, $p < .001$, but not of impulsive nonconformity, $F < 1$. There was an interaction between block and exposure, $F(3, 60) = 3.43$, $MSE = .63$ $p < .05$, but no other interactions (largest $F(3, 60) = 1.7$, $MSE = .63$, $p = .18$).

Impulsive nonconformity: Correct responses ratios

Panel 4B of Figure 36 illustrates the mean correct response ratios across the four conditioning blocks for the participants in the LOW and HIGH groups. Inspection of Panel 4B suggests that there is more learned irrelevance in the LOW than in the HIGH group in block 3. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi2(5) = 12.47$, $p < .05$. Therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .68$. ANOVA revealed no significant main effects of block or impulsive nonconformity nor an interaction between them (largest $F(2.04, 40.82) = 1.1$, MSE = .08, p = .34). One sample t-tests found no learned irrelevance in either the LOW impulsive nonconformity group, $t(10) = 1.7, p = .12$, or the HIGH impulsive nonconformity group, $t(10) = 1.74, p = .11$. As elsewhere, it is therefore difficult to know what to make of the ANOVA as the effect of learned irrelevance is not significant in this sample using the ratio measure.

Impulsive nonconformity: Reaction times

Panel 4C of Figure 36 illustrates the mean reaction times on the NPE and PE CS trials for the participants in the LOW and HIGH impulsive nonconformity groups. Inspection of Panel 4C indicates increased speed of responding as conditioning progressed and shorter reaction times on the NPE than on the PE CS trials in both the LOW and HIGH impulsive nonconformity groups. The LOW and HIGH groups do not appear to differ. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi2(5) = 23.96, p < .001$, and for the interaction between exposure and block, $\chi2(5) = 14.84, p < .05$. Therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .54$, and for the block and exposure interaction, $\varepsilon = .71$. ANOVA revealed a non-significant trend of an effect of exposure, $F(1, 20) = 4.11$, $MSE = 148878.57$, $p = .056$, and a significant effect of block, $F(1.63, 32.52) = 12.39$, $MSE = 79536.03$, $p < .001$, but not of impulsive nonconformity, $F < 1$. There was an interaction between block and exposure, $F(2.13, 42.56) = 3.28$, $MSE = 52132.43$, $p < .05$, but no other interactions, all $Fs < 1$. The interaction between block and exposure reflects that learned irrelevance was evident in blocks 2 and 3, both $ps < .05$, but not evident in block 1, $p = .62$, or in block 4 although there was an apparent trend, $p = .06$

5.3: Discussion

The results of Experiment 13 revealed that the cognitive disorganisation, introvertive anhedonia and impulsive nonconformity schizotypy dimensions do not influence the retardation in learning cause by uncorrelated exposure to the CS and US (i.e., learned irrelevance). However, this learned irrelevance effect was reduced in participants with high unusual experiences scores. This effect was a result of (non-significant) differences in responding to both the nonpreexposed and the preexposed CS. This pattern of results represents *prima facie* evidence that the ability to tune out experientially irrelevant stimuli is differentially sensitive to the schizotypy dimension that is aligned with the positive symptoms in schizophrenia. However, for that argument to be fully convincing, the reduced effect in high unusual experiences should have been exclusively an effect of differences in responding to the preexposed CS. As already indicated, this did not appear to be the case. One explanation for this pattern of results is based on the suggestion that the deficit in high unusual experiences may be a more general attentional deficit that relates both to the ability to tune out irrelevant stimuli and to tune in relevant stimuli: The failure to tune out the preexposed stimulus (resulting in a reduction in learned irrelevance) being complemented by a failure to tune into the relevant stimulus (resulting in somewhat less rapid learning about the novel stimulus). This form of analysis, however, appears to be somewhat inconsistent with the findings presented in Chapter 3, where latent inhibition was not disrupted in participants with high unusual experiences scores and conditioning to the novel stimulus was not influenced. These apparent inconsistencies deserve immediate further consideration.

One simple way to reconcile the differing overall patterns of results in Chapters 3 and 5 is to suppose that latent inhibition and learned irrelevance are subserved by differing psychological processes. For example, (long-term) latent inhibition might be solely a consequence of the formation of a context-CS association (cf. Wagner, 1981), whereas learned irrelevance might reflect a decline in attention to the CS that is determined by the principles presented in Mackintosh (1975). This suggestion has historical precedent (see Bennett et al, 1995, 2000; Mackintosh, 1975; Matzel et al, 1988; but see also, Bonardi & Hall, 1996; Bonardi & Ong, 2003). Moreover, there are other findings within this thesis that also provide empirical grounds for supposing that the latent inhibition and learned irrelevance effects are different: the former appearing to be more context specific than the latter (compare Experiments 4 and 12). However, the suggestion that latent inhibition and learned irrelevance are based on different mechanisms does not, in and of itself, provide an explanation for why in my studies of latent inhibition conditioning to the novel stimulus appeared to be normal, whereas in my studies of learned irrelevance this did not appear to be the case (although in neither case was there a difference between the high and low unusual experiences groups). One possible account for why conditioning to a novel stimulus following learned irrelevance training appears to be impaired in the high group is that it is a secondary consequence of failing to tune out the preexposed stimulus. Again, there is historical precedence for this suggestion in the form of the inverse hypothesis. This hypothesis supposes that a change in attention to a given stimulus (or set of stimuli) is accompanied by an equal and opposite change to another stimulus (or set of stimuli) when both are presented simultaneously. Although Mackintosh (1975) points out there is little evidence to support the inverse hypothesis, recent demonstrations of one-trial overshadowing are consistent with it (see James & Wagner, 1980; Kaye, Swietalski, & Mackintosh, 1989). James and Wagner (1980) and Kaye et al. (1989) found that following a single compound conditioning trial there was less evidence of learning about the components of that compound than when they had been conditioned in isolation. This one-trial overshadowing effect suggests the operation of a system with limited capacity where attention to (or processing of) one set of stimuli will necessarily be at the expense of attention to (or processing of) another set of stimuli.

There is an obvious implication of the arguments presented in the immediately preceding paragraph. Namely, procedures in which participants need to tune into one stimulus or dimension and to tune out another should be particularly sensitive to revealing the presumed attentional abnormalities associated with high levels of unusual experiences as measured by the O-Life. In my final empirical chapter I examine this prediction in a letter detection task which, while similar, in some respects, to my learned irrelevance task has obvious parallels to a continuous performance task, that has also be used to study attentional abnormalities in schizotypy and schizophrenia.

Chapter 6

6: Schizotypy, attention and encoding: Further investigation using a letter-detection task

6.1: Experiment 14

The results of Experiment 13 provide support for the suggestion that there is a deficit in an attentional change process in participants who have high scores on the unusual experiences dimension of the O-Life. Experiment 14 used a similar procedure to that employed in Experiment 13 to examine the generality of this effect within a procedure that did not use an explicit learning stage, but rather simply examined the ability of participants to detect letters that were occurring with different frequencies among distractor items (in the form of Arabic numbers).

The letter detection task used in Experiment 14 is in some respects similar to the continuous performance task, which is a test of vigilance and sustained attention where the participants are required to respond to an infrequently presented target stimulus in a continuous string of stimulus presentations (which are most often individual letters or numbers). A number of studies have found more errors on the continuous performance task in high compared to low schizotypy (e.g., Chen, Hsiao, & Lin, 1997; Lenzenweger, Cornblatt, & Putnick, 1991; Chen, Hsiao, Hsiao, & Hwu, 1998; Bedwell, Kamath, & Baksh; 2006; Meyer & Blechert, 2005; Gooding, Matts, & Rollmann, 2006; Bergida & Lenzenweger, 2006). Performance on this task is often assumed to reflect the ability to maintain attention in general. However, it is quite conceivable to suppose that accurate performance on the continuous performance task reflects, at least in part, an ability to tune out the irrelevant stimuli (the filler items, that are repeatedly presented) and tune in the relevant stimuli (the target item, that is presented occasionally).

The letter detection task in Experiment 14 used parameters that were similar to those of the learned irrelevance task. During the first, preexposure stage, participants received presentations of eight different letter stimuli (B, C, F, G, J, K, L, N) that were each preexposed on a different number of occasions (e.g., 20, 15, 10, 5, 4, 3, 2, and 1 time, respectively). These letter trials were intermixed with trials on which numbers were presented (i.e., 1-9). Participants were instructed to respond on each occasion that they saw a letter. During this stage, it was inevitable that the introduction of letters and/or their spacing was confounded with whether they were to be exposed on 20 occasions or once. Therefore, in a final test, all of the letters were presented together with a further novel letter (e.g., R). These presentations were again intermixed with numbers and the participants continued to make the same decision. Accuracy (d') and reaction times to the novel and preexposed letters constituted the dependent measures.

It was assumed that during this task, participants would have the opportunity to tune into the specific letters and that this process would be less rapid in the case of participants in the high unusual experiences group than in the low unusual experiences group. Moreover, it was assumed that the different levels of preexposure should provide a sensitive measure of this difference between the high and low groups. It should be acknowledged, however, that the effects of different schizotypy dimensions on sustained attention, as measured by the continous performance tasks, are inconsistent (see Gooding et al., 2006; Rawlings & Goldberg, 2001; Chen et al., 1997, 1998; Lenzenweger et al., 1991; Obiols, García-Domingo, Trinchería, & Doménech, 1993; Bergida & Lenzenweger, 2006). However, on the basis of the results of Experiment 13 and its similarity to Experiment 14, I predicted that any differences in Experiment 14 would be associated with variations in the unusual experiences schizotypy dimension. Therefore, in this study the participants were pre-selected on the basis of their scores on the unusual experiences dimension. Accordingly, while I focus on the unusual experiences dimension here, supplementary analyses of the remaining 3 schizotypy dimensions are presented in Appendix 4[5].

6.2: Method

Participants

One hundred and twenty-six (113 females, 13 male) psychology undergraduate university students in their first semester took part in the experiment and received course credit for their participation. The mean age was 19.52 years (standard deviation, *SD* = 3.86).

Apparatus

The stimuli used in the letter identification task consisted of 9 upper case letters (B, C, F, G, J, K, L, N, R) and the numbers 1-9. The stimuli were presented in Superlab 2.0 (Cedrus Corporation, San Pedro, CA) on a Fujitsu Siemens Amilo M7400 FB21 laptop. Each stimulus was black, measured 1.5 centimetres in height and was presented in the centre of an otherwise white screen. Each presentation lasted 1000 ms with no inter-trial interval.

Procedure

The letter identification task consisted of two stages, preexposure and test. The two stages were presented consecutively and the participants were not informed of any transition between the stages. They were given task instructions at the beginning of the task and the inter-stimulus interval between the last stimulus in the preexposure phase and the first stimulus

[5] In brief, d' was lower in the participants in the following HIGH schizotypy groups compared to their respective LOW groups: Full scale, cognitive disorganisation and impulsive nonconformity. The participants in the LOW introvertive anhedonia group were slower on the first trial of the novel letter than the participants in the HIGH introvertive anhedonia group. These results must, however, be interpreted with caution due to the absence of explicit counterbalancing for the participants in all these LOW and HIGH groups.

in the test phase was identical to that between the stimuli within each of the preexposure and test phases. The instructions were as follows: *You will now see a succession of letters and numbers presented on the screen. Your task is to press the spacebar as quickly as you can when the item presented is a letter. Do not press any keys when the item presented is a number. Please try to be as fast AND as accurate as possible. When you understand what to do and are ready, press the spacebar to begin.* The preexposure stage consisted of 60 letter and 60 number presentations. The letter presentations comprised 8 different letters presented 20, 15, 10, 5, 4, 3, 2, and 1 times, respectively, and were organised into 5 blocks. The first block consisted of 4 presentations of the letter to be preexposed 20 times (L20), 3 presentations of the letter to be presented 15 times (L15), 2 presentations of the letter to be presented 10 times (L10) and 1 presentation of the letter to be presented 5 times (L5). The second block consisted of the same type and number of letter trials as block 1 in addition to 1 presentation of the letter to be presented 4 times (L4). Block 3 was identical in numbers and types of presentations to block 2 but also contained 1 presentation of the letter to be presented 3 times (L3). Block 4 was identical to block 3 in numbers and types of letter trials but also contained 1 presentation of the letter to be presented twice (L2), and block 5 was identical to block 4 in terms of numbers and types of letter presentations, but also contained the 1 presentation of the letter to be preexposed once (L1). Furthermore, the letter trials of block 5 were organised so that all of the final presentations of the letters were presented at the end of the block in order to ensure that all the letters, despite having been preexposed a different number of times, had been presented in the same temporal proximity to the test phase. In addition to letters, each block contained an equal number of numbers. All blocks contained one presentation of each of the 9 numbers (1-9), but as more than 9 letter presentations occurred in each block, some of the numbers were presented twice. The numbers presented twice were varied across the blocks, so overall the numbers were presented an approximately equal number of times (6 or 7). The test stage was organised into 4 identical blocks. Each block contained 1 presentation of each of the 8 preexposed letters, 1 presentation of each of the 9 numbers as well as a presentation of a ninth novel letter (L0). Within both the preexposure and test stages the letter and number trials were presented pseudo-randomly. On no occasion did identical letter or number trials follow each other (e.g., 'B' was never followed immediately by 'B'), and there was a maximum of three consecutive letter or number presentations before a trial from the other stimulus class followed (e.g., 'L' 'K' 'J' '8' or '5' '7' '2' 'C'). Assignment of the letters to preexposure condition was done according to a latin-square. During the test phase the sequence in which the letters were presented was arranged according to a different latin-square for each of the original sequencing from the first latin-square. The minimum number of participants required to complete the counterbalancing conditions was 72. The sample size means that some of the counterbalanced conditions were over-represented. The task lasted no more than 4 minutes. The O-LIFE schizotypy scores were obtained from a pre-test session held during the first week of the semester for all the first-year undergraduate psychology students.

6.3: Results

Data analyses

D' and reaction times were examined with linear trend analyses. D' was used because it takes into account both the errors of omission and the errors of commission in one measure per letter. D' was however not suitable for the analysis of the latent inhibition (Experiments 1-8) and learned irrelevance (Experiments 9-13) data at the same level of detail as was desired (over four blocks) because the pseudo-random organisation of the trials during testing meant that there was not an equal number of trials on which a response was required within each block and this precludes the use of d'. The reaction times and accuracy scores were predicted to be a linear function of the amount of letter preexposure in Experiment 14, and statistical analyses (trend analysis) that take into account the linear relationship between the variables were therefore employed in the current experiment. In addition, criterion C was used to measure whether responding was subject to a conservative, liberal or neutral bias. When C has a positive value it indicates a conservative bias (which reflects a tendency to respond relatively less and is therefore characterised by relatively more errors of omission and less errors of commission). When C has a negative value it indicates a liberal bias (which reflects a tendency to respond relatively more and is therefore characterised by relatively more errors of commision and less errors of omission). When C has a value near zero the bias is neutral and falls in between the conservative and liberal biases. C was analysed in order to examine if the low and high groups differed in terms of their response biases.

Schizotypy statistics and sampling

The participants were selected on the basis of their unusual experiences score obtained in the customary pre-test session of the first-year undergraduate psychology students scheduled during the first week at university. The low and high groups were formed *a priori* on the basis of the distribution of the pre-test unusual experiences scores in order to ensure that the stimuli used in the letter identification task were counterbalanced (see section 6.1.1 above) within the low and high unusual experiences groups. The 38 (34 females, 4 males) participants scoring 4 or below on the unusual experiences schizotypy dimension were assigned to the LOW group and the 25 (22 females, 3 males) participants scoring 14 or above were assigned to the HIGH group. The mean schizotypy score in the LOW group was 2.42 ($SD = 1.27$) and the mean score in the HIGH group was 16.88 ($SD = 3.62$). The LOW and HIGH groups did not differ in age, $F(1, 61) = 1.07$, $MSE = 19.19$, $p = .3$.

Training data

For the sake of completeness, the training data for the low and high groups are reported. It must, however, be kept in mind that the inter-trial intervals were different for the different preexposure conditions due to how the task was designed. Table 14 lists the mean reaction times and the mean number of correct responses (i.e., hits) to each letter during training for the low and high group.

Table 14. Experiment 14: The mean reaction times (±*SEM*) and the mean number (±*SEM*) of correct responses (= hits) to each letter during training for the low and high groups.

	L1	L2	L3	L4	L5	L10	L15	L20
LOW								
Number correct	1	2	2.97 (.03)	3.97 (.03)	5	9.95 (.04)	14.87 (.06)	19.92 (.04)
RT	456.66 (13.65)	397.78 (7.55)	434.84 (9.88)	415.87 (7.93)	413.04 (5.95)	415.95 (6.64)	416.54 (6.67)	404.51 (6.08)
HIGH								
Number correct	1	2	2.92 (.06)	3.96 (.04)	4.96 (.04)	9.84 (.09)	14.76 (.13)	19.52 (.25)
RT	437.48 (20.38)	412.46 (11.3)	443.77 (12.13)	436.38 (12.01)	424.76 (10.1)	427.93 (9.35)	431.95 (9.04)	413.67 (8.69)

Note: 'L' refers to letter. The number that follows 'L' refers to the number of times the letter was presented during training and therefore also to the maximum number of correct responses that was associated with each letter. RT refers to reaction time.

Trend analysis of the reaction times showed that there was a linear trend of letter, $F(1, 61) = 7.06$, $MSE = 2678.88$, $p < .05$, but no effect of unusual experiences, $F < 1$, and no interaction between the factors, $F(1, 61) = 1.37$, $MSE = 2678.88$, $p = .25$. The linear trend of letter indicated that reaction times was faster to the more familiar letters than to the less familiar letters. Trend analysis of the proportion of correct responses (hits/total number of possible correct responses) showed a linear trend of letter, $F(1, 61) = 5.72$, $MSE = .001$, $p < .05$, but no effect of unusual experiences, $F(1, 61) = 2.22$, $MSE = .004$, $p = .14$, nor an interaction between the factors, $F(1, 61) = 2.03$, $MSE = .001$, $p = .16$. The linear trend indicated that there were more misses of the more familiar letters, which is likely to be an artefact of the number of opportunities that there were to miss a given letter. The mean number of errors of commision was 2.29 ($SEM = .34$) in the low group and 3.6 ($SEM = .56$) in the high group. This differences was significant, $F(1, 61) = 4.47$, $MSE = 5.8$, $p < .05$.

Test phase: D'

The mean d' values for the low and high unusual experiences groups for the novel stimulus and all of the preexposed letters during the test are shown in Figure 37. Inspection of Figure 37 indicates that the low schizotypy group performed more accurately than the high schizotypy group, and that the performance was equally accurate across all of the letters in the low group whereas the high schizotypy group performed less accurately to the novel and less familiar letters than to the more familiar letters. No linear trend of letter was found, $F(1, 61) = 2.9$, $MSE = .16$, $p = .09$, but there was an effect of unusual experiences, $F(1, 61) = 7.22$, $MSE = 2.28$, $p < .01$, and an interaction between letter and schizotypy, $F(1, 61) = 4.37$, $MSE = .16$, $p < .05$. Follow-up tests revealed a linear trend in the high, $F(1, 24) = 6.19$, $MSE = .16$, $p < .05$, but not the low, $F < 1$, unusual experiences groups, and Bonferroni adjusted simple effects tests showed that the low group responded more accurately to L0, L1, L3, L5, and L10, all *ps* $< .05$, and non-significant trends of more accurate responding to L2, $p = .069$, L4, $p = .066$, and L15, $p = .084$. D' did not differ between the low and high groups to L20, $p = .32$. These results might indicate that the low unusual experiences group is simply better at all but the highly familiar letter (where there was a ceiling effect) and that the performance of the low and high groups does not start on the same level. That is, the effect at test might not reflect an effect of preexposure on d'. The analyses of the next section examines this possibility.

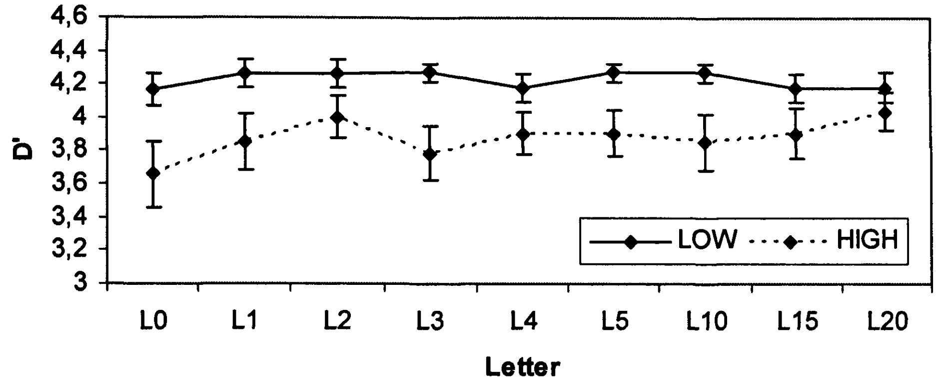

Figure 37. Experiment 14: The mean d' (±*SEM*) values for the low (0-4) and high (14+) unusual experiences groups for the novel (L0) and all the preexposed (L1-L20) letters in the test phase. The prefix 'L' refers to 'letter' and the number refers to the number of times the letter has been preexposed (e.g., L5 refers to the letter that was preexposed 5 times, whereas L0 refers to the novel letter that was not preexposed).

Test phase: First trial of L0

Performance on the first presentation of the novel letter between the groups was evaluated in terms of percent correct and reaction times. In the low group 100% (38/38) of the participants responded correctly to the first presentation of L0 whereas in the high group 92% (23/25) responded correctly. That is, there was a ceiling effect on the accuracy scores. The mean reaction time to the first presentation of L0 in the low group was 410.87 ($SEM = 8.33$) and in the high group was 429.29 ($SEM = 14.34$). This difference was not significant, $F(1, 61) = 1.44$, $MSE = 3414.27$, $p = .24$.

Test phase: Criterion C

Figure 38 shows the mean C values for the low and high unusual experiences groups for the novel and all the preexposed letters. Inspection of Figure 38 indicates that the low schizotypy group has a liberal bias across all the lettters whereas the high group starts off with a neutral bias to the less familiar letters that then progressively becomes more liberal as letter familiarity increases. There was no linear trend of letter, $F(1, 61) = 2.9$, $MSE = .04$, $p = .09$, and no effect of unusual experiences, $F < 1$, but interaction between letter and unusual experiences was confirmed, $F(1, 61) = 4.37$, $MSE = .04$, $p < .05$. Follow-up tests revealed a linear trend in the high, $F(1, 24) = 6.19$, $MSE = .04$, $p < .05$, but not the low, $F < 1$, unusual experiences groups. Bonferroni adjusted simple effects tests, however, showed that the response bias did not differ between the low and high groups on any of the letters, all $ps > .22$. One sample t-tests confirmed that in the low group responding to all the letters was subject to a liberal bias, as C was found to be significantly different from zero for all the letters ($-7.08 \leq t(37) \leq -3.07$, all $ps < .005$). In the high group, C was found to be significantly different from zero only on letters L2, $t(24) = -2.97$, $p < .01$, and L20, $t(24) = -2.96$, $p < .01$, with a non-significant trend on L15, $t(24) = -1.81$, $p = .084$. The bias on the other letters were not significantly different from zero ($-1.7 \leq t(24) \leq -.22$, all $ps > .1$).

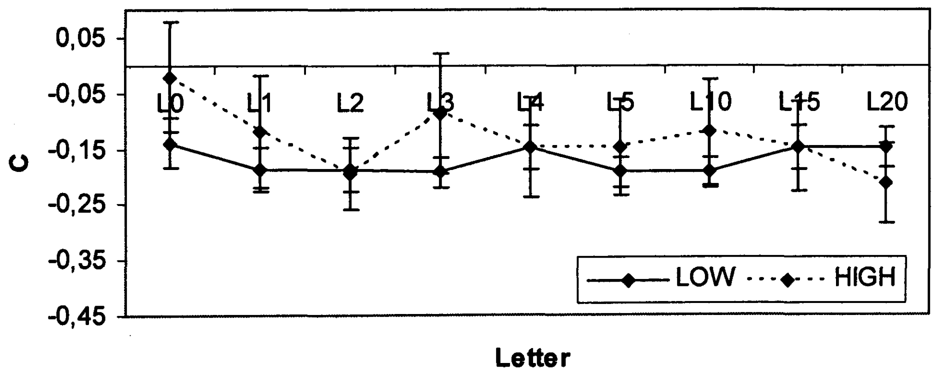

Figure 38. Experiment 14: The mean (±*SEM*) criterion C values for the low (0-4) and high (14+) unusual experiences groups for the novel (L0) and all the preexposed (L1-L20) letters in the test phase. The prefix 'L' refers to 'letter' and the number refers to the number of times the letter has been preexposed (e.g., L5 refers to the letter that was preexposed 5 times, whereas L0 refers to the novel letter that was not preexposed).

Test phase: Reaction times

The test phase consisted of four identical blocks. The reaction times in the first two blocks were combined and are illustrated in Panel A of Figure 39, and the reaction times for the second pair of blocks were combined and are illustrated in Panel B of Figure 39. The block combinations were analysed separately. Inspection of Panel A suggests that overall the reaction times were faster in the low than in the high unusual experiences group but otherwise the groups or the letters did not appear to differ markedly. This was suggested by a non-significant trend of an effect of unusual experiences group, $F(1, 60) = 3.18$, $MSE = 15690.96$, $p = .08$, and no effect of letter nor an interaction between letter and unusual experiences, both $Fs < 1$. Inspection of Panel B indicates that in the low schizotypy group reaction times become progressively faster with more exposure, but this trend is not indicated in the high unusual experiences group. A linear trend of letter was found in the combined blocks 3 and 4, $F(1, 59) = 7.71$, $MSE = 2438.71$, $p < .01$, but the there was no effect of schizotypy nor an interaction between degree of preexposure and schizotypy, both $Fs < 1$.

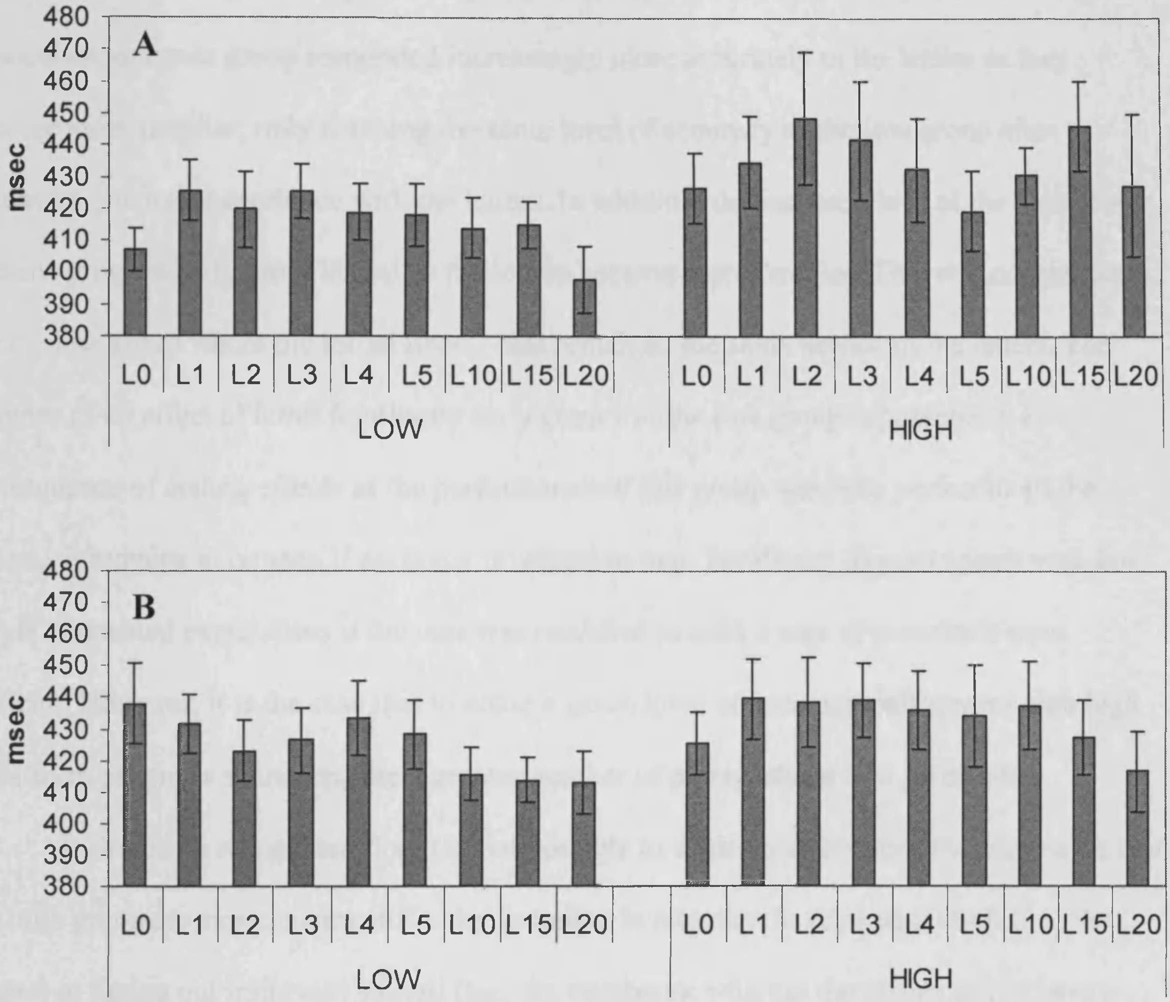

Figure 39. Experiment 14. Panel A: The reaction times (±*SEM*) to the novel and the preexposed letters in the combined blocks 1 and 2 for the low (0-4) and high (14+) unusual experiences groups. Panel B: The reaction times (±*SEM*) to the novel and the preexposed letters in the combined blocks 3 and 4 for the low and high unusual experiences groups. The prefix 'L' refers to 'letter' and the number refers to the number of times the letter has been preexposed (e.g., L5 refers to the letter that was preexposed 5 times, whereas L0 refers to the novel letter that was not preexposed).

6.4: Discussion

The results of Experiment 14 support the general suggestion, derived from the results of Experiment 13, that a process of changing attention to stimuli is disrupted in participants who report high levels of unusual experiences. Thus Experiment 14 showed that while the low unusual experiences group responded equally and very accurately to all the letters, the high unusual experiences group responded increasingly more accurately to the letters as they became more familiar; only reaching the same level of accuracy as the low group after extensive previous experience with the letters. In addition, the response bias of the high group became progressingly more liberal as the letters became more familiar. This was not the case for the low group where the initial liberal bias remained the same across all the letters. The absence of an effect of letter familiarity on accuracy in the low group is potentially a consequence of ceiling effects as the performance of this group was near perfect to all the letters. It remains to be seen if accuracy is related to item familiarity in participants with low levels of unusual experiences if the task was modified in such a way as to make it more difficult. However, it is the case that to attain a given level of accuracy participants with high unusual experiences scores require a greater number of presentations of a given letter.

It should be recognized that it is not possible to distinguish between the suggestion that the high group are experiencing difficulty in tuning in attention to relevant stimuli (i.e., the letters) or tuning out irrelevant stimuli (i.e., the numbers): whereas the former might have a direct effect on test performance, the latter might exert a more indirect influence. The claim that it is the tuning out of irrelevant stimuli that is compromised in the high group is clearly more consistent with existing theoretical analyses of aspects of schizophrenic symptomatology (e.g., Gray et al., 1991; Lubow, 1989). However, it should be remembered that this analysis, at least in part, was based on findings indicating that latent inhibition is disrupted in schizophrenia and in participant with high schizotypy scores. The results presented in this thesis (i.e., Experiments 5-8) consistently showed that variations in the unusual experience dimension of schizotypy were unrelated to latent inhibition. I have already argued, however, that latent inhibition might not represent a good assay of the kind of attentional processes that are abnormal in schizophrenia. At present, there are no empirical grounds for determining whether high levels of schizotypy are associated with an inability to change attention to stimuli in general or to an inability to tune out irrelevant stimuli. Indeed in Chapter 7, I will consider alternative interpretations for the results of Experiment 13 and 14 that do not require one to suppose that there is an attentional basis to the effects observed in these experiments.

Chapter 7

7: General discussion.

7.1: Summary of empirical findings

Chapter 2 established that a newly developed human latent inhibition task induced a large and robust latent inhibition effect that survived both an interruption and a delay between the preexposure and test stages. In addition, latent inhibition as measured by this task was found to show two characteristics of latent inhibition by being both a function of the amount of CS preexposure and context specific. The advantages of this novel task over existing tasks are that it is within-subjects, has two consistent, continuous measures and involves no explicit masking task. The observation that a masking task is required in the majority of existing latent inhibition tasks has, in particular, served to cast doubt on the equivalence between (apparent) latent inhibition in humans and latent inhibition in animals; this issue has serious repercussions not least because it undermines the link between animal models of schizophrenia (including the effects of antipsychotics on latent inhibition) and parallel human studies with schizotypic and schizophrenic groups. The alignment of human and animal latent inhibition tasks is thus important because of the obvious advantage of linking the neurophysiology and anatomy of latent inhibition (knowledge obtained primarily from animal studies) to the behavioural manifestation of latent inhibition in both humans and animals. The novel within-subjects latent inhibition task that has no secondary masking component therefore represents an important advance also because it, unlike the only other within-subjects unmasked latent inhibition task published to date (Escobar et al., 2003), allows the detailed examination of the development and time course of latent inhibition and the associated detailed examination of the potential influences of different variables on latent inhibition.

Chapter 3 found that the effect of schizotypy on latent inhibition was confined to the schizotypy dimension, introvertive anhedonia, that is related to the negative symptoms in schizophrenia. Reduced latent inhibition was found in high introvertive anhedonia after 5 CS preexposures. The absence of an effect of introvertive anhedonia on latent inhibition after 10 and 20 preexposures may be attributed to the size and robustness of the effect after these amounts of preexposure making the latent inhibition effect less sensitive to small differences in introvertive anhedonia. In line with Cohen and Servan-Schreiber (1992), the effect of introvertive anhedonia on latent inhibition was interpreted as a result of a deficit in the internal representation of (preexposure associative) context. Although Chapter 3 investigated the effect of schizotypy on latent inhibition after a context change between the preexposure and test stages, the low number of participants with high schizotypy scores compromised this investigation and no clear conclusions could be drawn.

Chapter 4 examined the proporties of a novel human within-subjects learned irrelevance task that was similar in design to the latent inhibition task. Learned irrelevance, as measured by the novel task, was a function of the number of uncorrelated CS and US preexposures and survived an interruption, a delay, and a context change between the preexpopsure and test stages. Although intact learned irrelevance after a context change was only found as measured by correct responses and not reaction time, this finding nevertheless constitutes the first of two dissociations between latent inhibition and learned irrelevance reported in this thesis. Chapter 5 found that learned irrelevance was reduced in high compared to low unusual experiences after 20 uncorrelated CS and US preexposures, and this effect appeared to be a consequence of a general attentional dysfunction that is related both to the ability to tune in novel stimuli and the ability to tune out irrelevant stimuli.

Chapter 6 examined in more detail the effect of unusual experiences on the ability to tune in novel stimuli (and tune out irrelevant stimuli) and showed that this ability seemed to be compromised in participants with high unusual experiences scores. However, with continued training the performance of the high unusual experiences group approached that of the low unusual experiences group.

7.2: Theoretical implications of new findings

The suggestion that reduced latent inhibition in participants with high levels of positive schizotypy is a failure of the impact of past experiences on current perception (e.g., Hemsley (1993, 1994; Gray et al., 1991) has received some support from the existing literature. However, as I have already pointed out, there are a number of limitations associated with this literature. The present experiments, however, provide only restricted support for this claim as learned irrelevance and not latent inhibition was affected by unusual experiences.

The research outlined in this thesis has used techniques that circumvent many of the methodological limitations of earlier human latent inhibition research. The findings are not consistent with the suggestion that latent inhibition provides an index of the ability to tune out irrelevant stimuli that is deficient in people with high levels of positive schizotypy. Instead, the findings suggest that latent inhibition does not measure any attentional abnormalities that are associated with high schizotypy. Learned irrelevance, on the other hand, appears to be sensitive to variations in unusual experiences schizotypy and is likely to be a better way to index (attentional) abnormalities in schizophrenia. It is, however, not clear whether the attentional deficit under consideration is in the ability to tune in novel stimuli or in the ability to tune out irrelevant stimuli, or both.

7.2.1: Learned irrelevance: Attention, encoding or interference

Throughout this thesis, the emphasis has been centred around attentional interpretations for the observed effects; this emphasis has reflected current opinion in the human literature regarding the deficits that might underlie the positive symptoms of schizophrenia (e.g., Gray et al., 1991). However, it is possible that none of the effects of schizotypy on the tasks used in this thesis are underpinned by attentional processes. Indeed, there are alternative explanations for both latent inhibition and learned irrelevance effects (e.g., Wagner, 1981; McLaren et al., 1989; Bouton, 1993; Bonardi & Ong, 2003). I will now outline two alternative perspectives for the effects of schizotypy reported in Chapters 5 and 6, in particular.

The first interpretation is based on the notion of stimulus encoding. It supposes that high levels of unusual experiences are associated with an inability to encode the stimuli presented during the learned irrelevance task. Even if it is assumed that the learned irrelevance effect reflects the operation of an attentional process or processes in the normal population, it remains possible that an inability to encode the stimuli during preexposure will limit any reduction in attention to the prexposed stimulus. In fact, using a delayed matching-to-sample task, Hartman, Steketee, Silva, Lanning and McCann (2002) provide evidence consistent with the suggestion that stimulus encoding is slower in schizophrenia (see also, Keefe, Perkins, Gu, Zipursky, Christensen & Lieberman, 2006). It is also possible that a failure in stimulus encoding might provide one basis for the general cognitive deficit in schizophrenia. This interpretation is also generally consistent with the results presented in Chapter 6. Although the failure to find significant difference between the low and high unusual experiences groups on the first presentation of the novel letter during the test is somewhat problematic for the account just outlined, this (null) result is consistent with the second alternative interpretation.

The second explanation for the effect of schizotypy on learned irrelevance is based on a different analysis of the learned irrelevance effect itself. One possible analysis of the retardation in the development of conditioning observed after uncorrelated exposure is that during the preexposure stage participants acquire an association that directly interferes with the excitatory associations formed during the second stage. For example, during preexposure participants might learn a CS→no X (or CS→no response) association that interferes with learning a CS→X (or CS→response) association during stage 2. A natural interpretation of the effect of schizotypy on learned irrelevance is that this process of interference is influenced by variations in schizotypy. For example, the process of acquiring associations (particularly CS→no X or CS→no response) might be compromised. This analysis provides an account for the differences observed in the letter-detection task if one supposes that the specific letter-response links ordinarily acquired during stage 1 are reduced in participants in the high unusual experiences group. Moreover, it provides a clear-cut interpretation of the failure for variations in unusual experiences to influence latent inhibition, once it is assumed that such associations are not acquired during the latent inhibition procedure that I have developed. Of course, the presence of a masking task might well result in participants learning some interfering associations (e.g., CS→no response) that, in the normal population, might contribute to latent inhibition. To the extent that such associations do contribute, then it might be anticipated that the latent inhibition effect will be disrupted in participants with a high level of schizotypy.

7.2.2: Context

A secondary motivation for conducting the research of this thesis concerns the effect of a context change on learned irrelevance. A large number of studies have establised the context specificity of latent inhibition, but only a small number of studies have examined the effect of a context change on learned irrelevance (Matzel et al., 1988; Dess & Overmier, 1989; Linden et al., 1997) and none of those have done so in humans. The finding that learned irrelevance is not abolished by a context change thus adds to a growing body of evidence that suggests that latent inhibition and learned irrelevance differ in terms of how each is affected by a context change. While this finding does not directly address the nature of learned irrelevance (e.g., in terms of whether it is a special form of latent inhibition or exceeds the individual effects of CS and US preexposure), it does indicate that learned irrelevance in humans is a more general/less context specific effect than latent inhibition.

7.3: Future directions and related research

7.3.1: Attentional deficit.

Further investigations of the putative attentional deficit in high unusual experiences might benefit from focusing on disentangling the relative contributions of the suggested deficits in tuning out irrelevant stimuli and tuning in novel stimuli. An experiment that employed a modified letter detection task could address this question by, for example, requiring participants to respond to letters during preexposure and then subsequently to numbers and letters during the test. Presumably the numbers would have begun to be tuned out during the preexposure phase and would therefore provide a measure of this ability.

Alternatively, the effect of unusual experiences on the ability to tune out irrelevant stimuli dimensions and tune in relevant stimuli dimensions may profitably be examined using different procedures that have very clear elements of attention, such as the Wisconsin Card

Sorting Task and procedures that assess intra- and extradimensional switches between stimulus dimensions. Both these tasks require participants to tune in novel stimuli, tune out irrelevant stimuli, tune in previously irrelevant stimuli, and tune out previously relevant stimuli. Research using these procedures have already established impairments in performance associated with schizophrenia (e.g., Pantelis, Harvey, Plant, Fossey, Maruff, Stuart, Brewer, Nelson, Robbins, & Barnes, 2004; Tyson, Laws, Roberts, & Mortimer, 2005; Barnett, Sahakian, Werners, Hill, Brazil, Gallagher, Bullmore, & Jones, 2005; Jazbec et al., 2007; for reviews see Robbins, 2000; Levaux, Potvin, Sepehry, Sablier, Mendrek, & Stip, 2007), but it remains unclear which symptom group is primarily related to performance deficits on these types of task (e.g., Braff, Heaton, Kuck, Cullum, Moranville, Grant, & Zisook, 1991; Liddle & Morris, 1991; Mahurin, Velligan, & Miller, 1998).

7.3.2: Associative interference

The possibility that reduced associative interference is responsible for reduced learned irrelevance (and reduced latent inhibition when a masking task is used) warrants further investigation. A clear prediction that follows from this analysis is that if the tasks used in this thesis were modified to either include (for latent inhibition) or exclude (for learned irrelevance) a response requirement during preexposure, then the influence of variations in unusual experiences should be reversed: a latent inhibition procedure in which participants needed to respond to a filler item during preexposure should be attentuated in participants with high levels of unusual experiences; and a learned irrelevance procedure without a response requirement during preexposure (i.e., one in which participants simply watched the preexposure stage) should be unaffected by high levels of unusual experiences. Alternatively, if these predictions were not confirmed then it would provide support for the alternative analyses that do not require responses to be made in order for attentional changes to occur.

The modulation of associative interference that might underlie the effects reported in Chapters 5 and 6 could occur at a variety of levels. For example, high positive schizotypy might impair the development of the associations themselves or one of several earlier processes involved in forming associations might be undermined. Future research will need to establish which of these putative (associative) processes is compromised in high positive schizotypy (e.g., sensory-perceptual, associative, or motoric processing). However, lower level deficits in schizophrenia and schizotypy have already been identified that may guide future research. Input dysfunction in the form of sensory gating deficits in schizophrenia (e.g., Adler, Pactman, Franks, Pecevich, Waldo, & Freedman, 1982; Yee, Nuechterlein, Morris, & White, 1998) has been found to be related to clinically rated attentional impairment (Yee et al., 1998) and sustained attention as measured by a digit cancellation test (Cullum, Harris, Waldo, Smernoff, Madison, Nagamoto, Griffith, Adler, & Freedman, 1993).

Moreover, Straube, Bischoff, Nisch, Sauer and Volz (2002) separated the continuous performance task into 5 components (perceptual organisation, selective attention, short term memory-storage, short term memory-rehearsal, and vigilance/sustained attention) and tested these components individually in a schizoprenia sample. Straube et al. (2002) found that performance on a version of the continuous performance task that emphasise concurrent context (i.e., respond to '7' whenever it is preceeded by '3') was related to (in descending order of amount of explained variance) working memory-storage, perceptual organisation and vigilance/sustained attention. However, none of these five components were found to significantly relate to performance on a version of the continuous performance task where the stimuli were degraded which suggests the involvement of additional processing steps in the continuous performance tasks in general. Elvevåg, Weinberger, Suter, and Goldberg (2000) concluded that the impaired performance by schizoprenia participants on the 1-9 (i.e., respond to 9 if preceeded by 1) and ready-press (respond after 'ready' when 'ready' is followed by 'press') versions of the continuous performance task was a result of encoding problems. Goldberg, Patterson, Taqqu and Wilder (1998) using a digit span test also found that schizophrenia patients had a working memory deficit that was related to limited capacity and maintenance of information over delays. However, the schizophrenia samples of both Elvevåg et al. (2000), Goldberg et al. (1998) and Straube et al. (2002) were medicated with a mixture of atypical and typical neuroleptics and the results are therefore confounded.

Lenzenweger and Maher (2002) found a fine motor deficit in high positive schizotypy that was unrelated to performance on the continuous performance task, although performance on both was affected by schizotypy. Elevated rates of neuromotor deficits have also been reported in patients with schizophrenia and their relatives (Ismail, Cantor-Graae, & McNeil, 1998) and motor dysfunction may be an early manifestation of schizophrenia proneness (e.g., Erlenmeyer-Kimling & Cornblatt, 1987; Fish, 1977, 1987). It remains to be seen how and if any of these deficits are related to associative binding, but it is clear that schizophrenia is characterised by multiple types of dysfunction that may influence associative binding in a variety of ways. In addition, stimulus-response (S-R) bindings themselves may be multiply determined such that S-R binding may arise via different routes that are related to the nature of the stimulus and its (associative) history. Kornblum, Hasbroucq and Osman (1990) suggest that stimulus representations may be translated into response representations in two ways; rule-based and associative. The rule-based route is characterised by the compatibility between any S and R, because the instructions setting up a given S-R mapping in a test situation mediates the S-R binding. The associative route to S-R mapping is a consequence of preexisting associations between the S and the R which mediate mapping. On the face of it, it would seem that the results of Experiments 13 and 14 relate to rule-based S-R mapping because the task instructions set up the S-R mapping. However, it is not possible to exclude the effects of potential preexisting associations between the critical letters (S, H and X) that may also have played a part.

7.3.3: Context

The effect of schizotypy on latent inhibition after a context change between the preexposure and test phases could not be adequately evaluated in Experiment 8. Running an identical study with more participants in especially the high groups would be an interesting investigation of whether latent inhibition differ in kind before and after a context change in high schizotypy. Context independent latent inhibition has already been observed in rats with hippocampal lesions (Honey & Good, 1993) and a parallel finding in humans participants with high schizotypy scores would not only indicate a possible neurophysiological basis for the effect, but also further strengthen the claim that studies of human and rat latent inhibition measure the same phenomenon.

7.3.4: Schizophrenia

An obvious and necessary study to conduct following the confirmation of any deficit in high unusual experiences, is to run the same study in an unmedicated (acute) schizophrenia sample with a primarily positive symptom profile: In order to claim that deficits identified in schizotypy reflects similar deficits in schizophrenia, it is necessary to empirically confirm this deficit. This would also be an important step in the endevour to link identified abnormalities in schizophrenia/high schizotypy with their behavioural manifestation in terms of the genesis and maintenance of schizophrenic symptoms and in the evaluation of the deficit as a potential endophenotype of schizophrenia.

7.4: General conclusion

The results outlined in this thesis lend little support to the suggestion that latent inhibition is an index of the ability to screen out irrelevant stimuli that is deficient in high schizotypy. In summary, on the basis of the arguments in the preceding sections, either (1) latent inhibition and learned irrelevance are qualitatively different and only learned irrelevance measures the form of attention that is associated with the unusual experiences dimension of schizotypy, or (2) latent inhibition and learned irrelevance will be compromised to the extent encoding and/or interference processes play a role. Future research will need to discriminate between these explanations, extend the results to patients with schizophrenia, and ultimately relate them to schizophrenic symptomatology.

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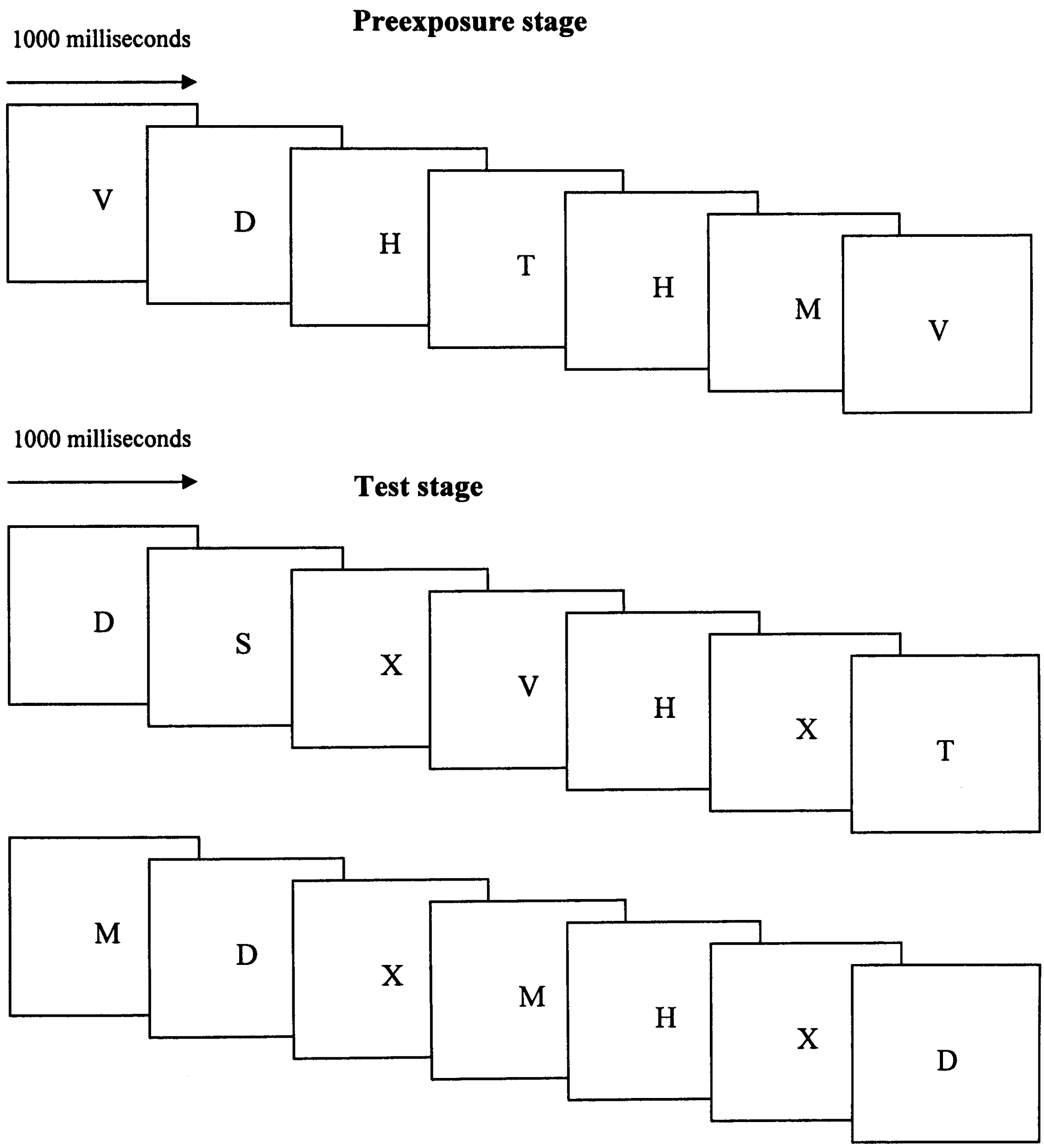
Appendix 1

Schematic illustration of the latent inhibition task



Appendix 2

Experiment 5: Norm mean split analyses

The data from Experiment 5 was split into low and high schizotypy groups in the same manner as in Experiment 8 unless otherwise stated. That is, on the basis of the norm means reported by Mason et al. (1995). This method meant that all the data from Experiment 5 was analysed and not just the data from the participants with extreme schizotypy scores.

Full scale schizotypy: Groups

The 40 participants scoring 39 or below on the full schizotypy scale were assigned to the LOW group and the 10 participants scoring 40 or above on the full schizotypy scale were assigned to the HIGH group. The mean schizotypy score in the LOW group was 28.48 (SD = 7.01) and the mean score in the HIGH group was 50.5 (SD = 6.74). The LOW and HIGH groups did not differ in age, $F < 1$.

Full scale schizotypy: Correct responses

Panel A of Figure A1 illustrates the mean number of correct responses to the NPE and the PE CSs for the participants in the LOW and HIGH schizotypy groups. Inspection of Panel A indicates more correct responding as conditioning progressed and greater correct responding to the NPE than to the PE CS for both the LOW and HIGH schizotypy groups. In addition, there appears to be more latent inhibition in the HIGH than in the LOW group. ANOVA confirmed effects of exposure, $F(1, 48) = 28.2$, $MSE = 2.9$, $p < .001$, and block, $F(3, 144) = 23.24$, $MSE = 1.05$, $p < .001$. However, there was no effect of schizotypy group and no interaction between any of the factors (largest $F(1, 48) = 2.24$, $MSE = 2.9$, $p = .14$).

Full scale schizotypy: Correct responses ratio

Panel B of Figure A1 illustrates the mean correct response ratios for the participants in the LOW and HIGH groups. Inspection of Panel B indicates that there appears to be more latent inhibition in the HIGH than in the LOW group. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi 2(5) = 15.62, p < .01$. Therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .86$. ANOVA did, however, not reveal any effects of block, $F(2.57, 123.29) = 2.44$, $MSE = .06$, $p = .08$, or schizotypy group, $F(1, 48) = 2.51$, $MSE = .17$, $p = .12$, nor an interaction between these factors, $F < 1$. One-sample t-tests confirmed latent inhibition in both the LOW, $t(39) = 3.78, p < .01$, and the HIGH schizotypy groups, $t(9) = 2.84, p < .05$.

Full scale schizotypy: Reaction times

Panel C of Figure A1 illustrates the mean reaction times on the NPE and the PE CS trials across the four conditioning blocks for the participants in the LOW and HIGH groups. Inspection of Panel C indicates faster responding as conditioning progressed and shorter reaction times on the NPE than on the PE CS trials. In addition, there appears to be more latent inhibition in the HIGH than in the LOW group. ANOVA confirmed that there were effects of exposure, $F(1, 48) = 27.69$, $MSE = 146328.24$, $p < .001$, and block, $F(3, 144) = 25.53$, $MSE = 38981.58$, $p < .001$. There was no effect of schizotypy group and no interactions between the factors (largest $F(1, 48) = 1.7$, $MSE = 146328.24$, $p =.2$).

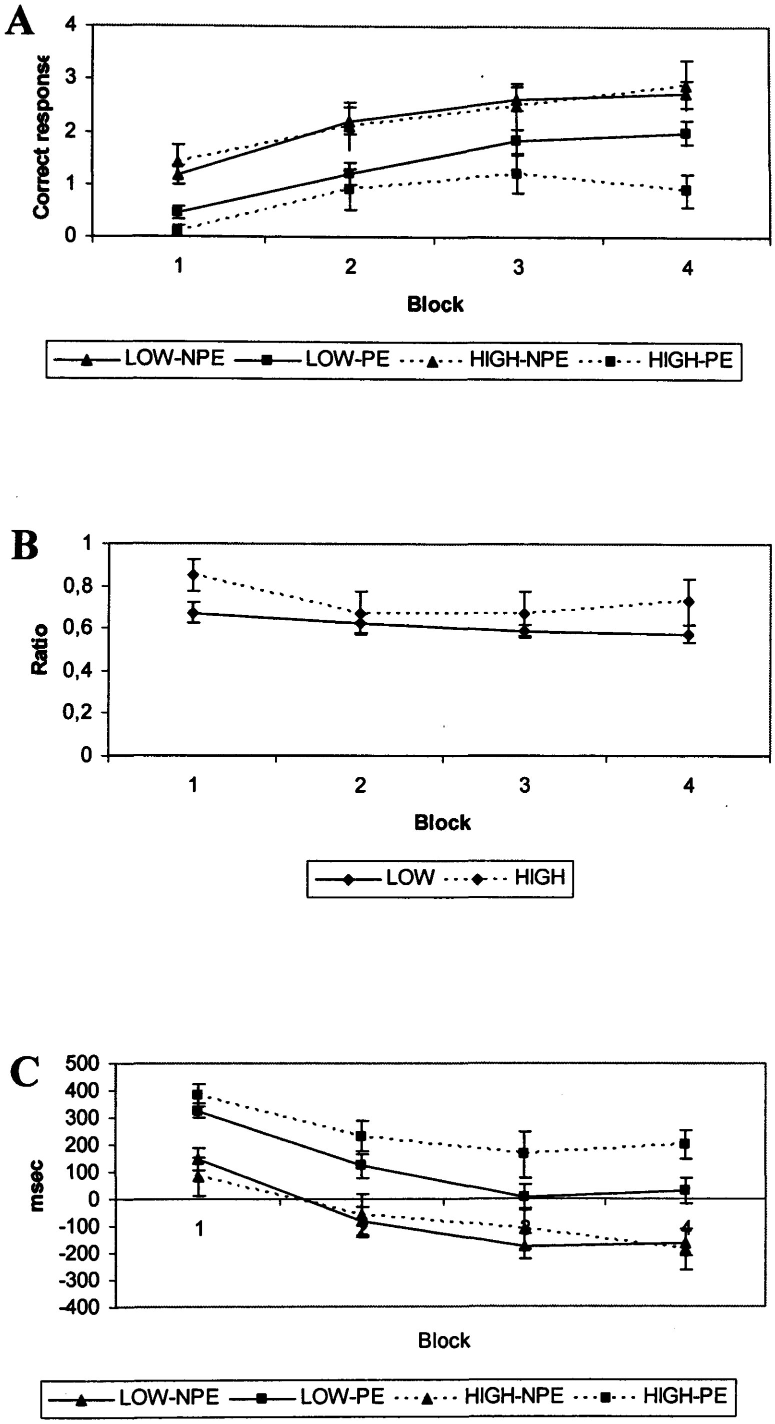


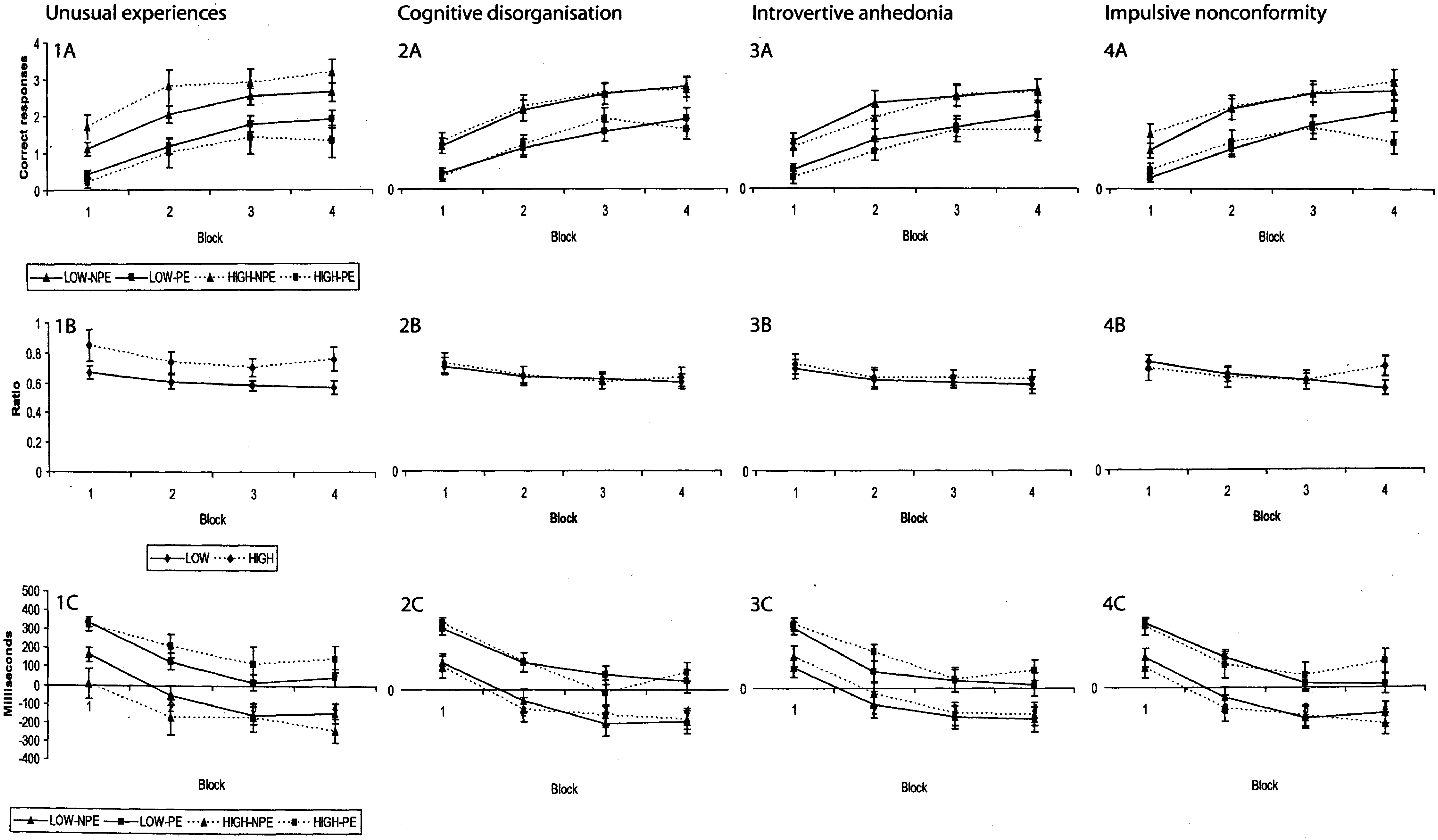
Figure A1. Experiment 5; Panel A: The mean number of correct responses (±*SEM*) to the nonpreexposed (NPE) and the preexposed (PE) stimuli in each block for the participants in the LOW (0-39, N=40) and HIGH (40+, N=10) full scale schizotypy groups. Panel B: The correct response ratios (±*SEM*) in each block for the participants in the LOW and HIGH full scale schizotypy groups. Panel C: The mean reaction times (±*SEM*) on the nonpreexposed and preexposed CS trials in each block for the participants in the LOW and HIGH full schizotypy scale groups.

Unusual experiences: Groups

The 40 participants scoring 11 or below on the unusual experiences subscale were assigned to the LOW group and the 10 participants scoring 12 or above on the unusual experiences subscale were assigned to the HIGH group. The mean schizotypy score in the LOW group was 4.55 ($SD = 2.96$) and the mean score in the HIGH group was 16 ($SD = 2.94$). The LOW and HIGH groups did not differ in age, $F < 1$.

Unusual Experiences: Correct responses

Panel 1A of Figure A2 illustrates the mean number of correct responses to the NPE and the PE CS for the participants in the LOW and HIGH unusual experiences groups. Inspection of Panel 1A indicates more correct responding as conditioning progressed and more correct responding to the NPE than to the PE CS for both the LOW and HIGH unusual experiences groups. There appears to be more latent inhibition in the HIGH than in the LOW group. ANOVA confirmed these observations, revealing effects of exposure, $F(1, 48) = 34.29$, $MSE = 2.76$, $p < .001$, and block, $F(3, 144) = 24.87$, $MSE = 1.05$, $p < .001$, but not unusual experiences, $F < 1$, and an interaction between exposure and unusual experiences, $F(1, 48) = 4.9$, $MSE = 2.76$, $p < .05$. There were no other interactions, all *Fs* < 1. However, Bonferroni adjusted simple main effects tests indicated that there was latent inhibition in both the LOW and HIGH groups, both *ps* < .001 (see also next section).



Unusual experiences
Cognitive disorganisation
Introvertive anhedonia
Impulsive nonconformity
1A
2A
3A
4A
Correct responses
Block
LOW-NPE
LOW-PE
HIGH-NPE
HIGH-PE
1B
2B
3B
4B
Ratio
LOW
HIGH
1C
2C
3C
4C
Milliseconds

Figure A2. Experiment 5: The twelve panels 1A-4C are organised into the three rows (A, B and C) that show the mean (±*SEM*) correct responses to the nonpreexposed (NPE) and preexposed (PE) CS, mean ratios (±*SEM*), and mean reaction times (±*SEM*) on the NPE and PE CS trials for the LOW and HIGH schizotypy groups that were given 20 preexposures, respectively; and into four columns that illustrate the results of the low (0-11, N = 40) and high (12+, N = 10) unusual experiences, the low (0-13, N = 29) and high (14+, N = 21) cognitive disorganisation, the low (0-4, N = 25) and high (6+, N = 21) introvertive anhedonia, and the low (0-9, N = 30) and high (10+, N = 20) impulsive nonconformity groups, respectively.

Unusual Experiences: Correct responses ratio

Panel 1B of Figure A2 illustrates the mean correct responses ratios for the participants in the LOW and HIGH groups. Inspection of Panel 1B indicates more latent inhibition in the HIGH than in the LOW group. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi 2(5) = 15.88, p < .01$. Therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .86$. ANOVA confirmed an effect of unusual experiences, $F(1, 48) = 4.77$, $MSE = .16, p < .05$, but no effect of block and no interaction between these factors (largest $F(2.57, 123.17) = 1.86$, $MSE = .06, p = .14$). One-sample t-tests confirmed that there was latent inhibition in both the LOW, $t(39) = 3.28, p < .01$, and the HIGH unusual experiences groups, $t(9) = 4.59, p < .01$.

Unusual Experiences: Reaction times

Panel 1C of Figure A2 illustrates the mean reaction times on the NPE and the PE CS trials for the participants in the LOW and HIGH unusual experiences groups. Inspection of Panel 1C indicates shorter reaction times as conditioning progressed and faster responding on the NPE than on the PE CS trials. There appears to be more latent inhibition in the HIGH than in the LOW group. ANOVA confirmed that there were effects of exposure, $F(1, 48) = 30.88$, $MSE = 142862.49, p < .001$, and block, $F(3, 144) = 25.07$, $MSE = 38822.92, p < .001$, but not unusual experiences group, $F < 1$, nor any interactions between the factors (largest $F(1, 48) = 2.91$, $MSE = 142862.49$, $p = .1$).

Cognitive disorganisation: Groups

The 29 participants scoring 13 or below on the cognitive disorganisation subscale were assigned to the LOW group and the 21 participants scoring 14 or above on the cognitive disorganisation subscale were assigned to the HIGH group. The mean schizotypy score in the LOW group was 9.1 ($SD = 2.74$) and the mean score in the HIGH group was 17.29 ($SD = 2.22$). The LOW (mean age = 19.48, $SD = 1.53$) and HIGH (mean age = 18.81, $SD = .81$) groups did not differ in age, $F(1, 48) = 3.38$, $MSE = 1.64$, $p = .072$, although the analysis, unexpectedly, approached significance.

Cognitive disorganisation: Correct responses

Panel 2A of Figure A2 illustrates the mean number of correct responses to the NPE and PE CSs for the participants in the LOW and HIGH cognitive disorganisation groups. Inspection of Panel 2A indicates greater correct responding as conditioning progressed and more correct responding to the NPE than to the PE CS for both the LOW and HIGH cognitive disorganisation groups. The LOW and HIGH groups did not appear to differ. ANOVA confirmed this description, revealing effects of exposure, $F(1, 48) = 28.43$, $MSE = 3.04$, $p < .001$, block, $F(3, 144) = 41.48$, $MSE = 1.04$, $p < .001$, but not of cognitive disorganisation group, $F < 1$, nor any interactions between the factors, all $Fs < 1$.

Cognitive disorganisation: Correct responses ratios

Panel 2B of Figure A2 illustrates the mean correct response ratios for the participants in the LOW and HIGH cognitive disorganisation groups. Inspection of Panel 2B indicates no difference in latent inhibition between the HIGH and LOW groups. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi^2(5) = 16.06, p < .01$. Therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .85$. ANOVA revealed a marginally significant effect of block, $F(2.56, 123.05) = 2.43$, $MSE = .06$, $p = .08$, but no effect of cognitive disorganisation nor an interaction between these factors, both $Fs < 1$. One sample t-tests confirmed significant latent inhibition in both the LOW, $t(28) = 3.22, p < .01$, and HIGH cognitive disorganisation groups, $t(20) = 3.42, p < .01$.

Cognitive disorganisation: Reaction times

Panel 2C of Figure A2 illustrates the mean reaction times on the NPE and PE CS trials for the participants in the LOW and HIGH cognitive disorganisation groups. Inspection of Panel 2C suggests increasingly rapid responding over the course of conditioning and faster responding to the NPE than to the PE CS. The HIGH and LOW cognitive disorganisation groups do not appear to differ. Mauchly's test indicated that the assumption of sphericity had been violated for the interaction between exposure and block, $\chi^2(5) = 11.32, p < .05$. Therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .88$. ANOVA confirmed effects of exposure, $F(1, 48) = 29.5$, $MSE = 151510.09$, $p < .001$, and block, $F(3, 144) = 47.44$, $MSE = 39383.21$, $p < .001$. There was no effect of cognitive disorganisation, and no interactions between the factors (largest $F(2.63, 126.07) = 1.97$, $MSE = 34786.44$, $p = .13$).

Introvertive anhedonia: Groups

The 25 participants scoring below 5 on the introvertive anhedonia subscale were assigned to the LOW group and the 21 participants who scored above 5 on the introvertive anhedonia subscale were assigned to the HIGH group. The mean found by Mason et al. (1995) was 5 and in Experiment 8 the participants who scored 5 were included in the high group due to a low number of high scorers. However, as that is not an issue in the present analyses, the participants (N = 4) who scored 5 were excluded from the analyses. The mean schizotypy score in the LOW group was 1.92 (*SD* = 1.53) and the mean score in the HIGH group was 8.14 (*SD* = 2.1). The LOW and HIGH groups did not differ in age, $F(1, 44) = 1.19$, $MSE = .75$, $p = .28$.

Introvertive anhedonia: Correct responses

Panel 3A of Figure A2 illustrates the mean number of correct responses to the NPE and PE CSs for the participants in the LOW and HIGH introvertive anhedonia groups. Inspection of Panel 3A suggests increasing rates of correct performance as conditioning progressed and more correct responding to the NPE than to the PE CS in both LOW and HIGH groups, but with no differences in latent inhibition between the LOW and HIGH groups. ANOVA confirmed that there were effects of exposure, $F(1, 44) = 23.15$, $MSE = 3.02$, $p < .001$, and block, $F(3, 132) = 35.73$, $MSE = 1.05$, $p < .001$, but not of introvertive anhedonia and no interactions, all $Fs < 1$.

Introvertive anhedonia: Correct responses ratios

Panel 3B of Figure A2 illustrates the mean correct responses ratios for the participants in the LOW and HIGH groups. Inspection if Panel 3B does not indicate any differences between the LOW and HIGH groups. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi_2(5) = 16.72$, $p < .01$. Therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .84$. ANOVA revealed no effects of block or introvertive anhedonia, and no interaction between the factors (largest $F(2.52, 110.88) = 1.95$, $MSE = .06$, $p = .14$). One sample t-tests confirmed latent inhibition in both the LOW, $t(24) = 2.65$, $p < .05$, and the HIGH introvertive anhedonia group, $t(20) = 3.05$, $p < .01$.

Introvertive anhedonia: Reaction times

Panel 3C of Figure A2 illustrates the mean reaction times on the NPE and PE CS trials for the participants in the LOW and HIGH introvertive anhedonia groups. Inspection of Panel 3C indicates shorter reaction times with training and faster responding on the NPE than on the PE CS trials in both the LOW and HIGH introvertive anhedonia groups; but no differences in latent inhibition between the two groups are apparent. ANOVA confirmed effects of exposure, $F(1, 44) = 24.59$, $MSE = 143873.82$, $p < .001$, and block, $F(3, 132) = 41.04$, $MSE = 39820.22$, $p < .001$, but not of introvertive anhedonia, nor any interactions between the factors, all $Fs < 1$.

Impulsive nonconformity: Groups

The 30 participants scoring 9 or below on the impulsive nonconformity subscale were assigned to the LOW group and the 20 participants scoring 10 or above on the impulsive nonconformity subscale were assigned to the HIGH group. The mean schizotypy score in the LOW group was 6.53 ($SD = 1.93$) and the mean score in the HIGH group was 12 ($SD = 1.95$). The LOW and HIGH groups were found to differ in age, $F(1, 48) = 6.55$, $MSE = 1.54$, $p < .05$. However, as the mean age in the LOW group was 18.83 ($SD = .83$) years and the mean age in the HIGH group was 19.75 ($SD = 1.68$) years, this was considered an unfortunate anomaly that, however, did not constitute a major concern.

Impulsive nonconformity: Correct responses

Panel 4A of Figure A2 illustrates the mean number of correct responses to the NPE and PE CSs for the participants in the LOW and HIGH impulsive nonconformity groups. Inspection of Panel 4C indicates increasing rates of correct responding as conditioning progressed and more correct responding to the NPE than to the PE CS in both the LOW and HIGH impulsive nonconformity groups. However, less latent inhibition seemed apparent in block 4 in the LOW than in the HIGH group. ANOVA confirmed that there were effects of exposure, $F(1, 48) = 30.44$, $MSE = 2.99$ $p < .001$, and block, $F(3, 144) = 38.93$, $MSE = 1.02$, $p < .001$. There was no effect of impulsive nonconformity and no two-way interactions (largest $F(3, 144) = 1.8$, $MSE = 1.02$, $p = .15$), but there was a non-significant trend of a three-way interaction between exposure, block and impulsive nonconformity, $F(3, 144) = 2.67$, $MSE = .69$, $p = .05$.

Impulsive nonconformity: Correct responses ratios

Panel 4B of Figure A2 illustrates the mean correct responses ratios for the participants in the LOW and HIGH groups. Inspection of Panel 4B suggests more latent inhibition in the HIGH than in the LOW group in block 4. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi 2(5) = 16.08$, $p < .01$. Therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .85$. ANOVA revealed no effects of block or impulsive nonconformity nor an interaction between these factors (largest $F(2.56, 122.94) = 2$, $MSE = .05$, $p = .12$). One sample t-tests confirmed latent inhibition in both the LOW impulsive nonconformity group, $t(29) = 3.95$, $p < .001$, and the HIGH impulsive nonconformity group, $t(19) = 2.67$, $p < .05$.

Impulsive nonconformity: Reaction times

Panel 4C of Figure A2 illustrates the mean reaction times on the NPE and PE CS trials for the participants in the LOW and HIGH impulsive nonconformity groups. Inspection of Panel 4C indicates shorter reaction times as conditioning progressed and faster responding on the NPE than on the PE CS trials in both the LOW and HIGH impulsive nonconformity groups. In addition, there seemed to be more latent inhibition in block 4 in the HIGH than in the LOW group. ANOVA confirmed effects of exposure, $F(1, 48) = 31.28$, $MSE = 149426.32$, $p < .001$, and block, $F(3, 144) = 45.24$, $MSE = 38893.41$, $p < .001$, but not of impulsive nonconformity nor any interactions between the factors (largest $F(3, 144) = 1.1$, $MSE = 30991.14$, $p = .35$).

Appendix 3

Experiment 13: Norm mean split analyses

The data from Experiment 13 was split into low and high schizotypy groups in the same manner as in Appendix 2 and the analyses were similar to those conducted in Experiment 12.

Full scale schizotypy: Groups

The 48 participants scoring 39 or below on the full schizotypy scale were assigned to the LOW group and the 12 participants scoring 40 or above on the full schizotypy scale were assigned to the HIGH group. The mean schizotypy score in the LOW group was 28.27 (SD = 7.04) and the mean score in the HIGH group was 47.25 (SD = 4.05). The LOW and HIGH groups did not differ in age, $F < 1$.

Full scale schizotypy: Correct responses

Panel A of Figure A3 illustrates the mean number of correct responses to the NPE and the PE CSs for the participants in the LOW and HIGH schizotypy groups. Inspection of Panel A indicated that correct responding increased with training and that there was greater correct responding to the NPE than to the PE CS for both the LOW and HIGH schizotypy groups. In addition, there appears to be less learned irrelevance in the HIGH than in the LOW group in block 3. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi_2(5) = 26.33, p < .001$. Therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .75$. ANOVA confirmed that there were effects of exposure, $F(1, 58) = 16.96$, $MSE = 2.96, p < .001$, and block, $F(2.26, 130.89) = 32$, MSE = 1.25, $p < .001$. However, there was no effect of schizotypy, $F < 1$. There was an interaction between exposure and block, $F(3, 174) = 3.7$, $MSE = .59$, $p < .05$, but no other interactions between any of the factors, all $Fs < 1$.

Full scale schizotypy: Correct responses ratio

Panel B of Figure A3 illustrates the mean ratios for the participants in the LOW and HIGH groups. Inspection of Panel B indicates no differences in learned irrelevance between the HIGH and LOW groups. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi^2(5) = 21.03$, $p < .01$, and the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .8$. ANOVA did not reveal any effects of block or schizotypy group nor an interaction between these factors (largest $F(2.39, 138.86) = 1.21$, $MSE = .06$, $p = .31$. One-sample t-tests, however, revealed learned irrelevance in only the LOW, $t(47) = 4.12$, $p < .001$, and not the HIGH group, $t(11) = 1.27$, $p = .23$.

Full scale schizotypy: Reaction times

Panel C of Figure A3 illustrates the mean reaction times on the NPE and the PE CS trials across the four conditioning blocks for the participants in the LOW and HIGH groups. Inspection of Panel C indicates faster responding as conditioning progressed and faster responding on the NPE than on the PE CS trials. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi^2(5) = 31.76$, $p < .001$, and for the interaction between exposure and block, $\chi^2(5) = 13.51$, $p < .05$. Therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .71$, and for the interaction between exposure and block, $\varepsilon = .86$. ANOVA revealed effects of exposure, $F(1, 58) = 11.93$, $MSE = 133749.52$, $p < .01$, and block, $F(2.14, 124.08) = 27.1$, $MSE = 54794.13$, $p < .001$, but not schizotypy, $F < 1$. There was an interaction between exposure and block, $F(2.57, 148.78) = 3.46$, $MSE = 32416.8$, $p < .05$, but no other interactions, all $Fs < 1$.

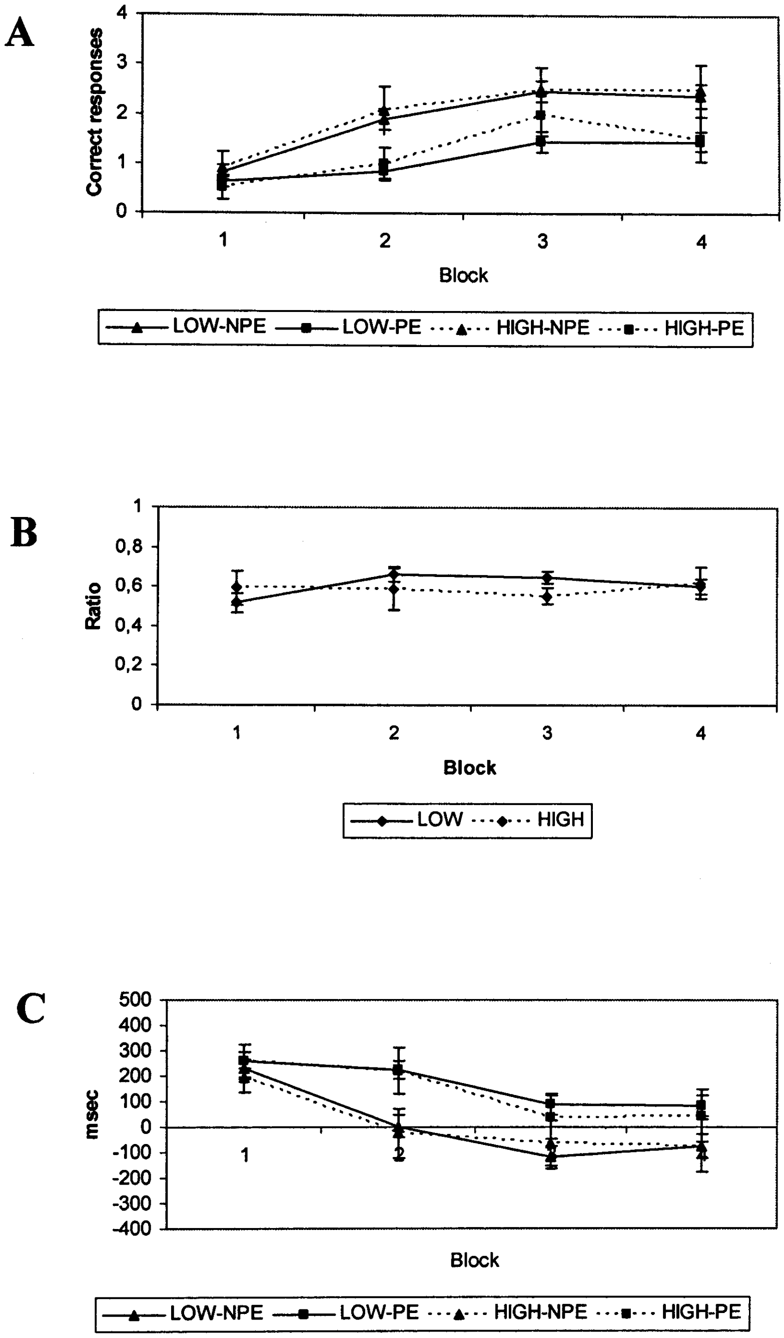


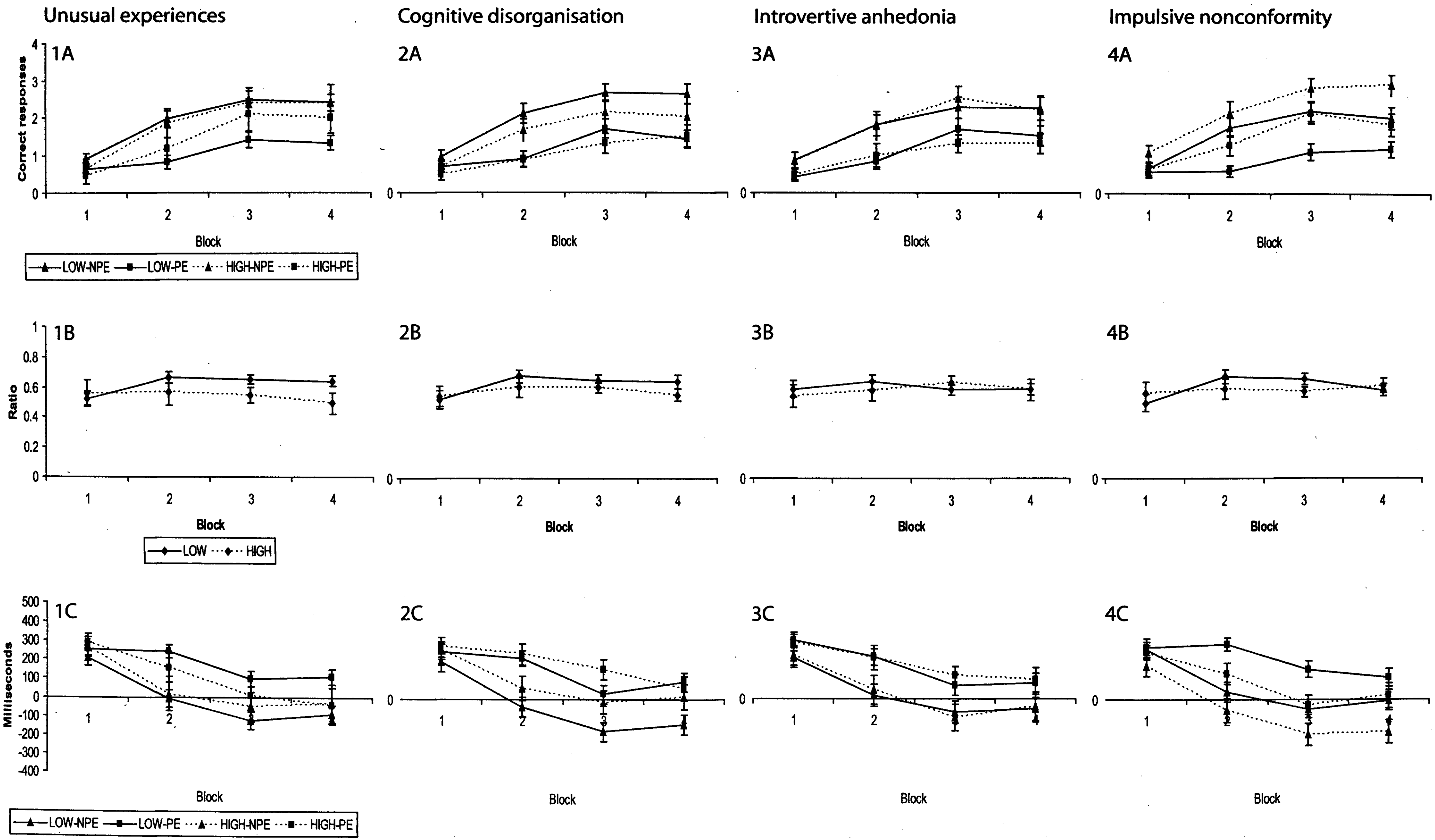
Figure A3. Experiment 13; Panel A: The mean number of correct responses (±*SEM*) to the nonpreexposed (NPE) and the preexposed (PE) stimuli in each block for the participants in the LOW (0-39, N=48) and HIGH (40+, N=12) full scale schizotypy groups. Panel B: The correct response ratios (±*SEM*) in each block for the participants in the LOW and HIGH full scale schizotypy groups. Panel C: The mean reaction times (±*SEM*) on the nonpreexposed and preexposed CS trials in each block for the participants in the LOW and HIGH full schizotypy scale groups.

Unusual experiences: Groups

The 47 participants scoring 11 or below on the unusual experiences subscale were assigned to the LOW group and the 13 participants scoring 12 or above on the unusual experiences subscale were assigned to the HIGH group. The mean schizotypy score in the LOW group was 4.28 (SD = 2.98) and the mean score in the HIGH group was 14.08 (SD = 2.66). The LOW and HIGH groups did not differ in age, $F < 1$.

Unusual experiences: Correct responses

Panel 1A of Figure A4 illustrates the mean number of correct responses to the NPE CS and to the PE CS across the four blocks for the participants in the LOW and HIGH groups. Inspection of Panel 1A indicates that correct responding increased with training and more correct responding to the NPE than to the PE CS in both groups. There appeared to be less learned irrelevance in the HIGH than in the LOW group in blocks 3 and 4. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi 2(5) = 24.45, p < .001$; and the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .77$. ANOVA revealed effects of exposure, $F(1, 58) = 12.8$, $MSE = 2.6, p < .01$, and block, $F(2.3, 133.36) = 39.25$, $MSE = 1.21, p < .001$, but not of unusual experiences, $F < 1$. There was an interaction between exposure and block, $F(3, 174) = 3.24$, $MSE = .59, p < .05$, but no other interactions (largest $F(1, 58) = 2.03$, MSE = 2.6, $p = .16$). ANOVA conducted on the data from block 3 and 4 revealed effects of exposure, $F(1, 58) = 12.49$, $MSE = 1.67, p < .01$, and a non-significant trend of an interaction between exposure and unusual experiences, $F(1, 58) = 3.33$, $MSE = 1.67, p = .073$. The remaining main effects and interactions were not significant, all $Fs < 1$.



Unusual experiences
Cognitive disorganisation
Introvertive anhedonia
Impulsive nonconformity
1A
2A
3A
4A
Correct responses
Block
LOW-NPE LOW-PE HIGH-NPE HIGH-PE
1B
2B
3B
4B
Ratio
Block
LOW HIGH
1C
2C
3C
4C
Milliseconds
Block
LOW-NPE LOW-PE HIGH-NPE HIGH-PE

Figure A4. Experiment 13: The twelve panels 1A-4C are organised into the three rows (A, B and C) that show the mean (±*SEM*) correct responses to the nonpreexposed (NPE) and preexposed (PE) CS, mean ratios (±*SEM*), and mean reaction times (±*SEM*) on the NPE and PE CS trials for the LOW and HIGH schizotypy groups that were given 20 CS and 20 US preexposures, respectively; and into four columns that illustrate the results of the low (0-11, N = 47) and high (12+, N = 13) unusual experiences, the low (0-13, N = 35) and high (14+, N = 25) cognitive disorganisation, the low (0-4, N = 31) and high (6+, N = 19) introvertive anhedonia, and the low (0-9, N = 35) and high (10+, N = 25) impulsive nonconformity groups, respectively.

Unusual experiences: Correct responses ratio

Panel 1B of Figure A4 illustrates the mean correct responses ratios across the four blocks for the participants in the LOW and HIGH groups. Inspection of Panel 1B indicates that there was more learned irrelevance in the LOW than in the HIGH unusual experiences groups. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi_2(5) = 20.79, p < .01$; therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .8$. ANOVA found no effect of unusual experiences or block nor an interaction between these factors (largest $F(1, 58) = 1.8$, $MSE = .14$, $p = .19$). ANOVA calculated on blocks 3 and 4 only, revealed an effect of unusual experiences, $F(1, 58) = 4.9$, $MSE = .07$, $p < .05$, but not of block nor an interaction between block and unusual experiences, both $Fs < 1$. One sample t-tests confirmed significant learned irrelevance in the LOW, $t(46) = 4.4$, $p < .001$, but not the HIGH, $t(12) = .74$, $p = .48$, unusual experiences groups.

Unusual experiences: Reaction times

Panel 1C of Figure A3 illustrates the mean reaction times on the NPE CS trials and on the PE CS trials for the participants in the LOW and HIGH groups. Inspection of Panel 1C indicates shorter reaction times with training and faster responding on the NPE than on the PE CS trials in both the LOW and HIGH unusual experiences groups. There appears to be more learned irrelevance in the LOW than in the HIGH group in blocks 3 and 4. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi_2(5) = 31.06, p < .001$, and for the interaction between exposure and block, $\chi_2(5) = 12.66, p < .05$; therefore the degrees of freedom were, once again, corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .72$, and for the exposure and block interaction, $\varepsilon = .86$. ANOVA revealed effects of exposure, $F(1, 58) = 8.53$, $MSE = 128386.74$, $p < .01$, and block, $F(2.15, 124.82) = 34.79$, $MSE = 53653.16$, $p < .001$, but not unusual experiences, $F < 1$. There was an interaction between exposure and block, $F(2.59, 150.16) = 3.03$, $MSE = 37318.73$, $p < .05$, but no other interactions between the factors (largest $F(1, 58) = 2.52$, $MSE = 128386.74$, $p = .12$). ANOVA calculated on blocks 3 and 4 only revealed the an effect of exposure, $F(1, 58) = 7.99$, $MSE = 70557.37$, $p < .01$, and an interaction between exposure and unusual experiences, $F(1, 58) = 4.87$, $MSE = 70577.37$, $p < .05$. There were no other effects of interactions, all $Fs < 1$. Bonferroni adjusted simple effects test showed that the interaction between exposure and unusual experiences reflected the fact that there was learned irrelevance in the LOW group, $p < .001$, but not the HIGH group, $p = .73$.

Cognitive disorganisation: Groups

The 35 participants scoring 13 or below on the cognitive disorganisation subscale were assigned to the LOW group and the 25 participants scoring 14 or above on the cognitive disorganisation subscale were assigned to the HIGH group. The mean schizotypy score in the LOW group was 8.57 ($SD = 2.73$) and the mean score in the HIGH group was 17.04 ($SD = 2.24$). The LOW and HIGH groups did not differ in age, $F < 1$.

Cognitive disorganisation: Correct responses

Panel 2A of Figure A4 illustrates the mean number of correct responses to the NPE CS and to the PE CS for the participants in the LOW and HIGH groups. Inspection of Panel 2A suggests that there was more correct responding as conditioning progressed and more correct responding to the NPE than to the PE CS in both the LOW and HIGH cognitive disorganisation groups. There also seems to be more learned irrelevance in the LOW than HIGH group. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi_2(5) = 26.59, p < .001$; therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .75$. ANOVA revealed effects of exposure, $F(1, 58) = 25.27$, $MSE = 2.64, p < .001$, and block, $F(2.25, 130.52) = 43.29$, $MSE = 1.25, p < .001$, but not of cognitive disorganisation, $F(1, 58) = 1.39$, $MSE = 7.29, p = .24$. There was an interaction between exposure and block, $F(3, 174) = 6.33$, $MSE = .59, p < .001$, but no other interactions between the factors (largest $F(1, 58) = 1.22$, $MSE = 2.64, p = .28$).

Cognitive disorganisation: Correct responses ratio

Panel 2B of Figure A4 illustrates the mean correct responses ratios across the four blocks for the participants in the LOW and HIGH cognitive disorgansation groups. Inspection of Panel 2B suggests no clear differences in learned irrelevance between the LOW and HIGH cognitive disorganisation groups. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi_2(5) = 20.98, p < .01$; therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .8$. ANOVA revealed a non-significant trend of an effect of block, $F(2.39, 138.79) = 2.63$, $MSE = .06, p = .065$, but no effect of cognitive disorganisation nor an interaction between block and cognitive disorganisation, both $Fs < 1$. One sample t-test confirmed learned irrelevance in the LOW group, $t(34) = 3.9, p < .001$, but only a non-significant trend of learned irrelevance in the HIGH cognitive disorganisation group, $t(24) = 1.91, p = .069$.

Cognitive disorganisation: Reaction times

Panel 2C of Figure A4 shows the mean reaction times on the NPE CS trials and on the PE CS trials for the participants in the LOW and HIGH groups. Inspection of Panel 2C suggests increased speed of responding as conditioning progressed and faster responding to the NPE than to the PE CS in both the LOW and HIGH cognitive disorganisation groups. There appears to be more learned irrelevance in the LOW than HIGH cognitive disorganisation group in block 4. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi_2(5) = 33.55$, $p < .001$, and for the interaction between exposure and block, $\chi_2(5) = 11.96$, $p < .05$; therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .7$, and for the exposure and block interaction, $\varepsilon = .87$. ANOVA revealed effects of exposure, $F(1, 58) = 18.73$, $MSE = 130584.07$, $p < .001$, and block, $F(2.1, 121.8) = 41.61$, $MSE = 54486.99$, $p < .001$, but not cognitive disorganisation, $F(1, 58) = 2.29$, $MSE = 130584.07$, $p = .14$. There was also an interaction between exposure and block, $F(2.61, 150.09) = 5.79$, $MSE = 36961.45$, $p < .05$, but no other interactions (largest $F(1, 58) = 1.5$, $MSE = 130584.07$, $p < .23$).

Introvertive anhedonia: Groups

The 31 participants scoring below 5 on the introvertive anhedonia subscale were assigned to the LOW group and the 19 participants scoring above 5 on the introvertive subscale were assigned to the HIGH group. The 10 participants scoring 5 were excluded from the analyses. The mean schizotypy score in the LOW group was 2.26 ($SD = 1.61$) and the mean score in the HIGH group was 8.95 ($SD = 2.7$). The LOW and HIGH groups did not differ in age, $F < 1$.

Introvertive anhedonia: Correct responses

Panel 3A of Figure A4 illustrates the mean number of correct responses to the NPE CS and to the PE CS for the participants in the LOW and HIGH groups. Inspection of Panel 3A indicates that correct responding increased during training and that there was greater correct responding to the NPE than to the PE CS; but there was no differences in learned irrelevance between the LOW and HIGH introvertive anhedonia groups. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi_2(5) = 25.96$, $p < .001$; therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .71$. ANOVA revealed effects of exposure, $F(1, 48) = 19.21$, $MSE = 2.77$, $p < .001$, and block, $F(2.14, 102.5) = 34.19$, $MSE = 1.35$, $p < .001$, but not introvertive anhedonia, $F < 1$. There was a non-significant trend of an interaction between exposure and block, $F(3, 144) = 2.57$, $MSE = .48$, $p = .057$, but no other interactions (largest $F(3, 144) = 1.59$, $MSE = .48$, $p = .2$).

Introvertive anhedonia: Correct responses ratio

Panel 3B of Figure A4 illustrates the mean correct responses ratios for the participants in the LOW and HIGH introvertive anhedonia groups. Inspection of Panel 3B indicates no differences in learned irrelevance between the introvertive anhedonia groups. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi_2(5) = 13.19$, $p < .05$; therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .83$. ANOVA found no effects or an interaction, all $Fs < 1$. One sample t-test, however, confirmed learned irrelevance only in the LOW group, $t(30) = 3.2$, $p < .01$, and not in the HIGH group, $t(18) = 1.63$, $p = .12$.

Introvertive anhedonia: Reaction times

Panel 3C of Figure A4 illustrates the mean reaction times on the NPE and on the PE CS trials for the participants in the LOW and HIGH groups. Inspection of Panel 3C indicates increased speed of responding as conditioning progressed and faster responding on the NPE than on the PE CS trials; but no learned irrelevance differences between the LOW and HIGH introvertive anhedonia groups are apparent. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi_2(5) = 27.75$, $p < .001$; therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .7$. ANOVA confirmed that there were effects of exposure, $F(1, 48) = 14.28$, $MSE = 143499.36$, $p < .001$, and block, $F(2.1, 100.62) = 32.8$, $MSE = 57686.87$, $p < .001$, but not of introvertive anhedonia, $F < 1$. The interaction between exposure and block approached significance, $F(3, 144) = 2.19$, $MSE = 25111.95$, $p = .092$, and there were no other interactions between the factors, all $Fs < 1$.

Impulsive nonconformity: Groups

The 35 participants scoring 9 or below on the impulsive nonconformity subscale were assigned to the LOW group and the 25 participants scoring 10 or above on the impulsive nonconformity subscale were assigned to the HIGH group. The mean schizotypy score in the LOW group was 6.8 ($SD = 1.71$) and the mean score in the HIGH group was 12.08 ($SD = 2$). The LOW and HIGH groups did not differ in age, $F < 1$.

Impulsive nonconformity: Correct responses

Panel 4A of Figure A4 illustrates the mean number of correct responses to the NPE and to the PE CS for the participants in the LOW and HIGH impulsive nonconformity groups.

Inspection of Panel 4A indicates that correct responding increased with training and that there was more correct responding to the NPE than to the PE CS in both LOW and HIGH groups. Although no differences in learned irrelevance between the LOW and HIGH groups is apparent, there is more correct responding overall in the HIGH group. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi 2(5) = 24.11$, $p < .001$; therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .77$. ANOVA confirmed these observations made about Panel 4A, revealing effects of exposure, $F(1, 58) = 26.47$, $MSE = 2.69$, $p < .001$, block, $F(2.31, 133.71) = 49.06$, $MSE = 1.19$, $p < .001$, and impulsive nonconformity, $F(1, 58) = 6.16$, $MSE = 6.75$, $p < .05$. There was an interaction between block and exposure, $F(3, 174) = 6.2$, $MSE = .58$, $p < .01$, but no other interactions between the factors (largest $F(2.31, 133.71) = 2.31$, $MSE = 1.19$, $p = .1$).

Impulsive nonconformity: Correct responses ratio

Panel 4B of Figure A4 illustrates the mean correct responses ratios across the four blocks for the participants in the LOW and HIGH impulsive nonconformity groups. Inspection of Panel 4B indicates no clear difference in learned irrelevance between the LOW and HIGH impulsive nonconformity groups. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi 2(5) = 21.58$, $p < .01$; therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .8$. ANOVA revealed that the effect of block approached significance, $F(2.39, 138.49) = 2.42$, $MSE = .06$, $p = .082$, and that there was no effect of impulsive nonconformity nor an interaction between block and impulsive nonconformity (largest $F(2.39, 138.49) = 1.81$, $MSE = .06$, $p = .15$). One sample t-test confirmed significant learned irrelevance in both the LOW group, $t(34) = 3.32$, $p < .01$, and in the HIGH group, $t(24) = 2.48$, $p < .05$.

Impulsive nonconformity: Reaction times

Panel 4C of Figure A4 illustrates the mean reaction times on the NPE and on the PE CS trials for the participants in the LOW and HIGH impulsive nonconformity groups. Inspection of Panel 4C indicates increased speed of responding as training progressed and faster responding on the NPE than on the PE CS trials in both the LOW and HIGH impulsive nonconformity groups. Although no differences in learned irrelevance between the LOW and HIGH groups are apparent, shorter overall reaction times are evident in the HIGH group. Mauchly's test indicated that the assumption of sphericity had been violated for block, $\chi^2(5) = 30.41$, $p < .001$, and for the interaction between exposure and block, $\chi^2(5) = 13.54$, $p < .05$; therefore the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for block, $\varepsilon = .72$, and for the exposure and block interaction, $\varepsilon = .85$. ANOVA revealed effects of exposure, $F(1, 58) = 20.17$, $MSE = 133934.67$, $p < .001$, block, $F(2.16, 125.53) = 45.78$, $MSE = 52862.8$, $p < .001$, and impulsive nonconformity, $F(1, 58) = 5.83$, $MSE = 286887.91$, $p < .05$. There was an interaction between exposure and block, $F(2.56, 148.2) = 5.31$, $MSE = 37734.34$, $p < .01$, but no other interactions between the factors (largest $F(2.16, 125.53) = 1.47$, $MSE = 52862.8$, $p = .23$).

Appendix 4

<u>Experiment 14: Analyses of the full scale, cognitive disorganisation, introvertive anhedonia, and impulsive nonconformity schizotypy dimensions.</u>

Descriptive analyses

Table A1 lists the means and inter-correlations of the full scale and individual schizotypy dimensions.

Table A1. Experiment 14: The means, standard deviations (*SD*) and inter-correlations for the schizotypy dimensions

Schizotypy dimension	Mean (N = 126)	CD	IA	IN
Full scale	32.33 (12.72)	-	-	-
Unusual experiences	8.24 (5.55)	.49*	.08	.44*
Cognitive disorganisation (CD)	11.85 (5.57)	-	.21*	.38*
Introvertive anhedonia (IA)	3.87 (3.13)	-	-	.05
Impulsive nonconformity (IN)	8.4 (3.77)			

* Significant ($p < .05$ or less)

Full scale schizotypy: Groups

The 34 participants scoring 22 or below on the full schizotypy scale were assigned to the low group and the 23 participants scoring 45 or above on the full schizotypy scale were assigned to the high group. The mean schizotypy score in the low group was 17.26 ($SD = 4.79$) and the mean score in the high group was 50.7 ($SD = 6.42$). The low and high groups did not differ in age, $F(1, 55) = 1.16$, $MSE = 20.27$, $p = .29$.

Full scale schizotypy: Training data

Table A2 lists the mean reaction times and the mean number of correct responses (i.e., hits) to each letter during training for the low and high groups.

Table A2. Experiment 14: The mean reaction times (±*SEM*) and the mean number (±*SEM*) of correct responses (= hits) to each letter during training for the low and high full scale schizotypy groups.

	L1	L2	L3	L4	L5	L10	L15	L20
LOW								
Number correct	1	2	2.97 (.03)	3.97 (.03)	4.97 (.03)	9.97 (.03)	14.88 (.06)	19.94 (.04)
RT	440.62 (12.83)	403.34 (8.71)	437.49 (10.7)	425.51 (7.94)	413.95 (6.97)	423.85 (6.1)	422.54 (6.35)	409.1 (6.16)
HIGH								
Number correct	1	2	2.91 (.06)	3.96 (.04)	5	9.87 (.1)	14.83 (.1)	19.61 (.12)
RT	446.7 (22.39)	417.11 (12.97)	438.48 (13.09)	420.82 (12.28)	424.65 (8.68)	431.91 (8.87)	425.18 (8.65)	410.92 (7.59)

Note: 'L' refers to letter. The number that follows 'L' refers to the number of times the letter was presented during training and therefore also to the maximum number of correct responses that was associated with each letter. RT refers to reaction time.

Trend analysis of the reaction times showed that there was a linear trend of letter, $F(1, 55) = 6.27$, $MSE = 2114.81$, $p < .05$, but no effect of schizotypy and no interaction between the factors, both $Fs < 1$. The linear trend of letter indicated that reaction times was faster to the more familiar letters than to the less familiar letters. Trend analysis of the proportion of correct responses (hits/total number of possible correct responses) showed a linear trend of letter, $F(1, 55) = 4.41$, $MSE = .001$, $p < .05$, but no effect of schizotypy, $F(1, 55) = 1.57$, $MSE = .002$, $p = .22$, nor an interaction between the factors, $F(1, 55) = 1.41$, $MSE = .001$, $p = .24$. The linear trend indicated that there were more misses of the more familiar letters, which is likely to be an artefact of the number of opportunities that there were to miss a given letter. The mean number of errors of commision was 2.62 ($SEM = .39$) in the low group and 3.83 ($SEM = .63$) in the high group. This differences was not significant, $F(1, 55) = 2.97$, $MSE = 6.75$, $p = .09$.

Full scale schizotypy: Test phase: D'

The mean d' values for the low and high schizotypy groups for the novel and all the preexposed letters during the test are shown in Figure A5. Inspection of Figure A5 indicates that the low schizotypy group performed more accurately than the high schizotypy group and the performance appeared to be equally accurate across all the letters in the low group whereas the high schizotypy group appeared to perform less accurately to the novel than to the more familiar letters. A linear trend of letter was found, $F(1, 55) = 6.08$, $MSE = .13$, $p < .05$, and an effect of schizotypy $F(1, 55) = 6.44$, $MSE = 1.91$, $p < .05$, but the interaction between these factors was just short of significance, $F(1, 55) = 3.45$, $MSE = .13$, $p = .068$.

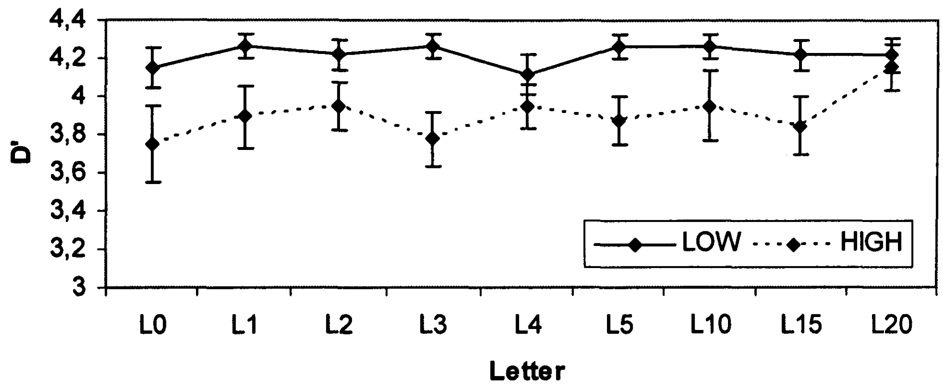


Figure A5. Experiment 14: The mean d' (±*SEM*) values for the low (0-22, N = 34) and high (45+, N = 23) schizotypy groups for the novel (L0) and all the preexposed (L1-L20) letters in the test phase. The prefix 'L' refers to 'letter' and the number refers to the number of times the letter has been preexposed (e.g., L5 refers to the letter that was preexposed 5 times, whereas L0 refers to the novel letter that was not preexposed).

Full scale schizotypy: Test phase: First trial of L0

Performance on the first presentation of the novel letter between the groups was evaluated in terms of percent correct and reaction times. In the low group 100% (34/34) of the participants responded correctly to the first presentation of L0 whereas in the high group 91% (21/23) responded correctly. There was a ceiling effect on the accuracy scores. The mean reaction time to the first presentation of L0 in the low group was 421.24 (*SEM* = 10.45) and in the high group was 423.05 (*SEM* = 16.33). This difference was not significant, $F < 1$.

Full scale schizotypy: Test phase: Criterion C

Figure A6 shows the mean C values for the low and high schizotypy groups for the novel and all the preexposed letters. Inspection of Figure A6 suggests that both the low and the high schizotypy group have a liberal bias across all the lettters and it appears that on L20 the high group has a more liberal bias than the low group. A linear trend of letter was found, $F(1, 55) = 6.08$, $MSE = .03$, $p < .05$, but no effect of schizotypy $F < 1$. The interaction between these factors approached significance, $F(1, 55) = 3.45$, $MSE = .03$, $p = .068$. One sample t-tests confirmed that in the low group responding to all the letters was subject to a liberal bias, as C was found to be significantly different from zero for all the letters ($-6.47 \leq t(33) \leq -2.46$, all *ps* $< .05$). In the high group, C was found to be significantly different from zero only on letters L2, $t(22) = -3.02$, $p < .01$, L4, $t(22) = -2.78$, $p < .05$, L10, $t(22) = -2.38$, $p < .05$, and L20, $t(22) = -6.68$, $p < .001$, although there was a non-significant trend on L1, $t(22) = -1.96$, $p = .063$, L5, $t(22) = -2.05$, $p = .052$, and L15, $t(22) = -1.81$, $p = .085$. The bias on the letters L0 L5, $t(22) = -1.25$, $p = .22$, and L3, $t(22) = -1.22$, $p = .24$, were not significantly different from zero.

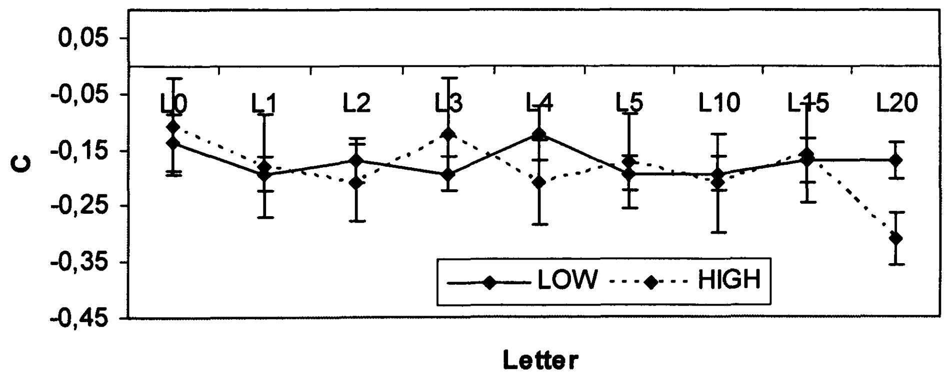


Figure A6. Experiment 14: The mean (±*SEM*) criterion C values for the low (0-22, N = 34) and high (45+, N = 23) schizotypy groups for the novel (L0) and all the preexposed (L1-L20) letters in the test phase. The prefix 'L' refers to 'letter' and the number refers to the number of times the letter has been preexposed (e.g., L5 refers to the letter that was preexposed 5 times, whereas L0 refers to the novel letter that was not preexposed).

Full scale schizotypy: Test phase: Reaction times

The test phase consisted of four identical blocks. The reaction times in the first two blocks were combined and are illustrated in Panel A of Figure A7, and the reaction times for the second pair of blocks were combined and are illustrated in Panel B of Figure A7, for the low and high groups, respectively. The block combinations were analysed separately. Inspection of Panel A suggests that overall the reaction times were faster in the low than in the high group but otherwise the groups or the letters did not appear to differ markedly. There was a non-significant linear trend of letter, $F(1, 54) = 3.91$, $MSE = 2294.44$, $p = .053$, but there was no effect of schizotypy, $F(1, 54) = 2.88$, $MSE = 17478.25$, $p = .1$, nor an interaction between these factors, $F < 1$. Inspection of Panel B suggests that in both groups the reaction times become progressively faster with more exposure and it appears that the low group is faster than the high group. A linear trend of letter was found in the combined blocks 3 and 4, $F(1, 55) = 6.86$, $MSE = 2887.33$, $p < .05$, but there was no effect of schizotypy, $(1, 55) = 2.52$, $MSE = 17981.64$, $p = .12$, nor an interaction between letter and schizotypy, $F < 1$.

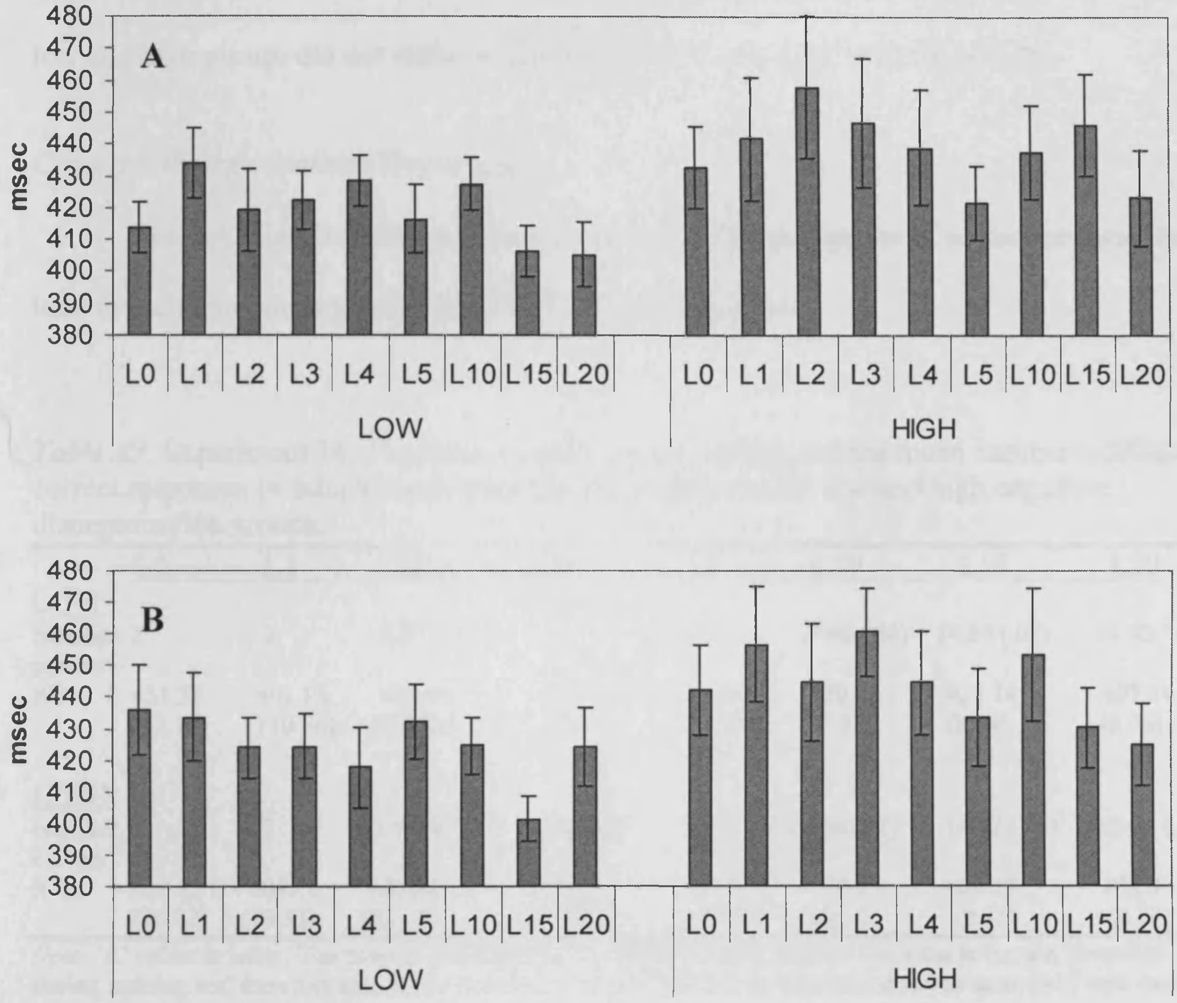


Figure A7. Experiment 14. Panel A: The reaction times (±*SEM*) to the novel and the preexposed letters in the combined blocks 1 and 2 for the low (0-22, N = 34) and high (45+, N = 23) schizotypy groups. Panel B: The reaction times (±*SEM*) to the novel and the preexposed letters in the combined blocks 3 and 4 for the low and high schizotypy groups. The prefix 'L' refers to 'letter' and the number refers to the number of times the letter has been preexposed (e.g., L5 refers to the letter that was preexposed 5 times, whereas L0 refers to the novel letter that was not preexposed).

Cognitive disorganisation: Groups

The 27 participants scoring 7 or below on the cognitive disorganisation scale were assigned to the low group and the 22 participants scoring 18 or above on the cognitive disorganisation scale were assigned to the high group. The mean schizotypy score in the low group was 3.93 (*SD* = 2.02) and the mean score in the high group was 19.91 (*SD* = 1.63). The low and high groups did not differ in age, $F(1, 47) = 1.37$, $MSE = 17.05$, $p = .25$.

Cognitive disorganisation: Training data

Table A3 lists the mean reaction times and the mean number of correct responses (i.e., hits) to each letter during training for the low and high group.

Table A3. Experiment 14: The mean reaction times (±*SEM*) and the mean number (±*SEM*) of correct responses (= hits) to each letter during training for the low and high cognitive disorganisation groups.

	L1	L2	L3	L4	L5	L10	L15	L20
LOW								
Number correct	1	2	2.96 (.04)	4	5	9.96 (.04)	14.89 (.06)	19.93 (.05)
RT	451.37 (13.18)	401.13 (10.56)	443.44 (12.23)	424.71 (9.3)	415.41 (7.56)	420.28 (7.95)	423.14 (8.94)	407.14 (6.96)
HIGH								
Number correct	1	2	2.9 (.06)	3.95 (.05)	4.95 (.05)	9.86 (.1)	14.82 (.11)	19.64 (.12)
RT	423.32 (21.32)	404.18 (13.52)	439.98 (13.65)	418.38 (13.99)	412.06 (9.87)	428.04 (9.78)	426.27 (9.23)	408.37 (8.67)

Note: 'L' refers to letter. The number that follows 'L' refers to the number of times the letter was presented during training and therefore also to the maximum number of correct responses that was associated with each letter. RT refers to reaction time.

Trend analysis of the reaction times showed that the linear trend of letter approached significance, $F(1, 47) = 3.07$, $MSE = 2327.91$, $p = .086$, but there was no effect of cognitive disorganisation and no interaction between the factors (largest $F(1, 47) = 1.82$, $MSE = 2327.91$, $p = .18$). Trend analysis of the proportion of correct responses showed that the linear trend of letter approached significance, $F(1, 47) = 3.43$, $MSE = .001$, $p = .07$. There was no effect of cognitive disorganisation, $F(1, 47) = 2.77$, $MSE = .002$, $p = .1$, nor an interaction between the factors, $F(1, 47) = 1.12$, $MSE = .001$, $p = .3$. The mean number of errors of commision was 2.44 (*SEM* = .43) in the low group and 4.32 (*SEM* = .69) in the high group. This differences was significant, $F(1, 47) = 5.72$, $MSE = 7.44$, $p < .05$.

Cognitive disorganisation: Test phase: D'

The mean d' values for the low and high groups for the novel and all the preexposed letters during test are shown in Figure A8. Inspection of Figure A8 indicates that the low group performed more accurately than the high schizotypy group and the performance appeared to be equally accurate across all the letters in the low group whereas the high schizotypy group appeared to perform less accurately to the novel than to the more familiar letters. There was an effect of cognitive disorganisation, $F(1, 47) = 10.02$, $MSE = 1.81, p < .01$, but no linear trend of letter nor an interaction between these factors (largest $F(1, 47) = 1.8$, $MSE = .2, p = .19$).

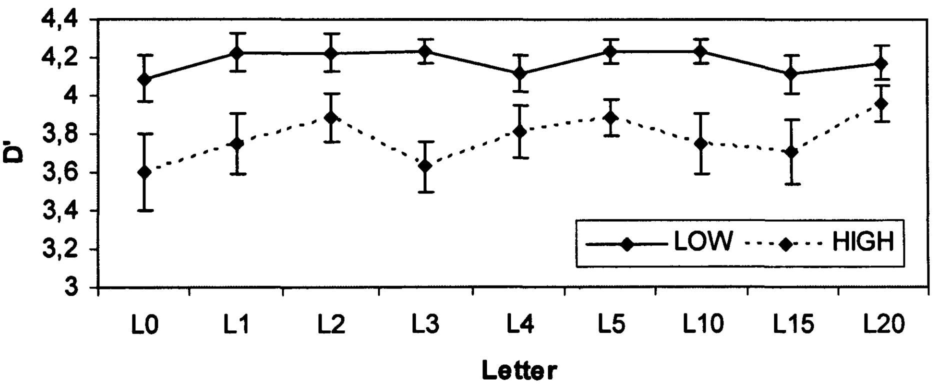


Figure A8. Experiment 14: The mean d' (±*SEM*) values for the low (0-7, N = 27) and high (18+, N = 22) cognitive disorganisation groups for the novel (L0) and all the preexposed (L1-L20) letters in the test phase. The prefix 'L' refers to 'letter' and the number refers to the number of times the letter has been preexposed (e.g., L5 refers to the letter that was preexposed 5 times, whereas L0 refers to the novel letter that was not preexposed).

Cognitive disorganisation: Test phase: First trial of L0

Performance on the first presentation of the novel letter between the groups was evaluated in terms of percent correct and reaction times. In the low group 100% (27/27) of the participants responded correctly to the first presentation of L0 whereas in the high group 91% (20/22) responded correctly. Again, there was a ceiling effect on the accuracy scores. The mean reaction time to the first presentation of L0 in the low group was 408.81 (SEM = 8.54) and in the high group was 425.15 (SEM = 22.35). This difference was not significant, $F < 1$.

Cognitive disorganisation: Test phase: Criterion C

Figure A9 shows the mean C values for the low and high cognitive disorganisation groups for the novel and all the preexposed letters. Inspection of Figure A9 suggests that both the low and the high schizotypy group have a liberal bias across all the lettters and it appears that on the high group has a more liberal bias than the low group. No linear trend of letter, no effect of schizotypy nor an interaction between these factors was found (largest $F(1, 47) = 1.8$, $MSE = .05$, $p = .19$). One sample t-tests confirmed that in the low group responding to all the letters was subject to a liberal bias, as C was found to be significantly different from zero for all the letters ($-6.83 \leq t(26) \leq -2.26$, all $ps < .05$). In the high group, C was not found to be significantly different from zero on letters L1, $t(21) = -1.74$, $p = .1$, and L3, $t(21) = -1.65$, $p = .11$. On the remaining letters, the C was significantly different from zero ($-7.42 \leq t(21) \leq -2.43$, all $ps < .05$).

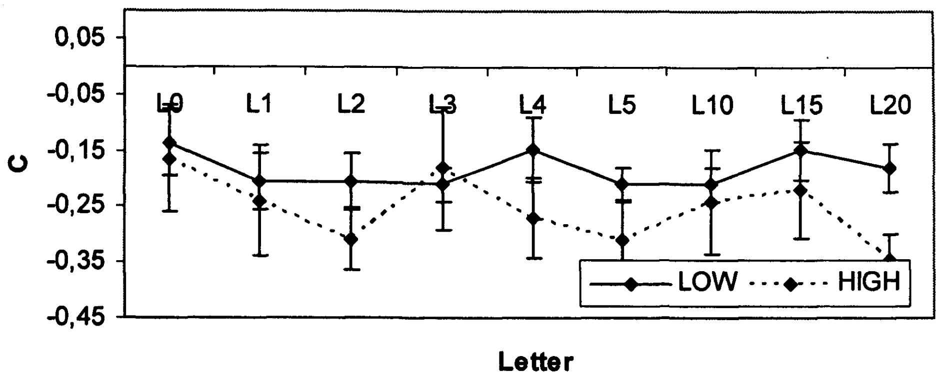


Figure A9. Experiment 14: The mean (±*SEM*) criterion C values for the low (0-7, N = 27) and high (18+, N = 22) cognitive disorganisation groups for the novel (L0) and all the preexposed (L1-L20) letters in the test phase. The prefix 'L' refers to 'letter' and the number refers to the number of times the letter has been preexposed (e.g., L5 refers to the letter that was preexposed 5 times, whereas L0 refers to the novel letter that was not preexposed).

Cognitive disorganisation: Test phase: Reaction times

The test phase consisted of four identical blocks. The reaction times in the first two blocks were again combined and are illustrated in Panel A of Figure A10, and the reaction times for the second pair of blocks were combined and are illustrated in Panel B of Figure A10, for the low and high schizotypy groups. Inspection of Panel A suggests that the reaction times do not appear to differ markedly between the groups although they appeared more variable in the high group. No linear trend of letter, no effect of schizotypy, and no interaction between these factors was found (largest $F(1, 46) = 1.9$, $MSE = 2804.39$, $p = .18$). Inspection of Panel B suggests that the reaction times become progressively faster with more exposure, especially in the low group. The linear trend of letter approached significance in the combined blocks 3 and 4, $F(1, 47) = 4$, $MSE = 3116.99$, $p = .051$, but there was no effect of cognitive disorganisation, $(1, 47) = 2.88$, $MSE = 12059.92$, $p = .1$, nor an interaction between letter and cognitive disorganisation, $F < 1$.

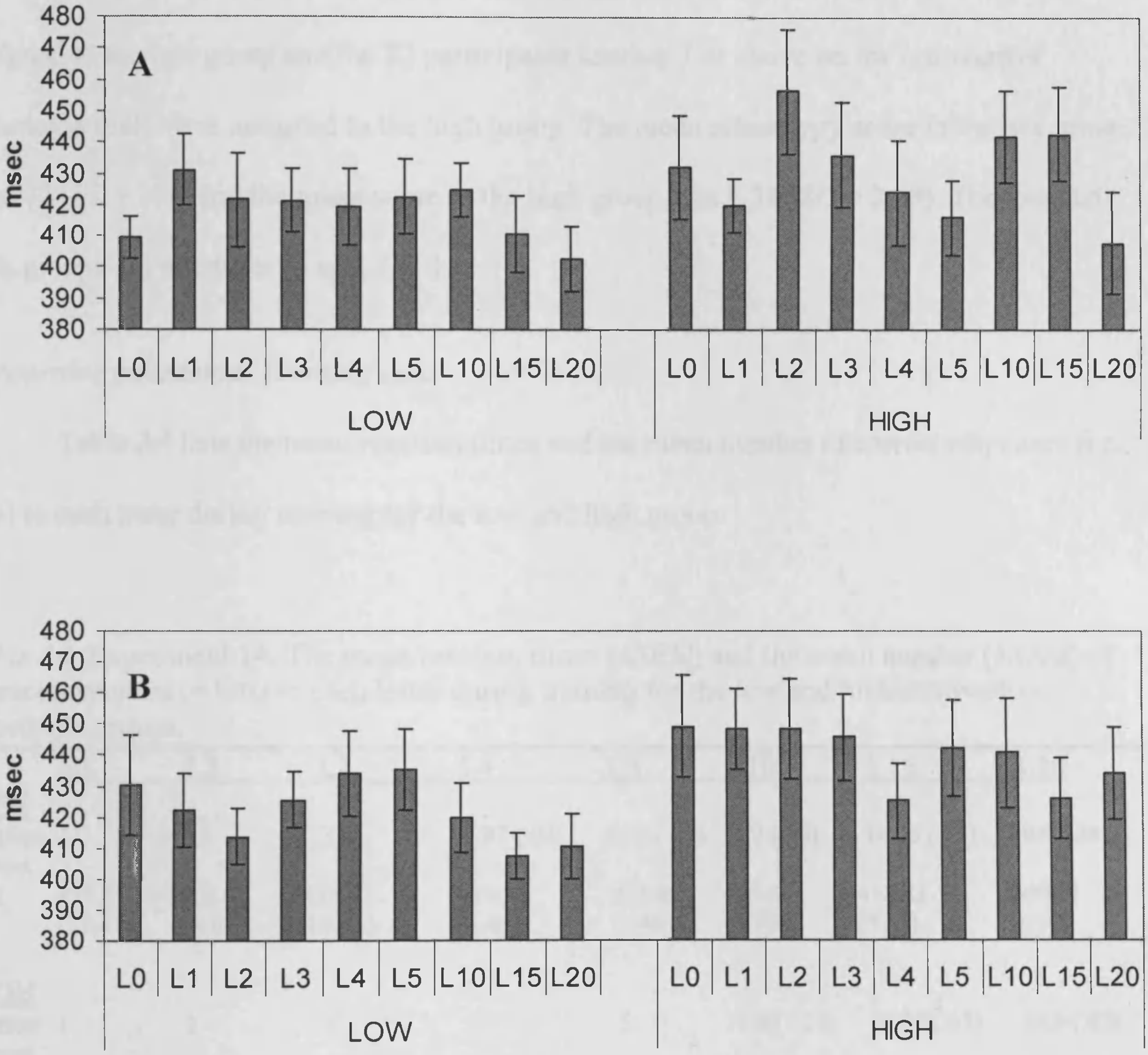


Figure A10. Experiment 14. Panel A: The reaction times (±*SEM*) to the novel and the preexposed letters in the combined blocks 1 and 2 for the low (0-7, N = 27) and high (18+, N = 22) cognitive disorganisation groups. Panel B: The reaction times (±*SEM*) to the novel and the preexposed letters in the combined blocks 3 and 4 for the low and high schizotypy groups. The prefix 'L' refers to 'letter' and the number refers to the number of times the letter has been preexposed (e.g., L5 refers to the letter that was preexposed 5 times, whereas L0 refers to the novel letter that was not preexposed).

Introvertive anedonia: Groups

The 29 participants scoring 1 or below on the introvertive anhedonia scale were assigned to the low group and the 22 participants scoring 7 or above on the introvertive anhedonia scale were assigned to the high group. The mean schizotypy score in the low group was .72 (SD = .46) and the mean score in the high group was 9.38 (SD = 2.69). The low and high groups did not differ in age, $F < 1$.

Introvertive anhedonia: Training data

Table A4 lists the mean reaction times and the mean number of correct responses (i.e., hits) to each letter during training for the low and high group.

Table A4. Experiment 14: The mean reaction times (±*SEM*) and the mean number (±*SEM*) of correct responses (= hits) to each letter during training for the low and high introvertive anhedonia groups.

	L1	L2	L3	L4	L5	L10	L15	L20
LOW								
Number correct	1	2	3	3.97 (.03)	4.97 (.03)	9.9 (.08)	14.86 (.07)	19.9 (.08)
RT	426.66 (17.41)	400.6 (9.8)	427.1 (10.91)	405.51 (6.46)	411.06 (7.46)	415.64 (6.79)	418.83 (5.61)	400.71 (6.29)
HIGH								
Number correct	1	2	3	4	5	9.95 (.05)	14.95 (.05)	19.9 (.07)
RT	422.48 (19.58)	415.19 (14.11)	424.94 (10.3)	404.71 (10.53)	415.11 (9.94)	407.27 (8.57)	405.78 (8.92)	392.43 (7.29)

Note: 'L' refers to letter. The number that follows 'L' refers to the number of times the letter was presented during training and therefore also to the maximum number of correct responses that was associated with each letter. RT refers to reaction time.

Trend analysis of the reaction times showed that there was a linear trend of letter, $F(1, 48)$ = 4.22, MSE = 3019.1, $p <$ .05, but no effect of introvertive anhedonia and no interaction between the factors, both $Fs < 1$. Trend analysis of the proportion of correct responses (hits/total number of possible correct responses) showed a linear trend of letter, $F(1, 48)$ = 5.34, $MSE < .001$, $p < .05$, but no effect of introvertive anhedonia nor an interaction between the factors (largest $F(1, 48) = 1.59$, $MSE = .001$, $p = .21$). The mean number of errors of commision was 3.31 ($SEM = .4$) in the low group and 2.81 ($SEM = .33$) in the high group. This differences was not significant, $F < 1$.

Introvertive anhedonia: Test phase: D'

The mean d' values for the low and high introvertive anhedonia groups for the novel and all the preexposed letters during the test are shown in Figure A11. Inspection of Figure A11 indicates that both groups performed equally accurately across all the letters. There was no linear trend of letter, or an effect of introvertive anhedonia nor an interaction between these factors (largest $F(1, 48) = 2.64$, $MSE = .11$, $p = .11$).

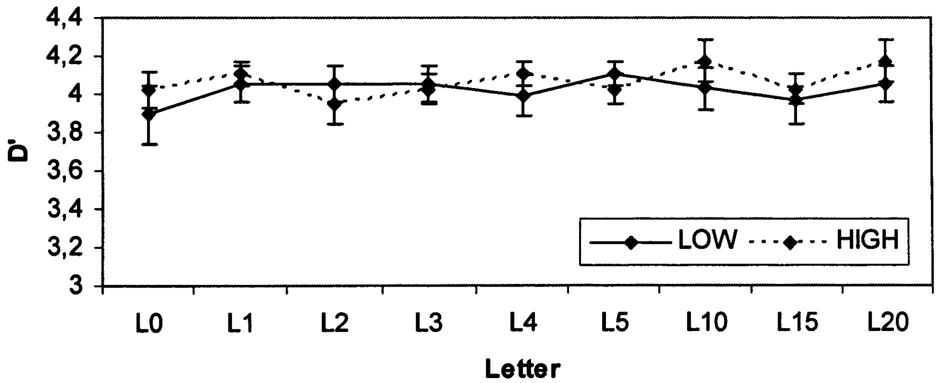


Figure A11. Experiment 14: The mean d' (±*SEM*) values for the low (0-1, N = 29) and high (7+, N = 22) introvertive anhedonia groups for the novel (L0) and all the preexposed (L1-L20) letters in the test phase. The prefix 'L' refers to 'letter' and the number refers to the number of times the letter has been preexposed (e.g., L5 refers to the letter that was preexposed 5 times, whereas L0 refers to the novel letter that was not preexposed).

Introvertive anhedonia: Test phase: First trial of L0

Performance on the first presentation of the novel letter between the groups was evaluated in terms of percent correct and reaction times. In the low group 97% (28/29) of the participants responded correctly to the first presentation of L0 whereas in the high group 100%

(21/21) responded correctly; there was a ceiling effect on the accuracy scores. The mean reaction time to the first presentation of L0 in the low group was 445.64 ($SEM = 15.22$) and in the high group was 399.24 ($SEM = 14.17$). This difference was significant, $F(1, 48) = 4.68$, $MSE = 5520.18$, $p < .05$.

Introvertive anhedonia: Test phase: Criterion C

Figure A12 shows the mean C values for the low and high introvertive anhedonia groups for the novel and all the preexposed letters. Inspection of Figure A12 suggests that both the low and the high introvertive anhedonia group have an equally liberal bias across all the lettters. There was no linear trend of letter, no effect of introvertive anhedonia nor an interaction between these factors (largest $F(1, 48) = 2.64$, $MSE = .03$, $p = .11$). One sample t-tests confirmed that in the low group responding to all the letters was subject to a liberal bias, as C was found to be significantly different from zero for all the letters ($-8.22 \leq t(28) \leq -2.65$, all $ps < .05$). In the high group, C was also significantly different from zero on all the letters ($-9.06 \leq t(20) \leq -2.7$, all $ps < .05$).

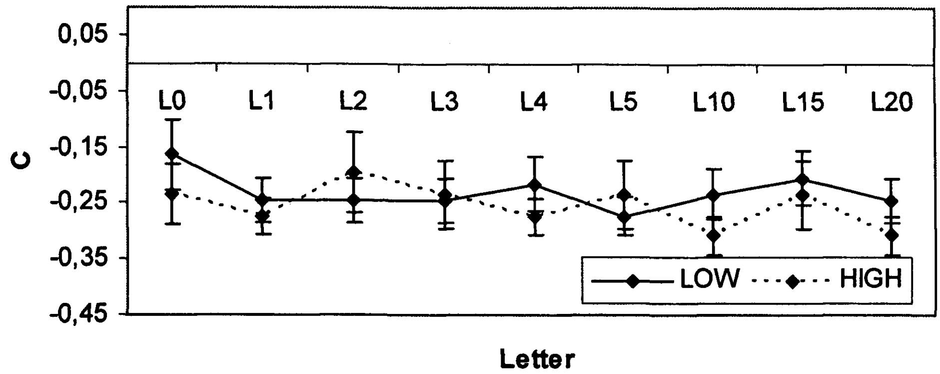


Figure A12. Experiment 14: The mean (±*SEM*) criterion C values for the low (0-1, N = 29) and high (7+, N = 22) introvertive anhedonia groups for the novel (L0) and all the preexposed (L1-L20) letters in the test phase. The prefix 'L' refers to 'letter' and the number refers to the number of times the letter has been preexposed (e.g., L5 refers to the letter that was preexposed 5 times, whereas L0 refers to the novel letter that was not preexposed).

Introvertive anhedonia: Test phase: Reaction times

The test phase consisted of four identical blocks. The reaction times in the first two blocks were combined and are illustrated in Panel A of Figure A13, and the reaction times for the second two blocks were combined and are illustrated in Panel B of Figure A13. Inspection of Panel A suggests that the reaction times do not appear to differ markedly between the low and high groups; although they appeared to become shorter with increasing letter familiarity in the high group. There was no linear trend of letter, no effect of introvertive anhedonia, and no interaction between these factors (largest $F(1, 48) = 2.69$, $MSE = 2412.22$, $p = .11$). Inspection of Panel B suggests that the reaction times become progressively faster with more exposure in both groups. A linear trend of letter was found in the combined blocks 3 and 4, $F(1, 48) = 5.16$, $MSE = 2831.96$, $p < .05$, but there was no effect of introvertive anedonia nor an interaction between these factors, both *Fs* < 1.

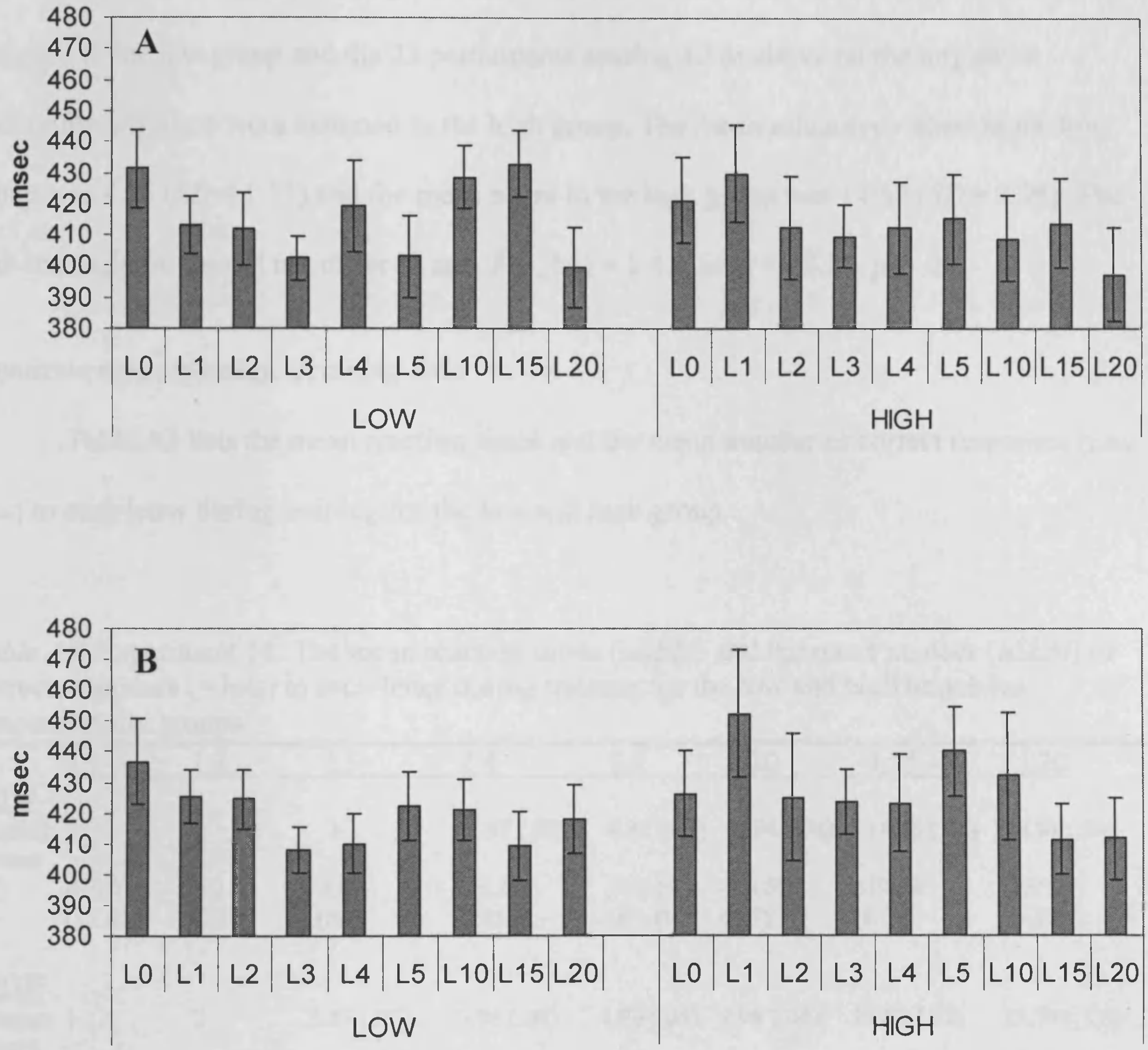


Figure A13. Experiment 14. Panel A: The reaction times (±*SEM*) to the novel and the preexposed letters in the combined blocks 1 and 2 for the low (0-1, N = 29) and high (7+, N = 22) introvertive anhedonia groups. Panel B: The reaction times (±*SEM*) to the novel and the preexposed letters in the combined blocks 3 and 4 for the low and high schizotypy groups. The prefix 'L' refers to 'letter' and the number refers to the number of times the letter has been preexposed (e.g., L5 refers to the letter that was preexposed 5 times, whereas L0 refers to the novel letter that was not preexposed).

Impulsive nonconformity: Groups

The 34 participants scoring 5 or below on the impulsive nonconformity scale were assigned to the low group and the 23 participants scoring 12 or above on the impulsive nonconformity scale were assigned to the high group. The mean schizotypy score in the low group was 4.15 (SD = 1.13) and the mean score in the high group was 14.52 (SD = 1.95). The low and high groups did not differ in age, $F(1, 55) = 1.41$, $MSE = 18.59$, $p = .24$.

Impulsive nonconformity: Training data

Table A5 lists the mean reaction times and the mean number of correct responses (i.e., hits) to each letter during training for the low and high group.

Table A5. Experiment 14: The mean reaction times (±*SEM*) and the mean number (±*SEM*) of correct responses (= hits) to each letter during training for the low and high impulsive nonconformity groups.

	L1	L2	L3	L4	L5	L10	L15	L20
LOW								
Number correct	1	2	3	3.97 (.03)	4.97 (.03)	9.94 (.04)	14.88 (.06)	19.94 (.04)
RT	439.71 (13.41)	422.03 (9.65)	438 (8.2)	425.14 (8.25)	409.16 (8.14)	419.57 (6.5)	419.26 (7.36)	407.04 (6.32)
HIGH								
Number correct	1	2	2.87 (.07)	3.96 (.04)	4.96 (.04)	9.96 (.04)	14.83 (.12)	19.74 (.11)
RT	423.13 (15.62)	410.15 (18.17)	428.8 (12.98)	417.72 (11.34)	416.09 (7.67)	415.2 (8.75)	417.4 (7.41)	398.56 (6.75)

Note: 'L' refers to letter. The number that follows 'L' refers to the number of times the letter was presented during training and therefore also to the maximum number of correct responses that was associated with each letter. RT refers to reaction time.

Trend analysis of the reaction times showed that there was a linear trend of letter, $F(1, 55) = 9.08$, $MSE = 2176.34$, $p < .01$, but no effect of impulsive nonconformity and no interaction between the factors, both $Fs < 1$. Trend analysis of the proportion of correct responses (hits/total number of possible correct responses) showed that the linear trend of letter approached significance, $F(1, 55) = 3.74$, $MSE < .001$, $p = .058$. There was no effect of impulsive nonconformity, $F(1, 55) = 2.55$, $MSE = .003$, $p = .12$, nor an interaction between the factors, $F < 1$. The mean number of errors of commision was 2.5 ($SEM = .27$) in the low group and 3.78 ($SEM = .76$) in the high group. This differences approached significance, $F(1, 55) = 3.33$, $MSE = 6.77$, $p = .073$.

Impulsive nonconformity: Test phase: D'

The mean d' values for the low and high impulsive nonconformity groups for the novel and all the preexposed letters during the test are shown in Figure A14. Inspection of Figure A14 indicates that both groups performed equally accurately across all the letters, but that the low group performed more accurately than the high group. There was an effect of impulsive nonconformity, $F(1, 55) = 4.88$, $MSE = 1.65$, $p < .05$, but no linear trend of letter nor an interaction between these factors, both $Fs < 1$.

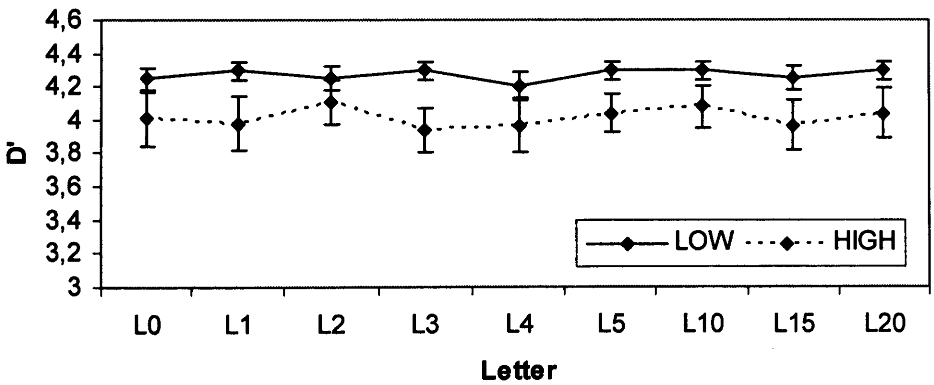


Figure A14. Experiment 14: The mean d' (±*SEM*) values for the low (0-5, N = 34) and high (12+, N = 23) impulsive nonconformity groups for the novel (L0) and all the preexposed (L1-L20) letters in the test phase. The prefix 'L' refers to 'letter' and the number refers to the number of times the letter has been preexposed (e.g., L5 refers to the letter that was preexposed 5 times, whereas L0 refers to the novel letter that was not preexposed).

Impulsive nonconformity: Test phase: First trial of L0

Performance on the first presentation of the novel letter between the groups was evaluated using percent correct and reaction times. In the low group 100% (34/34) of the participants responded correctly to the first presentation of L0 whereas in the high group 96% (22/23) responded correctly. A ceiling effect on the accuracy scores was apparent. The mean reaction time to the first presentation of L0 in the low group was 415.26 ($SEM = 9.85$) and in the high group was 438.77 ($SEM = 21.68$). This difference was not significant, $F(1, 54) = 1.22$, $MSE = 6035.49, p = .27$.

Impulsive nonconformity: Test phase: Criterion C

Figure A15 shows the mean C values for the low and high impulsive nonconformity groups for the novel and all the preexposed letters. Inspection of Figure A15 suggests that both the low and the high introvertive anhedonia group have an equally liberal bias across all the lettters. No linear trend of letter, no effect of impulsive nonconformity nor an interaction between these factors was found, all $Fs < 1$. One sample t-tests confirmed that in the low group responding to all of the letters was subject to a liberal bias, as C was found to be significantly different from zero for all the letters ($-6.48 \leq t(33) \leq -2.81$, all $ps < .01$). In the high group, C was not found to be significantly different from zero on letters L1, $t(22) = -1.4, p = .18$, L3, $t(22) = -1.15, p = .26$, L4, $t(22) = -1.71, p = .1$, and L15, $t(22) = -1.64, p = .12$. On letters L0, $t(22) = -2, p = .058$, and L5, $t(22) = -2.04, p = .053$, there was a trend of C being non-significantly different from zero. On the remaining letters, L2, $t(22) = -3.68, p < .01$, L10, $t(22) = -2.37, p < .05$, and L20, $t(22) = -2.52, p < .05$, C was significantly different from zero.

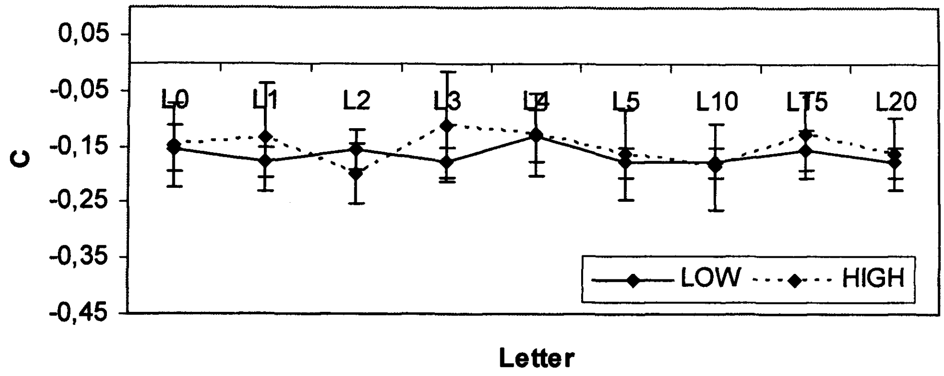


Figure A15. Experiment 14: The mean (±*SEM*) criterion C values for the low (0-5, N = 34) and high (12+, N = 23) impulsive nonconformity groups for the novel (L0) and all the preexposed (L1-L20) letters in the test phase. The prefix 'L' refers to 'letter' and the number refers to the number of times the letter has been preexposed (e.g., L5 refers to the letter that was preexposed 5 times, whereas L0 refers to the novel letter that was not preexposed).

Impulsive nonconformity: Test phase: Reaction times

The reaction times in the first two blocks were combined and are illustrated in Panel A of Figure A16, and the reaction times for the remaining two blocks were combined and are illustrated in Panel B of Figure A16. Inspection of Panel A suggests that the reaction times do not appear to differ markedly between the groups although they appeared to become faster with increasing letter familiarity. There was a linear trend of letter, $F(1, 55) = 8.24$, $MSE = 2107.12$, $p < .01$, but no effect of impulsive nonconformity, and no interaction between these factors, both $Fs < 1$. Inspection of Panel B suggests that the reaction times become progressively faster with more exposure in both groups. A linear trend of letter was found in the combined blocks 3 and 4, $F(1, 55) = 12.73$, $MSE = 2561.07$, $p < .01$, but there was no effect of impulsive nonconformity nor an interaction between these factors, both $Fs < 1$.

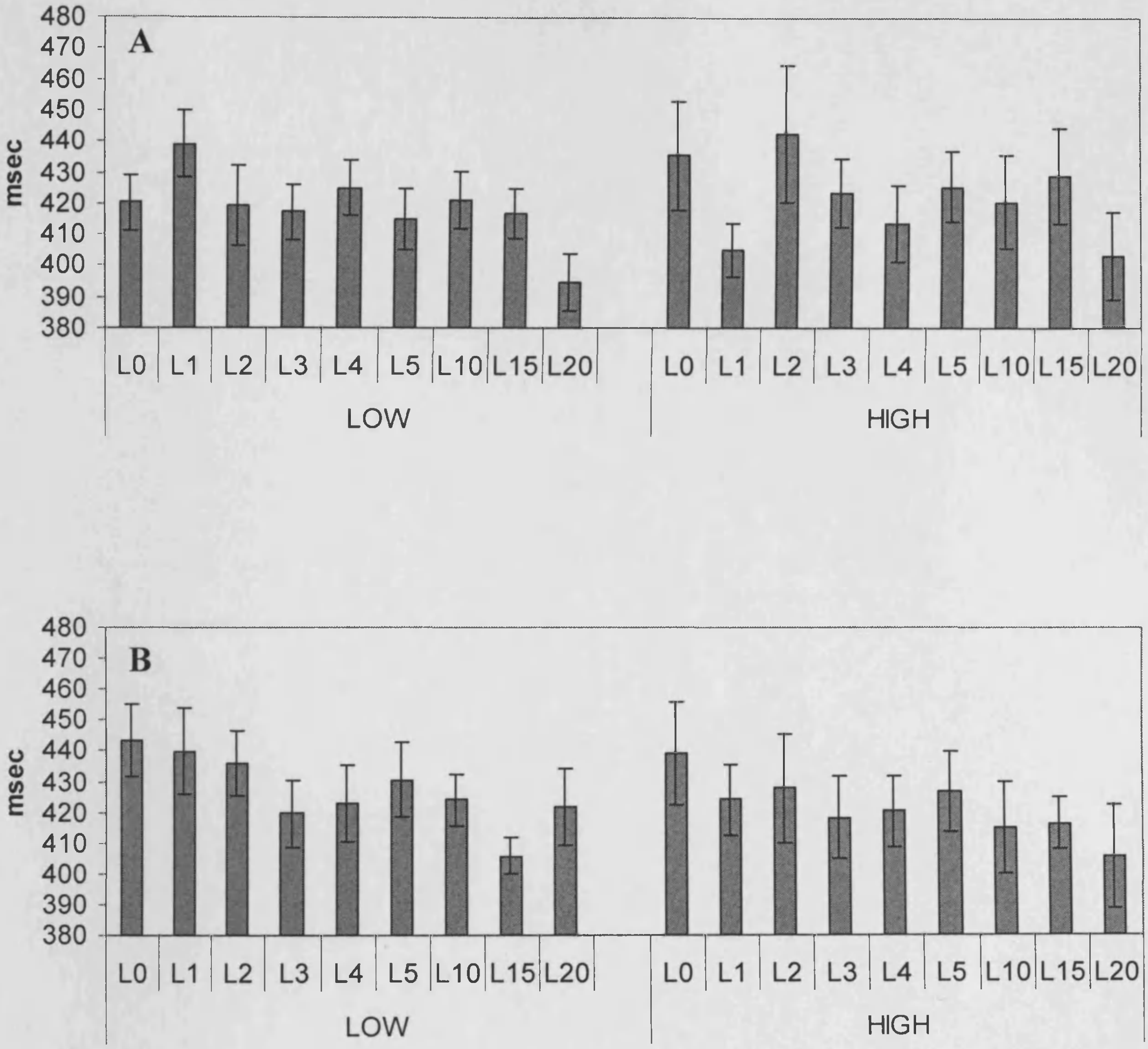


Figure A16. Experiment 14. Panel A: The reaction times (±*SEM*) to the novel and the preexposed letters in the combined blocks 1 and 2 for the low (0-5, N = 34) and high (12+, N = 23) impulsive nonconformity groups. Panel B: The reaction times (±*SEM*) to the novel and the preexposed letters in the combined blocks 3 and 4 for the low and high schizotypy groups. The prefix 'L' refers to 'letter' and the number refers to the number of times the letter has been preexposed (e.g., L5 refers to the letter that was preexposed 5 times, whereas L0 refers to the novel letter that was not preexposed).