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The relationship between incidental learning and multi-dimensional schizotypy as measured by the Oxford-Liverpool Inventory of Feelings and Experiences (O-LIFE)

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Abstract

This paper describes a study carried out to investigate the relationship between incidental learning and multi-dimensional schizotypy as measured by the Oxford-Liverpool Inventory of Feelings and Experiences (O-LIFE; Mason, Claridge, & Jackson, 1995). Whilst Jones, Gray, and Hemsley (1992) found incidental recall to be positively correlated with the 'unusual perceptual experiences' factor of Hewitt and Claridge's (1989) three factor solution to the Schizotypal Personality Scale (STA; Claridge & Broks, 1984), research in this area is generally limited. Further to the development of the O-LIFE, a reliable measure of multi-dimensional schizotypy, the aim of the current study was to re-investigate the relationship between schizotypy and incidental learning. Seventy-five undergraduate students completed the O-LIFE alongside a task for incidental learning and the Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999). Participants were dichotomised into low and high schizotypy scoring groups and results revealed that those scoring

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highly on the Unusual Experiences (positive-schziotypy) scale of the O-LIFE demonstrated higher rates of incidental recall than did the low Unusual Experiences scoring group. No differences in incidental recall were observed on the other dimensions of schizotypy or on intelligence. These findings are one of the first reports of the relationship between incidental learning and the O-LIFE scales and are consistent with the wider literature, and point to one of the important cognitive correlates of high schizotypy, namely over-inclusiveness of associative relations.

Keywords: Incidental learning; O-LIFE; Positive-schizotypy; Unusual Experiences; Over-inclusiveness

1. Introduction

Incidental learning has been described as a 'traditional' measure of selective attentional processing (e.g. Eysenck, 1982; Jones, Gray, & Hemsley, 1990), and is concerned with testing the recall of information to which individuals have *not* been informed to attend. For example, participants may be asked 'explicitly' to learn about a set of stimuli for later recall (intentional recall), but during later testing they are also asked about different aspects or features of the stimuli which they were not informed they needed to learn about (incidental recall). Thus, incidental learning tasks are a simple and effective way of assessing the extent to which non-salient stimuli have been processed, with a higher level of incidental recall suggesting that attention has continued to be paid to the non-relevant stimuli (Jones, 1989; Jones et al., 1990).

Attentional processes have received much attention in the schizophrenia spectrum research, where it has been suggested that there is a 'deficit' in the cognitive mechanisms associated with selective attention (e.g. Hemsley, 1975, 1977; McGhie & Chapman, 1961). Eysenck (1995) suggested that a common element of the cognitive theories of schizophrenia is the idea that the associative process is disrupted, whereby the cognitive processes of those diagnosed as having schizophrenia are disturbed, thus interfering with the ability to attend effectively to relevant stimuli and ignore irrelevant stimuli. Given these theoretical suggestions, it is not too surprising that procedures for incidental learning have been employed in the schizophrenia research.

A number of studies have set out to establish the relationship between schizophrenia and incidental learning. Payne, Hochberg, and Hawks (1970) found a higher level of incidental recall in those diagnosed as having schizophrenia than in a control group. Dykes and McGhie (1976) also found similar results on a dichotic shadowing task, with individuals diagnosed as having schizophrenia demonstrating increased incidental recall, concluding that they experience a wider range of environmental input than others. However, Stayte (1977) found that there was no clear increase in incidental learning in those diagnosed as having schizophrenia on either a dichotic shadowing task or an anagram solving task, whilst Jones (1989) found that incidental learning was only increased shortly following hospital admission otherwise incidental learning was decremented to below the level of that observed in the chronic phase of the illness.

From the majority of these reports, whilst there is evidence that incidental learning may be incremented in those diagnosed as having schizophrenia; it is not clear as to the phase of the illness, the symptoms manifest, or medication status in these samples. However, given Jones' (1989) findings associated with the acute phase of schizophrenia when positive symptoms are most likely

to be manifest, this suggests that incidental learning is related to the positive symptomatology of schizophrenia—this is consistent with attentional-deficit models of schizophrenia (e.g. Hemsley, 1993). Given this relationship, it would be expected that a similar pattern of results would be found in high schizotypy scorers (i.e. a 'healthy' sample scoring highly on questionnaire measures of schizotypy), where schizotypy is viewed as a continuum between 'normality' and schizophrenia (or psychosis), characterised by increasingly strange behaviours. Jones et al. (1990) set out to test this hypothesis in a study requiring participants to complete two tasks of incidental learning alongside the Psychoticism scale (Eysenck, Eysenck, & Barrett, 1985), the Schizotypal Personality Scale (STA; Claridge & Broks, 1984), the Rust Inventory of Schizotypal Cognitions (RISC; Rust, 1988) and the Launay-Slade Hallucination Scale (Launay & Slade, 1981). Results from the Jones et al. (1990) study revealed no relationship between incidental learning and any of these four measures. However, in the light of Hewitt and Claridge's three factor solution to the STA (Hewitt & Claridge, 1989), for which three distinct factors were identified tapping 'magical ideation', 'unusual perceptual experiences' and 'paranoid ideation and suspiciousness', Jones et al. (1992) reanalysed the data and found the 'unusual perceptual experiences' factor to be positively correlated with incidental recall on both of the incidental learning tasks employed in their study, suggesting incidental learning to be primarily associated with positive-schizotypy.

The findings from the Hewitt and Claridge (1989) study highlight the multidimensional nature of the STA. Moreover, as Mason et al. (1995) have pointed out, key schizotypal traits such as anhedonia (a lack of interest in enjoying life or living) were not included in the DSM-III-R descriptions of schizotypal and borderline personality disorders, and consequently were not tapped by the Claridge and Broks (1984) scales. However, there is increasing evidence that schizotypy is a multi-dimensional construct, with research from factor analytic studies (generally) revealing four factors (e.g. Bentall, Claridge, & Slade, 1989; Claridge et al., 1996; Williams, 1994): (1) positive-schizotypy, reflecting the positive symptomatology of schizophrenia; (2) negative-schizotypy, reflecting the negative symptomatology of schizophrenia; (3) asocial-schizotypy, reflecting more anti-social and tough-minded behaviour; and (4) cognitive disorganization/social anxiety, reflecting a difficulty with decision-making. One of the most recently developed measures of multi-dimensional schizotypy is the Oxford-Liverpool Inventory of Feelings and Experiences (O-LIFE; Mason et al., 1995). This questionnaire comprises four scales of schizotypy, with each scale tapping one of the four factors discovered through factor analysis of the Combined Schizotypal Traits Questionnaire (CSTQ; Bentall et al., 1989, a large battery of established schizotypy scales) (Claridge et al., 1996), with Unusual Experiences measuring positive-schizotypy; Cognitive Disorganization measuring disorganized-schizotypy/social anxiety; Introvertive Anhedonia measuring negative-schizotypy; and Impulsive Nonconformity measuring asocial-schizotypy.

Further to the development of the O-LIFE, it has been usefully employed in the schizophrenia spectrum research with a range of cognitive experimental procedures (e.g. Burch, Hemsley, & Joseph, 2004; Gray, Fernandez, Williams, Ruddle, & Snowden, 2002; Steel, Hemsley, & Jones, 1996; Steel, Hemsley, & Pickering, 2002). The general aim of the current study was, therefore, to replicate the Jones et al. (1992) study, but this time employing the O-LIFE to investigate the relationship between incidental learning and schizotypy. Given the Jones (1989) and Jones et al. (1992) findings, it would be expected that incidental recall would be related to the Unusual Experiences scale of the O-LIFE, but not to the other dimensions of schizotypy.

Incidental learning has been measured by a range of tasks (e.g. Davies & Jones, 1975; Hockey & Hamilton, 1970; Jones et al., 1990); for example, Jones et al. (1990) presented participants with 16 words, eight of which began with the letter 'A' and eight with a different letter, and were required to learn the words that began with the letter 'A' for later recall. Participants were asked to read out aloud each word as it was presented, to ensure that words could not just be ignored. In a subsequent test (recall) phase, participants were asked to recall, not only the words beginning with the letter 'A' (intentional recall), but also those that did not begin with the letter 'A' (incidental recall). In this type of task, intentional recall is found to be higher than incidental recall, as the irrelevant stimuli (those stimuli not asked to be attended to) are not attended to, but rather ignored or gated.

Incidental learning tasks are simple and easy to administer, and are ideal for use in the experimental context. Following the development of the O-LIFE and Jones et al. (1992) finding, the specific aim of the present study was, therefore, to investigate the relationship between incidental learning and multi-dimensional schizotypy, as measured by the O-LIFE. The underlying hypothesis of the current study was that those scoring higher in positive-schizotypy (Unusual Experiences) would demonstrate a higher level of incidental recall, whilst there would be no significant differences between high and low scoring groups on the other three schizotypy scales.

2. Method

2.1. Participants

Seventy-five undergraduate students from the University of Winchester volunteered to take part in the study (49 female, 26 male; mean age = 20.5 years, SD = 2.42). All participants spoke English as their first language and had normal, or corrected-to-normal, vision. Participants were paid £10.00 for their participation, which was approved by the Institute of Psychiatry Ethics Committee.

2.2. Psychometric measures

2.2.1. Oxford-Liverpool Inventory of Feelings and Experiences

Participants were required to complete the Oxford-Liverpool Inventory of Feelings and Experiences (O-LIFE; Mason et al., 1995), a multi-dimensional measure of schizotypy, comprising scales of positive-schizotypy (Unusual Experiences), disorganised-schizotypy/social anxiety (Cognitive Disorganization), asocial-schizotypy (Impulsive Nonconformity) and negative-schizotypy (Introvertive Anhedonia). The O-LIFE has been shown to demonstrate sound psychometric properties, e.g. internal reliability (Mason et al., 1995) and test–retest reliability (Burch, Steel, & Hemsley, 1998). Example items from each of the four O-LIFE scales include:

Unusual Experiences

- Are the sounds you hear in your daydreams usually clear and distinct?
- Have you occasionally felt as though your body did not exist?

Cognitive Disorganization

- No matter how hard you concentrate, do unrelated thoughts always creep into your mind?
- Do you worry about awful things that might happen?

Introvertive Anhedonia

- Do you like mixing with people?
- Do you prefer watching television to going out with other people?

Impulsive Nonconformity

- Do you at times have an urge to do something harmful or shocking?
- Have you ever felt the urge to injure yourself?

The O-LIFE comprises of 'YES/NO' response items with a range of possible scores on each of the scales being: Unusual Experiences = 0–30; Cognitive Disorganization = 0–24; Impulsive Nonconformity = 0–23; and Introvertive Anhedonia = 0–27.

2.2.2. Wechsler abbreviated scale of intelligence

Participants were also required to complete the Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999) Full Scale IQ two subtest (FSIQ—2; Vocabulary and Matrix Reasoning). The WASI is a brief and reliable measure of intelligence, providing an estimated IQ score against the WAIS-111 (Wechsler, 1997) and was included in the study in order to obtain a measure of general cognitive ability. Recent findings have shown IQ to be negatively related to Unusual Experiences scores on the O-LIFE. For example, Burch et al. (2004) found that Unusual Experiences scores negatively correlated with verbal intelligence as measured by the Mill Hill Vocabulary Scale (Raven, Raven, & Court, 1988), and Burch, Hemsley, Corr, and Pavelis (in press) found Unusual Experiences was negatively correlated with WASI scores.

2.2.3. Incidental learning task

The incidental learning task employed in the current study was based on that developed by Jones et al. (1990). During this task, participants were presented with a list of 16 bi-syllabic words on a computer screen, half of which began with the letter 'A' (example items included: 'Alight', 'Amuse') the remaining half did not (example items included: 'Convince', 'Succeed'. Participants were presented the following instructions on the computer screen:

> 'In this task read aloud the words that come up on the screen. Some of the words will begin with the letter 'A'. Your task is to learn the words beginning with the letter 'A'. Good luck. Press the space bar to begin'.

The words were presented on the screen one at a time for 1.5 s, with the order of presentation randomised by the computer. There was an inter-stimulus interval of 2 s. Text was centred vertically and horizontally, sized 100 in black bold (Times New Roman) on a neutral background. Par-

ticipants were required to read the words out loud to ensure that non-target words could not be ignored. Following presentation of the words, participants were asked to write down all the words they could remember from the list that began with the letter 'A' (intentional recall), and then all the words they could remember from the list that did not begin with the letter 'A' (incidental recall). Participants were allowed as much time as they needed in order to write down their responses.

2.3. Procedure

Participants were recruited into the study through direct canvassing and advertisements placed on the College intranet. On agreeing to take part in the study, and after completing a consent form, participants were given the O-LIFE to complete prior to the 'testing' session, in order to reduce any possible fatigue effects. During the actual testing session, participants were tested individually in the same 'testing room' by the same 'test-trained' psychologist. Participants completed the WASI and the incidental learning task, with order of completion counter-balanced between participants in order to counter any possible order effect.

3. Results

Means and standard deviations for the O-LIFE and WAIS, intentional recall and incidental recall scores are shown in Table 1, along with Pearson's correlation coefficients between these variables.

As can be seen, the mean intentional recall score was 4.29 (SD = 1.10), and the mean incidental recall score, 1.85 (SD = 1.29). In line with theoretical prediction, more items were remembered in the intentional recall condition than the incidental recall condition. This finding was confirmed by a related t-test ($t(74) = 12.8$; $p < .001$; 1-tailed), demonstrating that less attention was paid to the irrelevant stimuli than to the relevant stimuli; thereby validating the present task as an incidental learning procedure. Data were further broken down in order to examine differences between males and females on both intentional and incidental recall scores (see Fig. 1). Whilst a mixed 2×2 ANOVA (intentional recall vs. incidental recall; male vs. female) confirmed the main effect of recall

Table 1
Means and standard deviations (SD) of O-LIFE, WASI, intentional recall and incidental recall scores, and Pearson's correlation coefficients ($n = 75$)

	Mean	SD	1	2	3	4	5	6
1. Unusual Experiences	11.43	6.88	–					
2. Cognitive Disorganization	12.76	5.77	.57*	–				
3. Impulsive Nonconformity	9.45	4.15	.54*	.47*	–			
4. Introvertive Anhedonia	4.48	3.59	.14	.39*	.19	–		
5. WASI	107.27	11.32	−.02	−.14	.05	−.06	–	
6. Intentional Recall	4.29	1.10	.04	.16	.31*	.10	.13	–
7. Incidental Recall	1.85	1.29	.20	.12	.09	.09	−.20	.05

* $p < .01$ (two-tailed).

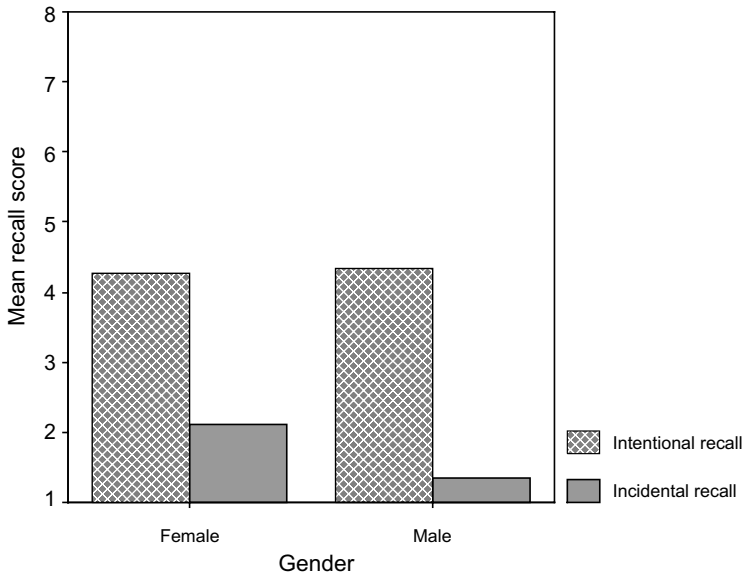

Fig. 1. Intentional and incidental recall for females and males.

($F(1,73) = 172.62$; $p < .001$) and a gender × recall interaction ($F(1,73) = 4.80$; $p = .03$), no main effect of gender was revealed ($F(1,73) = 2.79$; $p = .10$).

Subsequently, data were dichotomised into high and low scoring groups based upon a median split (Unusual Experiences = 10; Cognitive Disorganization = 13; Impulsive Nonconformity = 9; Introvertive Anhedonia = 4; WASI = 108) and comparisons between the high and low scoring groups were computed. Table 2 shows the means and standard deviations for both the low and high scoring groups on the O-LIFE scales of Unusual Experiences, Cognitive Disorganization,

Table 2
Means and standard deviations (SD) of incidental learning scores for both high and low schizotypy and IQ scoring groups, along with between participants *t*-tests and Cohen's *d*

	Low scorers			High scorers			t[a]	p[b]	d
	N	Mean	SD	*N*	Mean	SD			
Unusual Experiences	**39**	**1.51**	**1.23**	**36**	**2.22**	**1.27**	**−2.46**	**.01**	**−.58**
Cognitive Disorganization	37	1.65	1.36	38	2.05	1.21	−1.36	.09	−.31
Impulsive Nonconformity	39	1.79	1.44	36	1.92	1.13	−.41	.34	−.10
Introvertive Anhedonia	57	1.82	1.24	18	1.94	1.47	−.34	.37	−.09
WASI	38	2.08	1.40	37	1.62	1.14	1.55	.06	.36

Significant relationships highlights in bold.

d = (mean for the low scoring group—mean for the high scoring group/SD_{pooled}). Positive d-values indicate low scoring group scored higher in incidental learning, whilst negative d-values indicate that high scoring group scored higher in incidental learning. Effect sizes of .80 or greater can be considered to be large differences, those around .50, moderate, and those around .20, small (Cohen, 1988).

[a] df's = 73.

[b] One-tailed.

Impulsive Nonconformity, Introvertive Anhedonia, and the WASI, along with independent samples t-tests and Cohen's d, a measure of effect size.

Whilst all high schizotypy scoring groups demonstrated higher incidental recall, this difference was only revealed as significant on Unusual Experiences. Subsequently, for the Unusual Experiences groups, differences between the means on intentional recall were examined (low Unusual Experiences scorers mean intentional recall = 4.36, SD = 1.11; high Unusual Experiences scorers mean intentional recall = 4.22, SD = 1.10), where no significant difference was found ($t(73) = .54$; $p = .59$). These findings, therefore, support the current hypothesis that high positive-schizotypy scorers would demonstrate higher rates of incidental recall. In relation to WASI scores, whilst the low scoring group demonstrated higher incidental recall rates, this finding just failed to reach significance. Given the correlation between Impulsive Nonconformity and intentional recall, this relationship was examined further. The sample was dichotomised into low and high scoring Impulsive Nonconformity groups. Mean intentional recall for the low scoring group was 4.03 (SD = .93) whilst for the high scoring group mean recall was 4.58 (SD = 1.20), a significant difference ($t(73) = -2.25$; $p = .03$ (two-tailed).

4. Discussion

The aim of the present study was to investigate the relationship between incidental learning and multi-dimensional schizotypy as measured by the O-LIFE in a sample of healthy volunteers. The primary finding from the study was that incidental recall was higher in those scoring highly in positive-schizotypy, but not the other scales of schizotypy. This finding was similar to that of Jones et al. (1992), who found that incidental recall was consistently related to the 'unusual perceptual experiences' factor (in the light of Hewitt & Claridge's (1989) three-factor solution to STA), reflecting positive-schizotypy. Given this finding, the hypothesis in the present study predicted that incidental recall would positively correlate with the Unusual Experiences scale of the O-LIFE. This prediction was substantiated, with the high positive-schizotypy group demonstrating a higher level of incidental recall than the low positive-schizotypy scoring group, whilst no difference between these two groups was observed in terms of intentional recall. These results provide one of the first reports of the relationship between incidental learning and the O-LIFE; confirming that incidental recall is increased in those scoring highly in positive-schizotypy; and is thus a typified reflection of the failure to filter out non-relevant (or salient) stimuli in this schizotypal group.

Participants were also required to complete the WASI given recent findings that have demonstrated a negative correlation between IQ and Unusual Experiences scores; however, no such relationship was revealed in the current study, although there was a small (but non-significant) difference between the high and low scoring WASI groups in terms of incidental recall, where the low scorers demonstrated a higher recall rate. Whilst this finding may appear somewhat spurious at face value (i.e. intuitively it would be expected that increased intelligence might be an indicator of learning efficiency, whether intentional or incidental), the findings may suggest that intelligence has a functional role to play in selective attentional processing, i.e. lower intelligence is associated with a failure to filter out irrelevant stimuli and may be associated with the findings of Burch et al. (2004) and Burch et al. (in press) that IQ scores were negatively correlated with Unusual Experiences. This is something that clearly warrants further investigation, with correla-

tions between positive-schizotypy, IQ and selective attention monitored, along with possible gender effects. Finally, it is interesting to note that there was a positive correlation between intentional recall and Impulsive Nonconformity, with further analysis confirming this result. Clearly, this too needs further investigation, as it is not clear why such a finding is revealed.

In conclusion, the current study provides evidence that incidental recall is increased in those scoring highly in positive-schizotypy, but not on other dimensions of schizotypy, in a sample of healthy volunteers. This result is consistent with other findings in the literature from both clinical (e.g. Jones, 1989) and non-clinical (e.g. Jones et al., 1992) samples, and lends further support to the theoretical (e.g. Hemsley, 1993) and the wider experimental literature, suggesting that the positive symptomatology of schizophrenia is associated with the ability to ignore irrelevant stimuli.

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