Non-Psychotic Traits of Schizophrenia as Abnormalities of Cerebral Asymmetry: Development of a Potential Early Screening Instrument.

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A Thesis Submitted for the Degree of Doctor of Philosophy, University of Otago, August 2010
Acknowledgments

I wish to thank all the participants who completed the questionnaire at the drop in centres in Dunedin and Invercargill and the staff at Contact Energy. Many thanks to the staff at Tapestry Clubhouse in Dunedin. Particularly I would like to thank Trudy More, who generously facilitated my access to participants, also thanks to Jak Dennison and Jo. Thanks to Fiona at 420 Drop-In Centre who welcomed me and allowed me to be there for an extended period of time. Thanks also to Artsenta and GROW in Dunedin, and SF Southland, 494 Dee and The Bog in Invercargill.

Thanks to Pat McGorry for sponsoring my trip to speak at the PACE clinic and giving his time, discussing my project and encouraging my belief in early intervention and the belief that it is an achievable task to intervene early enough to actually prevent a psychotic episode.

I wish to thank Peter Herbison for his conceptual advice, regarding the type of statistics to use to achieve my objectives. Also to Ross Marshall-Seeley who so quickly and easily advised me how to structure data for input into SPSS. Also to Tony Vink for his readiness to support in the Anatomy IT department.

Many thanks to Helen Nicholson and the Department of Anatomy, Otago for their generous financial support of my project and for sending me to the conference in Switzerland. Thanks to my PhD committee, Gareth Jones, Nancy Tayles, and Neil Pickering for their time, interest and comments on the project at the PhD Committee Meetings.

Thanks to my office mates earlier in my PhD, Katharine, Anna, David, Rachel, and honorary office mate Sian.

To my sister Janet whose experiences with this disorder have driven my quest to understand and to be part of something that may one day prevent someone from experiencing the devastation of psychosis.

My profound thanks to my supervisor, Robert Miller for being my academic role model, and for providing the positive and inspiring experience of University I always hoped to have. Robert Miller has given me insight into the vital role of the theoretician who brings together all the strands to illustrate the bigger picture. To my mentor and friend, I am truly grateful.

And finally my love and thanks to my lovely husband Phillip who first encouraged me to do my PhD, kept me laughing through the process, and supported me so wisely through the many challenges that life brought through this time.

Also to my Mum and Dad who I know would have been so proud to have seen this completed.
## Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acknowledgements</td>
<td>2</td>
</tr>
<tr>
<td>Contents</td>
<td>3</td>
</tr>
<tr>
<td>List of Tables</td>
<td>6</td>
</tr>
<tr>
<td>List of Figures</td>
<td>7</td>
</tr>
<tr>
<td>Abstract</td>
<td>8</td>
</tr>
<tr>
<td>1. Introduction</td>
<td>10</td>
</tr>
<tr>
<td>2. History of Concept of Schizophrenia</td>
<td>10</td>
</tr>
<tr>
<td>2.1. Origins of the term ‘schizophrenia’</td>
<td>10</td>
</tr>
<tr>
<td>2.2. Origins of the Distinction between ‘State’ and ‘Trait’ Aspects of Schizophrenia</td>
<td>12</td>
</tr>
<tr>
<td>2.3. Symptoms of Schizophrenia</td>
<td>13</td>
</tr>
<tr>
<td>3. Early Intervention and Detection</td>
<td>19</td>
</tr>
<tr>
<td>3.1. Basic concepts</td>
<td>19</td>
</tr>
<tr>
<td>3.2. Duration of Undiagnosed Psychosis</td>
<td>21</td>
</tr>
<tr>
<td>3.2. Early Detection – What is the Prodrome?</td>
<td>22</td>
</tr>
<tr>
<td>3.3. Can the Prodrome be Predictive, and What Part do Precursor Symptoms Play?</td>
<td>24</td>
</tr>
<tr>
<td>3.4. High Risk Models – Importance of Precursor Symptoms.</td>
<td>27</td>
</tr>
<tr>
<td>3.5 Unsolved issues and ethical concerns</td>
<td>29</td>
</tr>
<tr>
<td>4. Theory of trait abnormalities</td>
<td>30</td>
</tr>
<tr>
<td>4.1. Introduction</td>
<td>30</td>
</tr>
<tr>
<td>4.2. Basic History, Basic Neuroscience and terms used</td>
<td>30</td>
</tr>
<tr>
<td>4.3. Application of the theory to various psychological traits of schizophrenia</td>
<td>34</td>
</tr>
<tr>
<td>4.3.1. Introductory comments</td>
<td>34</td>
</tr>
<tr>
<td>4.3.2. Perception</td>
<td>35</td>
</tr>
<tr>
<td>4.3.3. Motor Control</td>
<td>39</td>
</tr>
<tr>
<td>4.3.4. Cross-modal and interhemispheric co-ordination</td>
<td>40</td>
</tr>
<tr>
<td>4.3.5. Discrimination of the intensity of sensory stimuli</td>
<td>42</td>
</tr>
<tr>
<td>4.3.6. Meanings of the word “attention”.</td>
<td>43</td>
</tr>
<tr>
<td>4.3.7. Vigilance/sustained attention</td>
<td>44</td>
</tr>
<tr>
<td>4.3.8. Speed of learning</td>
<td>45</td>
</tr>
<tr>
<td>4.3.9. Excessive association, selective attention and distractibility</td>
<td>47</td>
</tr>
<tr>
<td>4.3.9.1. Excessive association.</td>
<td>47</td>
</tr>
<tr>
<td>4.3.9.2. Distractibility and selective attention</td>
<td>51</td>
</tr>
<tr>
<td>4.3.9.3. Sensory overload</td>
<td>53</td>
</tr>
<tr>
<td>4.3.9.4. Psychobiological explanations for excessive association, distractibility, impairments in selective attention and vulnerability to sensory overload.</td>
<td>54</td>
</tr>
<tr>
<td>4.3.10. Impairment in short-term/working memory</td>
<td>58</td>
</tr>
<tr>
<td>4.3.11. Tendency to ‘long trains of thought’ and problems with shift of attention.</td>
<td>58</td>
</tr>
<tr>
<td>4.3.12. Preference for Solitude: Avoidance of Social Activity</td>
<td>61</td>
</tr>
</tbody>
</table>
4.3.13. Overall stability of mental processes 61
4.3.14. Language and thought 62
  4.3.14.1. Comprehension of incoming language 62
  4.3.14.2. Production of Language: Subjective Experience
            of Trait Aspects of Thought Disorder. 65
  4.3.14.3. Psychobiological Explanations for Trait
            Aspects of Comprehension and Production of
            Language (Trait Aspects of Thought Disorder) 68
4.3.15. Sense of Self – Ego Strength 70

5. Methods 82
  5.1. Derivation of the Schizophrenia Traits Questionnaire (STQ) 82
  5.2. Initial formulation of STQ1 82
  5.3. Trialling of STQ1 84
  5.4. Administration of STQ 85
  5.5 Methods of Statistical Analysis of Results from STQ1 86
  5.6 Revision to produce STQ2 88
  5.7 Statistics performed on STQ2 data 89

6. Results 91
  6.1. STQ1 91
    6.1.1 Statistics performed in STQ1 data leading to elimination,
         change or retention of items for STQ2 92
  6.2. ‘Pruning’ of STQ1 94
  6.3. STQ2: Factor analyses 96
  6.4. STQ2: Paired T-Tests, Schizophrenia versus
       Control and Depression participants 114
  6.5. STQ: Paired T-Tests, Schizophrenia versus participants
       with Depression 120
  6.6. STQ2: Discriminant Function analyses 123
  6.6. Reliability statistics for repeat questionnaires 129

7. Discussion 131
  7.1. Critique of Methods 132
    7.1.1. The Questionnaire 132
    7.1.2. Use of Statistics 133
  7.2. Significance of Results 134
    7.2.1. Elimination of Items from STQ1 to STQ2 134
    7.2.2. Factor Analyses for STQ1 and STQ2. 135
    7.2.3. STQ2 Grand Factor Analysis. 138
    7.2.4. Representation of a priori Categories in Discriminant
            Function Analysis. 139

8. Summary, Conclusions and Future Directions 141
  8.1 Summary and Conclusions 141
  8.2 Future Directions 144

9. References 146

10. Appendices 155
1a: Information Sheet for Non-Mental Health Service Users. 155
1b: Information Sheet for Mental Health Service Users. 157
1c: Consent Form for Mental Health Service Users. 161
2. STQ1: Items as they appear chronologically in categories from Questionnaire 163
3. STQ1, as Used 166
4. Synopsis of Grand Factor Analysis factors for STQ1. 176
5. STQ1: Factor Analysis - MHU Results (5pt scale) 179
6. STQ1: Normal Population: Factor Analysis 187
7. Statistics performed in STQ1 data leading to elimination, change, or retention of items for STQ2 192
8. Items replaced or modified from STQ1 to STQ2 203
9. STQ 2: Items as they appear chronologically in categories from Questionnaire 209
10. STQ2, as used 213
11. Synopsis of Grand Factor Analysis factors for STQ2. 221
12. STQ2: Factor Analysis – MHU Results (5pt scale) 227
13. STQ2: Paired T-Tests, item by item (31-97, 1-30 in Table 6.6): Schizophrenia versus Comparison participants 237
List of Tables

2.1. Pure Defect Symptom Rate (in %) Found in Post-psychotic Schneider-diagnosed Schizophrenics in Bonn With Pure or Mixed Residual Syndromes (N = 285) on Follow-up 15
2.2. Cognitive and Perceptual Basic Symptoms Associated with Psychosis and Prototypic Self-observations by Patients (Schultze-Lutter, 2009, 7) 17
3.1 Schedule of Prodromal Symptoms (SOPS) items 25
4.1. Semantic priming in schizophrenia as a function of prime duration (msec). 50
6.1. Grand factor analysis of STQ1 data. 93
6.2. Eliminated items from STQ1. 95
6.3. STQ2 step 1 factor analysis: Items, sub-factor assignment, loadings 96
6.4. STQ2 step 1 factor analysis: Factor names, variance accounted for within factors, and distinctiveness of factor within a priori categories 111
6.5. STQ2: Grand Factor Analysis 113
6.6. STQ2: Paired T-Tests, item by item: Schizophrenia versus Comparison participants. 115
6.7. STQ2: Paired T-Tests, aggregate scores, factor by factor: Schizophrenia versus Comparison Participants. 119
6.8. STQ2: Paired T-Tests, item by item: Schizophrenia versus Depression participants 120
6.9a. Discriminant function analysis, Stepwise version: Summary of best seven discriminating items 124
6.9b Classification of participants (true/false positive or negative identification), based on stepwise Discriminant Function Analysis (Table 6.9.a) 125
6.9c. Discriminant function analysis, Independents entered together (“backward stepwise”) version: Summary of best thirteen discriminating items 126
6.9d. Classification of participants (true/false positive or negative identification), based on “backward stepwise” Discriminant Function Analysis (Table 6.9c) 128
6.10. A priori Category Key, for Items featuring in Discriminant Function Analysis (from Table 6.9c). 128
6.11. Reliability: Kappa statistics for repeat questionnaires 129
List of Figures

2.1 A Model of Huber’s Concept of Basic Symptoms (BS). (from Schultze-Lutter, 2009).  14
2.2: The early course of schizophrenia (from Larsen et al, 2001)  20
4.1. “Space-time” diagrams to illustrate the relation between axonal conduction time, and temporal convergence and divergence. (from Miller, 2008, 29)  32
4.2. Diagram to illustrate exaggerated processes of mental association in schizophrenia. (from Miller, 2008, 251)  56
4.3 Diagram to illustrate two dynamic regimes of cortical activity in schizophrenia (from Miller, 2008, 324)  60
4.4. Contributions of right and left hemispheres to planning and execution of emitted speech, in normal subjects (left) and schizophrenia patients subject to thought disorder (right)(from Miller, 2008, 316).  69
4.5. Mead/Smith Model of the Self (from Smith (1998)  77
Abstract

The main aim of this research is to provide the basis for future development of an early screening instrument to identify individuals who may be at risk of developing schizophrenia (or related disorders\(^1\)). It is based on a neurodynamic theory of schizophrenia (Miller, 2008) which accounts for the non-psychotic trait abnormalities that are characteristic of the disorder. These abnormalities are enduring traits present before, during and after a psychotic episode and may become manifest in teenage years. Hence there is a potential to use these traits to identify risk at this stage for the purpose of intervening early with supportive, and/or educative resources to guide at-risk individuals to utilise their potential strengths, and help with the inevitable challenges that such a disorder may bring.

The theory is based on a premise that there is a relative absence of rapidly conducting cortico-cortical axons thought to be associated with functions normally preferred by the right hemisphere. Most functions (but not all), that signify a trait abnormality in schizophrenia, come into this category. This suggests that schizophrenia has homogenous origins that manifest in a number of different impairments. The traits correspond broadly to two cortical states, the ‘upstate’ and the ‘downstate’. They were resolved further into 16 ‘\textit{a priori}’ subject areas of function. These \textit{a priori} categories were assessed in an instrument (the Schizophrenia Traits Questionnaire, or STQ), consisting of 96 statements about everyday experiences, to be rated on a 5-point Likert scale.

In order to test the theory as the basis for a potential early screening instrument, it was necessary to test the large-scale correlational structure of the 96 items deriving from it, using Factor analysis. A second aim was to assess whether the 16 \textit{a priori} categories could reliably distinguish schizophrenia and normal. The third aim was to find the combination of the items in the STQ which can best predict whether an individual will fall into the schizophrenia group or normal group with a high level of accuracy.

Two versions of the STQ (‘STQ1’ AND ‘STQ2’) were tested on 300 mental health users (MHU) and 300 non-mental health users (non-MHU). There was some overlap in respondents from STQ1 to STQ2 (40 identified in the MHU group). For both STQ1 AND STQ2, factor analysis involved a 2-step process (due to the requirements of factor analysis for 5-10 respondents per item). Step 1 consisted of 16 separate factor analyses from which 26 factors emerged overall. Summary scores of the 150 MHU and 150 non-MHU participants on each factor, were used for the second step in a Grand Factor Analysis to assess the overall conceptual structure. Both step 1 and step 2 of the factor analyses supported the underlying theory. Power analyses were performed on each item in STQ1 to determine how many respondents were needed for the comparison t-tests to have ‘power’ (to reject the null hypothesis). Paired t-tests were performed on all 96 items of STQ1 to compare MHU and non-MHU participants. 30 items were eliminated from STQ1 on the basis of 5 criteria. 1. Item loading above 0.400 on its factor 2. P-value (in relation to T value) ≤0.05; 3. Number of subjects needed for comparison from power calculations for each item, 4. Conceptual coherency, 5. Specificity and relevance to the underlying theory. On the basis of this process, items in STQ1 were changed and refined in developing STQ2. Consent to seek a verified diagnosis (including some associated information: see appendix 1c) was

\(^1\) which is implicit when using ‘schizophrenia’ from here on
given by 136/150 MHUs. 75/136 had a verified diagnosis of schizophrenia. Factor analysis was performed on STQ2 and gave the underlying theory further support. The results support the corresponding 2 factors (of ‘disorganisation’ and ‘psychomotor poverty’) of Liddle’s (1987) 3-factor classification of the symptoms of chronic schizophrenia. Paired t-tests were then performed on the 75 schizophrenia respondents matched to 75 normal respondents for age, sex and number of years at secondary school. These comparisons revealed statistically significant differences between groups in 56 of the STQ2 items, with no items giving significant challenge to the theory. Paired t-tests were also performed on a smaller group of 29 with a verified diagnosis of unipolar depression and 29 matched with schizophrenia and also 8 with diagnoses of bipolar disorder matched with 8 with schizophrenia. This was for the purpose of distinguishing statistically between schizophrenia and other mental health groups to eliminate the possibility that traits are associated with mental health users in general rather than schizophrenia in particular. Reliability statistics (kappa) were performed on 62 repeat (normal respondents) over a 6 to 12 month period. Using the results of the factor analyses, t-tests and kappa statistics, groups of items were chose to perform a Discriminant Function Analysis on 75 schizophrenia respondents and 150 normal respondents. A combination of 13 items was able to predict whether an individual would fall into the schizophrenia or normal group to 85% accuracy.

Strengths that stand out from other early intervention instruments are: (1) The STQ is based on a psychobiological theory backed by empirical evidence (2) The theory defines trait abnormalities that can be independently assessed by questionnaire (3) The traits are enduring and not dependent on prodromal symptoms but on everyday activities enabling earlier detection (4) STQ is easily administered, inexpensive, with innocuous items potentially suited to young people (5) Thirteen of the items in combination accurately predicted schizophrenia to 85% accuracy in this sample with no mention of psychotic symptoms.

In studying the theoretical background to the STQ, it was possible to link it to a previous work of the author (Smith 1998) on the sense of self in schizophrenia. It is therefore suggested that there is an imbalance in a ‘now experiencing I’ and an ‘objectified me’ in schizophrenia. There is justification for this, given that in schizophrenia there is difficulty in the self interacting in the moment as subject, until experience can be conceptualised and the self becomes object (to itself). This ‘I/me’ split has been further realised in the current work on trait abnormality: The functions normally preferred by the right hemisphere coincide with the function of the ‘I’ as the ‘subject’ of experience, which is impaired in a manner similar to other trait abnormalities. The strength of the conceptualising left hemisphere to compensate for impairment in the right corresponds to the ‘me’ as ‘object’ (and to a trait that is potentially better than normal in schizophrenia, the tendency to ‘long trains of thought’). Points are raised in regard to the ‘gap’ between the analysis of psychological or brain mechanisms and ‘whole person psychology’, which corresponds to the psychiatrist’s world of hard science while dealing with human beings, and the philosophical dilemma of mechanism versus meaning.
1. Introduction

The aim of this thesis is to provide the basis for a new approach to early detection and early intervention for schizophrenia and related disorders. It is not entirely without precedent but has not before been based on any underlying theory of brain mechanisms for this disorder. This theory aims to account for the non-psychotic traits of this disorder rather than actual psychosis or immediate precursors of psychosis (the prodrome). The introductory review of the literature covers historical background to the concept of schizophrenia and a review of previous studies of early intervention and early detection of this disorder. After that is a major section explaining those aspects of the theory which are relevant to the instrument whose development is described herein. The introductory literature review consists of two chapters covering these two parts of the background.

2. History of Concept of Schizophrenia

2.1. Origins of the term ‘schizophrenia’

Early conceptualisations of schizophrenia describe the disorder as a degenerative process beginning early in life progressing into an early dementia. A Belgian physician, Benedict Morel named it “Démence Précoce” after his first case of a 14 year old boy in 1852 who began as a good student, cheerful and outgoing becoming withdrawn and depressed with a gradual decline in cognitive ability. Emil Kraepelin, a German physician in 1899 incorporated Morel’s description with three added concepts (from the works of Kahlbaum and Hecker and his own) of catatonia, hebephrenia and paranoia. Catatonia, was identified by Karl Ludwig Kahlbaum, as symptoms of motionless and non-reactive behaviour to external stimuli. Ewald Hecker elaborated on Kahlbaum’s work and coined the name hebephrenia describing the disorder as erratic mood states beginning early in life with irreversible degeneration of mental processes. Both Kahlbaum and Hecker viewed catatonia and hebephrenia as separate disorders. However, Kraepelin, having himself identified paranoia (dementia paranoidea) as a related behaviour, viewed all three (catatonia, hebephrenia and paranoia) as having the same underlying disease process and so were three sub types of a single disorder with early onset and progressive mental deterioration to dementia, hence his term “Dementia Praecox” (Shean, 2004).

The term “schizophrenia” was first used in 1911 by Eugen Bleuler, a Swiss psychiatrist, when he reformulated “dementia praecox” to define the symptoms in a new way. He coined the word from the Greek roots schizo (split) and phrene (mind) signifying not a split personality but rather to demonstrate the “splitting of the different psychic functions” of the mind (Bleuler, 1950, 8) manifested in fragmented thoughts, incongruity of thoughts and emotions and withdrawal from reality.

Bleuler described schizophrenia in terms of two categories, ‘Basic Symptoms’ (‘grundsymptome’, not to be confused with Huber’s ‘basic symptoms’), and ‘Accessory Symptoms’ (‘akzessorische symptome’). Bleuler’s basic symptoms referred to abnormalities in association, affect, ambivalence and relationship to reality (autism). Accessory symptoms such as delusions, hallucinations and catatonic features were not necessary characteristics of schizophrenia. Both categories of symptoms, (excluding delusions and hallucinations) were
considered behavioural in nature and this emphasis and definition of schizophrenia remained the dominant description for many years (Koehler and Sauer 1984).

In the late 1950s schizophrenia, as well as other neurological diseases, was being divided into subtypes by Leonhard (1959, English translation, 1979) of ‘unsystematic’ and ‘systematic’ schizophrenias. The unsystematic types included affective paraphrenia, periodic catatonia and cataplasia and were seen as being more genetically determined. The systematic schizophrenias included Kraepelin’s subtypes of catatonic, hebephrenic and paraphrenia which he believed as less inheritable and more environmentally influenced.

More recently the concept of a ‘continuum of psychosis’ was developed by Crow (1990) ranging from schizophrenia in its various forms, to schizoaffective disorder, bipolar affective disorder and unipolar depression. Another simplification originated in nineteenth century neurology (in the writings of Hughlings Jackson) and was used more recently by Crow (1980) and Andreasen and Olsen (1982). It was applied to the positive and negative distinction (see below), where positive symptoms are abnormal because they contain something added to normal function and negative symptoms abnormal through missing attributes of normal.

Although not fully accepted in terms of an official definition for schizophrenia, in 1987, Liddle performed an important factor analysis from the data collected from 40 patients with chronic but stabilised schizophrenia. This revealed something more complex than the simple dichotomy of positive and negative symptoms to define schizophrenia. It is included here because it reflects more closely the findings of this thesis, and forms a better paradigm within which fits the theory of trait abnormalities (Miller, 2008) upon which this thesis is based. The three main factors are ‘Psychomotor poverty’, ‘Disorganisation’ and ‘Reality distortion’. Miller’s theory attributes the former two to a basic instability of cortical states in stabilised schizophrenia. This is encapsulated in the terms ‘downstate’ and ‘upstate’ (see section 4.3.13 which are basic to the theory and underlie many of the traits). Ultimately in Miller’s theory, they are consequences of slower-than-normal axonal conduction in this disorder. Such instability of mental activity leads to a vulnerability to the development of psychosis, of which the third factor, ‘reality distortion’ is a low level reflection. This will be further outlined in greater detail.

A clear and precise definition for schizophrenia remains elusive perhaps in part because ‘state’ and ‘trait’ aspects of the disorder are not separated, and because of lack of any underpinning disease theory. Emphases along the way have probably reflected the trends in thinking around the causes of the disorder. In the present study the ICD10 was used as the criterion for diagnosis. The other dominant tradition for official diagnoses, from the American Psychiatric Association, which produced the various editions of DSM is referred to later in this literature review, in discussing some of the early intervention studies. The operationalising of diagnoses does aid communication and replication of results. However, these definitions are not directly relevant to the present research and will not be expanded on here.
2.2. Origins of the Distinction between ‘State’ and ‘Trait’ Aspects of Schizophrenia

Although Bleuler’s work was always considered an important step forward, interest grew in the phenomena of delusions and hallucinations. Kurt Schneider devised his first rank symptoms in 1949 with the English translation available in 1959. His first rank symptoms consisted of:

1. Auditory hallucinations: Hearing voices talking to or about the patient
2. Thought insertion or withdrawal: Sensation of thoughts being put into or taken from the patient’s mind
3. Thought broadcasting: Sensation of one’s thoughts being heard by others
4. Passivity feelings: Sensation of being under external control or receiving bodily sensations from another source
5. Primary delusions: Delusions arising complete based upon experience considered by others to be normal\(^2\) (Taylor, 2006, 4).

In 1972, Claridge put forward the idea that schizophrenia is not a categorical illness, but emerges out of a personality that merges with normal psychology and range of personality types. He said that there are traits in schizophrenia that “represent, in an exaggerated form, cognitive and personality characteristics found distributed in the general population” (Claridge, 1972, 15). Such concepts were not new even then. A connection was originally made by Pavlov in 1941 between personality variants based on styles of information processing, and the physiological function of the brain. This was further expressed through Eysenck in 1947 where he sought to identify the physiological basis for variations of personality in his dimensional theory of personality. Claridge revisited this issue in 1987 reviewing more recent data investigating the biological underpinnings of personality as it related to schizophrenia. These included the psychophysiological and neuropsychological studies as well as studies of hemispheric laterality. Claridge found a variety of personality scales that distinguished schizophrenia from normal, and also identified a proportion of healthy individuals in the population that were not defined as mentally ill. However, Claridge admits that there has not as yet been a coherent biologically based personality dimension for representing these similarities.

Kety \textit{et al} (1968) conducted an adoption study of 306 relatives of adoptees. Blind psychiatric diagnoses of relatives were compared between adopted infants who developed schizophrenia and those who did not. Diagnoses of interest for the comparisons included not only chronic schizophrenia, but also schizophrenia spectrum disorders (including ‘borderline’ cases and ‘inadequate personality’) and acute schizophrenia. 8.7% of the 150 relatives of the adoptees with schizophrenia, qualified for the ‘spectrum’ diagnosis, as compared to 1.9% of 156 relatives of control adoptees. This was a highly significant difference. This was further tested in Kety \textit{et al} (1994) with chronic schizophrenia and ‘latent schizophrenia’, finding the prevalence of these diagnoses to be ten-fold higher in biological than adoptive relatives of adoptees with schizophrenia. The point here is that the wider spectrum of schizophrenic illness (including ‘inadequate personality’) appeared to be inherited from biological ancestry rather than from adopted family. This lends support to Claridge’s contention that there is personality dimension which has biological links to schizophrenia in its extreme range. It was

\(^2\) But subject to misinterpretation
also part of the developments leading to the idea that state and trait aspects of schizophrenia could be distinguished.

2.3. Symptoms of Schizophrenia

Kurt Schneider’s student Gerd Huber in the 1960s, made a systematic search for the core symptoms of schizophrenia, referring to Bleuler but with a new emphasis on his teacher’s findings, and based on longitudinal studies of schizophrenia. Carl Jaspers, in 1913, had made the distinction between experience and expression of psychopathology, or ‘phenomenology’ versus behaviour, in his book ‘General Psychopathology’. Bleuler’s basic symptoms were categorised as behavioural along with one of his accessory symptoms, catatonia, whereas the delusions and hallucinations as well as Schneider’s first rank symptoms were considered to be experiential. Huber developed the concept of ‘minus’ symptomatology and eventually ‘minus’ and ‘plus’ terminology. This was applied in Germany to Bleuler’s basic and accessory symptoms signifying respectively characteristics that are absent (but normally present) and other elements that are present (but normally absent). The equivalent terms negative and positive began to be favoured in the USA from around 1980, in the writings of Nancy Andreasen, and in the UK, from Tim Crow, about the same time (Koehler and Sauer, 1984).

Renewed interest in negative symptoms originated in Andreasen’s research, and was operationalised in the Scale of Assessment of Negative Symptoms (SANS) (Andreasen, 1983) with a focus on Bleuler’s work. Most of the items, however, were behavioural except for a few phenomenological symptoms. Huber believed that behaviours did not always reveal the underlying experience of the individual, and in accordance with Jasper’s phenomenology he sought the self-descriptions of patients, who were clearly aware of how the emerging symptoms, deficiencies and impairments compared with their previous ‘well’ state. This investigation developed into Huber’s ‘Basic Symptoms’ which differed from the previous focus on behaviour, in accordance with Jasper’s phenomenology, and were primarily experiential.

Schultze-Lutter explains the Basic Symptoms (BS) to be,

“…subtle, subjectively, experienced subclinical disturbances in drive, affect, thinking, speech, (body) perception, motor action, central vegetative functions, and stress tolerance. They can occur and have been reported in every stage of the illness, i.e., in the prodrome to the first psychotic episode, in prodromes to relapse, in residual states, and even during psychotic episodes per se. By definition, BS are different from what is considered to be one’s “normal” mental self. Being subjective, they remain predominantly private and apparent only to the affected person. They are rarely observable to others, although a patient’s self-initiated coping strategies (including avoidance strategies and social withdrawal) in response to his/her BS may be recognizable to others. Being self-experiences, BS differ from negative symptoms as they are currently understood, i.e., as functional deficits observable to others. BS are also distinct from frank psychotic symptoms that are experienced by the patient as real, normal thinking, and feeling. In contrast, BS are spontaneously and immediately recognized by the affected person as disturbances of his/her own (mental) processes.” (Schultze-Lutter, 2009, 5)
The inference here is that the basic symptoms start with the illness and do not exist before. It is not clear what the evidence is for this especially since the start of the illness is often in adolescence when people are changing rapidly regardless of any illness. The issue of pre-prodrome may not have been of interest to the authors but attention is drawn to it here because it is important for this thesis. However, both authors (Huber and Schultze-Lutter) write from the German speaking world where the word ‘psychosis’ has a broader meaning than in the English speaking world. The term psychosis can, for instance, sometimes be applied to depression.

‘Basic Symptoms’ were seen as the earliest symptomatic expression of what is happening at the neurobiological level, hence the term ‘basic’. The development of the ‘basic symptoms’ was seen to be in 3 stages or levels:
1. ‘Uncharacteristic’ - where the effects were evident in aspects of drive, volition, affect, concentration and memory,
2. ‘Characteristic’, and seen to be ‘qualitatively peculiar’ in aspects of thinking, speech, (body) perception, and motor action and
3. Psychotic symptoms.

The ‘uncharacteristic’ symptoms in most cases (apart from some which remit completely), gradually increase in number and severity developing into the stage where ‘characteristic symptoms’ are experienced, which are termed ‘outpost syndromes’, because they are said to signify the imminent progression into the prodrome which precedes psychosis (see figure 1: Schultze-Lutter, 2009, 6).

Figure 2.1. A Model of Huber’s Concept of Basic Symptoms (BS). (1) Reversible postpsychotic basic stage; (2) prodrome of relapse; (3) irreversible postpsychotic basic (“pure defect syndrome”). (Schultze-Lutter, 2009)
The explanation of this progression by Schultze-Lutter corresponds to the theory upon which the current research is based and gives support to the idea of intervening early with effective social supports and education. She writes:

“The emergence of level 2 or characteristic BS and their conversion to level 3 psychotic symptoms can be triggered by everyday situations and demands that overstrain an already pathologically vulnerable information processing capacity. Given favourable environmental and personal conditions (e.g. a supportive social network, good social, and problem solving skills or coping successfully with pressure), BS can be compensated for at any state almost completely as long as their number and/or severity do not overextend personal resources and coping strategies.” (Schultze-Lutter, 2009, 6)

Another point of difference from Andreasen and Crow, in Huber’s work is that the collection of ‘basic symptoms’ were not only present in schizophrenia, but were also fundamental to the disorder. In other words, the experienced phenomenon existed in the general population and in other psychopathologies, as well as in schizophrenia, on a continuum; yet the ‘basic symptoms’ were also quite fundamental to schizophrenia (Koehler and Sauer, 1984). Huber’s conclusions, in this way, closely resemble the theory upon which the current research of trait abnormalities is based where the general population experience some of the traits on a continuum but where individuals vulnerable to schizophrenia would experience such traits clustered more towards the extreme of the spectrum. The lesser visibility of the ‘basic symptoms’, in contrast to the more ‘observable’ negative behavioural traits, make the ‘Basic Symptoms’ another area of vital, information-rich detail for research into schizophrenia. It is potentially an important area to investigate to identify early predictive symptoms for the purposes of ‘Early Intervention’.

Koehler and Sauer (1984, 176) listed (shown in Table 2.1.) the following 24 most frequently occurring events (by %) of what Huber called the pure defect state. Schultze-Lutter describes this as the “irreversible symptomatic stage” in post-psychosis. This is taken from the Bonn 500 follow-up study of individuals with schizophrenia diagnosed according to Schneider’s criteria.

**Table 2.1 Pure Defect Symptom Rate (in %) Found in Post-psychotic Schneider-diagnosed Schizophrenics in Bonn with Pure or Mixed Residual Syndromes (N = 285) on Follow-up**

<table>
<thead>
<tr>
<th></th>
<th>Cognitive disturbances (concentration, thought, and memory disorders).</th>
<th>75.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>Somatic and mental fatigability and exhaustion.</td>
<td>71.2</td>
</tr>
<tr>
<td>3.</td>
<td>Disturbance in the general sense of well-being and feeling of deficiency in performance.</td>
<td>65.6</td>
</tr>
<tr>
<td>4.</td>
<td>Decrease in vigour, energy, endurance, and patience.</td>
<td>61.0</td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>Value</td>
</tr>
<tr>
<td>---</td>
<td>-----------------------------------------------------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>5</td>
<td>Coenaesthesia (disagreeable/unusual bodily sensations).</td>
<td>58.9</td>
</tr>
<tr>
<td>6</td>
<td>Increased excitability and impressionability.</td>
<td>58.2</td>
</tr>
<tr>
<td>7</td>
<td>Inability to tolerate everyday stress.</td>
<td>46.7</td>
</tr>
<tr>
<td>8</td>
<td>Oversensitivity to noise and the weather.</td>
<td>42.4</td>
</tr>
<tr>
<td>9</td>
<td>Sleep disturbances (aside from item 19).</td>
<td>41.0</td>
</tr>
<tr>
<td>10</td>
<td>Loss of self-confidence, feeling of insufficiency.</td>
<td>31.2</td>
</tr>
<tr>
<td>11</td>
<td>Tendency to coenaesthetic-dysthmic paroxysms and mood states.</td>
<td>30.5</td>
</tr>
<tr>
<td>12</td>
<td>Disagreeable experiencing of autonomic functions.</td>
<td>30.5</td>
</tr>
<tr>
<td>13</td>
<td>Decrease in drive and energy.</td>
<td>24.2</td>
</tr>
<tr>
<td>14</td>
<td>Loss of naturalness, greater tendency to obsessional reflection.</td>
<td>23.5</td>
</tr>
<tr>
<td>15</td>
<td>Tendency to subdepressive and/or hypomanic mood changes.</td>
<td>23.5</td>
</tr>
<tr>
<td>16</td>
<td>Inability to appear in public or socially interact.</td>
<td>22.4</td>
</tr>
<tr>
<td>17</td>
<td>Inability to be as happy as before.</td>
<td>20.3</td>
</tr>
<tr>
<td>18</td>
<td>Feeling of having no feeling.</td>
<td>19.6</td>
</tr>
<tr>
<td>19</td>
<td>Increased need for sleep.</td>
<td>14.7</td>
</tr>
</tbody>
</table>
In an effort to simplify and account for the overlap in these 24 symptoms, and to move towards the operationalising of Huber’s Basic Symptoms, Koehler and Sauer condensed the list above into 8 central areas of classification. These are included for later comparison to the current research where categorisation is made in terms of the supposed underlying neurophysiology that accounts for the ‘trait abnormalities’, according to Miller (2008). The condensed list of Koehler and Sauer are:

1. Subjective Complaints of Impaired Cognitive Functioning
2. Subjective Complaints of Impaired Emotional Functioning
3. Subjective Complaints of Impaired Energy
4. Subjective Complaints of Impaired Motor Functioning
5. Subjective Complaints of Impairment of Bodily Sensation
6. Subjective Complaints of Impaired External Perception
7. Subjective Complaints of Impaired Autonomic Functioning
8. Subjective Complaints of Impaired Tolerance to Normal Stress

In 2007, Schultze-Lutter *et al*., produced an instrument based on the ‘Basic Symptoms’ called the “Schizophrenia Proneness Instrument, Adult Version (SPI-A)”. In the same way that Huber stated, that some of the ‘basic symptoms’ applied to other disorders, Schultze-Lutter outlined that this applies to disturbances in drive, stress tolerance, affect, body perception and level 1 cognitive symptoms. However, she details some of the cognitive and perceptual ‘basic symptoms’ that appear to apply specifically to psychosis (and which overlap with the current research), and are displayed with examples based on personal accounts of subjective experiences by the author. These are listed in Table 2.2.
Table 2.2 Cognitive and Perceptual Basic Symptoms Associated with Psychosis and Prototypic Self-observations by Patients (Schultze-Lutter, 2009, 7)

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thought interference</td>
<td>is, an intrusion of completely insignificant thoughts hindering concentration/thinking (“I can’t help thinking about other things, which is very distracting.”)</td>
</tr>
<tr>
<td>Thought perseveration</td>
<td>i.e. An obsessive like repetition of insignificant thoughts or mental images (“I always have to mull over what I just said. I can’t stop thinking about what I might have said wrong or what I could have added although I really don’t think that anything was wrong with what I said.”)</td>
</tr>
<tr>
<td>Thought pressure</td>
<td>i.e., a self-reported “chaos” of unrelated thoughts (“If I am stressed out my mind gets chaotic and I have great problems thinking straight. Too many thoughts come up at once.”)</td>
</tr>
<tr>
<td>Thought blockages</td>
<td>either with or without intrusion of a new thought also includes a sudden loss of the thread or train of thoughts (“Sometimes my thoughts just stop, are suddenly gone, like being cut off.”)</td>
</tr>
<tr>
<td>Disturbance of receptive language</td>
<td>i.e., paralysis in the immediate comprehension of simple words/sentence, either read or heard, that can result in giving up reading or avoiding conversations (“I often can’t get the meaning of common words when I am reading.”)</td>
</tr>
<tr>
<td>Disturbance of expressive speech</td>
<td>i.e. problems in producing appropriate words, sometimes also experienced as a reduction in active vocabulary (“Sometimes I think it must appear as if English were really my second language, like I don’t know English very well because I have difficulties expressing myself. I forget the words.”)</td>
</tr>
<tr>
<td>Disturbances of abstract thinking</td>
<td>i.e., an unusual basic symptom seen when asking the patient to explain sayings or idioms (“Sometimes I get puzzled if a certain object or event only stands as a metaphor for some more general, abstract or philosophical meaning.”)</td>
</tr>
<tr>
<td>Inability to divide attention</td>
<td>between simultaneous nondemanding tasks that each draw primarily upon a different sense that would not usually require a switching of attention (“Doing two things at once has become impossible even with the simplest things. I always have to concentrate on one thing at a time, like if I prepare a sandwich, I cannot do anything else, like watch a film.”)</td>
</tr>
<tr>
<td>Captivation of attention</td>
<td>by details of the visual field that catches and holds the look (“Sometimes an object really seems to stand out from the rest of what I see. My eyes then fix on it. It’s like being spellbound, even though I don’t want to look at it at all.”)</td>
</tr>
<tr>
<td>Decreased ability to discriminate</td>
<td>between perception and ideas, true memories and fantasies (“I thought about my grandparents. Then a weird thing happened: I couldn’t remember if I knew my grandparents properly, if they were real or if they were just in my imagination. Did I know them, or had I made them up?”)</td>
</tr>
<tr>
<td>Unstable ideas of reference with insight</td>
<td>(“When I was listening to the radio the idea that the lyrics had some special meaning for me suddenly popped up into my head. Of course I knew straight away that it was just my imagination, a kind of weird thing. I did not have to think twice about it to know that.”)</td>
</tr>
<tr>
<td>Derealization, i.e., a decreased emotional</td>
<td>and gestalt connection with the environment (“Sometimes, I feel disconnected from the world around me, like I’m under a glass cover.”)</td>
</tr>
<tr>
<td>Visual or acoustic perceptual disturbances</td>
<td>with insight. Unlike hallucinations or schizotypal perceptual distortions, basic symptom perceptual observations are not regarded as real but are immediately recognised as a sensory or subjective problem. The knowledge that the misperception, e.g. a wrong coloring, distorted shape or changed sound quality/intensity, has no counterpart in the real world is immediate and unquestioned (“People suddenly seemed changed and had different hair colors.”)</td>
</tr>
</tbody>
</table>

In 1987, Liddle published a study that revealed something more complex than the positive and negative symptom divide that dominated description of symptoms. A factor analysis was
performed on symptoms using the Comprehensive Assessment of Symptoms and History (CASH: Andreasen, 1985) and the Present State Examination (PSE, items 13-20; Wing et al, 1974) on 40 schizophrenia patients. The symptoms fell into three factors, psychomotor poverty (poverty of speech, lack of spontaneous movement and various aspects of blunting of affect); disorganisation (inappropriate affect, poverty of content of speech, and disturbances of the form of thought); and reality distortion (particular types of delusions and hallucinations). The first two factors correspond, from a meta-perspective to the ‘up’ and ‘down’ states of the cortex from which all the trait abnormalities currently being tested, can be explained.

3. Early Intervention and Detection

“Our contention is that the ethical issues are essentially identical to those arising in early intervention research in mainstream medicine. This has been concealed by inconsistency and emotion, which has great potential to confuse, politicize and derail rational debate. The legacy of the isolation of psychiatry from medicine and consequent prejudice and stigma in the professional as well as the public mind seems to be fuelling a tendency in some societies to view psychiatric research as qualitatively different from other medical research. Sound clinical research data should be allowed to illuminate the options for potential consumers across all phases of illness. The alternative is research paralysis, which would force clinical practice to expand blindly without an evidence base” (McGorry et al, 2001).

3.1 Basic concepts

Schizophrenia often has devastating consequences for the individual and family. Since treatment with antipsychotic medications only alleviates certain aspects of the illness, early intervention is being sought as having the potential to: “delay the onset of the illness, lessen its severity or, perhaps in some individuals, avert it entirely. Early intervention offers the promise of a decrease in personal and psychosocial collateral damage and might lessen the deterioration in functioning associated with the onset of the first psychotic episode” (Hawkins et al, 2004, p3). Over the last 15 years there has been a proliferation of clinical and science-based research into schizophrenia with emphasis on the onset phase as well as the establishment of the International Early psychosis Association and International Conferences on Early Intervention. This has also brought a sense of optimism into what was initially considered a hopelessly deterministic “degenerative disease”, well stated by Phillips et al: “This shift in focus is associated with growing optimism toward the treatment of the early phase of illness and the recognition that these illnesses may not be as intractable as once thought” (Phillips et al 2002, 930).

As outlined by Larsen et al (2001) the concept of ‘early intervention’ is ambiguous and relates to what is ‘usually’ the situation, i.e. treatment usually commences after psychosis begins. ‘Early’ then means ‘earlier than usual’ and so strategies of early intervention can be implemented in (a) the prodromal phase or (b) after onset of psychosis.

The prodromal phase refers to the: “period of nonspecific symptoms and growing functional impairment prior to the full emergence of the more diagnostically specific positive psychotic symptoms…” (McGorry et al, 2003, 772).
Early intervention in the prodromal phase could lead to a decrease in the incidence of schizophrenia, referred to as Primary Prevention. Early intervention after the onset of psychosis involves administering treatment as soon as possible after psychosis is present, reducing the duration of undiagnosed psychosis (DUP) and should lead to the reduction in the prevalence of schizophrenia, referred to as Secondary Prevention. Tertiary Prevention refers to the treatment over a longer period of time administered after psychosis has begun, to control symptoms and prevent relapse. “Early intervention” does not refer to this phase in the course of schizophrenia. A precondition for early intervention in the primary prevention phase is based on accurate detection of prodromal symptoms predictive of the later onset of first episode psychosis.

Larsen et al (2001) provide a diagram which clearly shows the various phases described with the associated terms, useful for reference in the coming discussion.

Although the onset of psychosis is most reliably characterised by positive symptoms (delusions, hallucinations and thought disorder), 70% of patients develop negative symptoms earlier than they do the positive symptoms, in the prodromal phase (Häfner et al, 1992). The current research overlaps with a range of negative symptoms but includes characteristics (trait abnormalities) that might develop earlier than the prodromal phase often in teenage years, as competition for brain resources increase and are not matched by brain development in specific ways. Such characteristics exist on a continuum in the general population but appear to cluster in more predictable patterns which, put simply here, can be accounted for in a neurodynamic theory by Miller (2008), upon which this research is based. Given the earlier development of negative symptoms and trait abnormalities that appear long before a psychotic episode,
research is increasingly looking at this period in adolescent and early adult development for reliable and specific markers and vulnerabilities that reveal an individual at risk. The present research is unique in that it is generated from an actual theory of schizophrenia, many years in the making that has sought to explain the multi-paradigmatic research on schizophrenia and related disorders in terms of brain theory. It has promise to lead to a method of screening for risk in the pre-morbid stage (see figure 2.2)

So far in this overview of the research, some of the history and trends in the various research streams since dementia praecox/schizophrenia was first identified, have been outlined. Also discussed, in the area of ‘Early Intervention’, are the stages in the cycle of schizophrenia where intervention can occur. A more recent trend in research is to discover the earlier stages in life, when signs of vulnerability start to manifest, how these can be reliably and ethically identified, and then how and when responsible intervention can be implemented with the best long term results for the individual. Before we progress to this discussion in more detail, I will outline issues regarding late intervention, where active psychosis has been present over longer periods of time, unchecked. Here one should ask if there is indeed any danger to the individual’s welfare, and does it affect long term prognosis? Duration of Undiagnosed Psychosis (DUP) is an important issue to discuss in terms of such research. It may be intuitively obvious that delay of diagnosis and treatment is not advisable, but one should still ask whether statistically reduction of the delays has a significant effect on short and long term prognosis.

3.2 Duration of Undiagnosed Psychosis

Duration of Undiagnosed Psychosis (DUP) is an important concept related to the ‘Early Intervention’ of Schizophrenia, and more specifically to secondary prevention. The Research into DUP provides justification and validation for the emphasis on intervention coming earlier rather than later. There is some debate over whether DUP is a predictor of outcome of first episode psychosis. Larsen et al (2001) in a review of the literature found 15 studies up to 2001 that showed a statistically significant correlation between long DUP and poor outcome and 4 studies that did not find such a relationship. Although it is generally believed that DUP has predictive value on outcome, one potentially confounding variable is the interaction of DUP with pre-morbid functioning as they both relate to outcome. Verdoux et al (1998, 2001) found poor pre-morbid adjustment to be associated not only with poor outcome but also with low educational level and family history of psychiatric hospitalization (which in turn might delay seeking treatment). The suggestion made by Verdoux et al (2001) is that if the factors that contribute to the delay in seeking treatment also independently predict poor outcome then perhaps the association between DUP and poor outcome is a spurious one. Verdoux et al (2001) found a 37% reduction in effect size of the association between DUP and poor outcome (as measured by chronicity of psychosis) after adjusting for premorbid functioning.

Harrigan et al, (2003) also acknowledge that DUP is consistently associated with both outcome and pre-morbid adjustment. It is this characteristic that leads Larsen et al (2000) to pose the similar question as to whether long DUP is merely an epiphenomenon of poor pre-morbid adjustment. It is likely that with poor pre-morbid functioning, DUP may increase since the individual may not be capable of seeking help resulting in less detection and increased lapse in time before treatment. In an attempt to assess the independence of the impact of DUP from a number of confounding variables, Harrigan addresses this issue by using a series of hierarchical multiple regressions where the effect size of each additional predictor is measured in terms of outcome after 12 months. In the sample of 354 first-episode
psychosis patients, the total variance accounted for by all the predictors was about 27% and after the effects of gender, age of onset of illness, pre-morbid adjustment, education and duration of prodrome were accounted for, DUP explained an additional 5.7% of the variance, which was a statistically significant contribution. The conclusion made was that DUP is a “moderate yet consistent predictor of functional and symptomatic outcome even after controlling for age of onset of symptoms, gender, pre-morbid adjustment, education, duration of prodromal symptoms, severity of illicit drug use and diagnosis” (Harrigan et al 2003, 106).

While it may be generally acceptable that DUP possibly has sufficient predictive value to warrant emphasis on early intervention, another investigative question is whether DUP has longer term effects beyond the more obvious short term associations.

A 4 year outcome study of duration of untreated psychosis (Clarke et al 2006) was carried out to look into the previously inconsistent findings. 82 patients with schizophrenia or schizophreniform\(^3\) disorder out of an original sample of 177 were tested for both functional outcomes (global assessment of function: GAF) and psychological/symptomatic ones (Positive and Negative Syndrome Scale: PANSS and remission). An overall association was found between DUP and “midterm” outcome, “...each increment (one year) in duration of untreated psychosis was associated with a 7.8 point decrease in global functioning and an increase in positive symptoms scores by 1.9 points” (Clarke et al 2006, 236). A lower global assessment of function (GAF) score after 4 years was associated not only with increased DUP and DUI (duration of untreated illness) but also with fewer years education and earlier age at onset of psychosis. Remission after 4 years, in a stepwise multiple logistic regression model showed short DUP was associated with remission and female gender and a trend effect for a shorter prodrome, when the effects of gender, age at onset, years in education, original score, prodrome and social withdrawal were controlled for. A higher PANSS score was associated with increasing DUP, with the effect size of DUP having a moderate influence on PANSS score. This, in essence meant 76% of individuals in the short DUP group had PANSS outcome scores lower than the mean of the PANSS score of the long DUP group.

The study was a representative sample including all cases of first episode psychosis in the defined catchment area with an attrition rate of less than 30% over the 4 years. However, patients who had already been prescribed anti-psychotic medication for up to 30 days before referral to the service were included in the study, the number of which was not stated. This would appear to confound the results of some of the initial assessments of GAF and PANSS. Pre-morbid adjustment scores were also unavailable for various unavoidable reasons for 11 out of 82 of the schizophrenia group.

While the debate over whether DUP indeed has a significant contribution to quality of outcome, (short or long term) is not yet resolved, no-one on either side of the issue advocates for delays in treatment and it is suggested that the goal of implementing early detection strategies should proceed whilst continuing to seek “conclusive proof that DUP really matters” (Harrigan, 2003)

### 3.2 Early Detection – What is the Prodrome?

---

\(^3\) Schizophreniform Disorder is a diagnosis where symptoms of schizophrenia are present for a significant proportion of a month but not six months as is the requirement for schizophrenia.
Given that no one advocates longer DUP, and that it is generally accepted that increased DUP has predictive value for poorer outcome in schizophrenia (even if it is not an independent predictor), the next question to be asked is how reliably can schizophrenia be predicted from behaviours preceding psychosis? As stated, a “fundamental precondition for early intervention is the accurate detection of bona fide prodromal states, that is, sign and symptom constellations that predict the later onset of psychosis in persons with no prior history” (Hawkins et al, 2004, 3). Which particular prodromal symptoms, for instance, will predict onset of psychosis and/or schizophrenia. For there to be a strategy for ‘Early Intervention’ in the prodromal phase of a psychotic disorder or schizophrenia, it is first necessary to identify a clear criterion for ‘Early Detection’.

As stated previously, the prodromal phase refers to the period where there is a steadily increasing occurrence of nonspecific symptoms and functional impairment prior to the full emergence of psychosis (McGorry et al, 2003). While this term refers to the period preceding both the first psychotic episode and psychotic relapses, the latter are likely to contain residual symptoms from the previous episode (McGorry et al, 2000). The prodrome referred to in this discussion belongs to the ‘initial’ prodrome. The DSM-III-R (American Psychiatric Association, 1987 cited in McGorry et al, 2000) lists 9 prodromal symptoms as:

1. Marked social isolation or withdrawal
2. Marked impairment in role functioning as wage-earner, student, or home-maker
3. Markedly peculiar behaviour (e.g. collecting garbage, talking to self in public, hoarding)
4. Marked impairment in personal hygiene and grooming
5. Blunted or inappropriate affect
6. Digressive, vague, overelaborate, or circumstantial speech, or poverty of speech)
7. Odd beliefs or magical thinking, influencing behaviour and inconsistent with cultural norms, clairvoyance, telepathy, ‘sixth sense’, ‘others can feel my feelings’, overvalued ideas
8. Unusual perceptual experiences, e.g. recurrent illusions, sensing the presence of a foe
9. Marked lack of initiative, interests, or energy.

In theory then it should be a combination of ‘some’ of these characteristics that predict schizophrenia. Research by Jackson et al (1996) found the standard assessment using the DSM-III-R list of prodromal symptoms, above, to have poor inter-rater reliability and test-retest reliability. The prodromal symptoms were also tested for their specificity to schizophrenia, in relation to other psychotic disorders such as schizophreniform, schizoaffective disorder, delusional disorder, bipolar disorder, depression and psychotic disorder. “Diagnostic efficiency indices” were found to be the highest for schizophrenia. Individual prodromal symptoms predicted about 50% of the cases of schizophrenia and 25% of the cases of schizophreniform disorder. The other five psychotic diagnostic categories were diagnosed with even less efficiency. (Jackson et al, 1995).

Another criticism of the criteria was their narrow focus, and the importance of including ‘sub-syndromal’ psychiatric symptoms when considering the prodrome (in other words, the critics identify the need to compare and distinguish ‘precursor symptoms’ from ‘prodrome’ where the former signals increased risk in individuals, without predicting onset of disorder with any certainty). Such questions have necessitated studies with focus on either the prodrome or precursor symptoms. The former research aims to identify, the combination of symptoms in the prodrome which may predict schizophrenia, and the latter research investigates, the impact of precursor symptoms on the prodrome, and whether these have predictive value. The
precursor symptoms or ‘at risk mental state’ as they have become to be known, have been tested in conjunction with prodromal symptoms to discover whether they add any power to predict schizophrenia and/or psychosis.

3.3 Can the Prodrome be Predictive, and What Part do Precursor Symptoms Play?

Various attempts have been made in centres around the world to ascertain which symptoms can be identified as predictive prodromal indicators or “state markers” of vulnerability to development of psychosis/schizophrenia. Huber’s ‘Basic Symptoms’, as outlined earlier, were operationalised in the ‘Bonn Scale for the Assessment of Basic Symptoms’ (BSABS). This scale was used in 2001 by Klosterkötter et al, to identify and predict patients at risk of developing psychosis. They found a conversion rate into schizophrenia of just below 50% in just less than 10 years. The large time period used in this study may be due to the belief that ‘basic symptoms’ can be identified earlier than the more usually identified prodromal symptoms.

In 2002, T. Miller et al reported prodromal features converting to schizophrenic psychosis in 46% after 6 months and 54% at 12 months in 29 patients. This study will be discussed shortly with reference to the (COPS) criteria developed separately and differing from the (BSABS) derivation of ‘Basic Symptoms’.

In 2008, Cannon et al, sought the risk rate of conversion to psychosis in a clinically high risk sample over a 2½ year study of 291 subjects. They found the conversion rate to be 35%, with a decelerating trend where fewer cases converted to psychosis as time progressed. The risk of onset to psychosis after 2½ years reduced to 2.7% which indicates “the prodromal criteria are sensitive to risk for imminent onset and provide an empirical basis on which to time the application of preventive interventions” (Cannon et al, 2008, 32).

McGlashan and his team at Yale University have extended the literature on prodromal symptoms, in a clinical trial through the PRIME Research Clinic (Prevention through Risk Identification, Management, and Education) (T. Miller et al, 1999). The team “tailored a comprehensive diagnostic system for the identification of persons at high risk for the onset of an initial episode of psychosis” (Hawkins et al, 2004, 3). The research aim was to test atypical antipsychotic medications versus placebo in the hope of “delaying or averting the transition from a prodromal state to a full blown, psychotic episode” (Miller et al 1999, 275). For this end the diagnostic system was devised, and modelled on the Melbourne-based ‘PACE’ description of prodromal types, outlined later. The combination of state and trait factors, predict whether high-risk individuals will develop psychosis within a short time period (Yung et al, 1998). McGlashan et al, operationalised these syndromes in the Criteria of Prodromal Symptoms (COPS)

Candidates for assessment were selected on the basis of a ‘Structured Interview for Prodromal Symptoms’ (SIPS) arising from the scale of Prodromal Symptoms (SOPS). This is designed to “rate the severity of relevant symptoms along dimensions between normalcy, ‘…’, and the lower levels of pathology that form the floor of conventional rating scales employed with more advanced or overt illness presentations (such as the BPRS, SANS, SAPS or PANSS)” (Hawkins et al 2004, 3). The PRIME team designed these criteria and scales to “define, diagnose, and measure change systematically in individuals who may be in a pre-psychotic
state” (Miller et al 1999, 275). McGlashan reports conversion rates of between 36% and 54% within a year in three samples (Hawkins et al, 2004).

The items contained in the SOPS are presented in Table 3.1 containing five attenuated positive psychotic symptoms, six negative symptoms, four disorganisation symptoms and four general symptoms (Hawkins et al, 2004, 4).

Table 3.1. Schedule of Prodromal Symptoms (SOPS) items

<table>
<thead>
<tr>
<th>SOPS subscales</th>
<th>SOPS items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>Unusual thought content/delusional ideas</td>
</tr>
<tr>
<td></td>
<td>Suspiciousness/persecutory ideas</td>
</tr>
<tr>
<td></td>
<td>Grandiosity</td>
</tr>
<tr>
<td></td>
<td>Perceptual abnormalities/hallucinations</td>
</tr>
<tr>
<td></td>
<td>Conceptual disorganization</td>
</tr>
<tr>
<td>Negative</td>
<td>Social isolation and withdrawal</td>
</tr>
<tr>
<td></td>
<td>Avolition</td>
</tr>
<tr>
<td></td>
<td>Decreased expression of emotion</td>
</tr>
<tr>
<td></td>
<td>Decreased experience of emotions and self</td>
</tr>
<tr>
<td></td>
<td>Decreased ideational richness</td>
</tr>
<tr>
<td></td>
<td>Deterioration in role functioning</td>
</tr>
<tr>
<td>Disorganization</td>
<td>Odd behaviour or appearance</td>
</tr>
<tr>
<td></td>
<td>Bizarre thinking</td>
</tr>
<tr>
<td></td>
<td>Trouble with focus and attention</td>
</tr>
<tr>
<td></td>
<td>Impairment in personal hygiene and/or social attentiveness</td>
</tr>
<tr>
<td>General</td>
<td>Sleep disturbance</td>
</tr>
<tr>
<td></td>
<td>Dysphoric mood</td>
</tr>
<tr>
<td></td>
<td>Motor disturbances</td>
</tr>
<tr>
<td></td>
<td>Impaired tolerance to normal stress</td>
</tr>
</tbody>
</table>

Hawkins et al (2004) performed a principle components factor analysis, as in the current research, to explore whether the prodromal items cluster together in the sample population in the same way that a priori categories are set. 94 individuals with first episode prodrome were gathered from four sites in the United States and Canada over 1998 and 1999 with a mean age of 18.6 (S.D.=5.6).

As in the items in the table, there is clustering into separate factors similar to that found in schizophrenia. The psychotic positive symptoms and the strong negative symptoms separate into factors, but there is an absence of a separate disorganisation factor. This may reflect “the mild and nuanced nature of the clinical state under study” (Hawkins et al, 2004, 11). However, the ‘general distress’ category factored separately, reflecting the “subtle declines in psychological health that are expected to accompany the insidious but distressing onset of first episode of psychosis” (p11).

The current research investigating ‘trait abnormalities’, overlaps with some items in SOPS. However, the items chosen a priori, and explored via factor analysis (and other statistics) in the current study are based on a neurodynamic psychobiological theory, generated from a detailed overview of the literature of schizophrenia and related disorders by Miller (2008).

Working along the same lines as the Yale University group through the PRIME clinic is the Melbourne University group through the PACE (Personal Assessment and Crisis Evaluation)
clinic, referred to earlier. McGorry and associates have been involved for over 2 decades with Early Intervention in Schizophrenia and are leaders in the area. As part of this programme a rigorous and important study was carried out (McGorry et al, 2000), through the PACE Clinic based in Melbourne, Australia. They sought to test the ability of the DSM-III-R prodromal symptoms to predict schizophrenia, and the degree to which these symptoms compare to factors relating to premorbid functioning, precursor symptoms or ‘at risk mental state’. Since it was retrospective, with no comparison group who were not psychotic, it was not concerned with making estimates of differential prediction. They adopted an approach using signal detection theory and the ROC technique (Receiver Operating Characteristic). Along with the ROC, another technique, the QROC or Quality Receiver Operating Characteristic was adopted for the purpose of analysing the quality of each item. This was deemed necessary because often a smaller number of items perform just as well as a larger number where each added item does not contribute ‘enough’ extra value in terms of predictive power, in combination with other items, to warrant inclusion. Hence, it was necessary to assess the value or quality of each item. QROC, while not assuming diagnostic accuracy, re-scales each item’s sensitivity and specificity value to zero when it performs at the level of chance and to 1 when it performs at maximum. Together ROC and QROC analyse the combined positive and negative predictive power, sensitivity and specificity of prodromal symptoms according to DSM-III-R. McGorry et al also assess other factors such as duration of symptoms and premorbid social adjustment to test whether these extra “pre-cursor features” improve the “diagnostic efficiency of the prodromal symptoms” (McGorry et al, 2000, 4).

The information was gathered via a diagnostic tool developed by McGorry et al (1990a,b), the Royal Park Multi-diagnostic Instrument for Psychosis (RPMIP). The tool uses “multiple sources of information” including the DSM-III-R prodromal symptom criteria, duration of prodromal symptomatology and items relating to pre-morbid functioning. According to McGorry, the tool has a high standard of reliability and validity (McGorry et al, 2000). Information was gathered from the 200 individuals (122 males and 78 female) experiencing first episode psychosis and a close relative of each. The information was rated according to “operationalized decision rules” with careful defining of the boundaries of the prodromal phase from “perceptible changes from pre-morbid functioning” to the end when psychotic symptoms commenced.

The information collected for each subject was assessed using the SPAN program which initially formulated “diagnostic decision rules” by which the quality of test efficiency is assessed and in terms of QROC, produces a “weighted product of … chance-corrected specificity and sensitivity” (McGorry et al, 2000, 5).

It was found that using DSM-III-R prodromal variables alone, at least three or more needed to be present to predict schizophrenia with modest diagnostic efficiency (specifically, “marked impairment in role functioning or odd/bizarre behaviour/magical thinking, in conjunction with socially isolative behaviour/withdrawal” p7). However, incorporating DSM III-R prodromal symptoms with both prodrome duration variables and pre-morbid functioning variables the presence of more than six of the 12 variables predicted schizophrenia more efficiently than DSM-III-R variables alone. Specifically, the formula is, “DSM-III-R prodromal symptomatology for a period greater than 185 days, and (social isolation/withdrawal) or (poor premorbid social adjustment/work history and poor premorbid adjustment)” (p7). Also interestingly the items for duration and premorbid functioning predicted significantly better than the nine prodromal symptoms alone.
The authors do qualify the results by pointing out the “circular nature of the efficiency of prodromal duration in predicting the diagnosis of schizophrenia” (McGorry et al, 2000, 8). A diagnosis of schizophrenia in DSM-III-R is dependent upon symptoms of psychosis lasting at least 6 months and it would be expected that the longer the prodromal period the more likely this criterion for schizophrenia would be met. Another limitation they point out is the less-than-ideal research conditions in which the study group all had a diagnosis of psychosis preventing extrapolation to the wider population of those merely at ‘higher risk’ of developing psychosis. While an epidemiological sample would be a better approach, the impracticality of this due to low incidence in the general population leads researchers to identify sub-populations that are at higher risk, using models such as ‘genetic high risk’ and ‘ultra high risk’, for prediction of future psychotic disorders.

This significant study lent support to the abandoning of the 9 prodromal symptoms stated in DSM-III-R while retaining the term ‘prodrome’. The authors summed up the findings this way:

“It will be a significant challenge, however, to add predictive power to the general variable of ‘duration of deterioration in functioning’. Some of the enhancement may be derived from symptoms and behaviour, some from other sources, including historical variables and ultimately biological markers… In clinical terms, sustained decline in psychosocial functioning in a young person should probably give rise for concern about the risks of incipient psychosis. Within the group of ‘true positives’ who develop a first episode of psychosis, it is clearly predictive in its own right of schizophrenia.” (McGorry et al, 2000, 9)

As this trend progresses to identify earlier and earlier signs of vulnerability, there is increasing evidence to suggest that not only can an ‘at risk mental state’ be identified but in doing so the possibility of averting a psychotic episode has been realised as an attainable objective. With the devastating effects of such an experience eliminated, in some cases, the long term prognosis may be better. This is the focus of the PACE (Personal Assessment and Crisis Evaluation) Clinic based in Melbourne, Australia, in association with the EPPIC Service (Early Psychosis Prevention and Intervention Centre).

### 3.4 High Risk Models – Importance of Precursor Symptoms

The problem with focusing earlier and earlier is that strategies have to be devised for identifying a population that is likely to include at-risk individuals at a rate above ~1% (the incidence of schizophrenia in the general population). Research carried out in several populations, has shown some groups are at higher risk of developing schizophrenia. Kake et al (2008) assessed contact prevalence in a capture recapture procedure to estimate 12 month prevalence of schizophrenia. In schizophrenia for Maori (0.97%) it was significantly higher than for non-Maori (0.32%), even after adjustment for age, case under-ascertainment, and socioeconomic deprivation. In a study of adolescent cannabis use (Zammit, 2002) among a historical cohort from 1969-1970 of over 50,000 Swedish conscripts, cannabis was associated with an increased risk of developing schizophrenia in a dose dependent fashion. The adjusted odds ratio for using cannabis more than 50 times was 6.7. Harrison et al, (1988) found African-Caribbean second generation in the UK had increased risk of developing schizophrenia. Since then this finding has been made in many different countries (in Denmark, Cantor-Graae et al, 2003; in The Netherlands, Veling et al, 2006; in Finnish and Southern and Eastern European groups, Hjern et al, 2004)
Traditionally, “Genetic High Risk Models” have been used to recruit ‘at risk’ individuals via family history of schizophrenia/psychosis. These studies, however, generally include relatives that are other than first degree, which even after lengthy latent periods yield low proportions who eventually develop schizophrenia or psychosis (McGorry et al., 2003).

The strategy developed in Melbourne called the “Ultra High Risk” or “Close In” Strategy stresses the importance of timing and accuracy of prediction, along with the need for clinical care and preventive intervention focusing on patients with “manifest symptoms and impaired functions [who] demonstrate a substantially increased risk of psychosis onset” (McGorry et al., 2003, 773).

At the Clinic in Melbourne this model has been established as a safe and effective strategy for both continuing research and clinical intervention in the prodromal or pre-psychotic phase of mental disorder (McGorry et al., 2003). A system of “multiple gate screening” together with “close in” follow up, as proposed by Bell (1992) has been adopted, which involves multiple screening measures in conjunction with a shorter follow up period, concentrating on the level of risk, and coinciding follow up with the age of maximum incidence of psychotic disorders. This approach has been assimilated by other clinical research centres around the world (Cornblatt 2002; T. Miller et al., 2002; Morrison et al., 2002), identified as “ultra high risk” (UHR) studies, as distinguished from ‘traditional high risk’ studies.

Since prodrome is a retrospective concept, the term ‘at risk mental state’ (ARMS) is used to describe the criteria for screening young people who have voluntarily approached the service for help, who may or may not develop schizophrenia. The UHR criteria, refers to individuals 14 to 30 years old who have not experienced a previous psychotic episode, who can be recognised as belonging to at least one of the following three groups:
1. The Attenuated Psychosis Group: experience of subthreshold attenuated positive symptoms within the last year;
2. BLIPS group (Brief, Limited or Intermittent Psychotic Symptoms) experienced within last year and not longer than 5 years;
3. Vulnerability Group – Individuals presenting with both trait and state risk factors, for belonging to a family with first degree relatives with a psychotic disorder or schizotypal personality disorder together with a decrease in functioning over the last year. There are certain exclusion criteria. (For more detail see McGorry et al., 2003,775).

Standardised measuring of symptoms in this prepsychotic stage was developed when the PACE Clinic found existing psychopathological measures to be inadequate to describe the subthreshold spectrum of positive symptoms. The measures they were referring to were the BPRS - Brief Psychiatric Rating Scale, Overall and Gorham (1962); the SANS - Scale for the Assessment of Negative Symptoms, (Andreasen, 1983); and the PANSS - Positive and Negative Syndrome Scale, (Kay et al., 1987). The CAARMS or Comprehensive Assessment of At-Risk Mental States was developed as a semi-structured interview to assess prodromal symptomatology. It takes into account small changes in intensity, frequency and duration of symptoms that previous measures had tended to collapse into one score (McGorry et al., 2003). The instrument is similar with local variation to the SIPS (Structured Interview for Prodromal Symptoms) developed by the PRIME group outlined earlier.

Apart from the advances made in both sensitivity of detection strategy and timeliness of intervention, the PACE clinic approach itself provides side effect benefits which are worth
outlined, and a justification for the principle of early intervention itself. These are stated in McGorry et al (2003), as:

1. It provides an avenue of help and communication about social withdrawal, impaired functioning, and subjective distress. The value of this may be far reaching and should not be underestimated regardless of whether the transition to schizophrenia actually occurs.
2. A foundation for future therapeutic interventions (particularly drug therapy) is laid by trust developing in these earlier stages. This includes emotional support for families.
3. Duration of Untreated Psychosis (DUP) can be reduced and avoidance of hospitalisation due to greater service access with no time delays.
4. Comorbidity, such as substance abuse or depression can be dealt with prior to any potential worsening psychosis, so the patient is better equipped to cope.
5. Treatment received may be influencing biological pathophysiology and/or psychosocial causes that have contributed to developing psychosis and therefore may prevent the actual onset of full psychosis or delay it.
6. The close monitoring of the transition process for research purposes from neurobiological, psychopathological and environmental perspectives is possible. Patients themselves have improved cognitive and emotional competency enabling better informed consent for the research.

3.5 Unsolved issues and ethical concerns

One of the main ethical concerns surrounding pre-emptive treatment in early intervention is the use of anti-psychotic drugs. The assumption among some investigators in the early intervention community is that the same therapy that works for full-blown psychosis may work for prodromal patients in lower doses (Schaffner and McGorry, 2001). Comblatt et al (2001) advocate instead stress-reducing medications, such as anti-depressants, that may ameliorate developing psychosis. Evidence given for this approach comes from the diathesis-stress model which proposes the stress factor involved in the development of psychosis. McGorry et al (2001) have advocated cognitive therapies, low doses of lithium and essential fatty acids to be more fully explored. Lithium and eicosapentaenoic acid (Omega 3 fatty acid) are considered to be a neuroprotective agents.

There are legitimate concerns about inadvertently including false-positive at-risk individuals, which represent half to two thirds of the UHR population. However, genuine concern to help and identify early stages of serious mental illness has been seen by some to be an attempt to “medicalize distress in adolescence” (McGorry, 2003). Problems associated with being wrongly identified are effects of stigma and labelling or from side-effects of treatment. There is evidence of mild/moderate side-effects from use of atypical antipsychotic agents with mild sedation and weight gain. No ill-effects of psychosocial intervention have been recorded. At the PACE clinic, retention rates are over 70% of patients free to leave the programme at any time.

Other concerns come from the varying types of appropriate studies, whether naturalistic, randomised, open versus blinded. McGorry et al (2001) carried out a randomised study using either psychosocial therapy alone or low dose atypical anti-psychotics with psychosocial therapy, where both patient and psychiatrist know the treatment (open label). The McGlashan PRIME trial did a similar study but with a double-blinded placebo-controlled design so neither patient nor psychiatrist knew the treatment assignment (McGlashan, 2001). Comblatt et al...
(2001) has argued for more naturalistic studies (already performed by McGorry and others) where a base rate is first established, necessary to assess the extent to which an intervention is actually working.

Ongoing debate continues on these issues. However, this makes the argument for more accurate detection, with the greatest of warning time, all the more important and has implications for an earlier screening tool for teenagers with early signs of risk, where more naturalistic and low risk interventions would have increased impact.

4. Theory of Trait Abnormalities

4.1 Introduction

The current study was conducted on subjects in the middle years of life. It may eventually be adapted for use with younger people, but in the period earlier than the prodromal phase, when enduring basic symptoms prevail (rather than either the symptoms of the prodromal phase or those of more acute psychosis). In neuropsychological and cognitive research, there is evidence of many enduring functional traits not so well documented in clinical literature. Such research is performed mainly to understand schizophrenia rather than for clinical purposes. However it opens the door to identifying ‘at risk’ individuals at an earlier stage than the prodromal phase. This literature is also the foundation of Miller’s (2008) neurobiological theory of the traits. These traits are the basis for the questionnaire developed here, which is called the ‘Schizophrenia Traits Questionnaire’ abbreviated to ‘STQ’. At the present stage the instrument has been developed using responses from individuals with established schizophrenia (and others), but will be adapted and developed later for use in teen-agers and young adults (but that is not dealt with here).

4.2 Brief History, Basic Neuroscience, and Terms Used

The categories, from which the ‘trait abnormality’ items in the questionnaire were drawn, are explained partly ‘in terms of’ psychological concepts and partly neuronal concepts. The neuronal concepts originated with Charles Sherrington, whose discoveries about the functions of neurones gained him a Nobel Prize in 1932. The concept of the synapse was first named by Sherrington in a chapter of a ‘Textbook of Physiology’ he wrote in 1897. Although his work was mainly in the spinal cord, some of the concepts he first articulated in the 1920s (see Creed et al, 1932) are relevant today and important in understanding the theory upon which this thesis is based. Concepts such as spatial and temporal convergence and divergence (dispersion) will be explained, as they are fundamental, not only to specialisation in each hemisphere, but also to understanding the loss, in schizophrenia, of the benefits of laterality, normally found in the brain.

Communication between nerve cells in the brain occurs via electrical impulses along their axons, and chemical transfer at the synapse. For a neurone to fire, a threshold potential must

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4 Although he initially named it ‘syndesm’, his colleagues suggested ‘synapse’ which remained the term for the junction between one nerve cell and another, a term beginning to have functional importance in physiology (Shepherd and Erulkar, 1997).
be reached, usually by summation of several synaptic influences. In the cerebral cortex, *excitation* occurs via cortico-cortical pathways which can be either local or distant. *Inhibition* is crucial to keeping the system in balance by extinguishing the excitatory signal after firing, and bringing the process back to a resting equilibrium. The spread of inhibition tends to be local to regions recently excited. There is little or no long distance inhibition in the cortex.

Nerve fibres or axons are morphologically of two types, myelinated and unmyelinated. These are long, cylindrical and made of axoplasm surrounded by a cell membrane. The myelinated axons are surrounded by a myelin sheath made from lipids or multiple cell membranes which increase the conduction velocities for impulses. These axons are of larger calibre than unmyelinated ones. Cortico-cortical axons are a mixture of myelinated and unmyelinated axons. The calibre of both types varies greatly within a population of axons. Conduction velocity in axons is closely related to their morphology, the large calibre and myelinated axons having higher conduction velocity than the fine calibre, or unmyelinated ones. For cortico-cortical axons, conduction velocity ranges from ~0.1 m/sec for the slowest conducting axons up to ~5 m/sec for the most rapidly conducting ones (Miller, 1975; Swadlow, 2000). Conduction time is the reciprocal of conduction velocity, and therefore, for equivalent lengths of axon, also varies over a more than ten-fold range amongst a population of axons. For a conduction distance of (say) 5 centimetres, it might differ from ~10 msec for the most rapidly-conducting axons, up to several hundred milliseconds for the slowest-conducting ones. The assumption is that axonal conduction time is a stable structural aspect of brain organisation (Miller, 2008).

The ‘integration interval’ is a term used by Miller (2008) which is crucial to his theory. The ‘integration interval’ (simply put) describes the interval within which inputs of an axon to a neurone can combine and summate, most effectively within ~10msec, with some summation happening over a slightly longer period, up to ~20 msec. In a more detailed definition it is the period following the arrival of the presynaptic impulse in one axon, when its post-synaptic potential can summate with those coming from other axons (or with later impulses coming along the same axon). In principle, some summation may occur as late as 20 msec after the beginning of the first, but it would be slight. The ‘effective’ integration interval is thus somewhat notional, but a round figure of ~10 msec would theoretically suffice. This figure is derived from measuring an intracellular response, and recording a depolarising excitatory synaptic response (EPSP: excitatory post-synaptic potential), whose total duration is roughly about 20 msec, the peak being in the first two or three milliseconds, with an exponential decline to baseline after that.

The theory upon which the current research is based makes assumptions about the range of conduction times in populations of cortico-cortical axons. This cannot be directly measured in humans, but the assumptions made helps to understand a great deal of data, of many types, as discussed by Miller (1996, 2008). The cortex is specialised for different tasks and requires faster-transmitting, myelinated axons for some types of information processing and mostly slower-transmitting, unmyelinated ones for other processing.

As already indicated, convergence of a number of synaptic influences is normally needed to make a neurone fire an action potential. ‘Temporal convergence’ is a term used by

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5 There is evidence however that an enriched or complex environment can increase myelination and calibre of axons in rat corpus callosum (Juraska and Kopcik, 1988).
Sherrington to describe the process of summation of signals which are separated in time. Figure 4.1., which shows ‘space-time’ diagrams, illustrates these processes. Firing of a neurone occurs when converging signals reach a target neurone within one temporal integration interval, which lasts about 10 to 20 msec. If the axons which convey these influences are rapidly conducting (upper diagram in Figure 4.1.), it follows that firing of the presynaptic neurones are also in quite close synchrony. If however, the population of axons is generally slower-conducting, the conduction times in these axons will differ amongst themselves. Therefore, if impulses start in the presynaptic neurones at the same time, they will reach their destination at significantly different times. This is ‘temporal divergence’ (lower left diagram, Figure 4.1.): Signals in different axons do not reach their target neurone in synchrony within a single integration interval. They are dispersed in time (‘temporal dispersion’) and may fail to make the post-synaptic neurone fire. For the signals in such a slowly-conducting population of axons to be more effective in firing a neurone, they must be initiated pre-synaptically at slightly different times (see lower right diagram, in Figure 4.1). This is what Sherrington called ‘temporal convergence’.

![Figure 4.1](image.png)

Donald Hebb is regarded as the father of neuropsychology. In his book “The Organisation of Behaviour” (1949) he put forward the two seminal and inter-related concepts: (i) the basic entity for representing information in the cortex is not a single neurone, but a distributed cluster of neurones, more strongly connected with themselves, than with other surrounding neurones (ii) Connection strength is determined by synaptic modification, dependant on the prior history of activation of a synapse. Specifically, when pre- and post-synaptic sides of a junction are repeatedly activated in close synchrony, the synapses become functionally stronger. Since this tends to happen when several synapses upon a neurone are activated together, synapses on any cortical neurone become strengthened in groups, those that tend to be activated in close synchrony.
Hebb’s theory did not deal in detail with temporal relations between neurones in a cell assembly, but later development by Moshe Abeles (1982) presented a modification of Hebb’s concept, that connected neurones might fire in organised sequences, with precise timing between the firing of successive neurones in a chain. The essence of Miller’s theory of normal cerebral asymmetry is that cell assemblies in the right hemisphere contain neurons activated in near-synchrony, while those of the left have longer delays between their respective firing, and so correspond in same ways to Abeles’ ‘synfire chains’.

Initially there was no coherent theory of normal asymmetry from which the deviation in schizophrenia could be argued. A theory of normal asymmetry was developed by Miller in 1996 in a book entitled, *Axonal Conduction Time and Human Cerebral Laterality*. The book is based on the fact that, in general terms, in 90% of normal human brains there are specialisations of processing in the right and the left hemispheres. The book argues that the left hemisphere has developed a greater capacity than the right to assimilate patterns of events with time delays of up to a few 100 msecs, such as many of those in language, necessitating slower axonal conduction of signals. In other words, the complex array of detail from a variety of sequential signals, occurring at varying times in a neural system associated with language, requires a system that uses a ‘rich repertoire of delay lines’. Miller explains the subtlety of left hemisphere specialisation in terms of the underlying premise as follows:

“The central hypothesis of the book is that the physical basis of the left hemisphere specialisation lies in the properties of the axons connecting together different regions of the cortex in that hemisphere. Specifically, it is suggested that in the left hemisphere there is a greater proportion of the fine calibre, slowly conducting axons than in the right. This means that, as far as direct monosynaptic cortico-cortical connections are concerned, there can be a greater temporal dispersion of any signal in the left than in the right hemisphere. This in turn, it is argued, gives the left hemisphere a better capacity than the right for linking the representation of events which are separated in time (especially for short intervals of the order of 100 msec). This then allows the left hemisphere to represent short temporal patterns in greater detail and with greater accuracy than can the right hemisphere.” (Miller, 1996, 2)

In contrast to this, the right hemisphere has developed to process instantaneous patterns more effectively, necessitating rapidly conducting axons from a rich array of signals that arrive at a target neurone more commonly within about 10 msec.

“The right hemisphere also has its own distinctive manner of specialisation. According to the central hypothesis this depends on there being a richer repertoire of cortico-cortical connections, with rapid (and, effectively, instantaneous) transmission in right than in the left hemisphere. This leads the right hemisphere to have a superiority over the left in representing patterns which are complex “instantaneous” conjunctions of signals, rather than complex temporal patterns. The obvious example of such “instantaneous” patterns are visual spatial patterns, and the term “spatial” will often suffice as a general label for the functions for which the right hemisphere has an advantage.” (Miller, 1996, 2)

Suffice it to say that the structural differences via axonal conduction velocities in the right and left hemispheres in ‘normal’ brains enable efficient processing of different signal patterns with different consequences for behaviour.
In schizophrenia, there is known to be abnormal functional asymmetry (Flor-Henry, 1969, 1972; Andreasen, 1982), often amounting to slower-than-normal processing of some types of information. This is explained by the hypothesis that in schizophrenia, there is ‘a relative loss of rapidly conducting axons’, normally abundant in the right hemisphere, which ultimately manifests itself in the loss of asymmetry as explained above. Behaviourally this may affect the speed of processing information and in some cases whether some tasks will be accomplished at all. A corollary of a loss of rapidly conducting axons, in the right hemisphere for example, is that in a population of axons from A to B there will be a greater temporal spread of signals arriving at their destination, affecting the integration of stimuli. In other words, there is greater than normal temporal dispersion, and with it, less-than-normal temporal convergence within a single integration interval.

While this could be an advantage in processing temporal patterns such as some of those in language, it is not advantageous in a network that needs instantaneous processing. Temporal dispersion here will often mean a loss of function. In other words, when signals come from various stimuli that instantaneously make up a pattern, these need to arrive at ‘the same time’ (or within one integration interval), which is favoured by rapid conduction along the axons. If signals in the right hemisphere, for example, do not reach the target neurone within about 10 msec of the ‘other’ signals then summation or ‘convergence’ does not happen and the neurone does not fire. The signals are dispersed in time, not reaching their target ‘in synchrony’ and, therefore the threshold for excitation in the neurone may not be reached. In schizophrenia, the specialisation of the normal right hemisphere is then lost, it becoming more like the normal left hemisphere, and the benefits of lateral specialisation are lost. In effect, it is as though the schizophrenia brain consists of “two left hemispheres”, although this does not apply to all cerebral functions (Miller, 2008, 30).

4.3 Application of the Theory to Various Psychological Traits of Schizophrenia

4.3.1 Introductory Comments

The topic of trait abnormalities includes a large volume of psychological, behavioural and psychophysiological evidence. However, the emphasis here is on the psychological evidence, since the STQ is about whole persons, without investigation of brain biology or physiology. This section deals mostly with the methods of various experiments, since a full discussion can be found in Miller (2008). The aim here is not to critique the theory but show the thread of the argument upon which the current research is based, and from which items in the STQ were derived.

There is overlap conceptually in some of the categories used in the questionnaire but they will be outlined according to increasing functional complexity. Each section will cover the theory first, with mention of STQ items related to that category, then the experimental evidence relating it to schizophrenia. The list of categories that will be outlined are in this order:

1. Perception
2. Motor Control
3. Cross-modal co-ordination and Interhemispheric co-ordination
4. Discrimination of the intensity of sensory stimuli
5. Attention – Vigilance/Sustained Attention
6. Speed of Learning
7. Excessive Association
   - Selective Aspects of Attention
   - Distractibility-
   - Sensory Overload
8. Impairment in short-term/working memory
9. Shift of Attention Vs Long Trains of Thought
10. Preference for Solitude – Avoidance of Social Activity
11. Overall Levels of Stability and Mental Activity
12. Language and Thought
   - Comprehension of Incoming Language
   - Production of Language – Subjective Experience of Trait Aspects of
     Thought Disorder
13. Sense of Self

In the sections below, items drawn from the STQ are indicated by their being quoted in italics.

4.3.2 Perception

Perception is the translation of sensory stimuli into organised experience. In the context of the theory here, variations in the stimuli reveal aspects of their processing. Dimensions of variation, such as intensity, duration, size, complexity, modality, fine temporal structure and side of presentation, reveal something of the differences in processing in the right as opposed to the left brain.

The literature on perception in schizophrenia covers visual, auditory, somatosensory and olfactory modalities. There are a large number of perceptual tasks or functions that can be tested, that require sophisticated experiments and do not lend themselves to a questionnaire. A common way to test deficit in schizophrenia is in the perception of gestalts. Gestalts are patterns of sensory stimuli, the elements of which are present at the same time, rather than in sequence. The most common gestalts are visuospatial in stimuli such as faces. In the auditory domain, perceiving chords where several frequencies are to be perceived simultaneously is an auditory gestalt. In the somatosensory modality, recognising shapes via touch alone is another example. In normal subjects gestalt perception is generally performed better by the right hemisphere. In the experimental literature deficits are found in all three modalities in schizophrenia.

The STQ contains items related only to visuospatial perception, mostly to do with face recognition. Recognising ‘an acquaintance’ by their voice rather than their face initially, for instance, is a sign of impairment in gestalt perception because the vocal quality depends considerably on fine sequential pattern (and left hemisphere-type processing, which is relatively intact in schizophrenia). However, the questionnaire also includes some associated traits of general visual insensitivity to environment, such as not noticing what someone is wearing and possible resulting preferences for listening to music rather than watching television.

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6 Gestalt, is a German word meaning “form” or “shape”.

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In analysis of perceptual abnormalities in schizophrenia, two issues about normal perception are relevant. The first is the interaction between time and intensity of the stimuli for detection to occur. The second is the lateral differences in perception that exist in ‘normal’ humans.

For the first issue there is a relationship between time of exposure to a stimulus, objective stimulus intensity, and perceived intensity. This is a recognised relation in psychophysics. For exposure times up to about 150 msec, perceived intensity increases with increase in objective intensity but also with prolonging of the stimulus duration. This effect does not increase beyond the duration of ~150msec, and the further lengthening of the stimulus is then perceived as increased duration (Miller, 1996).

As outlined earlier, for a neurone to fire, a threshold must be reached, usually by convergence of several synaptic influences. The stimulus intensity threshold for detection rises as the duration of the stimulus is reduced for stimuli less than about 100-150 msec. The lower the intensity, the longer the stimulus duration must be in order for the subjective criterion of threshold to be reached.

The main type of experiment used to test perception in schizophrenia is the ‘Critical Stimulus Duration’ design where a pattern of visual stimuli is presented for a short time, and duration is adjusted until the stimulus is just detected according to the criterion. In schizophrenia it generally takes longer to detect a stimulus to the same criterion as in normal subjects. There are variations in experiments such as varying illumination levels and size of stimuli, which reveal more of the underlying process. Where ‘deeper’ levels of perception are required, the stimulus must be of longer duration for full integration to occur. An example may be reading road signs when driving at speed (not represented in the STQ, but may be relevant).

This brings us to the second issue in discussing the relation to normal perception, as outlined in the introduction to trait abnormalities. The right hemisphere appears to be specialised for more rapid integration of patterns such as gestalts, whose component parts are present at the same time. This applies to the visual, auditory and somatosensory modalities alike. Where ‘deeper’ levels of perception occur, such as when a greater level of analysis is required in the perception, a longer stimulus duration time is required for full integration because the neural pathways travel deeper into the visual system (Ericksen and Schultze, 1978). In a normal system, the longer the pathways the greater the temporal dispersion as a result of a wide range of conduction times in the population of axons. Along the way increasingly specific aspects of analysis of information will occur, characteristic of the sensory pathway up to that stage.

According to Miller’s theory of trait abnormalities (2008), the type of neural network which would be necessary for recognition of gestalts would be one in which simultaneous convergence upon recipient neurones of signals from several sources could occur easily. This would be one where conduction time in axonal connections was generally rapid. In a network where conduction is slower, signals from converging inputs to a neurone would be dispersed in time, and simultaneous convergence would be less. Such a network may be good for recognition of brief temporal patterns (such as consonant speech sounds) but would not be good for recognition of visuospatial patterns (such as faces) or gestalts in other modalities. Hypothetically, in normal persons the right hemisphere has more rapidly-conducting cortico-cortical axons than the left, and it is this difference which gives the right hemisphere its superiority in gestalt perception. In schizophrenia, there is hypothetically a loss of rapidly conducting axons, and with it a loss of functions normally performed by the right hemisphere,
including gestalt perception. This is one example where schizophrenia traits can be summed up, as previously stated, in the slogan “two left hemispheres”.

Abundant literature deals with various aspects of perception in schizophrenia. Here, as in each category covered in the questionnaire, I will present a sample of research to demonstrate and develop the overall flow of the theory upon which the STQ is based rather than to critique or explain in detail what has taken a substantial sized book to expound and clarify. Indeed for a more detailed analysis see Miller (2008).

Tests of gestalt perception do not necessarily test for lateralisation. While they vary in complexity from perception of geometric figures to facial identity and facial emotion, the more complex they are, the greater the confounding variables of other psychological processes. In research with simple visual patterns, Kline et al (1992) conducted a simple memory task with geometric figures devoid of emotional content. Individuals with non-paranoid schizophrenia were particularly deficient in processing the less structured stimuli as in geometric shapes. Borod et al (1993), compared perception in a visual task which required subjects to match a simple matrix of non-facial and non-emotional visuo-perceptual analogues to 4 response choices. The schizophrenia patients were significantly less accurate than the normal controls, as were the right-brain damaged patients. They concluded that there was right hemisphere disorganisation in schizophrenia. Gabrowska et al (2003) varied the level at which visual object perception and recognition were achieved. Impairment was found in schizophrenia which was greater at higher levels of visual processing (or more complex gestalts) than for the lower levels of processing, with a specific impairment at the stage of analysis where objects are identified and named. Doniger et al (2001) presented subjects with fragmented pictures with increasing clarity of form. In schizophrenia a greater degree of intact image was required for recognition. The impairment correlated with negative symptoms rather than positive symptoms. The comment was made that such deficits in perceptual closure may contribute to the muted world experienced by patients with persistent negative symptoms. Since many real-world stimuli are observed in fragmentary form, perceptual closure allows relatively automatic identification of objects such as a cat behind venetian blinds. This conclusion coincides with related items on the current STQ for gestalt perception, in subjects’ general insensitivity to environment. “The correlation between the deficit in perceptual closure and the negative symptom score suggests that patients with negative symptoms may navigate a world that is form-impoverished and that the absence of salient forms may directly contribute to such diagnostic features as a lack of interest in the environment” (Doniger et al, 2001, 1824).

Many studies have looked at facial identity, increasing the level of complexity of gestalt perception from simple visual patterns. As with simple gestalts, impairment in schizophrenia in perceiving facial identity was found by Borod et al (1993) in the same study as previously cited. In matching faces, Novic et al (1984) used the Benton Test of Facial Recognition. This requires matching a target face with up to 3 pictures of the same person in a six-stimulus array of faces, a deficit being found in the schizophrenia group. Feinberg et al (1986) tested facial identity-matching, independent of emotion expressed, and in one task, the faces were inverted and the other, upright, where faces with similar characteristics were presented and subjects asked whether the pair were the same person or different. Schizophrenia patients were deficient in this task. Archer et al (1992) compared schizophrenia, depression and a control group with no psychiatric history. Familiar faces were presented in one task where the subject had to match them to their profession and the second task presented unfamiliar faces from different viewpoints. The second task proved to be harder and performance by the
schizophrenia patients was significantly lower on each task, leading to the conclusion that there was a generalised face processing deficit associated with schizophrenia.

Impaired perception of facial emotion in schizophrenia is consistently found in the literature. This requires deeper perceptual processing than gestalt-perception previously outlined. However, tests that involve naming emotions may be identifying deficits in language, a left hemisphere function. The impairment may be associated with that in the previous two categories, a generalised face processing deficit, or they may be specific to emotional cues in faces.

Borod et al (1993), Novic et al (1984), and Kucharska-Pietura et al (2005) find impairments in recognising emotion in faces when using verbal responses. However, Novic et al (1984), Borod et al (1993), and Feinberg et al (1986) found impairments in non-verbal tasks in matching faces for emotion. Generally the deficit found is associated with representation of emotion in faces (rather than verbal processing) this being a function normally performed better by the right hemisphere. In a laterality study using chimeric faces (Gooding et al, 2001), differing expressions make up the left and right hand sides of the face, for instance one half of the face is smiling and the other is neutral. Most right-handed individuals are biased to perceive such a composite face to be happier if the happy side of the face is presented on the left rather than the right side of the face. The conclusion made by Levy et al (1983) is that right-handers normally have right hemisphere specialisation for processing faces. Gooding et al (2001) found in schizophrenia a decreased left visual field perceptual bias in response to emotional chimera. In their experiment they included non-emotion (gender) facial chimera stimuli and did not observe the same differential response as in emotional chimera, which led them to conclude that these schizophrenia patients did not display global right hemispheric dysfunction. They point out that, in general, right-handed individuals display greater perceptual biases to face chimera than to non-face chimera and the mean asymmetries are greater on faces with emotional content than without. However, schizophrenia patients in comparison showed decreased left-sided perceptual biases only in response to the emotion chimera, suggesting that in schizophrenia, visually-perceived emotion is processed differently.

There is evidence here that the right hemisphere specialisation for facial emotion may not be identical to that for facial identity but may reflect a deeper level of processing. To sum up (see also Miller, 2008), as outlined previously, the deficits in schizophrenia of right hemisphere processing associated with facial gestalts, for example, point to excessive temporal dispersion of visual signals at the cortical level beyond the primary visual cortex. Such processing more likely identifies an on-going trait abnormality than a deficit specific to a psychotic state. Experiments testing laterality in schizophrenia show right hemisphere impairment when right hemisphere-preferred visual stimuli are used. Often there is no impairment found when left hemisphere-preferred stimuli are used. Normally the right hemisphere is specialised for rapid integration of gestalts rather than representing temporal patterns. Miller asserts that with a general slowing of signal conduction in schizophrenia, right hemisphere-type functions mostly are impaired and specialisation in the right hemisphere is lost. In Miller’s (1996) theory of normal cerebral laterality, the right hemisphere owes its functional specialisation to a “preponderance of rapidly-conducting cortico-cortical axons”. However, in schizophrenia where, hypothetically cortico-cortical axons tend to be slower in both hemispheres, greater loss of functions is expected for right than left hemisphere functions. This is because gestalt perception requires rapidly conducting cortico-cortical axons rather than a wide range of axonal conduction times.
4.3.3 Motor Control

Motor control can be divided into two main forms, pre-planned motor control, and control involving moment-by-moment sensory guidance. The subject here is the second of these two, i.e. motor control by sensory guidance. It includes such skills as catching a ball, as opposed to throwing a ball at a target (pre-planned), and smooth pursuit eye movements - where eye position is to be controlled, in order to keep a visual image centred on the fovea. There are also many experimental tasks which involve the same process, such as mirror drawing. It is proposed by Miller (2008) that the normal left hemisphere, or either hemisphere in schizophrenia is at a disadvantage in such tasks, compared to the normal right hemisphere. As a result performance in schizophrenia is slower than normal if it is to be accurate, or is less accurate than normal if it is to be of normal speed. Items used in the STQ directly accessing these skills are statements related to batting or catching a ball. Related items concern following pictures at the movies when they are moving fast across the screen. This may be extended to having rapid and immediate spontaneous responses to life events in general, although this involves a variety of other psychological functions, especially rapid refocusing of attention.

It is proposed that motor control by sensory guidance involves sensorimotor links through the hemispheres, where speed and accuracy are dependent on the speed of conduction in the fastest axonal pathways between sensory and motor cortical areas. The normal right hemisphere, with faster conducting cortico-cortical connections should therefore out-perform the normal left hemisphere. From the central hypothesis for schizophrenia traits, one would also expect speed or accuracy to be impaired in schizophrenia. The two basic eye movements are saccades, and smooth pursuit movements. Smooth pursuit eye movements, often referred to as SPEM, track a moving object steadily rather than in step form, as do saccades, and are designed to keep the image centred on the fovea. SPEM are a type of motor control by sensory guidance as opposed to pre-planned, memory guided, or anticipatory movements. There is considerable evidence that smooth pursuit eye movement is impaired in schizophrenia and a number of other demonstrations of impaired control by sensory guidance, involving manual tasks (Miller, 2008).

In a review of early literature on reaction time in schizophrenia, Nuechterlein (1977) echoed a phrase that reaction time was the ‘north star’ in schizophrenia research which he consistently found to be considerably slower than normal. Ninomiya et al. (1998) demonstrate impairments in manual/visual control in schizophrenia. They evaluated reaction times and visuomotor adaptation of visually guided behaviour to reversed vision in schizophrenia. The subject was required to touch randomly illuminated switches as rapidly as possible through goggles with the index finger. After some time a left-right reverse in vision was made which was considered the actual trial. Although reaction time in schizophrenia was slower than normal, the rate of adaptation over trials was normal. This highlights the impairment to be specifically in the actual use of sensory information for immediate guidance but not for the ability to learn from repetition or in alertness. Griffiths et al. (1994) demonstrate the impairment in trait abnormality of motor control by sensory guidance. They studied the tracking of sinusoidally-moving targets in normal compared to schizophrenia subjects using two fingers on the dominant hand on a joystick. Most control subjects accurately tracked showing a nearly sinusoidal pattern. In contrast, the schizophrenia tracking was characterised by greater amplitude variability and frequent loss of position relative to the target followed by catch up movements and overall poor performance. In schizophrenia, in times of reversal of direction there is a significant flat period in the traces of finger movement which is negligible in the
normal traces. This would be consistent with the theory, where sensory feedback of position errors, is slower than normal in schizophrenia.

There are complex issues surrounding measurement of reaction time in experiments comparing normals with schizophrenia subjects. Part of reaction time is initiation time and when this alone is measured in normal subjects, it is faster with the left hand than the right supporting the normal dominance of the right hemisphere (Miller, 1996). Where issues relevant to schizophrenia, such as lapses of attention are compensated for, by brightening the field where the stimulus will appear, normal reaction time decreased. However, it is still significantly slower than normal in schizophrenia (Posner et al, 1988).

Impairment in smooth-pursuit eye movement in schizophrenia has long been seen as a ‘phenotypic marker’. Smooth pursuit eye movement tracks a moving object smoothly rather than in sudden steps, to keep it centred on the fovea. Use of eye-tracking as a marker for schizophrenia was pioneered by Philip Holzman in the early 1970s although there was some work in the early 1900s which identified impairments in ‘dementia praecox’ (Miller, 2008). Holzman et al (1973) used a pendulum-following task for investigating the oculomotor and vestibular system in schizophrenia patients. The two ways that were used to measure tracking were, 1. The frequency of ‘velocity arrests’, where the eye comes to a complete stop (pursuit velocity falls to zero) despite the pendulum continuing to move, and 2. A count of the number of ‘positive saccades’ (following ‘velocity arrests’ as ‘catch ups’), where the eye exceeds by 33%, the maximum speed of the pendulum. A saccade is a rapid step-like movement, used to catch a visual image on the fovea either voluntarily or reflexively. These measures were taken before and after an instruction, to increase alertness and counteract attentional lapses. There were significantly more velocity arrests in the schizophrenia group, despite re-alerting, which suggested the impairment was not related to attention. The tracking patterns remained the same for each group, showing reliability over time. For positive saccades, there tended to be a greater number in the patient group before being re-alerted but after re-alerting all groups greatly improved.

4.3.4 Cross-Modal and Inter-hemispheric Co-ordination

These two subject areas have been linked because they both refer to interaction between areas of the cortex which are often centimetres apart increasing the likelihood of significant temporal dispersion and the likelihood of significant impairment in schizophrenia.

Some tasks involve rapid coordination between hemispheres. These may involve either analysis of incoming signals or coordination of motor output. For instance, experimental studies show that in normal subjects, speech heard with both ears is comprehended slightly better than with either ear by itself. In schizophrenia this ‘binaural advantage’ is lost. Either ear by itself is as good as both together. However, this finding does not lend itself easily to clinical assessment. In the motor domain a simple task relying on bi-hemispheric coordination is ‘drumming’ with rapid alternating movements of the two hands. The STQ includes such an item, and has been reversed, “I can keep good time in rapid drumming with two hands”. It is hypothesised that this would be less accurate, and would break down at a slower speed of alternation in schizophrenia compared to normal.

The literature on inter-hemispheric co-ordination is somewhat confusing mostly due to the lack of time constraints stipulated in the experiments, leading to a failure to uncover the impairment. When rapid co-ordination is required, impairment in inter-hemispheric co-
ordination is observed in schizophrenia. This can be interpreted as due to slower than normal callosal conduction, which according to the theory, is most probably due to a relative absence of rapidly-conducting callosal axons originating in the hemispheres.

In studies (Mohr et al, 2000) where words and pseudo-words, presented to left or right visual fields are to be distinguished for both normals and schizophrenia patients, a right visual field advantage is observed, consistent with left hemisphere language dominance. When stimuli are presented to both hemispheres simultaneously to increase accuracy, a bilateral advantage is seen in normals but not in schizophrenia. The bilateral advantage is normally interpreted as co-operation between the hemispheres, which appears to be impaired in schizophrenia. Mohr et al concluded that, for schizophrenia patients, information transfer through the corpus callosum is impaired so that inter-hemispheric co-operation fails.

Barnett and Kirk (2005) used a lexical-decision task and measured inter-hemispheric transfer time (IHTT) and bilateral gain, assessed in males with ‘negative symptom schizophrenia’ and controls matched for age and handedness. Words and non-words were presented to the left visual field (LVF), right visual field (RVF), or bilaterally while a 128-channel EEG was recorded. The IHTT was estimated using the N160 EP component. In the behavioural measures the schizophrenia group were not less accurate than the controls but they were slower. As in other studies, IHTT was faster right-to-left than left-to-right in normals. In the schizophrenia group, this asymmetry of transfer was not seen. Right to left transmission was slower in schizophrenia than in normal controls.

According to Miller (2008), just as motor control by sensory guidance relies on rapidly conducting cortico-cortical connections from sensory to motor areas, so, for bi-hemispheric motor coordination, rapidly conducting callosal connections between the motor areas of the two hemispheres are required. If such rapidly conducting connections are replaced by more slowly conducting ones, the regularity and maximum speed of rhythmic drumming may be reduced. In the same way, in the analysis of incoming signals, such as in the lexical decision tasks, the loss of bilateral gain indicates the relative loss of rapidly conducting connections. In the right to left inter-hemispheric transfer (with stimuli presented to the left visual field) these axons originate in the right hemisphere and are relatively slower in schizophrenia.

Some tasks involve rapid coordination of sensory information received in different modalities. The small literature investigating cross-modal co-ordination is limited and not very recent, so the conclusions are more predictions in light of the theory than review of evidence. Similar to the loss of bilateral advantage in hemispheric interaction in schizophrenia, so it would be predicted that bi-modal advantage should be lost in schizophrenia.

An example used in the current STQ of cross-modal co-ordination is drawn from the first-hand accounts of schizophrenia patients in McGhie and Chapman (1961). It relates to the difficulty of processing two modalities of complementary information (in that of visual and auditory) in the experience of watching television, described this way by a patient:

“I can’t concentrate on television because I can’t watch the screen and listen to what is being said at the same time. I can’t seem to take in two things like this at the same time especially when one of them means watching and the other means listening. On the other hand I seem to be always taking in too much at the one time and then I can’t handle it and can’t make sense of it” (McGhie and Chapman, 1961, 105).
Just as for rapid bi-hemispheric motor coordination, rapidly conducting callosal connections between the motor areas of the two hemispheres are required, so for rapid bimodal coordination, rapidly conducting connections between main sensory areas for different sensory modalities (e.g. visual and auditory) are required. If they are replaced by slower-conducting connections, such impairments might appear. Another everyday example contained in the STQ is of visual and auditory (bimodal) signals at pedestrian crossings in the street. The STQ item reads “At pedestrian crossings I am confused by the ‘green man’ or ‘red man’ signs telling me when to walk”. A visual symbol (a “green man walking”) is combined with an auditory signal, to indicate the times to cross. Difficulty with cross-modal coordination here means that the two signals in combination lead to sensory confusion rather than collaborating to give a unitary message to cross the street. In principle, experimental methods might be devised to demonstrate the difficulty objectively. Thus, when presenting words for recognition in written form, spoken form, or both together, normals should show a ‘bimodal advantage’, similar to the binaural advantage mentioned above. Hypothetically people with the schizophrenia trait should lack a bimodal advantage, and may even show a bimodal disadvantage, compared with unimodal presentation.

4.3.5 Discrimination of the Intensity of Sensory Stimuli

This category did not emerge from the theory of trait abnormalities but can be explained by it. It was included as a result of personal accounts of people experiencing such phenomenon as not being able to distinguish loud from soft sounds well. Levine and Whitney (1970) found, that people with chronic schizophrenia had a higher absolute auditory threshold for detecting sound but a lower threshold of unpleasantness for when the tone became unpleasantly loud. The working range was therefore narrower than normal. The authors accounted for it in terms of motivational differences, as a result of the low threshold for unpleasantness and performance deficits. Illustrating the narrow working range Levine and Whitney (1970, 76) described the findings as follows: “Once a stimulus is intense enough to be perceived, chronic schizophrenic [sic] patients tend to find it unpleasant and therefore tend to avoid it”.

In terms of trait abnormality theory, normally, intensity of auditory stimuli is processed by Hebbian-style cell assemblies. These assemblies do not detect exact timing of each impulse in each neurone nor do they represent information such as temporal structure. However, mean firing rate of cells in the assembly can be used to represent the intensity of the stimuli which initially ignites the assembly. Miller (2008) attributes this type of processing as occurring in the right hemisphere. In contrast, the left hemisphere is more akin to Abeles “synfire chain” where exact timing of impulses in each neurone is accurately determined and the sequence of neuronal activations can be used to represent temporal structure in a sensory stimulus, or in speech. The coding of information in the ‘synfire chain’ relies on exact timing of individual impulses, not on impulse frequency averaged over a period of time (representing intensity). As a result, Hebbian assemblies are more characteristic of the right hemisphere, and ‘synfire chains’ are more characteristic of the left hemisphere, or, hypothetically, of both hemispheres in schizophrenia (characterised as “two left hemispheres”). From this it would follow that perception of stimulus intensity should be best achieved in the normal right hemisphere. In schizophrenia, where, hypothetically there are “two left hemispheres”, perception of stimulus intensity should be impaired (Miller, 2008).

In terms of Levine and Whitney and the theory for trait abnormalities, normally with higher intensity stimuli there is greater intensity of firing of neurones, with corresponding rebound
inhibition. Thus loud signals will cause high frequency firing in a few neurones, with all others being suppressed by inhibition, thus diminishing unpleasantness. However, in hemispheres with slowly conducting axons, as in schizophrenia, activation of a chain of neuronal activity does not happen until subjective detection threshold is reached which may be higher than normal, and in a synfire chain there is no way to represent stimulus intensity. Since convergence is lower even at relatively high levels of arousal, there is low level firing amongst a large number of neurones with little rebound inhibition, rather than firing in a restricted population, graded according to intensity. Therefore since greater stimulus intensity is needed to transmit any signal, combined with low inhibition, unpleasantness occurs more easily, hence a narrower range of working.

Items in the questionnaire relating to ‘Discrimination of the Intensity of Sensory Stimuli’ are: “I have difficulty distinguishing loud from soft sounds”, “I am sometimes told that I have the radio or stereo on too loud”, “I find music sounds much the same when the volume is turned down (I do not notice it is not so loud)”, and “When I am singing with others, I find that other people’s voices are so loud that I cannot hear my own voice”.

4.3.6 Meanings of the word ‘Attention’

‘Attention’ is a somewhat confusing word because it includes different concepts, despite the same word being used. For this reason I will group studies according to tests used since this is also the path towards understanding the underlying biology as expounded in Miller (2008).

We automatically abstract information from physical stimuli which help form our perceptions. The conditions, or psychological environments that determine what information can be apprehended comes under the heading of ‘attention’. Although it encompasses several different brain processes, psychologically, it refers to concepts such as signal detection (affected by distraction), vigilance (sustained performance over time), selective attention (signal detection and information processing in the presence of competing stimuli), and tests of association (detecting associations between stimuli). Selective attention and tests of association can be viewed metaphorically as two sides of a coin. Impairment in the ability to selectively attend to a stimulus may mean competing stimuli may distract more easily than normal. This tendency has featured historically in Bleuler’s work on schizophrenia, as outlined in a previous section. This converse side of selective attention can also be viewed through the concept of processing resources. The ability to selectively attend to a stimulus and represent it in the presence of a distractor implies sufficient processing resources to hold each representation separately. Therefore, the inability to do this may imply the fusing of the two representations (strongly associating one to the other). This can be tested where two tasks are required to be performed simultaneously. Representations of the stimuli would need to be active in the memory for at least a few seconds. This brings into the ‘mix’ the concepts of short term memory and working memory, which are bound up with selective attention. Short term memory refers to the ability to actively hold newly presented material awaiting recall. Working memory refers to the ability to manipulate and use the material held in short term memory. Another related concept, but a different aspect of attention is the ease of switch of attention. If short term memory holds onto a piece of information with greater tenacity, then the ability to extinguish the activity in favour of processing new information will be limited. The psychological process that follows short term memory and working memory is that of lasting memories or long term memory. The fundamental process underlying memories that are enduring, are aspects of learning.
In relation to the STQ, I will cover the concepts above, which are conceptually related to ‘attention’, under the following headings:

1. Vigilance/Sustained Attention
2. Speed of Learning
3. Selective Attention/Distractibility/Excessive Association
4. Sensory Overload/Processing Resources
5. Preference for Solitude/Avoidance of Social Activity
6. Short-term Memory
7. Shift of Attention/Long Trains of Thought

### 4.3.7 Vigilance/Sustained Attention

Vigilance or sustained attention is the ability to sustain attentive performance without decline over time. An example from the STQ concerns perceived problems in paying attention for any length of time either to television or people talking. A method used to test this was introduced in 1956 by Rosvold et al still known as the Continuous Performance Test (CPT). The test involved identifying target letters amongst a visually presented sequence of random letters requiring a response via a button push. Originally this was designed for brain damaged patients and later in the mid 1960s identified impairments in schizophrenia patients. Deficits in CPT performance in schizophrenia have been well established over the years.

Essentially the CPT is a signal detection test with several variations of target stimuli with distractors built in. The basic test, where for instance an “X” is to be identified amongst random letters is referred to as CPT-X. In one variation, the target “X” is to be preceded by a letter ”A” referred to generically as CPT-AX. Other versions require detection of an ‘identical pair’ of stimuli in sequence, known as CPT-IP, and yet another contain targets that are ‘degraded stimuli’ for example, by blurring, CPT-DS.

The CPT-X was first used in 1966 by Orzack and Kornetsky where the target ‘X’ was presented amongst letters that were displayed for 0.1 sec every 1.1 sec. Chronic schizophrenia patients, neuroleptic free, were compared with age-matched controls. In the control group only 4% of the target ‘X’’s were missed compared to at least 44% in the schizophrenia group. In another test of CPT-X and CPT-AX (Suwa et al, 2004) performance was assessed in terms of omission error (reduced hit rate) and commission error, reaction time and discriminability. In stabilised states of schizophrenia, acute and subacute psychosis, an excess of omission errors tend to occur, as opposed to an excess of commission errors in active psychosis. Omission errors were found to vary with reaction time indicating difficulty in sustaining attention. Commission errors, in contrast, were more related to thought disorder during acute episodes of schizophrenia. Omission errors are therefore a better indicator of trait abnormality. Deficits of vigilance or sustained attention can be assessed by the decline in performance over the session of any of the CPT variants (CPT-X, CPT-AX, CPT-IP, CPT-DS) compared to normal. In CPT-X performance is impaired, but less consistently than in the CPT-DS version (Nuechterlein, 1994). Across-session decline is often observed in longer sessions of the latter, a clear deficit in vigilance.

The immediate effect of antipsychotic medication is to impair performance in CPT tests but, along with the improvement of psychotic symptoms, there is an improvement of CPT results. The improvements do not restore performance to levels of normal controls, and therefore, there remains a trait abnormality impairment when a patient is stabilised (Nuechterlein, 1992).
Greater impairment is also found in schizophrenia patients where there is a family history of schizophrenia than when there is not.

The basic CPT task is better carried out in normals by the right hemisphere and former performs better than the left when visual stimuli are degraded or shortened in duration. Both conditions worsen the performance in schizophrenia highlighting impairment of functions normally preferred by the right hemisphere. In Miller’s theory this is due to loss of rapidly conducting axons where there is greater-than-normal temporal dispersion of signals arriving at the neurones responsible for detecting stimuli, and therefore less effective temporal convergence. Levels of alertness continually fluctuate - in anyone, regardless of schizophrenia. This affects detection more in schizophrenia than normal because of the lower temporal convergence, so some stimuli are missed. If the same loss of rapidly conducting axons applies to axons interconnecting cell assemblies, sustaining activity in a cell assembly will be more difficult.

4.3.8 Speed of Learning

‘Speed of learning’ is placed here following ‘vigilance/sustained attention’ because the reasoning relating to trait abnormality in schizophrenia is very similar. The term ‘learning’ is broad, and for these purposes, it is necessary to state what it is and what it is not. In terms of the theory it is ‘new memory’ of verbal material (such as word lists) or non-verbal material (such as visual patterns or faces). It refers to ‘rote learning’ rather than what is stored in long-term memory. It also excludes learning via reinforcement by favourable outcome.

Learning could be defined in neural terms as temporal summation at post-synaptic neurons that triggers the (Hebbian) process for synaptic modification. This means that there are neural changes when new information is assimilated. Since learning leads to formation of memory it can be assessed via memory tests. However, there are many processes that influence the final measure of learning or new memory and therefore act as confounds in identifying what is pure rote learning. The factors preceding this final measurement of memory include (i) attention/vigilance at presentation of stimulus; (ii) short term memory (STM), which may occur without enduring synaptic change; (iii) rehearsal in the interval of STM; (iv) organisation of the material at the encoding stage which may be impaired independently of the Hebbian process; (v) retrieval of material from memory, which may be impaired independently of encoding of memory perhaps due to deficient search strategies or impaired vigilance at retrieval; (vi) forgetting, which may reduce memory independent of learning.

Controlling for these confounds permits one to obtain a more accurate measure of learning. These include orientation procedures to compensate for attention/vigilance lapse, distracting procedures to exclude STM and rehearsal contributors, and longer memory lists that are beyond the scope of STM span to ensure that recall is from the long-term store. Impairment in organisation at the encoding stage that set limits on recall can be controlled with the use of simple stimuli. Alternatively, to assess the impact of organisation, comparisons can be made between organisable lists (using semantic categories, for instance) and unorganisable ones. Active recall is aided by organisation to a greater extent than recognition memory (as prompted by cues). Hence cued recall (recognition) is a better indicator of the fundamental processes of learning than active recall (Miller, 2008).

Aleman et al (1999) conducted a meta-analysis of 70 studies using effect size from the pooled results in the various designs. They found a significant and stable association between
schizophrenia and memory impairment in both recall and recognition designs, the latter to a lesser extent. The magnitude of impairment was not affected by age, medication, duration of illness, patient status, severity of psychopathology, or positive symptoms. There was however a small but significant positive correlation to negative symptoms (which more closely resemble trait abnormalities).

The impairment in recognition memory points to a real slowing of learning processes. However, several factors complicate many of the findings on which this conclusion is based. The ability to organise material to aid recall is also impaired in schizophrenia. In two experiments by Culver et al (1986), systematic manipulation of encoding and retrieval was carried out to identify which parts of memory performance is impaired in schizophrenia. An orienting task (for encoding) ensured semantic processing of the target word, followed by free recall. The second experiment then used cued recall. The opportunity to organise material was an aid to free recall in normal subjects but not in schizophrenia. The use of cued recall eliminated the difference. They concluded that encoding was not the problem, as other studies had reported similar results of using cued recall. Encoding had taken place. The ability to organise material is impaired in schizophrenia, this being an attentional issue, separate from any effect on learning per se. This complicates assessing rate of learning, but does not explain away impairments in rate of learning in schizophrenia. Memory impairment has been tested on ultra-high risk individuals for psychosis to identify whether impairments such as these predate the onset of illness and to what extent are predictive of later transition to psychosis (Brewer et al, 2005). In relation to the comparison group, the ultra-high risk group had significant impairment in aspects of visual and verbal learning. Impaired verbal learning was specific to the individuals who developed psychosis in the follow up period. The group that developed psychosis was significantly more impaired than the group that did not on measures of logical memory. These required rapid processing of incoming material and its efficient organisation for accurate recall without cuing. This suggested compromised organisational strategies as seen in schizophrenia itself.

The qualitative effects of memory impairment on executive function in a battery of tests (Nathaniel-James et al, 1996) suggested that the underlying skills are supported by various subsystems which are vulnerable in schizophrenia. The schizophrenia group performed poorly on immediate recall and on several aspects of verbal memory, and had a tendency not to employ semantic encoding/retrieval strategies. However, delayed recall and retrieval were not impaired.

Despite the complications, there does seem to be a genuine impairment in rote learning. The theory behind this is similar to that explaining impairment in target detection and vigilance in schizophrenia in terms of axonal conduction times. The mechanism of learning presumably depends on synaptic modification that occurs in Hebbian cell assemblies. In such synaptic modification, the greater the number of synapses on a neurone that are active at the same time, the more rapid the synaptic modification. In a hemisphere where most connections are rapid, there would be little temporal dispersion of a signal, and a high degree of coincidence of signals on recipient neurones. Hence learning would be rapid. However, in the normal left hemisphere, and as it is proposed in schizophrenia, there are many connections that are slow-conducting due to the relative loss of rapidly conducting axons. Therefore, there would be temporal dispersion of signals arriving at a recipient neurone, and the degree of coincidence would thus be lower with less temporal summation. Such summation is necessary for suprathreshold activation of neurons. Learning by Hebb-like mechanisms could still occur, but would take more repetitions for synaptic modification to occur. In the normal brain there
is some evidence that the right hemisphere learns faster than the left, so that, over a series of trials there may be a “right-to-left” shift in performance measures. One can make the same comparison between normal and schizophrenia. The predicted trait abnormality, in schizophrenia, is that rote learning should occur more slowly than normal, but with sufficient trials, the strength and durability of the memory would not be impaired (Miller, 2008). An everyday example used in the STQ identifies adaptation to new situations and remembering someone’s name on the first occasion of meeting.

4.3.9 Excessive Association, Selective Attention and Distractibility

Abnormalities of association, selective attention and excessive distractibility were salient features of Kraepelin’s dementia praecox in the early 1900s, in Bleuler’s schizophrenia, and continue through to present day understanding. Bleuler considered altered associative functions to be a primary symptom of schizophrenia from which other secondary symptoms arose. Specifically, he highlighted ‘clang’ associations, related by the way a word sounds, and indirect associations mediated by an unspecified link. Rather than random unrelated leaps from one thing to another, associations in schizophrenia are seen as being linked semantically in a way that is more remote or ‘loose’ than in normal speech. However this is explained, abnormalities of association constitute part of the symptom of thought disorder whether it be regarded as part of a state of psychosis or a more enduring trait abnormality.

Excessive association, abnormalities of selective attention and distractibility are placed together here, not only for their philosophical coherence but also for their explanation via the same biological mechanism (Miller, 2008). Ultimately for this study, it is necessary to relate the underlying theory to everyday examples in the STQ that may predict vulnerability of developing schizophrenia.

In essence, if an individual readily makes associations between stimuli, that is, easily sees patterns, then using the same reasoning, such an individual may tend to have difficulty concentrating on one ‘thing’ to the exclusion of everything else. Therefore, that individual would be more easily distracted (by something that may appear to be associated) and less able to attend selectively. McGhie and Chapman (1961, 104) recorded a first-hand account by an individual who is able to perceive his/her own behaviour with some rationality and objectivity. It demonstrates the involuntary interaction between the concepts of excessive association, distractibility and selective attention in schizophrenia:

“Everything seems to grip my attention although I am not particularly interested in anything. I am speaking to you just now but I can hear noises going on next door and in the corridor. I find it difficult to shut these out and it makes it more difficult for me to concentrate on what I am saying to you. Often the silliest little things that are going on seem to interest me. That’s not even true; they don’t interest me but I find myself attending to them and wasting a lot of time this way”.

4.3.9.1 Excessive Association

In the same study (as above) of phenomenological accounts, a patient expresses how associations are made easily from the mundane:
My trouble is that I’ve got too many thoughts. You might think about something, let’s say that ashtray and just think, oh! yes, that’s for putting my cigarette in, but I would think of it and then I would think of a dozen different things connected with it at the same time” (McGhie and Chapman, 1961, 108)

These patients, among others, were described as being in the early stages of schizophrenia. The disturbance in the process of attention was summed up by the authors this way:

“These patients appear to have lost the ability and freedom to direct their attention focally as required in normal concentration. Their attention is instead directed radially in a manner which is determined, not by the individual’s volition but by the diffuse pattern of stimuli existing in the total environmental situation. In effect, what seems to be happening is that the individual finds himself less free to direct his attention at will. Instead, his control of attention is now being increasingly determined for him by concrete changes in the environment” (McGhie and Chapman, 1961, 105)

In the pre-neuroleptic era, abnormalities in association were conceived as a symptom of psychotic thought disorder. The boundary between what was considered to be psychotic, and what was just an exaggeration of normal association within thought processes, was unclear. When anti-psychotic drugs were introduced it was evident that some associational disturbance and thought disorder were limited to psychotic episodes and some features were on-going stable impairments, more related to a trait abnormality.

In an anonymous article published as a first-hand account of someone slipping into a delusional state, the associations made that were part of her thought-disordered state did not differ greatly from the symbolic associations she maintained in a stabilised state. The latter part of the quote arguably may be viewed as an enduring trait abnormality but both appeared to play a constructive role in her daily life.

“When I went to the store, I bought things that symbolically meant something else to me; each fruit, flavour, or color had a meaning that tied in with my delusion. For example, I would not buy Trix cereal, because it was associated with prostitution in my mind, but I bought a lot of Cheerios to make my day happier….. I still have trouble with making up symbols that I compulsively act on to appease my inner needs. For example, when I need to be close to my grandfather, I buy blackberries” (Anonymous, 1990, 548 and 549).

Older methods of testing abnormalities in association revealed consistently excessive susceptibility to hyperactive association. However, it was not until tachistoscopic tests (with apparatus that presents words, pictures, etc. for a measured fraction of a second, used to test various psychological phenomena) in the more modern priming experiments that greater subtlety and detail could be acquired of the abnormality. These methods use stimuli that can be precisely defined in time, allowing understanding of the relation of psychological findings to dynamic brain processes.

Modern priming methods involve two stimuli, one acting as a prime for the second, which is a target, presented close together in time, and requiring a speeded response to the target. The prime may be related or unrelated, the relation usually being semantic in nature, associated according to common usage (e.g. ‘hand’ and ‘glove’) or in terms of meaning (synonyms), or
by category. Word pairs may be used in a categorical or associative way (‘cat’ and ‘dog’), phonologically (e.g. rhyming words), orthographically (e.g. ‘bear’ and ‘beak’), or syntactically (e.g. ‘neither’ and ‘nor’). Some tests may be more indirect, mediated by semantic relations (e.g. ‘lion’ and ‘stripes’). Non-verbal stimuli (e.g. pictures) are also used often as primes in a lexical decision task to target stimuli of words or ‘non-words’. When there is a decrease of reaction time (RT) to a prime that is related to the target word, priming has occurred. However since there is often a trade-off between speed and accuracy, accuracy of decisions may also be recorded so as to not invalidate group differences, assuming that speed varies inversely with accuracy (Miller, 2008).

Priming can also be used in the opposite way, as ‘negative priming’ where a prime word is presented that has to be actively ignored, producing inhibitory effects, and so RT would be expected to increase. Such a prime may be a colour word (e.g. red) presented in another ink colour (e.g. green), and it is the name of the ink colour in which the word is presented (green) that is the target response. As well as ‘negative priming’, experimental methods that produce these inhibitory effects are also known as ‘cognitive inhibition’. Usually related and unrelated words are used as primes, however, ‘neutral’ words (e.g. ‘BLANK’) can be used to compare RT to unrelated words, known as a control prime. These serve to establish a baseline. Priming occurs in relation to a control prime when RT is slower in response to an unrelated word than to a neutral word. Two issues that prove to be crucial in understanding the results of semantic priming experiments are the time difference between onset of prime and target (stimulus onset asynchrony SOA) and the duration of the prime itself.

The literature appears to be inconsistent in demonstrating abnormal associations in schizophrenia, but with the aid of the more modern methodologies outlined above, results have become clearer. There is research to show a greater than normal RT advantage gained from semantically related primes in schizophrenia. In one such study, Manschreck et al (1988) showed a significantly greater gain in the associated prime condition in the ‘thought-disordered schizophrenia group’, in comparison with ‘non-thought disordered schizophrenia group’, ‘unipolar affective group’ and normal controls. This study highlights the issue that thought disorder is a factor to be considered when investigating whether priming is associated with state or trait aspects of schizophrenia, or both. In another study, increased semantic priming effects were found in a lexical decision task using auditory primes with a visual target (cross-modal priming) in schizophrenia (Surguladze et al, 2002). Enhanced semantic priming was also found using word pairs where there was a tendency to process the less common meaning rather than the dominant one. (Moritz et al, 2001a). Increased indirect semantic priming was also found in schizophrenia and particularly in the thought-disordered group, in a related study (Moritz et al, 2001b). However although many studies have made similar findings, some do not find any differences between normal controls and schizophrenia (cited in Table 4.1).

A review by Minzenberg et al, (2002) categorises results for semantic priming in schizophrenia according to two conditions of SOA, which is an important factor in understanding the difference between automatic associative processing and ‘controlled’ or ‘conscious’ processing. They find that semantic priming is variable under automatic processing conditions (short SOA), and more consistent impairment (reduced semantic priming) under controlled conditions (long SOA). They conclude that the latter reflects underlying deficits in attentional or strategic function. A study by Spitzer et al (1993) demonstrates this distinction by varying the delays between the prime and target stimulus (SOA). A lexical decision task was set up involving the recognition of words primed by either
associated, indirectly associated or non-associated words, for schizophrenia and normal groups. Normal control subjects showed no indirect semantic priming effect at an inter-stimulus interval of 0 msec, in contrast to the schizophrenia group who did show a trend towards an effect. However, a clear difference between schizophrenia patients and normal control subjects in indirect semantic priming was detected at the short SOA of 200 msec. This indicated that the effect was caused by fast acting automatic, rather than voluntary (controlled) slow processes. Unlike the direct priming condition in which all three groups showed some degree of priming, the indirect priming condition elicited priming only in the schizophrenia group. The error rate was lower in the indirectly related condition at 0 msec SOA than in the other conditions. The error rate was also about half that of normal subjects in the same condition. However, the RTs for all conditions were longer for schizophrenia. With a longer interval of 500 msec the priming effect was present in both groups. It was concluded that there was a trend towards a larger indirect semantic priming effect in schizophrenia patients as compared to normal subjects but this difference was greater for the interval used for automatic processing.

Another methodological issue is crucial to make sense of the data on association. As outlined in previous sections, the 'critical stimulus duration' for recognising letter stimuli is longer in schizophrenia than normal, and can be explained by the proposition of Miller (2008) that there is a shift towards slower axonal conduction times. Therefore the duration of the priming stimulus needs to be longer (at least 140 msec) for it to be detected and fully encoded. This issue is separate from that of SOA - the delay period between prime and target. The implication here is that comparison of groups is not valid unless all subjects are able to fully encode the priming stimulus. If this were not so, detection of hyperpriming would not be possible.

This is demonstrated well in the Table 4.1 below (from Miller, 2008), summarising 20 semantic priming studies in schizophrenia, listed according to duration of priming stimulus in 3 categories (1) showing semantic priming, (2) a trend to semantic priming and (3) not showing semantic priming. This clearly shows that no hyperpriming in schizophrenia is detected in any study which has presented the priming stimulus less than 140 msec, at which duration trends towards hyperpriming can be detected. For longer presentations, hyperpriming is detected in all except 3 studies, for 2 of which there is a trend.

Table 4.1 Semantic priming in schizophrenia as a function of prime duration (msec).

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<td><strong>Semantic priming in schizophrenia as a function of prime duration (msec)</strong></td>
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<td>Vinogradov et al 1992</td>
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<td>Quelen et al 2005</td>
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<td>Ober et al 1995</td>
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<td>Baving et al 2001</td>
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*Control values for semantic priming from 1995 paper, those for schizophrenia from 1996 paper.
† Mean values (individually determined) for control and schizophrenia groups. Since these values gave 70% correct identification in a forced-choice design, they probably did not represent full encoding of the prime for either group (Miller, 2008, 219).

Although many studies (some already cited) find stronger hyperpriming in thought-disordered patients, one found the opposite result, where there was greater priming compared with controls in non-thought disordered (Besche et al, 1997). It is clear that in schizophrenia associative processes, as evidenced by semantic priming studies, while exacerbated by psychosis, also form part of a trait abnormality. The long-held belief that associations are made more readily in schizophrenia via remote and indirect association is confirmed by modern studies and occurs in both verbal and non-verbal mediums.

### 4.3.9.2 Distractibility and Selective Attention

As outlined previously, there is a close relationship between heightened associative processes and a weakened ability to suppress awareness of irrelevancies. This susceptibility to distraction also translates into an inability to selectively attend. Bleuler writes about the two sides of the abnormality this way:

“On one hand it is evident that the uninterested or autistically encapsulated patients pay very little attention to the outer world. On the other hand, however, it is remarkable how many of the events which the patients seem to ignore are
registered nevertheless. The selectivity which normal attention ordinarily exercises among the sensory impressions can be reduced to zero so that almost everything is recorded that reaches the senses. Thus, the facilitating as well as the inhibiting properties of attention are equally disturbed” (Bleuler, 1911/1950, 68)

Where it is normal for an individual to be distracted at times, it is necessary to be able to suppress attention to a distraction, so as to focus on a selected event, such as being able to ignore a noise or other people in order to listen to someone speaking. In schizophrenia the ability to ignore such distracters is impaired. This process of inhibiting is known as cognitive inhibition, previously outlined. In a personal account, a patient expresses the difficulty in screening out other voices when several people are talking and the personal effects of it:

“If there are three or four people talking at one time I can’t take it in. I would not be able to hear what they were saying properly and I would get the one mixed up with the other. To me it’s just like a babble – a noise that goes right through me” (McGhie and Chapman, 1961, 105-106).

While it may be easy to relate to the dilemma of several people talking at once in the same conversation, this last example outlines the more extreme paralysing effects of simple noises that cannot be ignored, and how debilitating this can be in everyday life:

“I get stuck, almost as if I am paralysed at times. It may only last for a minute or two but it’s a bit frightening. It seems to happen even when something unexpected takes place, especially if there’s a lot of noise that comes on suddenly. Say I am walking across the floor and someone suddenly switches on the wireless, the music seems to stop me in my tracks and sometimes I freeze like that for a minute or two” (McGhie and Chapman, 1961, 106).

These examples show how an irrelevant stimulus has the effect of disturbing on-going information processing. Such a stimulus is usually a sudden one, or one with sudden variations over time, rather than a continuous one. It is most often in the auditory modality (squeaking doors, crackling paper, windows rattling in the wind, conversation, repetitive stimuli, whether regular or irregular). Continuous auditory stimuli do not appear to be so disruptive. Visual stimuli (especially movement in the periphery of vision) or tactile stimuli (sudden touches of one’s body) may have the same effect. Repetitive stimuli (e.g. the sound of a ball being bounced on a pavement) may not be noticed at first, but after a few recurrences may not be able to be ignored becoming increasingly disruptive. The effect is to prevent on-going information processing. This information processing may be either internal (a ‘train of thought’), or external (focus of attention on some other source of stimulation, or actions being performed). The process of disturbance may involve a definite ‘startle response’. The disturbance of attentional focus or the startle response are not proportional to the intensity of the disturbing stimulus. Very quiet sounds against a background of silence may be more disruptive than much louder sounds against a continual ‘hum’ of background noise. After the disturbance, it may take some time to ‘refocus’ attention, and when attention has been refocussed, the vulnerability to disruption is regained if the irrelevant stimulus recurs (i.e. there is no habituation to recurrence of the stimulus; there may even be sensitisation.) The effect may be exacerbated if the stimulus is unexpected (e.g. unexpected touch), or repetitive, or if one’s attention is intensely focussed at the time of the stimulus, or if one is anxious about something. If however, one is relaxed, e.g. day-dreaming without attentional focus, there may, surprisingly, be no effect (e.g. no startle response) (Miller, 2008).
Three items used in the STQ are “Sudden noises make me jump”, “I am very sensitive to noise” and “I am more sensitive to noise when I am trying to concentrate on something else or when I am anxious”.

As in the studies of associative processes using semantic priming, experiments testing distractibility and cognitive inhibition have an older literature on distractibility, and more modern methodologies using what is referred to as ‘negative priming’. Difficulty in suppressing awareness of distracters in schizophrenia has been found in many studies (Cornblatt et al, 1989; Bergman et al, 1995; Serper et al, 1994) but not all.

Negative priming has already been outlined as a method used in association experiments. The Stroop task is used to test distractibility and selective attention, where a prime is to be actively disregarded in order to focus attention on the required information. An example may be an extension of the previous negative priming method outlined, where the ink colour of a colour word (“red”) is the target (green), and this word is followed by a second word in the colour of the previous word to be ignored (red). This condition is compared to a control condition where the ink colour of the second word is unrelated.

The literature again can be conflicting and confusing but due in most part to the same confounds that exist in the experiments of hyperpriming. This is where critical stimulus duration is not always long enough in schizophrenia (about 140 msec) for the prime to be first registered before it can be actively ignored, so as to assess distractibility and the ability to selectively attend.

Before the biological processes underlying excessive association, distractibility and selective attention are outlined, it is appropriate to link the next topic of sensory overload to these three concepts.

4.3.9.3 Sensory Overload

Under the overarching heading of attention, the concepts of vigilance/sustained attention, speed of learning, excessive association, distractibility and selective attention have been discussed. Evidence reveals that the psychological function of attention consists of processing resources that are limited and in competition. In schizophrenia, attempts to focus on one channel of information may be challenged by distractions or interfered with by oversensitivity to associations, thereby diverting attention away, and weakening one’s ability to selectively attend or sustain attention to a chosen stimulus. Such challenges to ‘processing resources’ may be summed up in the concept of sensory overload.

In the STQ, many of the items included under this heading may just as appropriately be in other sections of attention. Items included relate to working in groups, distractions from movement in the side of one’s field of view, to physical contact being overwhelming, light at night, background noises, busy streets, continual company being exhausting, to sensitivity to temperature changes and remembering things when emotionally upset.

Methodologies adopted to investigate processing resources (and sensory overload) in schizophrenia are ‘choice reaction time’, ‘span of apprehension test’ and ‘dual task performance’. Overall results show disproportionately slowed reaction time (RT) when a choice is required. In a choice reaction time experiment, as complexity of choice increases,
RT slows more steeply in schizophrenia than in normal (Williams and Hemsley, 1986). In the span of apprehension test, target letters are presented tachistoscopically in varying letter arrays and speed and accuracy of target detection fall with increasing array sizes. In dual task performance, single tasks and dual tasks can be compared with usual results of one task being favoured by subjects over the other. Span of apprehension test is related to choice RT but performance is measured as accuracy rather than speed of response. Studies which measure performance as a function of array size, develop the test into one that assesses processing resources.

Neuchterlein et al, (1991) investigated information processing in schizophrenia in order to assess whether they fitted into categories of (a) stable vulnerability indicators (b) mediating vulnerability factors or (c) episode indicators. Compared to normal, schizophrenia patients showed a stable level of deficit in detection accuracy on 10-letter arrays (larger arrays) in a forced-choice span of apprehension task. The results remained stable over periods of psychosis through to remission, indicating the deficit in span of apprehension task is mainly an on-going trait (stable vulnerability indicator).

In a dual performance study using a multiple-frame search task, Granholm et al, (1996) found patients with schizophrenia reached the limits of their available processing resources at lower processing loads than controls. They concluded that this was due to reduced resource allocation availability and not due to faulty allocation of resources. They surmise the reasons for reduced resource availability in schizophrenia may result from a:

“failure to mobilize appropriate cortical resources when processing demands increase…. These failures would lead to information overload of cortical resources either from insufficient arousal of cortical resources or wasteful processing of information normally gated at lower brain centers, which would leave fewer cortical resources available for processing task-relevant information.” (Granholm et al, 1996, 18)

4.3.9.4 Psychobiological Explanations for Excessive Association, Distractibility, Selective Attention and Sensory Overload.

A complex interaction has been presented of aspects of attention that essentially are in competition for processing resources, and which, in schizophrenia, culminate in sensory overload. Impairment in associative processes has historically been considered fundamental to schizophrenia, and current evidence upholds this view. The working out of this impairment is revealed in associations being accessed more easily than normal in schizophrenia, and often they access associations which are more remote than those accessed by normal subjects. This has been tested extensively in semantic priming experiments and reveals consistent results as long as the duration of the prime is long enough for full encoding in schizophrenia.

Negative priming experiments, test difficulties in distractibility and cognitive inhibition. The difficulty in suppressing attention to irrelevant material, in the process of cognitive inhibition, provides some evidence of impairment in schizophrenia. Confounds (of failures in ‘priming’ to reach critical stimulus durations necessary for schizophrenia) in tachistoscopic methods, undermine solid conclusions that can be reached as to impairments into cognitive inhibitory processes. However, there is still much evidence that supports the view that there are great limitations in ‘processing resources’ in schizophrenia. The methods outlined that demonstrate
this are the effects on reaction time of tasks of varying complexity, performance on ‘span of apprehension’ tasks and dual task performance.

It is easy to understand how closely related these psychological concepts are, and how they would interact to impact an individual with schizophrenia. The question here is how Miller accounts for these concepts in psychobiological terms and the central hypothesis, of there being ‘a relative absence of rapidly-conducting cortico-cortical axons’. Considering first the concept of association, it is accepted that the cerebral cortex is a complex associative network that has the ability to communicate with itself via a vast number of synaptic connections. This network is dependent upon neuronal firing and changes made in synaptic effectiveness where many synapses converge on each of the billions of cortical pyramidal cells (Miller, 2008). In such a complex system of interactions it is feasible that connections would need to be efficient and rapid.

A fundamental concept of the theory is that of ‘delay lines’. This accounts for differences between left and right functioning in a normal brain, each specialising in processing different psychological material. In the section giving an overview of the theory, differences between left and right specialisations, in a normal brain, have been outlined. If two locations on the cortex were connected by a population of cortico-cortical axons, one could be named the transmitting locus and the other the recipient locus. In any population of axons there is a wide variety of conduction velocities, with more than a ten-fold range. In terms of similar conduction distances, conduction times will vary greatly and this is what Miller refers to as a ‘rich repertoire of delay lines’ between the two loci (Miller, 2008).

A diagram (Figure 4.2) simplifying these differences shows distributions that coincide with hypothetical normal left and right brain conduction velocity ranges. Both distributions are flat represented by rectangles containing the same area and therefore the same number of axons, exaggerated to illustrate the point. The vertical rectangle (A), where the range of conduction times is between 0 and 15 msec, represents a normal right hemisphere distribution. The horizontal rectangle (B), with conduction times ranging from 0 to 100 msec, depicts a distribution closer to the normal left hemisphere, and to either hemisphere in schizophrenia as is theoretically the case according to the central hypothesis (Miller, 2008).
Figure 4.2. Diagram to illustrate exaggerated processes of mental association in schizophrenia. Figure depicts schematised axonal conduction time histograms in a hypothetical cortico-cortical pathway in the normal right hemisphere (A) and either the normal left hemisphere or both hemispheres in schizophrenia (B). Vertical dashed line drawn at 10msec, indicates duration of a single neuronal integration time. Unhatched areas in each rectangle indicate roughly (in area) the amount of suprathreshold activity of post-synaptic neurones, and the consequent rebound inhibition. Oblique hatched areas represent the amount of “subliminal activation” (axons activated, producing only subthreshold activation of post-synaptic neurons). (Miller, 2008)

As illustrated in the diagram by the broken line intersecting the horizontal axis, integration time for a single pyramidal cell is likely to be 10 msec. As in rectangle A, if connections from the transmitting locus are activated, for example, at the same time, and arrive at the recipient loci within 15 msec of one another (which is likely if conduction times are relatively short), the majority of the population of axons (>50%) will contribute to summation and thereby influence the recipient neuron. In rectangle B a smaller proportion (~10%) will summate which means these axons are activated but do not summate with a sufficient number of other axons to make the recipient neurone fire by reaching threshold. This means the information is not transferred to the post-synaptic neurone effectively and becomes what Sherrington referred to as the ‘subliminal fringe’. As far as inhibitory processes are concerned, any suprathreshold activation which is produced postsynaptically will be lessened, since normally, cortical inhibitory interneurons are generated as a result of activity in the neighbouring excitatory principle neurons or pyramidal cells. Since there is greater activation of post-synaptic neurons in distribution A than in distribution B, rebound inhibition will be more intense (in A) and any effect of what is already a small subliminal fringe, will be further suppressed by strong inhibition. In contrast, the greater subliminal fringe of distribution B will also have less reduction by inhibition (Miller, 2008).

It is at this point that the potential for easy associations can be demonstrated. For instance, if a similar occurrence of subthreshold activation of neurons is coming from somewhere else in the cortex and summating with the subliminal activity already outlined, such convergence
would be more effective in the system represented by B with less rebound inhibition. It is succinctly stated by Miller as follows:

“…the relative size of the subliminal fringe, and the paucity of its suppression by rebound inhibition is directly related to the capacity of the network for association between two sources of activity” (Miller, 2008, 226-227).

As Miller’s central hypothesis for schizophrenia states, due to the relative absence of rapidly conducting cortico-cortical axons, the distribution of conduction velocities is best represented by distribution B and so associative processes are likely, in this scenario, to be more easily made with more remote and distant associations than in normal subjects, and in theory also in the left hemisphere in normal subjects.

The success of two subliminal sources summating, creating the experience of a remote association, relies on the assumption that the cortex has to be in a relatively excited state, so that only a few synaptic inputs will bring neuronal membrane potentials to threshold for firing. Miller accounts for an alternative scenario, of when the cortex may not be in a heightened state of arousal yet still needing to ‘process’ subliminal activity (in the absence of normal rebound inhibition) and its effect on trait abnormality. This will be discussed later in the section on ‘Overall levels of stability and mental activity’.

As outlined, strong activation of recipient neurons as in scenario A, where summation of inputs happens mostly within 10-15 msec, is followed by strong inhibition so that any concurrent stimulus will also be suppressed. Psychologically, the subject will not be distracted and is ‘free’ to selectively attend to the next stimulus presented, that reaches threshold for firing. In scenario B, there is less activation with smaller numbers of inputs to each neurone summating due to lack of synchronicity within the critical integration time (due to the ‘rich repertoire of delay lines’ of B). Rebound inhibition will then be weak leaving the subject vulnerable to irrelevant stimuli experienced as distractions, limiting the ability to change focus and selectively attend to new material.

A distinction was made previously between thought disorder that is related to psychosis, and trait aspects of it; and the literature is not clear as to whether hyperpriming is related to just the former, or, also the latter in schizophrenia. However, it is feasible to see how free association may cause thinking to be diverted, and unrelated topics that come into focus via the subliminal process outlined, to derail lines of thought in a network quite separate to psychosis. This will be further discussed in a following section on ‘Production of language: trait aspects of thought disorder’.

In schizophrenia, the theory proposes that a slower-than normal conducting system, as in scenario B, can give a biological account of trait abnormalities of attention covered in this section, including excessive association, selective attention and distractibility, and also culminates in the psychological concept of sensory overload or reduced ‘processing resources’. The latter corresponds to the number of cell assemblies that can be activated simultaneously without interference of one to another. In a rapidly conducting system there will be synchronous inputs with strong activation of member neurons followed by strong rebound inhibition suppressing other assemblies and reducing interference. In a slowly conducting system, activation will be weaker with less rebound inhibition and more interference via associative processes and distractions. This would manifest in a reduced ability to handle a number of concepts at the same time without succumbing to confusion.
It has already been stated that there is much overlap in these sections, and this is likely since they indeed can be accounted for by the same underlying psychobiological theory. This lends weight to the assertion that schizophrenia rather than having traits that are superficially similar but which are fundamentally heterogeneous, appears to be a disorder with different expressions that arise from the same neuronal basis. This also makes a questionnaire based on such traits all the more valid as a potential first screening tool for identifying early signs of vulnerability to schizophrenia.

4.3.10 Impairment in Short-Term/Working Memory

Another impairment in the same class as ‘sensory overload’ is that in short-term memory especially visuo-spatial short term memory (STM). It refers to holding information ‘online’ and available for further processing for periods up to a minute. The term ‘working memory has a similar meaning but with emphasis on the manipulation of information that is actively held. Baddeley (1986) outlined two components in working memory, the ‘phonological loop’, often auditory and dealing well with lists, and the ‘visuo-spatial sketch pad’, which holds spatial patterns of visual material. The ‘phonological loop’ appears not to be impaired in schizophrenia and its functions are preferred by the left hemisphere, in contrast to the apparent impaired workings of holding visuo-spatial material active ‘online’, and functionally preferred by the normal right hemisphere. This impairment is probably not in any sort of memory, but rather in the processing resources available for manipulating what is held ‘online’. Working memory often involves a number of steps which places great demands on processing resources. In working memory tasks, performance declines more steeply than normal in schizophrenia as complexity increases.

The special vulnerability of visuo-spatial working memory in schizophrenia may be explained by the nature of the patterns of information being dealt with. In terms of neural dynamics, the impairment for visuo-spatial STM tasks corresponds to a difficulty in maintaining a cell assembly in activated state when it is no longer directly activated from an external stimulus. This is likely to arise because communication between neurons of an assembly is subject to greater-than-normal temporal dispersion.

4.3.11 Tendency to ‘Long Trains of Thought’ and Problems with Shift of Attention

These traits are placed together because they can be viewed as the ‘flip-sides’ of the same coin. A well documented abnormality in schizophrenia is a tendency to ‘perseverate’, that is, there is a relative difficulty in shifting the ‘set’ or focus of attention. This is demonstrated in the Wisconsin Card Sorting Test (WCST) (Nieuwenstein et al, 2001), the Stroop Test (Henik and Salo, 2004) or the antisaccade test (Fukushima et al, 1988. In the WCST, cards show various designs and can be sorted according to one of several criteria, either by number, colour, shape or design. They are dealt one by one by the experimenter, and it is the task of the subject to sort them, with the experimenter indicating just whether or not each decision was correct. The subject works out from these responses which is the current criterion for sorting. When the criterion changes the subject’s task is to recognise and identify the change. The tendency of ‘persistence to set’ is an aspect of impairment in schizophrenia. Similarly, in the Stroop test, outlined previously, the difficulty in suppressing the dominant tendency to read a colour word rather than naming the ink colour is tested, and there is impairment in this
in schizophrenia. In the antisaccade task subjects are required to suppress a dominant tendency to produce a saccadic eye movement towards an object coming off-centre in the visual field. The task is to produce an eye movement away from the object, and reflects ability to switch attention, this being impaired in schizophrenia, an impairment which is not a side-effect of medication.

The explanation proposed by Miller (2008) of the difficulty in shifting attention (and the complementary tendency to “long trains of thought”) is illustrated in Figure 4.3. This shows the excitatory interactions between cell assemblies of a normal brain (right hemisphere), and in the schizophrenia brain in low activation (‘downstate’), and high activation (‘upstate’). The high activation state shows sequences of persisting activity, corresponding subjectively to long trains of thought, and to perseveration in experiments designed to assess shift of attention. The normal right hemisphere can be said to have low ‘inertia’ (easily activated) and low ‘momentum’ (easily brought back to resting state from an active state). In schizophrenia however, the hemispheres can be said to have high inertia and momentum (slow to activate, but once activated with a tendency to continued reverberatory activity, and not easily restrained).

In the EASE study (Parnas et al, 2005) referred to in more detail in the ‘Sense of Self’ section (4.3.15), various aspects of anomalous self-experience are investigated for a questionnaire. One domain corresponds specifically to ‘long trains of thought’ under the name “Ruminations-Obsessions” referring to “obsessive-like mental states… apparently not motivated by perplexity, paranoid attitude, or sense of vulnerability or inferiority” (Parnas et al, 2005, 241). The tendency to ‘long trains of thought’ is potentially a strength in schizophrenia, and is the ability to stay with a thought and ruminate as this name suggests. While it can be unproductively obsessive when focused on trivial matters, it can also potentially be the mechanism of invention, creativity and the developing of complex and useful ideas.
Figure 4.3 Diagram to illustrate two dynamic regimes of cortical activity in schizophrenia (dominated respectively by negative symptoms and slowness to activate or symptoms of disorganization and sustained reverberation of activity). Sequences of activity are depicted in cortical networks following a brief stimulus (hypothetical latencies given to left, msec). The single locus of activation at 0 msec (green circles) is shown in the upper three brains. After this, evolution of activity occurs differently in three circumstances: Left: Normal brain: rapid spread of activity to secondary loci (5 msec), with rapid onset of rebound inhibition (red circles at 20 msec); Centre: Schizophrenia in low-activation conditions. It is assumed that membrane potential in member neurons is far negative of threshold (i.e. the “down-state” prevails), so that convergent activation of any afferent synapses is needed to fire them. Potential spread of initial activity to secondary loci (5-50 msec) fails, due to temporal dispersion of signals; Right: Schizophrenia in high-activation conditions above. It is assumed that membrane potential is close to firing threshold (the “up-state” prevails), so that little convergence is needed to fire neurons. Spread of activity to secondary loci occurs easily, but non-synchronously. Rebound inhibition (red circles) occurs weakly and non-synchronously. Continued reverberation of activity may occur Insets indicate differences in temporal convergence in the three scenarios: (Horizontal axes: time, with time of stimulus onset shown as arrows; Vertical axes: membrane potential, with firing threshold shown as dashed horizontal lines) Left: Strong convergence within a short interval (normal); Centre: Ineffective convergence in low activation conditions, due to temporal dispersion of signals; Right: Strong convergence when high activation in sustained, which can overcome temporal dispersion. (Miller, 2008, p324)
4.3.12 Preference for Solitude: Avoidance of Social Activity

This section includes items in the STQ that are an obvious consequence of tendencies to sensory overload, and the need to mentally process alone and without interference and distraction. In a clinical example from a subject with early signs of schizophrenia, it is a reminder of just how distracting movement and noise is, such as would cause an individual experiencing such interference to seek solitude and avoid social interactions,

I am easily put off by what I am doing or even what I am talking about. If something else is going on somewhere, even just a noise, it interrupts my thoughts and they get lost. If I am somewhere where there is a lot going on I am swinging from one thing to another instead of concentrating on one thing and getting it done (McGhie and Chapman, 1961, 105).

Four items were included in this section, two are reversed to counter habituation.
1. I like time with my own thoughts
2. I would prefer to live alone
3. I do not like solitude (reversed)
4. I prefer to work with other people (reversed).

4.3.13 Overall Stability of Mental Processes

The overall level of stability of mental processes is fundamental to previous sections describing psychological trait abnormalities in schizophrenia. In other words, the trait abnormalities that have been outlined are envisaged to arise from either the ‘upstate’ or ‘downstate’ of the cortex, as these states are expressed in the brains typical of schizophrenia. In a normal cortex, single unit studies, in vivo, have shown that principle cells of the cortex can operate in a ‘downstate’ when membrane potential is far negative of firing threshold, or in an ‘upstate’ when membrane potential is poised not far below threshold (see for instance Timofeev et al., 2001). A neural network, or hemisphere interconnected by rapidly-conducting connections can be set into a state of vigorous activity quickly by phasic stimuli, because the activity produced by the stimuli will easily synchronize as it converges in single neurones, so they can be activated above threshold for firing. In contrast, a network or hemisphere connected together by slowly-conducting connections requires more prolonged stimuli to be set into a state of vigorous activity, because eventual activity produced will not synchronize immediately, and most activity will form a reservoir of subthreshold excitation (i.e. impulses in axons, but subthreshold for neuronal activation). Suprathreshold activation will occur only when a stimulus, or barrage of different stimuli, have been activating the hemispheres for some time. In this situation, neural activity is accumulated progressively over the extended stimulus, until a relatively high proportion of neurones in a population are active. Then, synchronous activity can be generated, even though activity from any one transmitting source is dispersed temporally (Miller, 2008).

It is envisaged that the right hemisphere in the normal brain typically displays the first sort of activation. The left hemisphere displays the second style of activation. With the two hemispheres working together, the forebrain as a whole has a versatile and balanced response to a wide variety of stimulus types. Its right hemisphere can respond quickly, and switch off quickly afterwards. The left hemisphere develops its responses more slowly, and switches them off more slowly afterwards. The two hemispheres are of course connected. Thus, with
regard to the forebrain as a whole, excess momentary activity of the right hemisphere does not affect the left hemisphere much, because of its greater ‘inertia’; the potential of the left hemisphere for prolonged chaining of activity, when stimuli are prolonged, is rarely realised in practice, because, the right hemisphere, with quick response, and quick rebound-inhibition does not reciprocate the progressive build up of activity in the left hemisphere. Nevertheless, the asymmetry of normal brain function is evident in the fact that the right hemisphere (especially the parietal lobe) generally has a better capacity for sustained attention (vigilance) than the left, e.g. for detection of phasic stimuli.

As proposed by Miller (2008), in schizophrenia, as an enduring trait, there is not such a nice balance between the two dynamic regimes. Both hemispheres tend to have the dynamics of the normal left hemisphere. As a result, without the ‘quick on’, ‘quick off’ characteristics of the normal right hemisphere under many circumstances, brain function as a whole is dominated by the ‘inertia’ typical of the normal left hemisphere. The resulting symptoms are the impairments already outlined such as, difficulty in sustaining attention, impairments in gestalt perception, difficulty with motor control by sensory guidance, impairments in visuospatial short term memory, rote learning, difficulty in arousal (perhaps especially early in the day), difficulty in working to full capacity for a full day. On the other hand, once aroused, the brain with ‘two left hemispheres’ has considerable ‘momentum’, so that people can produce prodigious works of creativity, cannot rest, and do not sleep at night without sedation, because of a vigorously active mind. The three main trait abnormalities associated with the ‘upstate’ are the excessive ease of mental association, the difficulty in ‘shutting out’ distracting stimuli and the reduction in ‘processing resources’ outlined in more detailed earlier.

The items contained in the STQ for this section associating the ‘upstate’ and ‘downstate’ with everyday activities refer to energy levels in the day, difficulty in keeping up a full day’s work, ‘things leaving a big impression’, laying awake at night with an active mind, difficulty waking up, getting downhearted or excited about life, difficulty working normally in the early part of the day, and waiting to make decisions until one is in a good mood.

4.3.14 Language and Thought

This section moves further from the fundamental assumptions of the theory upon which this work is based. However it is descriptively important for understanding traits associated with language. Language is complex and each hemisphere is engaged in both comprehension and production of language. Language includes not only representation of meaning via syllables and words but also the motor aspects of production, whether spoken or written. It includes grammar, and its subset syntax which covers word endings, number designation, gender, tense, use of conjunctions, articles and prepositions and word order for meaning. Grammar also includes sentence construction with embedding of clauses. Language includes semantics or meanings of actual words, phrases, sentences and paragraphs. For language to reach its target audience, it must communicate by being delivered in such a way that takes into account the knowledge base and mental capabilities of the listener, with awareness of what has already been said, and understanding reciprocal ‘turn-taking’, as in a conversation (Miller, 2008).

4.3.14.1 Comprehension of Incoming Language

The complexities of language make it difficult to reach clear and conclusive understanding of which component is impaired in schizophrenia. For the STQ, this section will concentrate on two areas of language that can be explained by the theory corresponding to normal left and
right hemisphere processing, one of which is consistently impaired in schizophrenia. On the one hand, grammar and syntax rely on precise sequencing of speech sounds on a fine time scale. Semantics, on the other hand, deals with slower change and meaningful relationship between sentences, paragraphs and topics. Various methods are used to explore whether deficiencies in understanding come from inadequacies in identifying syntactic and grammatical devices or in grasping meaning. Sometimes it is difficult to distinguish whether deficits as a result of syntactic complexity is due to impairment in representation of syntax itself or the semantic implications contained in the syntactic structure.

Various methodologies have been used to test awareness of syntactic structure separate from semantic understanding. One such design uses sentences presented in such a way as to test awareness of syntactic structure, by locating auditory clicks in relation to clause breaks. Another uses target words placed at the end or beginning of embedded clauses, presented in such a way as to test syntactic boundaries, assessed separately from understanding the sentence. These designs are based on the assumption that humans can normally handle a discrete number of items (the magical number of 7±2) and therefore tend to ‘chunk’ items together as one item, in order to increase memory capacity. In reading or listening to verbal material words are processed in segments corresponding to syntactic structure. Consistently these experiments show no specific impairment in schizophrenia in representing syntactic structure, despite some general impairment (Carpenter, 1976, Grove and Andreasen, 1985).

This changes when semantic understanding is introduced into the design. Condray et al, (1995) evaluated language comprehension in relation to medication use and clinical state (positive and negative symptoms, and mood states). The Luria-Nebraska language comprehension scale was used, measuring understanding of logical relationships expressed through syntactic connectives, word order and inter-clausal relations. Grammatical constructions included comparatives, and inverted and complex embedded sentences. The example given is “The woman who worked at the store came to the school where Mary studied to give a talk. Tell me, who gave the talk? (Pause for response) Tell me. What was Mary doing?” The response measure used was number of errors made. The results found that language performance in schizophrenia patients did not differ between medication conditions, was not associated with haloperidol dose, and was also independent of positive symptoms, mood symptoms and clinical course. Accuracy was not associated with intelligence level or education. However, comprehension was associated with negative symptoms. The experiment provided information about the stability of language capacity across state changes and that impairment was a trait resistant to the effects of state, antipsychotic medications and symptoms of psychosis. Although there appears to be no fundamental impairment in decoding syntax in schizophrenia, there may be an overload of working memory when syntactically complex sentences are not well comprehended.

Other approaches that do not rely on complex syntax to test semantic understanding are found in tests of awareness of meaning in various types of word strings. Generally, the sentences that are more meaningful and have better syntactic organisation, elicit better performance in all participants, but normal subjects take better advantage of it than do schizophrenia subjects. Specific types of meaning that have been tested are distinctions between concrete and abstract words or phrases, metaphorical and literal, direct and inferential statements, or in the appreciation of jokes.

In a study by Brownell et al (1984) subjects were presented with sets of three words that were grouped either in terms of their denotation (‘cold and warm’ both referring literally to
temperature), or in terms of their connotation as metaphorical equivalents (‘cold and warm’ connoting remoteness and intimacy, respectively). The subjects used were either left- or right-hemisphere damaged patients, assessed on whether either facet of meaning was favoured by one or the other hemisphere. Each subject was asked which two of each three-word set were the closest in meaning. Right hemisphere damaged patients were more sensitive to denotation (especially antonyms) and selectively insensitive to connotative meanings. In contrast, left hemisphere damaged patients relied on connotative relations (especially metaphorical equivalents) and had a selective insensitivity to denotative aspects of meanings. Normal controls made use of both strategies. There is particular impairment in schizophrenia in comprehending metaphor (Stuss et al, 1983) which corresponds to Brownell’s right hemisphere damaged patients.

In a case study example, a woman who developed schizophrenia at the age of thirty, developed as her major symptom, a difficulty in deriving inferential meanings in everyday life, by failing to interpret speech according to its situational context. For example, a statement cited of her husband asking “Where are my slippers?” implied an instruction for her to bring the slippers to her husband, instead she would answer literally, their whereabouts (Peters, 1973).

Appreciating a joke is another level of abstracting meaning that is impaired in schizophrenia. In a study by Marjoram (2005), the ‘theory of mind’ is the paradigm used to understand what may be happening in schizophrenia. It describes the ability to represent mental states, one’s own and/or others by recognising that we and other people have minds that contain beliefs and intentions, and the study tests the ability to interpret these correctly. In the study a visual joke is presented where subjects are asked to describe two types of cartoon images of either a purely physical nature or one requiring inferences of mental states for interpretation, and to grade them according to difficulty and humour. The study showed that individuals with schizophrenia who also have a normal IQ had poorer understanding of both types of jokes, (and a reduced ability to relay their humorous intent) compared with matched controls. The difference between the physical jokes and those in the theory of mind paradigm was significantly greater for schizophrenia patients than controls, implying that the impairment may be in representing mental states (a type of perceptive gestalt) rather than a general difficulty with appreciation of humour.

A summary of some of the research in schizophrenia (and from patients with right and left hemisphere damage), in comprehension of incoming language shows that the impairment is not in syntactic understanding but in the assimilation of semantic organisation in word strings, sentences and longer passages, and in deeper processing to interpret inference and metaphor. Recognising the exact temporal structure of spoken language is normally a function of the left rather than the right hemisphere. In schizophrenia there is no deficit in this. However, grasping the actual meaning conveyed by phrases, sentences and paragraphs is normally a function of the right hemisphere. Thus, it is right rather than left hemisphere lesions which lead to impairment in understanding jokes, metaphors, or indirect inferences. On the surface, some of this evidence may appear to be contradictory to the previous section on hyper-priming in schizophrenia, where awareness of associations is supernormal rather than impaired. The difference is in the ease with which associations are made to a word without the need to make reference to a context. When a broader semantic context is required such as in the sets of three words (Brownell et al, 1984) or as in comprehending inference or metaphor, the process looks more like gestalt perception, since semantic content of speech involves configurations of information without temporal structure, all of whose components are
available at once. Comprehension of sentences and paragraphs can be regarded as involving a sequence of such ‘semantic gestalts’ which is much more slow-moving than the exact phonetic structure represented in the left hemisphere. In schizophrenia, the deficit is somewhat similar to that of patients with right hemisphere lesions, an inability to grasp the gist of utterances, especially the longer ones (sentences, connected paragraphs), including grasping a metaphor, joke or indirect inference. The impairment may be less severe for written than for spoken language, because intake of information can occur at the speed allowed by the reader, whereas in spoken language it is at the speed necessary for fluent speech (Miller, 2008). Evidence showed that the impairment in comprehension of incoming language did not change over the clinical course through admission to stabilisation, and is considered to be an enduring trait (Condray et al, 1995).

A more complex neurobiological outline of language input and language output in terms of the theory will appear after the following section on ‘Production of Language: Subjective Experience of Trait Aspects of Thought Disorder’. Briefly, if comprehension of semantic aspects of extended speech involves the deployment of representations of a series of semantic gestalts, it should be mediated by neural networks, and hemispheres connected by relatively rapid-conducting axons – hypothetically those of the normal right hemisphere. The replacement of such axons by slowly conducting ones, as hypothetically occurs in schizophrenia, would account for the difficulty in semantic aspects of language.

The following quotation is an example of a recently admitted patient expressing understanding of language structure by knowing when it is appropriate to respond yet having difficulty understanding the meaning of the words spoken to them:

When people are talking I have to think what the words mean. You see, there is an interval instead of a spontaneous response. I have to think about it and it takes time. I have to pay all my attention to people when they are speaking or I get all mixed up and don’t understand them (McGhie and Chapman, 1961).

Some of the items in the STQ from this section refer to difficulty in understanding what people are really trying to say, or finding it difficult when people only suggest or imply their meaning rather than saying something directly. Also included are items with reference to taking part in debates, following the plot in a film or play and about getting the point of a joke.

4.3.14.2 Production of Language: Subjective Experience of Trait Aspects of Thought Disorder

Disturbances in the production of language and their underlying thought structures have long been known as characteristic of schizophrenia since the time of Kraepelin’s ‘dementia praecox’. Influenced by the early German neurologist Wernicke, Kraepelin believed that although schizophrenia was similar to sensory (receptive) aphasia as a disturbance of the temporal lobe, it was more complicated (Kraepelin, 1919/1971). In 1908, Bleuler (1911/1950) characterised associative disorder as a basic symptom of schizophrenia. He believed the deficit in language production was more indicative of an underlying disturbance in thought processes. The associations which direct thoughts lose their connections in schizophrenia, so the ideas being expressed become unclear. In a review of studies by Maher (1972), it was concluded that less advantage is made in schizophrenia of redundant language such as repetition and pausing (both semantically and syntactically) than in normal subjects but the
deficits were mainly errors in semantics. Individuals with schizophrenia tend to use limited vocabulary and frequently repeat the same words with the same number of syllables in passages of utterance. The problem is in a tendency of words already uttered to intrude into the utterance again, suggesting an associational or attentional dysfunction rather than a limited vocabulary. Other research methods were being developed, which began to quantify uttered speech of schizophrenia patients, measuring speed of reading aloud (generally slower), percentage of nouns, verbs and adverbs, mean word length, verbosity, speech rate, repetitiveness of word use and so on. Issues that have been factored into most of the older literature are the deleterious effects of long term institutionalisation on language function and the interference of early onset illness on full development of language capacity (Miller, 2008).

More recent studies have revisited the relationship between aphasia and schizophrenia. Rausch et al (1980) compared the ability to apply linguistic rules in a word-ordering task of a group with aphasia, two groups with schizophrenia, (one acute, and one stabilised with predominantly negative symptoms) and a normal group. The subjects with aphasia could be distinguished from both schizophrenia and normal groups by the time taken to complete the tasks and the number and type of errors. There was no distinction between schizophrenia groups, nor were there any differences between them and the normal group on all measures except one (in the number of errors in rearranging sentences involving both direct and indirect objects). Syntactic disorder is clearly a trait of aphasia and not of schizophrenia.

A discussion similar to that in the previous section on comprehension of language, about syntax versus semantics, can be made here. Is the disturbance in speech derived from a problem in sentence construction from a syntactical and grammatical standpoint separate from its meaning, or are the underlying representations of meaning or semantics the problem, which then leads to sentence construction being compromised? In addition, are the difficulties in producing language connected to thought disorder, as documented in the clinic, as a trait?

Evidence of semantic dysfunction and the relationship to thought disorder in speech in schizophrenia is documented in a study by Rochester et al (1977). The researchers sought to identify specific elements of language from the listener’s point of view that cause lay judges to assess the spoken language to be thought-disordered or not. Results showed that clinically diagnosed thought-disordered speech can reliably be distinguished from samples of both non thought-disordered and normal utterances on the basis of a) lay judges’ evaluations of coherence in transcripts and b) linguistic variables measuring coherence. The linguistic measures which best predict judges’ evaluations indicate that in thought-disordered samples, the speaker makes the listener’s task difficult a) by asking the listener to search for information which is not clearly given and b) by providing relatively few conjunctive links between clauses.

Such links between and within clauses tie together independent ideas in discourse via pronouns, use of conjunctions (e.g. ‘and’ ‘but’) to connect clauses, and lexical ties (e.g. synonyms or similar root word). These links help to make speech cohesive and rely on the processing capacity of working memory, which as outlined before is limited in schizophrenia. The use of cohesive ties also develops from experience of learning to put oneself in the place of the listener, using cohesive links to make the listener’s task easier. This involves remembering what has been uttered recently and awareness of the knowledge base of the listener (Miller, 2008).
In addition to a lack of use of conjunctive words in thought-disordered schizophrenia in the Rochester et al study, the authors also found a preponderance of implicit references within sentences that left the listener searching for the referent. Examples given of implicit references are: A donkey was crossing “the other river.” “A commuter and a skier are on a ski lift and “he” looks completely unconcerned”. The use of these ambiguous references distinguished thought-disordered patients from non thought-disordered ones, who were similar to normal controls.

While this study clearly showed the connection of semantic problems in thought-disordered schizophrenia discernible from a listener’s point of view, the authors of the study also clearly pointed out that the patients were not incoherent, suggesting that the thought-disordered patients displayed trait characteristics of thought disorder. In their words:

“...In conjunction with these findings, two corollary points should be mentioned. First, it is important to note that the thought-disordered speakers we studied were not, in general, incoherent ... Certainly it is not true that the schizophrenic [sic] speakers, as a whole, were incoherent. Much to the contrary, the acute schizophrenic [sic] speakers in this study produced essentially adequate discourse ... half the schizophrenic [sic] samples (from speakers with no clear signs of clinical thought disorder) are almost indistinguishable from the samples of normal controls. Furthermore, even those utterances which were singled out as being thought-disordered by our psychiatric judges were still not generally incoherent ... The fact that schizophrenic [sic] subjects, even those who are thought disordered, are essentially adequate communicators should not be overlooked” (Rochester, et al 1977, 108-109).

Studies investigating various aspects of pauses in speech in schizophrenia have investigated such aspects as fluency in words with low predictability and the effects of words in and out of context on pauses. However, the finding of increased number of between-clause rather than within-clause pausing reflects the problem to be in semantic processing rather than syntax. Many studies have been performed to support both sides of the argument. The methods used are diverse and the issues complicated in separating syntax from semantics. The studies summarised, show convincing evidence that not only is the problem primarily one of semantics that impacts secondarily on syntax, but also that the trait of thought disorder can be subjectively identified by individuals who experience it, as suggested in the following case study. An extension of the recorded experiences of a newly diagnosed patient, partially quoted earlier, shows the subjective understanding of such difficulties of both incoming language, and the thought processes associated with outgoing language in the following quote:

When people are talking I have to think what the words mean. You see, there is an interval instead of a spontaneous response. I have to think about it and it takes time ... My responses are too slow. Things happen too quickly. There’s too much to take in and I try to take in everything. Things happen but I don’t respond ... (McGhie and Chapman, 1961, 105 and 106).

For the purposes of this thesis it is necessary only to outline the flow of the reasoning that justifies these sections on language to be included in the theory on which this questionnaire is based. The issues and justifications are more fully discussed in Miller (2008). Suffice it to say, this section is one of the several already outlined which form part of the underlying
proposed ‘big picture’: Relatively slower axonal conduction in the cortico-cortical system applying mainly to the right hemisphere can account for almost all the sections used in the questionnaire. Some sections can be accounted for quite directly, (sections on attention vigilance, speed of learning, excessive association, selective attention and distractibility) while others take a more circuitous route.

4.3.14.3 Psychobiological Explanations for Trait Aspects Comprehension and Production of Language (Trait Aspects of Thought Disorder)

The conclusion reached here is that the semantic disorganisation in comprehension and production of language is the primary problem, and it is common to both processes, from which syntactical disruption may also occur. The central premise for the theory used here is that the normal left hemisphere has relatively slower axonal conduction than the right. This gives the left hemisphere an advantage in dealing with exact sequences of information in language. The processing of sounds such as phonemes occur as temporal chains of information (progressively spoken over intervals corresponding to short term memory) with fine temporal structure resolved within up to 100 msec. STM in general is considered to deal with information over tens of seconds. Temporal structure of phonemes can be distinguished on a much finer time scale - down to at least 10 msec, although we cannot consciously report the sequence on this scale. This system of processing corresponds to Abele’s ‘synfire chains’, outlined earlier, specialised for representing exact timing of sensory information. In contrast, right hemisphere processing normally represents information without temporal structure, with potentially denser and more rapidly-integrated information which is actively held over short-term memory intervals with slower change over seconds. Such processing of highly integrated inputs (a form of gestalt) can be represented by sequential activation of a set of Hebbian cell assembly configurations (Miller 2008).

In both comprehension and production of language there is normally a precise coordination of these two processes corresponding to functions of the left and right hemisphere. As incoming language is heard syllable by syllable and word by word, with their syntax and grammar the focus is on precise and detailed timing within a phrase and then a sentence, by the left hemisphere. The right hemisphere holds these phrases and sentences that make up a paragraph in order to decipher meaning over the slower moving information blocks. This applies to interpreting meaning from incoming language that makes up each ‘idea’. Such meaning is accumulated when speech unfolds into what is referred to as a ‘semantic Gestalt’ essential for interpreting metaphors, jokes or inferences. At this level there is no temporal structure or need for awareness of syntactical relationships between words with incoming speech (Miller, 2008).

In planning outgoing language, a synergy between precise temporal structure and longer term semantic planning must be coordinated in order for fluent and meaningful speech to be produced. As demonstrated, in schizophrenia there are clear difficulties in semantic structure underlying extended and detailed speech which correlates clinically with thought disorder. The disturbance of deep semantic structure in both language comprehension and production supports the underlying assumptions of the theory, on which the questionnaire is based, a primary impairment being in right hemisphere functioning.

In the section on sensory overload it was seen that ‘processing resources’ are reduced in schizophrenia. In terms of the theory, for optimal right-hemisphere-type function, a high degree of synchrony, with prolific summation of signals is required, to fire neurones, with
rapid rebound inhibition to bring the system back to rest. This enables rapid response to new stimuli and an ability to maintain equilibrium, the system being ready to respond equally rapidly again, and to keep discrete focus on each stimulus (or to hold pieces of information separate). It is proposed, that, in schizophrenia, this system in the right hemisphere is impaired, axonal conduction being less rapid than normal, hindering the process of summation, restricting firing, decreasing rebound inhibition, reducing the likelihood of equilibrium and increasing a subliminal fringe (of unresolved stimuli) for any focus of activation. There is then greater difficulty in maintaining foci separately due to co-active assemblies tending to merge. This will impact on working memory where ‘pieces of information’ are not held discreetly for later manipulation in both the left (for syntax) and right hemisphere (for semantic representation).

Figure 4.4 shows in diagrammatic form, the suggested scenario of slower than normal axonal conduction in the right hemisphere in schizophrenia in contrast to normal. The consequences of poor organisation of blocks of meaning impacts on left hemisphere organisation of the practical (i.e. phonetic and syntactic) aspects of speech to cause syntactical fragmentation. This reveals thought disorder as a result of poor organisation of ideas, as a trait abnormality rather than how it manifests itself in active psychosis.

Items used in the STQ for ‘production of language/subjective experience of trait aspects of thought disorder’ refer to getting tongue-tied or not saying the things one would want to, not being able to make sentences as fast as one would need to, getting mixed up in speech when embarrassed to spending a long time planning what one would want to say.

Figure 4.4. Contributions of right and left hemispheres to planning and execution of emitted speech, in normal subjects (left) and schizophrenia patients subject to thought disorder (right). In the former, an organized sequence of “semantic Gestalts” in the right hemisphere coordinates the program for detailed syntactic and phonetic execution of the utterance in the left hemisphere. In schizophrenia, the right hemisphere sequence is poorly organized, so that coordination of the detailed execution fails, although fragmentary segments of the detailed execution may be uttered (Miller 2008, p316).
4.3.15. Sense of Self – Ego Strength

This section brings together previous investigation by the author\(^7\) in sense of self in schizophrenia, extending the analysis to include the theory of trait abnormalities. Included in the argument are clinical neuroscience case studies where changes in sense of self are linked to right hemisphere brain trauma. Finally further clarity is brought to the understanding of the split in sense of self in schizophrenia with the combination of a psycho/philosophical analysis with concepts of cerebral asymmetry.

A sense of oneself is inherent in language in the very use of ‘I’ and ‘me’ and even ‘you’ and ‘he/she’ which is unavoidable in western languages. Some spiritual/philosophical traditions refute that there is even any such entity as a ‘self’. In philosophy, the ‘search for self’ has long been a source for intricate philosophical argument in the western traditions of Germany, France and England in particular. Developmentally and socially, psychologists have sought to define and explain its genesis. In schizophrenia, the very term means “a fragmentation of the mind or the self”. The most directly applicable dysfunctions are passivity symptoms emphasised by Kurt Schneider which refer to being a passive recipient rather than agent of control of one’s thoughts, actions and words. The experience of psychosis itself challenges to the core one’s very sense of trust in any previously held beliefs and therefore sense of oneself. It is thus the very processes that work together to produce a sense of being a unified person, which are compromised in schizophrenia. In this section, a cross-section of studies will be covered, including a social/developmental psychological view of the acquiring of a sense of self, and a part of the author’s previous study on the relationship of the ‘I’ and the ‘me’ to the self in schizophrenia (Smith, 1998) and how this correlates with a diagnostic tool (Parnas et al., 2005), developed in the EASE study (Examination of Anomalous Self-Experience). Also included are a review of neuroimaging studies of the self (Decety and Chaminade, 2003), the current neuroscience findings in loss of self in dementia (B.L. Miller et al, 2001), and R. Miller’s (2008) theory on schizophrenia and self in relation to axonal conduction. For the purposes of the STQ, a more operationalised correlate of sense of self is adopted of ‘ego strength’ as a more easily ‘measured’ term describing the strength required in a demanding or testing moment as a trait abnormality and marker for potentially developing schizophrenia.

George Herbert Mead, a social psychologist early last century posthumously published a highly influential book defining a socially acquired self, *Mind, Self and Society* (1934). Mead saw the self as developing through social experience and activity rather than being present at birth. His approach to the self known as Symbolic Interactionism describes how human social interaction is effected through the exchange of symbols. Writers, such as Martin Skinner have used Mead’s theory to explain schizophrenia and the self. According to Skinner, the three important concepts in Mead’s discussion of self-consciousness are the significant symbol and its genesis, social objects and social acts. A significant symbol, for Mead in Skinner’s terms is:

> “an action or event with a shared meaning so that it produces a similar conventional response in the organism producing it and the onlooker” (Skinner, 1986, 92).

In other words, through the process of the ‘taking on’ of another’s attitude in relation to an event, the shared experience is encapsulated into a meaningful symbol that elicits what

\(^7\) The author = Ball, née Smith, hence previous work referred to is, Smith (1998).
becomes a normalised response. In the same way, social objects and acts have no meaning until they are validated by a consensus of meaning by other people.

Selfhood does not develop in a vacuum in Mead’s terms. One becomes a significant self through relationship with other selves. This self forms through the process of meaningful acts and symbols which we internalise from the collective actions of others by viewing ourselves as an object like objects in the outside world. The “self implies that one acts towards oneself as an object: one knows oneself, one praises and blames oneself” (Skinner, 1986, 94). Acquisition of the self is not through direct sensing, but through a series of symbolic internalisations of social acts. Skinner puts it this way:

“Just as one internalizes the meanings of other significant objects, so one internalizes those pertaining to oneself. Signification of an object gives it an experiential existence beyond that directly sensed. Thus the signification of one’s material being allows it to be experienced in its entirety: not merely as experienced through the senses. The self then is made an object in the same way as other objects are: through the definition of others” (Skinner, 1986, 94).

In a review of studies ranging from developmental psychology to cognitive neuroscience and clinical neuropsychology, Decety and Chaminade (2003) confirm this view that sense of self emerges from the activity of the brain in interaction with other selves and that self-other connectedness is underpinned by a network of shared representations in the brain that enables the self to represent the other, project thoughts and feelings to the other, feel sympathy for the other, and may also account for psychological identification with others.

The process of the self objectifying itself is a rational process. Self consciousness is therefore linked with rationality, according to Mead. He reasons that to be rational about oneself, one must be able to be objective about oneself. This objectivity is achieved by seeing oneself from outside as an object, by the cues we pick up from others which indicate how we are being perceived by the ‘generalized other’. Without this, he says, one might have consciousness, but not necessarily self-consciousness. Mead says, “consciousness [is] answering to certain experiences such as those of pain or pleasure, [and] self-consciousness refer[s] to a recognition or appearance of a self as an object” (Mead, 1934, 169). Therefore, a self’s reaction to a sensation elicits mere consciousness, but once the self can observe or ‘know’ that it has reacted, then it can be said that it has self-consciousness.

Mead’s maintenance of selfhood, is dependent on the concept of ‘reflexivity’, the process by which the self is able to become an object to itself, and thereby see itself as a whole. This follows on from the concepts of the generalised other (the ‘me’) and the internalisation and reorganising of the generalised other (the ‘I’). In other words, it involves a back and forwards reflecting of the ‘me’ and the ‘I’. The ‘I’ is seen as that which is spontaneous or biologically propelled, or the ‘self as subject. The ‘me’ “arises whenever this activity [of the ‘I’] is signified, defined and regarded from the standpoint of another”, hence it is the ‘self as object’ (Skinner, 1986, 94-95).

The ability of the self to see itself as a whole relies on this process of the self as both subject and object, and the reflexive back and forwards ‘reflecting’ that occurs between the two separate perspectives of the ‘I’ and the ‘me’. This relationship is described as:
a dialectical relationship because the ‘I’ is continually recognised in social terms, making it the ‘Me’ which instantly becomes the ground state for the next phase of ‘I’ and so on. Thus the ‘I’ can never be self-consciously experienced as such for in that moment it has already become the ‘Me’” (Skinner, 1986, 95).

Mead claimed that language is crucial to the development of the self. The self develops through dialogue with others which later becomes internal dialogue, as Levin (1992) puts it, “a dialogue of the self to the self”. It is through this process that the self develops socially through language. Levin writes of Mead’s view of the role of language this way:

“That is how the self becomes object to itself – becomes simultaneously subject and object. The self as object to itself is essentially a social structure; it is communicative, interactive, indeed dialectical, and always mediated by language. The process starts with gestures rather than speech, but self is inconceivable without words. Self is a dialogue I have with myself in which I take the role of a generalized other, or of particular others, and speak to myself as subject as if I were an object of the others’ subjectivity” (Levin, 1992, 128-129).

In schizophrenia it is well recognised that the sense of self is compromised or distorted. In the British instrument for psychopathology, the Present State Examination (Wing et al, 1974) this is given emphasis, especially with regard to the way auditory hallucinations are experienced. In the section giving definitions of symptoms, and the ways of rating them, the symptom ‘Non-affective verbal hallucinations (about the subject), the definition is as follows:

This symptom includes only a voice or voices heard by the subject speaking about him and therefore referring to him in the third person . . . Rate (1) if the subject hears the voice commenting on his thoughts or actions and thus speaking about him in the third person. Rate (2) if the subject hears voices talking to each other about him in the third person.

In an earlier work (Smith, 1998) the way in which a person thinks of him/her-self is also seen as important in schizophrenia:

In the ‘normal’ person, the self is presumably a balanced whole, consisting of two inter-dependent parts, the ‘me’ and the ‘I’. What I am suggesting here is that the I/me balance is upset in schizophrenia and this is the result of inappropriate development of either the ‘me’ or the ‘I’ components, or both.

An important segment of the language aspect in the Mead’s generalised other is the language input of others. In an extract from Autobiography of a Schizophrenic Girl by Sechehaye (1951), the protagonist Renée is not able to relate to the first or second person pronouns, either as these relate to herself or to the therapist (referred to by Renée as ‘Mama’), or to the collective “we”. Renée relates:

“What did me the most amazing good was her use of the third person in speaking of herself, "Mama and Renée," not "I and you." When by chance she used the first person, abruptly I no longer knew her, and I was angry that she had, by this error, broken my contact with her. So that when she said, "You
will see how together we shall fight against the System," (what were "I" and "you?") for me there was no reality. Only" Mama", "Renée," or, better still, "the little personage," contained reality, life, affectivity” (Sechehaye, 1951, 32).

This example suggests Renée has difficulty in relating to herself in the first person, but not in the third person. From this, the inference could be made that Renée cannot readily relate to the ‘I’ (self as subject – that which perceives) but can relate to the ‘me’ (self as object – recognised in social terms). If this example can be extended to schizophrenia in general, then we can make the case that there is a major imbalance between the ‘I’ and the ‘me’ in schizophrenia. This takes the form of a strongly represented ‘me’ and a weak or absent ‘I’ (Smith, 1998). It is relevant here to consider the stage of schizophrenia that Renée is in. Since this thesis is concerned mostly with trait abnormality (which is enduring before, during and after a psychotic episode, but separate from active psychosis), it is important to note that this case study occurred in the period before antipsychotic medication was available as a treatment, where the discernible boundaries of prodrome, active psychosis and stabilisation are not clear.

Mead’s concept of reflexivity is relevant to an imbalance between the ‘I’ and the ‘me’ in schizophrenia. The theoretical framework on which the present work is based permits a more precise formulation of the imbalance, in schizophrenia, between the ‘I’ and the ‘me’, suggested in 1998. Normally, healthy self functioning requires a continuous interchange between the ‘me’ and the ‘I’. In the case where there is psychological trauma in a developmental stage it is feasible to imagine a psychological distancing from such an event whereby the ‘I’ ‘defends itself (out of pain at ‘looking’ at the ‘me’, as the object of the trauma – not yet internalised). This may be one way to articulate the psychic split in the term ‘schizophrenia’. In the case of Renée, this imbalance between the ‘I’ and the ‘me’ is shown in the dominance of the ‘me’ which seems to have ‘taken over’, and the ‘I’ which barely seems to exist. R.D. Laing remains a controversial figure many decades after his anti-psychiatry stance, yet he had some worthy insights. He speaks of the self with a similar divide, albeit in reversed terms:

“There is still an ‘I’ that cannot find a ‘me’. An ‘I’ has not ceased to exist, but it is without substance, it is disembodied, it lacks the quality of realness, and it has no identity, it has no ‘me’ to go with it. It may seem a contradiction in terms to say that the ‘I’ lacks identity but this seems to be so. The schizophrenic [sic] either does not know who or what he is or he has become something or someone other than himself” (Laing, 1965, 172)

With over-identification in schizophrenia with the ‘me’ and the absence of a strong ‘I’, it follows that there tends to be identification with objects and events in the outside world. Many delusions relate to identity, but without a stabilising ‘I’, may cause an individual at risk of being overwhelmed.

The tendency to seek explanation through metaphor and symbols, outside of direct experience or sensing, is explored in a study by Parnas et al (2005). They developed a descriptive and diagnostic tool, EASE - Examination of Anomalous Self-Experience – from observations of the phenomenology of “self” experience as expressed in semi-structured interviews with schizophrenia patients. Observations of the prevalence of experiential distortions of a ‘first-person’ perspective lead to the seeking of detailed accounts of this type of phenomena in
schizophrenia as a “deficiency in the sense of being a subject, a self-coinciding center of action, thought, and experience” (Parnas et al 2005, 236).

Interestingly and significant to the current investigation is a conclusion of a separate study carried out by Parnas et al in 2003 that self-disorders, rather than being a symptom of mental health disorders in general were actually the most significant discriminators between residual schizophrenia and psychotic bipolar illness in remission. The disorders of self-experience were greater discriminators over all experiential anomalies. This is significant to the current study which includes such items related to sense of self in schizophrenia. There have been attempts to test this distinction in the current study to eliminate possibilities that the trait abnormalities in general and specifically those relating to the self are not just characteristic of mental health disorders in general. In fact even the term used here of “residual” schizophrenia specifically coincides with the abnormal traits outlined in the theory of Miller (2008) which he views as the crux of schizophrenia. These residual abnormal traits endure beyond (before, during and after) a psychotic episode in schizophrenia. This distinction made between “residual” schizophrenia and psychotic bipolar illness, is currently relevant to support the efficacy of identifying these enduring traits as potential markers for at-risk teenagers who may be vulnerable to developing schizophrenia. Consequently, any such tool developed to identify such markers could be used in the first screening stage.

Another aspect of specific significance to the current study that comes out of the EASE research is the recognition of the use of symbolism in an unusual or anomalous way to aid the process of ‘accessing’ the self in schizophrenia (more specifically the ‘I’ as subject rather than ‘me’ as object). The point was made that symbolism is used by healthy people by transferring meaning from one conceptual domain to another, one signifying the other such as in the example given “life is a journey” where the concept of a journey lends meaning to the concept of life. However, in schizophrenia the observation made is that, given that there is a distortion of how one ‘experiences’ in general, in schizophrenia, articulation of such an experience as happening to ‘oneself as subject’ becomes a problem which the use of metaphor resolves in a sense. The experience becomes “progressively conceptualized”. It is well stated by Parnas et al this way,

“an experience… [becomes] transformed into a conceptual (linguistic) format, in order to be grasped by the reflecting subject, thematized and rendered communicable to others. The metaphor should be seen here as a basic functional aspect of this symbolization process, where it operates as a linguistic vehicle or medium through which the experience first articulates itself and so becomes reflectively accessible. The metaphor is therefore the first stage of making a prelinguistic or prereflective experience explicitly accessible to oneself and to the other. The choice of metaphor is linked to the nature of experience in a noncontingent way, i.e., experience and metaphor are not entirely independent.” (Parnas et al, 2005)

This explains the use of symbolisation as a process to access and articulate experience (after the fact) as a remedy for not being able to directly experience oneself as subject (or articulate it without conceptualising it first). Another example of this is in the personal experience of R. Miller of a person in a hospital ward who wondered around the ward with an open book in his hands, and when anyone spoke to him, all he could say was “My mind is an open book”. I would suggest this can be explained neurodynamically by Miller’s theory (2008) with further development in the laterlisation of the ‘I’ and the ‘me’ of the self.
Briefly put, Miller explains schizophrenia as a deficiency of mainly the right hemisphere where transfer of signals (via axonal conduction) is relatively slower than in the normal right hemisphere. The visuo-spatial, ‘now experiencing’ right hemisphere is the area where the coherency of sense of self happens or does not happen, the latter tending to be the case in schizophrenia. In relation to the discussion, distinguishing the ‘I’ and the ‘me’ is important here for detailing the hemispheric lateralisation of the self in relation to everyday life and trait abnormality. I would suggest the self as subject (the ‘I’) is indeed the ‘now experiencing’ right hemisphere part of the self which is required to respond as subject in the visuo-spatial world. It is the part of the self which perceives aspects of memory and personality and experience as parts that make up the Gestalt of self summoned within a moment of time to cope with a specific testing event. Such demands of life require the summoning of aspects of the self which have been operationalised, in the STQ, under the term ‘ego strength’, since most of the items refer to instantaneous responses in the ‘now experienced’ world.

The left hemisphere however, is often better developed to compensate for the lack in the right in schizophrenia. I would suggest that this corresponds to the ‘me’ or self as object. The left brain rather than being ‘now experiencing’ is past- and future-focused and highly conceptual. This highly conceptual hemisphere is skilled at embracing symbolisms, (which generalises across time, rather than being anchored to a particular moment), in order to articulate experience in the visuo-spatial world. However, rather than experiencing the self as the subject (the ‘I’) of that world, experience becomes articulated reflectively as concept (in terms of ‘me’ as object), or as Parnas et al state, experience and metaphor are not entirely independent. The left hemisphere which embraces symbolism compensates by accessing and articulating the self via concept and symbols but cannot respond rapidly in the moment for the requirements of most everyday activities, with ease. However, with time, and less demands for rapid response, the ‘me’ progressively conceptualises experience which potentially adds to ‘ego strength’ but only when there is space and time to apprehend metaphor and concept to encapsulate experience and provided that it is to cope with a non-novel event.

The ‘I’ savours the moment within the moment while the ‘me’ understands it after the fact, perhaps momentarily after the fact, long enough for conceptualisation of it. The ‘presence of mind’ to act in certain ways that are beneficial to the self may not be there, unless previously and consciously learned as a beneficial way to act. This may be more applicable to a novel event which has not previously been thought through or learned as being ‘appropriate’ or ‘good’ for oneself. An analogy can be drawn here. In perceiving a face, the face is perceived but it may be in a diminished capacity which does not include the recognition of an acquaintance for instance. In the same way there has to be some perception of the ‘now’ experience for it to be conceptualised but the diminished version applies to the self reference in the moment, thereby separating consciousness and self-consciousness within that moment.

The concept of role-taking serves as an adaptation to ‘deal’ with the lack of ‘now experiencing’. When the ‘world’ requires a response, in the moment of a novel event, role-taking serves the self well to take on a role of responding in a way that is expected, to enable ongoing interaction and relationship. For example, in receiving a gift of some sort, the recipient with schizophrenia may in actual fact need some time to just appreciate or contemplate the usefulness (beauty etc) of the gift, which may be a longer time frame than would be a normalised response. Role-taking comes into play where the required response is to immediately show appreciation, yet the full conceptualising of the experience may take
some moments longer. Hence the response may seem insincere which may in fact not be the case.

Figure 4.4 is a series of diagrams showing a theoretical sequence of the self’s development as conceived by Mead, but adapted by Smith (1998). Diagrams (1) to (4) relate to the development of the self in the ‘normal’ person and (5) relates to the particular variation of the self’s development in schizophrenia.

(1) *Perceiving of Objects*: This diagram starts by showing the first stage in perceptual development (in the infant) where a semblance of a perceiving process ‘looks’ at objects in the real world (tree). No self is operative.

(2) *Perceiving ‘me’ as object*: conforms to the first part of Mead’s theory where at a stage in the infant’s development, the infant starts to experience itself as an object, which is the beginning of the ‘generalised other’ or the ‘me’. This ‘me’ is an amalgam of responses and reactions made to the infant by others, which creates its impression of itself. Here, the ‘me’ is represented as being separate from the ‘perceiving process’, which allows it to be perceived like any other object in the world. At this stage although the basic ingredients are there, there is still no ‘self’ as such.

(3) *Internalisation of ‘me’ to form the ‘I’*: This diagram shows the process of the ‘me’ being internalised and becoming the ‘I’. Presumably, there is a process of ‘identification’ occurring, where the ‘perceiving process’ begins to identify with the ‘I’. The combination of three components – the perceiving process, the ‘me’, and the ‘I’, together represent the self.

(4) *Normal reflexivity*: This diagram shows Mead’s ‘reflexivity’. In this process, the ‘I’ sees objects in the world but includes the ‘me’ in the ‘perceptual loop’, so that the ‘I’ is making constant reference to (or is being influenced by) the ‘me’. This leads to Mead’s self-consciousness, which is the ‘I’s continuous awareness of the ‘me’ in the individual’s interaction with the world.

(5) *Schizophrenic reflexivity*: This diagram represents the self in schizophrenia, where the ‘me’ is dominant and the ‘I’ reduced. Also, the ‘me’ is negative or aversive to the ‘I’, and there is a split between the two, interrupting the normal process of reflexivity. The result is a self out of balance, with the person with schizophrenia seeing themself primarily in terms of the ‘generalised other’ or ‘me’ component of the self, and most readily relates to themself in the third person. The self in schizophrenia is thus out of balance, with an essential component reduced in its role, namely the ‘I’. This not only creates a disintegrated kind of self, from the person’s perspective, but it leaves a ‘gap’ in what would otherwise be a normal self.
Figure 4.3. Mead/Smith Model of the Self

1. Perceiving of Objects
   - Perceiving
   - No self
   - Object

2. Perceiving 'me' as object
   - Perceiving
   - No self
   - 'me' as object

3. Internalisation of 'me' to form the 'I'
   - 'I'
   - Internalisation
   - 'me'
   - The self
Over-identification with the outside world with an absence of a stabilising ‘I’ may cause a feeling of being at risk of being overwhelmed generally by stimuli from the outside world. This may be what Laing referred to as the “threat of engulfment” (Laing, 1969).

Some further domains and subtypes identified in EASE are variations on the theme, but they do lend detail and complexity to the overarching distortions in sense of self, similarities of which are identified in the present study. The domain, ‘Thought Interference’ in Parnas et al, 2005) and the related loss of thought ipseity (loss of a sense of “mineness” in experience
‘belonging’ to oneself) and thought pressure relate to the concept in the present study of ‘Difficulty in Gestalt Perception’ which is an example at the crux of Miller’s theory. In basic terms, perceiving a gestalt, or perceiving a whole made up of many parts, for example in facial recognition, the same reasoning is proffered for perceiving the many parts that make up the sensing of self in an instant of time. Since this appears to occur in the right hemisphere, synthesis of the many parts for a gestalt, must happen within around 10ms. However, for perceiving the self it may be more complex, involving several ‘layers of processing’ for ‘sense of self’ compared with face recognition, even though the same principle applies. If the speed of the right hemisphere’s conducting axons are relatively slower, as they are proposed to be in schizophrenia, then synthesis of stimuli representing the parts of the self is not going to occur. The result would be a loss of thought ipseity where one’s sense of oneself as the subject (‘I’) perceiving the thought (a self gestalt) fails to happen. In a similar way to this, with some variation, is the ‘thought interference’ which may create sensory overload with a lack of resources to cope with the extra sensory inputs. Put simply here, as a result of reduced summation of signals from slowed axonal conduction there is reduced rebound inhibition which prevents the system coming to rest and reach equilibrium, which in turn does not allow it to be ready to deal with fresh incoming signals. The unresolved stimuli reverberate around the brain ‘cluttering’ the system (as subliminal fringe), which possibly coincides with the experience here termed ‘thought pressure’. Parnas et al also outline as part of this domain of ‘Thought Pressure’ the “lack of common theme and hence a loss of coherence or meaning for the patient” (2005, 240). As outlined previously, perceiving meaning in language is normally a right brain function and impaired in schizophrenia, which is included in the STQ.

While not explicitly included in the STQ, the following EASE domain of ‘Perceptualization of Inner Speech or Thought’ demonstrates the distancing of verbal thoughts in schizophrenia from the self. This is a trait abnormality identified in Miller’s theory (rather than a psychotic symptom, as acknowledged too by Parnas et al). They outline the acoustic and auditory qualities that thoughts and inner speech can acquire, yet also point out the ability of the patient to dispel transient notions that others may also be able to hear or have access to them. This makes them trait abnormalities rather than psychotic traits. In addition to this is demonstration of disruption in ‘directly experiencing’ where “a patient somehow internally sees his thoughts as being written down… [creating] a strong feeling of experiential distance to one’s inner speech” (Parnas et al, 2005, 241). Even speech which is generated in the left brain is not easily experienced as belonging to ‘oneself’ and is dependent on the right hemisphere gestalt perceiving mechanism of the self.

In a review of functional neuroimaging studies that investigate the brain mechanisms involved in understanding actions performed by others, imitation, and sharing mental states such as intentions and emotions, the inferior parietal cortex in conjunction with prefrontal areas play an important role in how the self relates to other, as well as in the sense of agency. The ability to represent one’s own thoughts and represent another’s thoughts are intimately tied together and the conclusion was made that self-awareness, empathy, identification with others, and more generally intersubjective processes, are largely dependent upon right hemisphere resources, which are the first to develop (Decety and Chaminade, 2003). In terms of schizophrenia, passivity symptoms or Schneiderian symptoms where the individual feels as if they are a passive recipient of control rather than an agent exerting control, symptoms are observed in both psychosis and as a trait abnormality. In other words, sometimes these symptoms are responsive to antipsychotic medication (when they are active psychotic symptoms), and sometimes they are not (usually when they are a trait abnormality).
Another perspective of the self is investigated in a study evaluating the frequency and types of change in sense of self in right hemisphere frontotemporal dementia using neuropsychology tests and neuroimaging (B.L. Miller, 2003). Acknowledgement that maturation of the self develops with myelination of the frontal structures fits with the theory behind slower axonal conduction in schizophrenia. In evaluating each case a fundamental change needs to have taken place from the premorbid state of the self as defined as temporally stable, trans-situational consistencies in behaviour, dress, or political or religious ideology. These included the material self (clothes, cars, the body), the social self (the self recognised by others), and the spiritual self (the internal philosophical values of the person such as religion or political ideology). In six out of seven of the cases (who were right-handed, the other was left-handed), there was bi-temporal or bi-frontal hypo-perfusion but with greater damage in the right hemisphere. In left-handers there is often less lateralisation of function resulting in less consistent results. All had basically normal neurologic examinations. The findings, they concluded, supported the emerging focal brain lesion and functional imaging literature on ‘the self’ as specific to the right hemisphere and the frontal region. The patients who had dominant hemisphere dysfunction (which is left damage in right-handers) were able to maintain an emotional sense of who they were, despite the loss of language.

In a case of amnesia by traumatic injury to the right inferior frontal lobe, the patient had retained little of his former personality yet was able to learn new information but less able to re-experience learned episodes. The authors suggested that,

this injury disrupted systems that facilitate “autonoetic consciousness”, the sense of self as a unitary temporally continuous entity with a personal past and an imaginable future. This type of awareness facilitates knowledge that “the self doing the experiencing now is the same self that did so at an earlier time ... and supports formulation of future goals” (B.L. Miller, 2003, 820)

To conclude this section on sense of self as a trait abnormality, a number of points have been made to justify its inclusion in the STQ, and also to bridge the gap between the psycho-philosophical conceptual aspects of the self and how these correlate with biological tests and theory. A conspicuous symptom experienced in schizophrenia is that of one’s thoughts, feelings and words ‘not being one’s own’ in passivity symptoms which is observed in psychosis and stabilised states as a trait abnormality. More subtle traits linked to sense of self are those of difficulties in experiencing oneself in the moment as subject. This is compensated for with progressive conceptualisation of the experience to see oneself as object, which is then internalised. Understanding of this in social/developmental/psychological terms is backed up by neuropsychological tests and neuro-imaging studies including dramatic changes in expression of self in cases of right frontal lobe damage in dementia. Ultimately, it theoretically follows from the I/me distinction of the self, and the evidence presented, that this split can be explained by the ‘now experiencing’ right hemisphere (the I) and the past- and future-focused left hemisphere (the me). This conceptualisation of the ‘divided/fractured’ self (which is what the term schizophrenia means) specifically correlates with the right hemisphere deficit as a result of slower axonal conduction, outlined many times already. The interesting and positive twist to this is the compensation and strength of the left hemisphere that compensates in its ability to conceptualise and engage in ‘long trains of thought’ and may be advantageous in circumstances other than when a quick and spontaneous response is required in a testing moment. The advantage of being able to think through and plan strategies may bring confidence in a different way that may not be as available to those who can respond quickly in a moment. The term ‘ego strength’ has been used instead of sense of self
in the STQ because it identifies better, the requirements of the moment that call for the summoning of the many parts of oneself (a self gestalt) to cope with a specific testing moment. It may correspond to the distinction made by Pavlov between ‘strong’ and ‘weak’ nervous systems, which, in Eysenck personality theory was transformed to ‘extrovert’ and ‘introvert’. The items used for ego strength in the STQ are as follows, some are presented in a reversed way to reduce habituation.

1. If a friend does not turn up to a planned meeting with me, I would feel a sense of rejection even if I knew it was probably for a “good” reason.
2. I like acting in a play or skit or acting out another character (reversed)
3. Unexpected obstacles can embarrass or upset me.
4. If I am feeling well prepared for an event, one negative comment towards me can weaken my self-confidence
5. Setbacks or obstacles do not put me off what I am doing. (reversed)
6. Things don’t easily upset me. (reversed)
7. I have difficulty in forming opinions which are really “my own”.
8. I have difficulty standing up for myself, when I am in competition or conflict with others.
9. I am not put off by criticism. (reversed)
10. I have difficulty taking the initiative in forming new friends (especially with a potential partner).
11. I know my own mind on most things. (reversed)
12. I feel new clothes take a while to feel right.
Methods

5.1 Derivation of the Schizophrenia Traits Questionnaire (STQ)

A questionnaire called the “Schizophrenia Traits Questionnaire” (STQ) with 96 items, falling into 16 subject blocks has been designed to assess three aspects of psychological function

1. Functions normally preferred by the right hemisphere of the brain
2. Functions normally preferred by the left hemisphere of the brain
3. The “robustness of the sense of self”.

The STQ arises from two interlocking theories, which attempt to provide a biological basis, on the one hand for the normal left/right differences and on the other, for enduring non-psychotic trait abnormalities of schizophrenia and related conditions.

In the development of STQ, an early version, “STQ1” was formulated, trialled and the results submitted to statistical analysis. From the results, some items were found to be of little value (see below) and were eliminated. These were replaced by other items, to produce STQ2 (again 96 items). The method of development from STQ1 to STQ2 is explained below in the following sections: (i) Initial formulation of STQ1; (ii) Trialling of STQ1; (iii) Methods of statistical analysis of results from STQ1; (iv) Revision to produce STQ2; (v) Participants, including clinical detail about mental health service users; (vi) Recommendations for administration of STQ2

5.2 Initial Formulation of STQ1

From the 16 topic groups, 96 items were devised in “brainstorming” sessions of insights from personal and professional experience of persons with schizophrenia between the author, Miller and G. Chouinard. The initial idea came from a conversation between Miller and Chouinard, and has been developed since then with the author and Miller. The strategy behind the STQ is to present participants with a series of statements, each about a personal habit, preference, or difficulty, or everyday experience, and to ask the participant whether he or she agrees/disagrees with the statement. Thus, the STQ is a self-report questionnaire, where subjects report on personal habits, experiences, preferences etc of which they are themselves aware. In this regard the STQ differs from many clinical instruments, where a clinician makes the judgement on each item. However, some clinical instruments, such as the system for Huber’s “Basic Symptoms” of schizophrenia, use the same strategy as used here, as previously discussed.

A 5 point Likert scale was applied consisting of ‘Strongly Agree’, ‘Agree’, ‘Not Sure’, ‘Disagree’, ‘Strongly Disagree’. This was on the advice of a research psychiatrist, K. Skegg. A number of possible wordings for the five degrees on this scale were considered. However, after advice sought from colleagues, this was the preferred terminology. A 7 point scale was considered with potential to bring more sensitivity to the data, but a judgment was made that it was more likely to be confusing given the target population.

From the underlying theory, it was anticipated that persons with schizophrenia would have item scores tending towards one extreme or the other of the five-point scale. However for each of the 16 categories of items, the aim was to assign an equal number of items to be answered in the reverse way, so that stereotyped responding at one or other extreme of the
scale would not bias the data in a group of subjects. This would also help ensure the answers were made according to authentic responses rather than fatigue. This was not achieved in all categories because some items lost their meaning in terms of trait abnormality when asked in a reversed way.

To follow is a list of the number of reversals out of the total for each category.

1. Gestalt perception – see section 4.3.2 in introduction 6/12
2. Discrimination of intensity of sensory stimuli 0/4
3. Motor control by sensory guidance 2/4
4. Cross-modal co-ordination 1/3
5. Speed of learning new material 1/2
6. Comprehension of incoming language 2/6
7. Subjective experience of trait aspects of thought disorder 0/5
8. Distractibility 1/3
9. Vigilance/Sustained Attention 2/5
10. Sensory Overload 4/10
11. Preference for Solitude/Avoidance of Social Activity 1/3
12. Attentional Shift 4/6
13. Long Trains of Thought 3/9
14. Working memory/Visuo-spatial/Verbal 2/3
15. Ego Strength 5/12
16. Overall levels and Stability of Mental Activity 1/9

The items were then arranged systematically so that there would be a regular frequency of reversed items with maximum spacing between each category and that items in each category, as well as “reverse direction” items were randomly ordered, rather than grouped together. Items from the larger categories were used with the appropriate frequency to reflect the greater numbers. This design was to enable patterns and categories to be disguised to elicit genuine responses and minimise fatigue.

The system of reversals and non-reversals is as follows with categories matching above but in shortened form.

R - Reversed        NR - Not Reversed

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<tr>
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<th>R</th>
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<tr>
<td>1.</td>
<td>Gestalt</td>
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<td>2.</td>
<td>Discrim</td>
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<td>3.</td>
<td>Motor sen/guid</td>
<td>NR</td>
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<td>4.</td>
<td>Cross</td>
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<td>5.</td>
<td>SpLearn</td>
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<td>6.</td>
<td>ComLang</td>
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<td>8.</td>
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<td>10.</td>
<td>Sens Overload</td>
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<td>Solitude</td>
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<td>13. Long Thought</td>
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<td>14. Memory</td>
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<td>15. Ego Strength</td>
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<td>16. Mental Stability</td>
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<td>Question number</td>
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Ethics approval was gained from the Lower South Regional Ethics Committee for trial of the STQ in Otago and Southland.

### 5.3 Trialling of STQ1

The STQ was trialled first on a small group of non-mental health users for comment on sentence understanding, structure and completion time. The first STQ (STQ1) (see Appendix 3) was then trialled on 150 people without a major mental illness (or non-mental health users: non-MHUs) and 150 mental health service users (MHUs) mainly with psychotic disorders. The latter group was mostly recruited in Dunedin and 30 respondents from Invercargill. The non-MHU group were recruited mainly from Contact Energy Call Centre (including some of their family members), and a small group of associates of the researcher. The MHU group were recruited from Tapestry Clubhouse/SF Otago, 420 Drop In Centre (PACT), Artsenta, GROW, and from Invercargill, SF Southland, 494Dee, The Bog.

The questionnaire is accompanied by an Information Sheet on the nature of the study, and a personal information sheet, where name and address is optional, with compulsory information sought on age, gender, number of years secondary and tertiary education, whether English is the participant’s first language, nationality and, for MHUs medication and current usage. Two versions of these documents were used, one for the non-MHUs, the other, with small additional statements for the MHU (Appendices 1a and 1b).

After STQ1 was trialled, ethics permission was gained for a consent form to be offered to those among the second, overlapping group of 150 MHUs who identified themselves to consent to five questions. This consent form (Appendix 1c) was included with the STQ2 at the time the STQ2 was being completed, hence many more respondents gave consent. Advice was sought from a psychiatrist as to the questions to be asked in the consent form as suitable inclusion/exclusion criteria. This was in addition to questions asked in the personal information sheet on age, gender, education etc. Verification was made via the hospital database. These questions included:

1. A diagnosis preferably according to ICD10
2. Age of onset of the disorder
3. Date of most recent admission to hospital
4. Whether the disorder is associated with street drugs or alcohol
5. Medication and dosage.

For comparison with the non-MHU group, a subgroup of the MHU population would be identified who:

1. Have a diagnosis of schizophrenia or schizoaffective disorder
2. Age of onset is not below 20, so as to not interfere with educational achievement and so that more accurate matching of subjects for level of education could be attained
3. Admission to hospital was to be not less than one year before completing the STQ. We wanted to compare stable subjects so measurement was of enduring trait abnormalities rather than those due to active psychosis or being unwell.
4. Exclusion of known association with street drugs or alcohol decreases the likelihood of answers being due to this variable, rather than enduring traits.
5. Comparing medication usage with degree of trait abnormality investigates correlations to account for medication as a confounding variable.

Each person was given a $10.00 petrol voucher in return for completing the questionnaire.

5.4 Administration of the STQ

The non-MHU respondents and some of the MHU respondents completed the STQ in their own time, without any assistance. However, some MHU respondents preferred assistance by accompanying them and reading the items aloud. Although the number that required breaks was not recorded, this applied to a very small proportion, perhaps 2-3%. Some clarification was given on the meaning of various questions and their wording in the ‘guided interview’ style of administration of a questionnaire. From a scientific perspective it is important to standardise the delivery of the questionnaire, especially at this stage in its development, firstly to ensure that all respondents receive the same information so that what is being delivered is the same, and secondly, to test whether the questions are easily understood. In retrospect it would have been beneficial to record which individuals needed this guidance to check if the guidance introduced a bias. In principle there is no way of getting proper matching of MHU to non-MHU in their comprehension of the questionnaire due to confounds of the illness affecting comprehension (even though they are matched for education). However, in defence of this from a clinical perspective, firstly, comprehension of incoming language is an issue in schizophrenia and if no extra explanation is given the answers will be meaningless. Therefore, it serves the purposes of measurement to bring the MHU to the “same” level of understanding as a “normal subject” by giving explanation. Secondly, in practice an instrument such as the STQ would be administered in a clinical interview where a GP or psychiatrist would naturally clarify points for understanding. On advice in relation to this question we consulted a psychiatrist personally involved with using similar questionnaires who advised it be termed a “guided interview”. There are advantages and limitations to clarifying questions on an individual basis and these potential weaknesses are acknowledged, but the advantage of the ‘one on one’ process does give insight as to the particular questions that tended to bring the most ambiguity or lack of clarity.

The questionnaire was administered in a similar way to the development of SSTICS (the Subjective Scale to Investigate Cognition in Schizophrenia by Stimpert et al, 2003), which provided explanations and questions, where necessary. However, these authors did an inter-rater reliability agreement between two research assistants trained on PANSS with a sample of only 11 participants. In the future this may be included in the administration of the STQ, however, it does set up another problem of the possibility of overwhelming the respondent. It
is a delicate process to gain trust and reassure a respondent in this environment of his/her psychological safety and personal information being honoured and treated confidentially. Relating to one person in those respects is sometimes a major ordeal, let alone having to trust two people which may result in less honest responses and lower rates of responding and a less empowering experience for the person. It may be appropriate therefore to choose a small sample as in the SSTICS with prior consent gained for the purpose of inter-rater reliability.

To illustrate the merits of this “guided interview” approach, (compared to a fully objectivised approach) for administering STQ1, only 21/150 MHUs gave permission for the researcher to obtain clinical detail from case notes. By the time STQ2 was administered, the researcher had “won the confidence” of many more participants.

The MHU participants ranged from individuals who in my opinion had degrees of mild to moderate paranoia, to individuals who were willing and even eager to participate, some of which were extremely open about their lives. The individuals who were displaying some degree of paranoia were not necessarily clinically paranoid but rather appeared to be understandably suspicious from past disempowering experiences or just cautious about identifying themselves in a research/medical context for fear of future consequences of disclosing personal information. For these very understandable reasons and for ethical concerns the utmost care has been taken to preserve anonymity of the participants even when they have identified themselves for follow-up diagnosis verification.

For STQ1, due to the method by which contact was made and the MHU groups participating, it is likely that a high proportion of the MHU participants would have had a disorder of schizophrenia or related disorder. 29 out of the first 150 who completed STQ1 gave permission for their diagnosis to be sought by the author. Confirmed diagnoses were not sought for these participants because of the developments that took place from STQ1 to STQ2 (30 replaced items and 16 modified items). Ethics approval to ask for the diagnosis was gained after most of the STQ1 questionnaires had been completed, which accounts for the low number giving permission. For STQ2, however some trust had been established, 136 out of the 150 participants gave permission for their diagnosis to be sought. 75 participants had a confirmed diagnosis of schizophrenia out of the 136 who gave permission for STQ2. Of the 103 participants identified in STQ1, 40 of them also completed STQ2. There were other diagnoses of Aspergers Syndrome, Borderline Personality Disorder, Tourettes Syndrome.

5.5 Methods of Statistical Analysis of Results from STQ1

Each questionnaire had a number of reversed items which, at the analysis stage, were reversed back to match the sequence of 1 - 5 Likert Scale answers so that all questions that related to trait abnormality tended towards 1 and those on the opposite side of the continuum away from trait abnormality tended towards 5.

The data from 96 items were entered on a spreadsheet for each of the 150 non-MHUs and 150 MHUs, with the corresponding age, gender and number of years at secondary school.

Factor Analysis: MHU and non-MHU: A factor analysis was performed on the non-MHUs and MHUs separately as a data reduction technique that summarises the correlational structure of complex data sets. The aim is to identify whether the underlying structure supports the a priori list of categories derived from the theory of trait abnormalities (Miller,
2008). It attempts to explain the variability between the items in terms of a smaller number of factors. Each factor is then, as far as possible, statistically independent of the others.

Factor analysis requires 5 – 10 subjects per item. Since the required sample size was not attained for 96 items (in each questionnaire), the factor analysis was performed in a two-step process. First a factor analysis of items within each topic area was performed. Second, from the 26 factors that emerged, a composite score of each of the participants for each of the 26 factors (rather than for 96 items) was calculated. This was achieved by averaging the raw scores for each participant over the items which contributed to each of the 26 factors. Third, two grand factor analyses for the whole instrument were performed, using the summated scores for each stage 1 factor for the MHU and non-MHU groups. The factor named ‘Sensory overload no 4’, was omitted in the next stage to give 25 factors. This was because one of the constituent items was clearly ambiguous, one was reassigned for the second stage of STQ1, and the third loaded much more strongly on another sensory overload factor. So, in terms of the 4 criteria given below, this factor could be rejected with regard to number 1, 2, and 4.

The type of Factor Analysis performed was Exploratory Factor Analysis rather than Confirmatory Factor Analysis. Ideally, this makes no assumptions about mutual correlations between items in deriving factors; but, because of the inability to recruit large numbers of subjects, some assumptions were made here, based on a priori derivations of factors. This practice was also used in some of the early factor analyses of MMPI scores, where summary scores for each subscale were used for a Grand Factor Analysis. In the current Factor Analysis the factor structure within each a priori factor was assessed with some reassignment options considered to allow for more flexibility to move in another direction if the data so dictated. When data were reassigned in this way a repeat computation was performed to see if the results were improved.

In SPSS, the default, varimax rotation was used. SPSS describes the “rule of thumb” used to work out how many factors should be retained for analysis, by plotting all the eigenvalues in their descending order. It uses the analogy of the plot resembling the side of a mountain, and the “scree” refers to the debris fallen from the mountain and lying at its base. The scree test therefore stops the analysis at the point the mountain ends and the debris (error) begins. The point before which the error begins stands as the eigenvalue criterion.

Factors from the two groups of participants were included in the grand factor analysis if they:

1. were conceptually coherent
2. the items loaded well on the factor, with statistical independence (that is, they tended not to load on other factors as well) (see p 88 for fuller explanation)
3. had higher correlation coefficients between items in the same factor (in contrast to the low correlations with items in different factors)
4. had no loading above the criterion mentioned in 2 on more than one factor

These points usually supported each other in that when there were high loadings on the factor and strong correlations between items there was also distinctness between factors i.e. low correlations between individual items in different factors.

In some topic areas the initial factor analysis revealed more than one factor and therefore the total number of categories in the second stage is larger than the number of a priori categories initially set according to the theory. The factor analysis confirmed the theory but divided the
items into factors that fell into 26 (rather than 16) factors that would be included in a grand factor analysis.

**Paired T-Test: MHU Vs Non-MHU:** The second statistic performed on the STQ1 data is a paired t-test on each of the 96 items. The subjects in the MHU and non-MHU groups were matched for age, sex and number of years of secondary education. In some cases MHU participants were matched with average scores of several non-MHU participants within the age and educational range. This would give a more accurate value of the controls by which to match the MHUs.

**Bonferroni correction:** This was performed as a correction for multiple comparisons of 96 items in STQ, where a set of statistical inferences are being considered simultaneously. To reduce errors in inference, a more stringent criterion is set in order for individual comparison to be deemed significant, to compensate for the number of inferences being made. In relation to the t-test comparisons of each of the 96 items, the Bonferroni test used a probability value that the t values occurred by chance to be set at p≤0.0005 rather than 0.05.

**Power Analysis:** The third statistic performed on STQ1 was a series of power calculations using the data collected to work out for each question how many subjects were needed to compare non-MHUs with the MHU group for a statistically “powerful” result. This was defined as the number of respondents needed to ensure that the t-tests will reject the null hypothesis at the level p<0.05 – that the MHU and normal populations are not different - when the alternative hypothesis is true. The questions that were statistically strong discriminators between the two populations (MHU versus non-MHU) needed fewer subjects for comparison.

Inter-rater reliability measures were not carried out at this stage because the situation in which the work was done did not allow this. Further down the track when a revised instrument is developed for teenage/young people, inter-rater reliability and test-retest will be required.

### 5.6 Revision to produce STQ2

Items from STQ1 were eliminated in the light of the results from the three statistical methods outlined. For each item the criteria were as follows:

1. How the item loaded on the group factor, taking a loading of above +0.400 or below -0.400 as a cut-off. This criterion was chosen as the most meaningful cut-off point because it divided between factor loadings which retained the statistical independence of different factors, and those lower loadings where items tended to load on more than one factor (and therefore are probably reflections of noise in the data set). Apart from the actual computations a subjective judgment was occasionally also necessary.
2. P value (in relation to the value of the T statistic) to be equal or less than 0.05
3. The number of subjects needed for comparison from the power calculations for each item. Where the programme did not give a number, it indicated that the number was very large, and the item was eliminated or changed.
4. Conceptual coherency of items within the factor
5. Subjective decisions made in regard to specificity to the theory

Further detail on the process of ‘pruning’ is given in the results section.
Some items were changed slightly in wording mainly from the experience of respondent’s need for clarification due to ambiguity or lack of clarity. 30 items were eliminated and replaced with 30 new items. Some decisions were made between stage 1 and 2 of STQ1 (see pp. 92-93), and more extensive pruning and decisions to modify were made before designing STQ2 (as described in section 6.2. of the results).

Table 6.2 of results identifies (and Appendix 8 lists) the 30 items in STQ1 that were eliminated for STQ2. Table 6.6 in results (and Appendix 8 and 13) list the final STQ2 items, and identifies the (new) replaced 30 items from STQ1 and the 16 items that contain modified wording (changed, and includes 2 items that were moved to different categories) from STQ1.

### 5.7 Statistics performed on STQ2

**Factor Analysis:** A two-step factor analysis was performed using SPSS, on MHU and non-MHU groups in the same way as in STQ1. The first step included the data reduction by averaging scores over the items in each factor from the initial factor analysis. The second step used the reduced data to enable a grand factor analysis to be performed. The data sets with both 26 factors and 21 factors were available for the Grand Factor analysis. The data set with 26 factors contained five “oddball” factors which were outliers in the group factor analyses. These were combined to see how they correlated and co-varied into factors which might be able to show that they had not been assigned to the ‘best’ *a priori* categories.

136 MHU participants gave consent to the author to seek verified diagnoses from the hospital administration, including age of onset, the date of most recent admission to hospital, whether the mental health problem was associated with street drug or alcohol use, and medication and dosage, if known.

**Bonferroni correction:** This was used to address the problem of multiple comparisons in the 96 items in STQ2, as outlined earlier. The Bonferroni test sets a criterion that the results occurred by chance at $p \leq 0.0005$.

**T-Test: Schizophrenia Vs Normal:** 136 participants gave consents on the trialling of STQ2, out of a total of 150 MHU participants. 75 of those had a verified diagnosis of schizophrenia. A paired t-test was performed on this subgroup matched to 75 normal participants on age, sex and number of years of secondary school. Where there were several normal respondents who matched the criteria, a mean of scores were used for better representation of the normal match.

**T-Test: Schizophrenia Vs Depression:** A paired t-test was performed on 29 with a verified diagnosis of unipolar stabilised depression matched to 29 of the schizophrenia subgroup on the same criteria as normal participants.

**T-Test: Schizophrenia Vs Bipolar Disorder:** A paired t-test was performed on 8 with a verified diagnosis of bipolar disorder matched to 8 of the schizophrenia subgroup on age (±2), sex and number of years of secondary school.

A non-parametric test was considered which is used in cases where distributions are not normally distributed. For samples where members of each group are paired, this would be the Wilcoxon matched pairs, signed rank test. However, the statistician outlined that for a paired t-test it is the distribution of the within-pair differences that should be normally distributed, and that it would be unusual for them not to be so. The non-parametric test was therefore not used.
**Kappa Statistic:** Test-retest reliability was assessed using the Kappa Statistic on a sample of 62 identified repeat participants from STQ2.

**Discriminant Function Analysis:** Discriminant Function Analysis was performed on the 75 schizophrenia subgroup with 150 normal participants to test the best combination of items for predicting which individuals would fall into the schizophrenia category and which into the normal category. Both a ‘stepwise’ analysis and ‘independents entered together’ analysis were performed. It was not necessary for the groups of participants to be matched in number, therefore using all current data (including 150 normal participants) increased the sample size.

**Cross-tabs:** A cross-tabs calculation was performed on the Discriminant Function Analysis results, tabulating predicted group membership and actual group membership. Criteria can be set to different levels depending on the stringency of inclusion or exclusion of false positives and false negatives.
6. Results

Factor analyses were conducted in two stages, for each of STQ1 and STQ2. When the content of a particular item in the STQ is being referred to, it will be “italicised”. Names for factor or subfactors are given using Capital Letters.

6.1. STQ1

The purpose of the statistical analyses performed on data obtained with STQ1 are two-fold: (i) to test whether the correlation structure in the factor groupings generally support the theory upon which the questionnaire is based (Miller, 2008); (ii) to refine the questionnaire by eliminating items that are not good discriminators of trait abnormality.

Appendix 7 contains the majority of the statistical analyses performed for STQ1 data. The items are listed by a priori category. If the preliminary factor analysis separated the items for that category into sub-factors, these are listed in rank order of their contribution to overall variance. Within each factor or sub-factor, items are ranked according to their loading. Factor loading lies between -1 and +1. Generally a factor loading greater than +0.3 or preferably +0.4 (or less than -0.3 or -0.4) is considered to load sufficiently well on a factor to warrant its inclusion. Factor analysis generally separates groups of items which are statistically independent of each other, but occasionally items load on more than one factor or sub-factor, above the cut-off levels used, indicating that the factors are not completely separable. In the preliminary analysis, this was considered when deciding whether to eliminate a whole factor or individual items. In some cases, items in eliminated factors were included (as outliers) in the second step of the STQ1 factor analysis to see if they would better fit another factor. Since some items could as easily ‘fit’ more than one category, including some items as outliers in the second step of the factor analysis (‘Grand Factor Analysis’) allowed for such re-assignment. On advice from the statistician, such ‘juggling’ is considered acceptable in this way, and did not compromise the initial task of showing that data broadly supported the theory while not amounting to decisive proof of it.

The next important statistics in Appendix 7 are the paired t-tests, performed on each of the 96 items, with only the t-test results of the items accepted for the second stage STQ1 factor analysis, displayed here. As outlined in the method, the Bonferroni correction addressed the problem of multiple comparisons by setting the probability cut-off in the t-tests higher at p<0.0005 rather than <0.05, to minimise the possibility that the differences between populations of MHU and non-MHUs arose by chance. Most of the items accepted for the second stage reached p-values below 0.0005. However, a small number were included with less stringent probabilities that were deemed to be still relevant and worthy of scrutiny in terms of the other statistics. These are identified in Appendix 7 with a double asterix (**). Out of 96 items 57 reached significance at the p<0.0005 level, in the direction expected from the theory. This showed good support for the theory.

A power analysis was performed on each of the 96 items to determine how many subjects would be required to compare MHU and non-MHUs for a statistically ‘powerful’ result, with a cut-off level of significance of p=0.05. Items which required a relatively small number were those which were good discriminators between the two populations.
Lastly, included in Appendix 7 are judgements made as to specificity to theory (S-specific/NS-not specific) and also relevance (R-relevant/NR-not relevant). These judgements were not formalised, and therefore were somewhat subjective, but were sometimes helpful in deciding whether to retain or eliminate items. Where some items may not be specific to the theory, they may, however be deemed still relevant as determined by other criteria apart from the theory, such as from phenomenology of experience.

6.1.1 Statistics performed in STQ1 data leading to elimination, change, or retention of items for STQ2.

Statistics that were performed on STQ1 data leading to elimination, change, or retention of items for STQ2 are displayed in a table in Appendix 7. The statistics presented were used to identify items which failed to measure up as good predictors of trait abnormality. The criteria used were Factor Analysis for STQ1 (including factor loadings), T-test (MHU vs Non-MHU), Power calculations and Effect Size. Items are grouped according to their a priori category, and within each category, subfactors and items are ranked by the value of their strength of loading. Also included are the judgements made on whether an item was specific to the theory (S/NS) and its relevance (R/NR). An * indicates reversal. Two ** indicate the item that has been retained despite less stringent probabilities because they were deemed to be still relevant and worthy of scrutiny in terms of other statistics. Together, these criteria were used to decide whether to eliminate, change, or retain an item for STQ2, or to relocate it to another a priori category.

It is necessary here, to give explanations for some items that were not eliminated (see Appendix 7) despite loading negatively. These shall be dealt with individually:

1/1c – “Sometimes I am unaware of the visual world around me” loaded at -0.527. This was still considered to be specific to the theory and relevant and perhaps could have been expressed in a more discriminating way. Therefore a change in wording for STQ2 was made to “I usually notice what someone is wearing or the details of what’s around me”. In reference to the statistician’s words previously stated, this change was made and the intuition to change rather than eliminate proved correct, since the loading of this item also changed to 0.789 in STQ2 factor analysis.

1/3a – “It is sometimes easier to recognise someone by their voice”, negatively loaded at -0.731. This was also considered to be specific and relevant and had some potential if the wording were changed. Hence it was changed to, “It is sometimes easier to recognise someone by their voice than by their face”. In the same way as the previous item the improved version loaded positively at 0.518 in STQ2 confirming the intuition to retain it.

10/4b – “I am distracted by things moving in the side of my field of view, especially when I am thinking about something else”, negatively loaded at -0.451. The wording was changed to “I am distracted by things moving in the side of my field of view”, and was moved to the distractibility category. As previously stated, any number of items could be applicable to other categories. Again, instincts proved correct with the changed item loading at 0.714 on factor 1 of distractibility in STQ2.

10/4c – “Physical contact overwhelms me” loaded at -0.331. The wording was not changed and was retained for STQ2, as it was clearly stated, was specific to the theory and still considered to be relevant. This loaded well in 10/2b
5/1a – this had n/a for factor loading because it was the only item in the category.

In step 2 of the factor analyses, the intention was to understand the larger-scale correlational structure of factors so derived, with a fitting label for each. However since the STQ1 is an approach to the main version (STQ2), it was not necessary to fulfil this intention in detail, and therefore the aim was partially but not fully realised. Appendix 4 lists the factors from the STQ1 Grand Factor Analysis with the individual items that make them up.

Table 6.1:
Grand Factor Analysis of STQ1 data

Step 2 of STQ1 using the summed scores from the Step 1 factor analysis

<table>
<thead>
<tr>
<th>Factors</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensory overload (general)</td>
<td>0.707</td>
<td>0.249</td>
<td>-0.092</td>
</tr>
<tr>
<td>Subjective thought disorder</td>
<td>0.677</td>
<td>0.125</td>
<td>0.303</td>
</tr>
<tr>
<td>Ego strength</td>
<td>0.641</td>
<td>0.200</td>
<td>0.211</td>
</tr>
<tr>
<td>Sustained attention</td>
<td>0.622</td>
<td>0.043</td>
<td>0.128</td>
</tr>
<tr>
<td>Cross-modal</td>
<td>0.608</td>
<td>-0.104</td>
<td>0.050</td>
</tr>
<tr>
<td>Attentional shift</td>
<td>0.595</td>
<td>0.070</td>
<td>0.225</td>
</tr>
<tr>
<td>Motor control (by sens guid)</td>
<td>0.567</td>
<td>-0.101</td>
<td>-0.032</td>
</tr>
<tr>
<td>Long trains of thought (2)</td>
<td>0.554</td>
<td>-0.003</td>
<td>-0.078</td>
</tr>
<tr>
<td>Mental stability</td>
<td>0.547</td>
<td>-0.04</td>
<td>0.318</td>
</tr>
<tr>
<td>Compreh inc language (1)</td>
<td>0.524</td>
<td>0.338</td>
<td>0.302</td>
</tr>
<tr>
<td>Compreh inc language (2)</td>
<td>0.472</td>
<td>-0.488</td>
<td>-0.058</td>
</tr>
<tr>
<td>Speed of learning</td>
<td>0.457</td>
<td>-0.007</td>
<td>0.422</td>
</tr>
<tr>
<td>Gestalt perception (faces)</td>
<td>0.403</td>
<td>-0.151</td>
<td>-0.126</td>
</tr>
<tr>
<td>Discrim inten of stimuli (2)</td>
<td>0.403</td>
<td>0.095</td>
<td>0.097</td>
</tr>
<tr>
<td>Gestalt perception (situations)</td>
<td>-0.513</td>
<td>-0.216</td>
<td>-0.043</td>
</tr>
<tr>
<td>Ego Strength</td>
<td>0.396</td>
<td>0.037</td>
<td>-0.311</td>
</tr>
<tr>
<td>Pref for solitude (2)</td>
<td>-0.131</td>
<td>0.567</td>
<td>0.031</td>
</tr>
<tr>
<td>Long trains of thought (1)</td>
<td>0.125</td>
<td>0.501</td>
<td>0.050</td>
</tr>
<tr>
<td>Ego Strength (2)</td>
<td>-0.077</td>
<td>0.470</td>
<td>-0.188</td>
</tr>
<tr>
<td>Gestalt percep (vis awareness)</td>
<td>-0.030</td>
<td>-0.426</td>
<td>0.132</td>
</tr>
<tr>
<td>Spontaneity</td>
<td>0.080</td>
<td>-0.487</td>
<td>0.578</td>
</tr>
<tr>
<td>Sensory overload (social)</td>
<td>0.304</td>
<td>-0.033</td>
<td>0.559</td>
</tr>
<tr>
<td>Distractibility</td>
<td>0.366</td>
<td>0.404</td>
<td>0.504</td>
</tr>
<tr>
<td>Preference for solitude (1)</td>
<td>0.011</td>
<td>-0.115</td>
<td>0.494</td>
</tr>
<tr>
<td>Sensory overload (noise/temp)</td>
<td>0.011</td>
<td>0.271</td>
<td>0.466</td>
</tr>
<tr>
<td>Percent of variance</td>
<td>18.6</td>
<td>7.8</td>
<td>6.9</td>
</tr>
</tbody>
</table>

Factor 1 was too complex for a single name to sum up the factors. Factor 2 was named “Loner by preference to develop own thoughts” and Factor 3, “Loner for different reasons: Needs quietness to avoid threat”
6.2. “Pruning” of the STQ1

Pruning of the STQ1 was based on t-test results, power analysis, specificity to theory and factor loadings. The results of this process are given in Table 6.2, which is a list of the 30 eliminated items (plus two relocated in a different subject category and 16 with modified wording) (see also Appendix 8).

There is a variety of reasons why certain items did not perform well in the range of statistics used which were thus eliminated. For example in Gestalt Perception, the eliminated items were attempts to identify more subtle behaviours which were deemed to be consequences of Gestalt perceptual difficulties. The 5 eliminated items may not be good discriminators of the trait, or the items themselves may be too complex in the setting of such a long questionnaire. They required the respondent to visualise themselves in unfamiliar settings requiring more extreme shifts of attention, which is itself a difficulty in schizophrenia. The non-eliminated items about recognising faces may be more salient experiences to identify. Some of the items attempted to access trait abnormality but did not do so directly. For instance, the reasoning behind not favouring communal singing, in the reversed item “I like communal singing” (in the category, ‘Discrimination of Intensity of Sensory Stimuli’), is highlighting the difficulty that arises from not being able to ‘shut out’ other voices singing while singing another part. The reasons for the item failing to distinguish MHUs from non-MHUs may not be related to the phenomenon itself (namely the ability to discriminate between intensities of auditory stimuli), but rather that communal singing is also something not enjoyed for other reasons. The items retained access the problem more directly, making statements about distinguishing loud and soft sounds and having the stereo too loud. There are items that in retrospect are ambiguous with respect to what is actually being asked/stated, which may have been answered with caution or confusion, for example several ‘Ego Strength’ items stated in a similar way are couched in confusing or convoluted language such as “My sense of personal strength is supported by”.... with differing endings such as (1) “ignoring peer pressure”, (2) “a belief that there is an underlying order or purpose in the world” (3) a belief that there is a higher power or God guiding and protecting me” etc. Such judgements were based on experience gained while administering the STQ1.

In the various categories the eliminated items are distinguishable by not being good discriminators of trait abnormalities (i.e. not identifying the issue for the MHUs), or not being distinctly characteristic of MHUs as opposed to non-MHUs. The items that remain are usually specific and clearly relevant, non-ambiguous and identifying difficulties more precisely. These are reflected in high t-values, low p-values, low numbers required for a statistically powerful result, and with ‘good’ factor loadings.

Items that were still considered relevant and which could be better worded were changed to include in STQ2. Thirty new items were included. These, together with 16 items modified from STQ1 are listed in Appendix 8.
Table 6.2:  
Eliminated items from STQ1

<table>
<thead>
<tr>
<th><strong>Gestalt Perception</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I tend to make judgments on first impressions rather than after careful analysis (reversed)</td>
<td></td>
</tr>
<tr>
<td>2. I tend to buy on impulse rather than after careful consideration (reversed)</td>
<td></td>
</tr>
<tr>
<td>3. When I listen to music, I am more aware of the beat than the melody</td>
<td></td>
</tr>
<tr>
<td>4. Sometimes I am unaware of the visual world around me</td>
<td></td>
</tr>
<tr>
<td>5. When I am taking a trip I prefer to use a map rather than write down instructions. (reversed)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Discrimination of Intensity of Sensory Stimuli</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>6. I like communal singing (reversed)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Rapid Co-ordination of Sensory Input and Motor Control</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>7. In games like cricket or softball I prefer to bowl rather than bat</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Comprehension of Incoming Language</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>8. I like taking part in debates (reversed)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Subjective Experience of Trait Aspects of Thought Disorder</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>9. I get tongue-tied</td>
<td></td>
</tr>
<tr>
<td>10. Sometimes I do not say the things I want to, especially in places like committees or the classroom</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Sensory Overload</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>11. I am irritable or jumpy when there is a lot of noise around me</td>
<td></td>
</tr>
<tr>
<td>12. I get easily rattled or upset when lots of things are going on at once</td>
<td></td>
</tr>
<tr>
<td>13. I like contact sports such as rugby or wrestling etc (reversed)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Preference for Solitude</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>14. I prefer to work with other people (reversed)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Long Trains of Thought</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>15. I have a good imagination</td>
<td></td>
</tr>
<tr>
<td>16. I spend a long time thinking through questions before I form opinions</td>
<td></td>
</tr>
<tr>
<td>17. Tunes, rhythms and music run through my head</td>
<td></td>
</tr>
<tr>
<td>18. I like day-dreaming or fantasising</td>
<td></td>
</tr>
<tr>
<td>19. I like inventing or writing stories</td>
<td></td>
</tr>
<tr>
<td>20. I am able to let go and think strange thoughts without being upset or frightened</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Spontaneity</strong></th>
<th></th>
</tr>
</thead>
</table>

21. I prefer to plan carefully future events
22. I like being asked out on the spur of the moment (reversed)

**Ego Strength**

23. My sense of personal strength is supported by ignoring peer pressure
24. I feel I am thick-skinned (reversed)
25. My sense of personal strength is supported by a belief that there is an underlying order or purpose in the world.
26. I feel parts of my body don’t belong to me
27. My sense of personal strength is supported by a belief that my life has value and meaning
28. I feel rejected if someone important to me is not giving me all his or her attention
29. My sense of personal strength is supported by a belief that there is a higher power or God guiding and protecting me
30. It is important to how I see myself, to know my whakapapa or about my ancestors (parents, grandparents, great grandparents etc)

**6.3. STQ 2: Factor analyses.**

Factor analyses for STQ2 are presented in more detail than those for STQ1. Table 6.3 gives details for the step-1 factor analyses of STQ2 data. All items, which, when agreed to would give results opposite to theory of trait abnormality, were reversed in the analyses, and are indicated with the letter R. Where a name for a collection of items encapsulates the meaning of that factor, this name is given below. Items which load on more than one factor, are put in parentheses for the factors which are not the one most strongly loaded.

<table>
<thead>
<tr>
<th>A priori Category</th>
<th>Factor no.</th>
<th>Item no. within category</th>
<th>Item no. within questionnaire</th>
<th>Factor loading</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Commentary</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1) Gestalt - Difficulty with Gestalt Perception</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Factor 1. Perception of Facial Expressions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. I sometimes find I have misjudged people on the basis of their facial expression. 51</td>
<td></td>
<td></td>
<td>(.828)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>I have been told that I misinterpret people’s facial expressions or get them wrong.</td>
<td>(.764)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>I sometimes find I have guessed a person is angry from their expression and then find out that they are not.</td>
<td>(.673)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>When I meet someone I know I find that they can recognise me by my face, but I cannot recognise them by their face.</td>
<td>(.528)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Factor 2 – Facial Identity**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>At a pedestrian intersection I can often sum up when it is safe to cross without needing to wait for the buzzer/green man.</td>
<td>(.693)</td>
</tr>
<tr>
<td>2.</td>
<td>It is sometimes easier to recognise someone by their voice than by their face.</td>
<td>(.518)</td>
</tr>
<tr>
<td>9.</td>
<td>When I meet people I have only met once or twice, I sometimes have difficulty recognising them by their face.</td>
<td>(.509)</td>
</tr>
<tr>
<td>(8.)</td>
<td>I tend to remember people by their faces more than by their names.</td>
<td>(.459)</td>
</tr>
<tr>
<td>4.</td>
<td>When I meet someone I know I find that they can recognise me by my face, but I cannot recognise them by their face.</td>
<td>(.528)</td>
</tr>
</tbody>
</table>

**Factor 3 Gestalt awareness of environment**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>10.</td>
<td>I usually notice what someone is wearing or the details of what’s around me.</td>
<td>(.789)</td>
</tr>
<tr>
<td>3.</td>
<td>My home is usually tidy.</td>
<td>(.754)</td>
</tr>
</tbody>
</table>

**Factor 4 – Eliminated**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>12.</td>
<td>I prefer television to radio.</td>
<td>(.740)</td>
</tr>
<tr>
<td>9.</td>
<td>When I meet people I have only met once or twice, I sometimes have difficulty recognising them by their face.</td>
<td>(-.540)</td>
</tr>
<tr>
<td>8.</td>
<td>I tend to remember people by their faces more than by their names.</td>
<td>(.480)</td>
</tr>
</tbody>
</table>

*Redo: without item 1 and item 12*

**Gestalt - Difficulty with Gestalt Perception**

**Factor 1 - Perception of facial expressions**
5. I have been told that I misinterpret people’s facial expressions or get them wrong. 35 (.822)

7. I sometimes find I have misjudged people on the basis of their facial expression. 51 (.814)

4. When I meet someone I know, I find that they can recognise me by my face, but I cannot recognise them by their face. 30 (.561)

11. I sometimes find I have guessed a person is angry from their expression and then find out that they are not. 81 (.553)

(9. When I meet people I have only met once or twice, I sometimes have difficulty recognising them by their face. 66 )

Factor 2 - Gestalt awareness of environment

3. My home is usually tidy. 26 R (.722)

10. I usually notice what someone is wearing or the details of what’s around me. 73 R (.703)

Factor 3 – Facial Identity

8. I tend to remember people by their faces more than by their names. 58 R (.767)

2. It is sometimes easier to recognise someone by their voice than by their face. 17 (.537)

(4. When I meet someone I know, I find that they can recognise me by my face, but I cannot recognise them by their face. 30)

(Commentary on Difficulty with Gestalt Perception Factors

As outlined in the method, factor analysis was described by the statistician as an art as much as a science. The items in the questionnaire have been assigned an a priori category of which several may apply. In the factor analysis, it became apparent that indeed some items were not coherent with the other items in the factor and therefore the factor analysis (step 1) was performed twice. Some items were removed from the a priori category and some were reassigned to other categories, where the ‘fit’ seemed more appropriate, and the rest put into an ‘oddball’ category to see how they grouped. This explains the ‘redos’ above in italics where the items tended to load more strongly and became more coherent as factors and were more easily encapsulated in a name.

Gestalt perception fell clearly into 3 factors that are dealt with separately in the literature as outlined in the literature review especially ‘difficulty in perception of facial expression’ and ‘difficulty in facial recognition’. Before the redo, factor 2 (Face Recognition) contained the ‘oddball’, “At a pedestrian intersection I can often sum up when it is safe to cross without needing to wait for the buzzer/green man”. This was removed along with the other ‘oddball’ in the eliminated factor 4 “I prefer television to
radio”. This could have been included in the category ‘Rapid Co-ordination of sensory input and motor control’ but it was added to a number of other oddballs and included in the redo factor analysis, included at the end of this table. Both these items are included in the final statistic as good discriminators. 4/13 items in the final Discriminant Function Analysis were from the Gestalt category. The total variance accounted for in all 3 items is 49.05% split into contributions from factor 1 of 23.13% variance, factor 2, 13.92% variance and factor 3, 12% variance. Otherwise the way the factors split into categories supports the literature and therefore the theory (Miller, 2008) upon which the questionnaire is based.

<table>
<thead>
<tr>
<th>(2) Discrimination of the intensity of sensory stimuli</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Factor 1 - Difficulty distinguishing loud from soft sound</strong></td>
</tr>
<tr>
<td>1. I have difficulty distinguishing loud from soft sounds. 2</td>
</tr>
<tr>
<td>3. I find music sounds much the same when the volume is turned down (I do not notice it is not so loud). 36</td>
</tr>
<tr>
<td>2. I am sometimes told that I have the radio or stereo on too loud. 21</td>
</tr>
<tr>
<td>4. When I am singing with others, I find that other people’s voices are so loud that I cannot hear my own voice. 82</td>
</tr>
</tbody>
</table>

**Commentary on Discrimination of the Intensity of Sensory Stimuli**

This is a unitary factor, all the items falling into one factor, and they clearly target the trait concerning loud and soft sounds. Item 4 is a changed item from STQ1. The item accounts for 37.29% of the variance.

<table>
<thead>
<tr>
<th>(3) Rapid Co-ordination of sensory input and motor control</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Factor 1 - Rapid co-ordination of incoming stimuli and motor control</strong></td>
</tr>
<tr>
<td>1. I have difficulty striking a ball with a bat or racket. 3</td>
</tr>
<tr>
<td>2. I am good at catching a ball. 37 R</td>
</tr>
<tr>
<td>3. I have difficulty following pictures at the movies when pictures are moving fast across the screen (especially when I am sitting near</td>
</tr>
</tbody>
</table>
the front of the movie theatre). 67

**Factor 2**

4. I like to be spontaneous 83 R (.931)

*Redo without item 4*

**Rapid Co-ordination of sensory input and motor control**

<table>
<thead>
<tr>
<th>Item</th>
<th>Factor Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I have difficulty striking a ball with a bat or racket. 3</td>
<td>.786</td>
</tr>
<tr>
<td>2. I am good at catching a ball. 37 R</td>
<td>.730</td>
</tr>
<tr>
<td>3. I have difficulty following pictures at the movies when pictures are moving fast across the screen (especially when I am sitting near the front of the movie theatre). 67</td>
<td>.650</td>
</tr>
</tbody>
</table>

**Commentary on Rapid Co-ordination of sensory input and motor control**

Initially this category split into 2 factors with only one item in the second factor. After this was removed and the factor analysis performed again, it became a unitary factor accounting for 52.47% of the variance. The reason the item/factor was removed is because, ultimately the purpose of sorting out the factors is to ensure as much coherency at this stage so the Grand Factor Analysis is more meaningful due to each factor containing several items that are screened at each step to account for increased variances. Each item in this factor directly accesses problems with co-ordinating sensory inputs in order to make a motor response or perceive and understand moving pictures.

**Factor 1 - Cross modal Co-ordination**

<table>
<thead>
<tr>
<th>Item</th>
<th>Factor Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. When I am watching television I have difficulty matching the pictures to the words that someone is speaking. 4</td>
<td>.836</td>
</tr>
<tr>
<td>2. At pedestrian crossings I am confused by the “green man” or “red man” signs telling me when to walk. 42</td>
<td>.825</td>
</tr>
</tbody>
</table>

**Factor 2 – Inter-hemispheric Co-ordination**

3. I can keep good time in rapid drumming (.984)
with two hands. 68 R

<table>
<thead>
<tr>
<th>Commentary on Cross-modal and Inter-hemispheric Co-ordination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Both factors have been retained since they are separate categories in some senses, and each of the items directly accesses the co-ordination of either different modes of external stimuli or the internal crossing between hemispheres, when using both hands to retain a rhythm. Total variance accounted for is 80.09% contributed to by cross modal co-ordination by 46.13% and inter-hemispheric by 33.95%.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(5) Speed of learning new material</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I am good at adapting to new situations. 5 R (,693)</td>
</tr>
<tr>
<td>2. When I meet someone, I am not good at remembering their name on the first occasion. 43</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Commentary on Speed of learning new material</th>
</tr>
</thead>
<tbody>
<tr>
<td>This is a unitary factor accounting for 51.99% variance.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(6) Comprehension of Incoming Language</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor 1- Socially contextualised comprehension of Incoming Language</td>
</tr>
<tr>
<td>1. I have difficulty understanding what people are really trying to say. 6 (.775)</td>
</tr>
<tr>
<td>3. I have difficulty understanding people when they only suggest or imply their meaning, but do not say it directly. 44 (.652)</td>
</tr>
<tr>
<td>5. When I ask for directions in the street, I find it hard to understand the answers I get. 74 (.637)</td>
</tr>
<tr>
<td>4. I find it difficult to get the point of a joke. 59 (.607)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Factor 2 – Comprehension of Language as an Individual Skill</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. I can easily follow the plot in a film or play. 22 R (.803)</td>
</tr>
<tr>
<td>6. I am a fast reader. 91 R (.702)</td>
</tr>
</tbody>
</table>

| Commentary on Comprehension of |
**Incoming Language**

This category splits into 2 factors that separate into comprehension skills that are associated with people, and the other as an individual skill. Total variance accounted for is 55.31% contributed by factor 1 by 30.97% and factor 2 by 24.34%. 7/8 of the items correlate with items in the other factor under 0.3 as to show distinctiveness of the factors.

<table>
<thead>
<tr>
<th>(7) Subjective Experience of Trait Aspects of Thought Disorder</th>
</tr>
</thead>
</table>

### Factor 1 – Disordered Speech

1. When I want to say something, I sometimes find that I cannot make my sentences as fast as I need to. 7 (.809)
2. My speech sometimes gets mixed up. 31 (.727)
3. Sometimes I know that I cannot explain what I want to say so I keep quiet. 84 (.571)
4. I will often rehearse conversations with someone I am going to meet to prepare myself for them. 75 (.449)

### Factor 2 – Reluctance to Speak/Defence Mechanism

4. I will often rehearse conversations with someone I am going to meet to prepare myself for them. 75 (.885)
3. I spend a long time planning what I want to say. 60 (.691)
5. Sometimes I know that I cannot explain what I want to say so I keep quiet. 84 (.348)

*Redo: without item 3 and item 4*

### Subjective Experience of Trait Aspects of Thought Disorder

<table>
<thead>
<tr>
<th>Factor 1- Disordered Speech</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. When I want to say something, I sometimes find that I cannot make my sentences as fast as I need to. 7 (.776)</td>
</tr>
<tr>
<td>2. My speech sometimes gets mixed up. 31 (.757)</td>
</tr>
<tr>
<td>5. Sometimes I know that I cannot explain what I want to say so I keep quiet. 84 (.658)</td>
</tr>
</tbody>
</table>

### Commentary on Subjective Experience of Trait Aspects of Thought Disorder
The items fell into 2 factors, factor 1- identified as disordered speech and factor 2-as reluctance to speak as a defence mechanism, implying a degree of self knowledge. There was overlap between the two factors for one item (showing that they were not completely distinct). Therefore items 3 and 4 were removed and added to the ‘oddball’ items, to test if they grouped with the other oddball items in the redos, at the end of this table. The single factor from the redo accounted for 53.56% of the variance. The items clearly identify thought disorder/disordered speech which is subjectively discerned.

<table>
<thead>
<tr>
<th>(8) Distractibility</th>
</tr>
</thead>
</table>

**Factor 1 – Distracted when competition for attention**

| 3. I am more sensitive to noise when I am trying to concentrate on something else or when I am anxious. 69 (.777) |
| 5. I am distracted by things moving in the side of my field of view. 92 (.714) |
| 2. I am very sensitive to noise. 52 (.542) |

**Factor 2 – General Sensitivity**

| 4. Sudden drafts or changes of temperature don’t worry me 85 R (.770) |
| 1. Sudden noises like a person coughing, or dog barking don’t make me jump. 8 R (.744) |
| (2. I am very sensitive to noise. 52) (.382) |

**Redo:Distractibility With item 5 from LongTrains of Thought**

**Factor 1**

| 3. I am more sensitive to noise when I am trying to concentrate on something else or when I am anxious. 69 (.782) |
| 5. I am distracted by things moving in the side of my field of view. 92 (.682) |
| 2. I am very sensitive to noise. 52 (.563) |

**Factor 2**

| 4. Sudden drafts or changes of temperature don’t worry me 85 R (.799) |
1. Sudden noises like a person coughing, or dog barking don’t make me jump. 8 R

5. LongTh: I find my train of thought interferes with my ability to concentrate on what someone is saying. 38

**Commentary on Distractibility**

This category split into two factors where one item loaded on both. However in the redo an item was added from the ‘Long Trains of Thought’ category and item 2 no longer loaded on the second factor, but was replaced with the new item. In total the variance accounted for is 48.11% contributed to by factor 1, by 24.24% and factor 2, by 23.86%. All items correlated below 0.3 between factors, indicating good and improved distinctiveness in the redos.

<table>
<thead>
<tr>
<th>(9) Sustained Attention</th>
</tr>
</thead>
</table>

**Factor 1- Sustained Attention**

1. I have problems paying attention for any length of time (e.g. television, or other people talking). 9 (.495)

2. I find my mind wanders when I am doing boring tasks. 53 (.477)

3. In repetitive tasks I am good at staying alert. 70 R (.442)

**Commentary on Sustained Attention**

All three items fell into the same unitary factor accounting for 49.90% variance.

<table>
<thead>
<tr>
<th>(10). Sensory Overload</th>
</tr>
</thead>
</table>

**Factor 1**

5. I get overwhelmed by emotional people, even if they are expressing friendly and positive emotions. 45 (.747)

2. Physical contact overwhelms me. 19 (.738)

1. When I am in busy streets, the sight of everyone walking in front of me is very distracting. 10 (.725)

3. Bouncing balls distract me. 27 (.681)

6. I find continual company exhausting. 54 (.583)

**Factor 2**

8. I don’t get upset when there is a lot of noise around me. 76 R (.815)

10. I am not sensitive to background noises. (.779)
When I am emotionally upset, I find it difficult to remember things. 61

**Factor 3 - Eliminated**

Little sounds or lights at night don’t stop me sleeping. 32 R

Working in groups gives me energy. 86 R

**Commentary on Sensory Overload**

There is not a clear enough distinction between factor 1 and 2 to give either of them a name, although factor 1 is more socially contextualised overload, and factor 2 could be said to be more general sensitivity to noise and emotional overload. Factor three was eliminated and the 2 items added to the oddball category to see how they fell together with others. The total variance accounted for here is 43.10% contributed by factor 1 by 25.35% and factor 2 by 17.75%.

<table>
<thead>
<tr>
<th>Preference for Solitude/Social Avoidance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor 1- Preference for Solitude</td>
</tr>
<tr>
<td>2. I do not like solitude. 46 R           (0.500)</td>
</tr>
<tr>
<td>1. I like time with my own thoughts. 11   (0.483)</td>
</tr>
<tr>
<td>3. I would prefer to live alone. 77       (0.457)</td>
</tr>
</tbody>
</table>

**Commentary on Preference for Solitude**

The three items fell into a unitary factor accounting for 48.19% of the variance. Each item clearly accesses preference for solitude or social avoidance.

<table>
<thead>
<tr>
<th>Shift of Attention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor 1- General Preferences for Variety</td>
</tr>
<tr>
<td>6. I like having to make quick decisions on a wide variety of topics. 94 R (0.798)</td>
</tr>
<tr>
<td>1. I find it easy to make a sudden change of plans. 12 R (0.786)</td>
</tr>
<tr>
<td>4. I am good at doing several things at once. 62 R (0.558)</td>
</tr>
</tbody>
</table>

**Factor 2 – Shift of Attention in social situations**

In a classroom (or committee etc) I get confused by the continual change of subject. (0.868)
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3.</td>
<td>I have difficulty making quick decisions in new situations. 47</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Commentary on Shift of Attention</strong></td>
<td></td>
</tr>
<tr>
<td>Shift of Attention fell into 2 factors where an approximation of a name was given to each. Factor 1 contained 3 reversed items, indicating that MHU respondents do not prefer variety where shift of attention is required. Total variance accounted for is 51.56% with contributions from factor 1 of 32.33% and factor 2 of 19.23%.</td>
<td></td>
</tr>
<tr>
<td><strong>(13). Long Trains of thought</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Factor 1- Conceptual/Specific</strong></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>I like thinking of other possible ways of explaining complicated questions including questions about health. 63</td>
</tr>
<tr>
<td></td>
<td>(.765)</td>
</tr>
<tr>
<td>9.</td>
<td>I am interested in looking at new possible ways of explaining things in the world. 95</td>
</tr>
<tr>
<td></td>
<td>(.735)</td>
</tr>
<tr>
<td>1.</td>
<td>I am interested in systems of ideas in politics, religion, philosophy. 13</td>
</tr>
<tr>
<td></td>
<td>(.686)</td>
</tr>
<tr>
<td><strong>Factor 2- Conceptual-General predispositions</strong></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>I like plain facts rather than ideas 20</td>
</tr>
<tr>
<td></td>
<td>(.791)</td>
</tr>
<tr>
<td>3.</td>
<td>I get bored when people take ideas too seriously 24</td>
</tr>
<tr>
<td></td>
<td>(.702)</td>
</tr>
<tr>
<td><strong>Factor 3- Awareness of Creative Potential</strong></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>I have fantasies that can be used as the basis for artistic productions or activities. 48</td>
</tr>
<tr>
<td></td>
<td>(.770)</td>
</tr>
<tr>
<td>4.</td>
<td>My thoughts seem to run on by themselves 33</td>
</tr>
<tr>
<td></td>
<td>(.743)</td>
</tr>
<tr>
<td><strong>Factor 4- Eliminated</strong></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>I prefer to deal with day to day matters rather than dwelling on the future. 55</td>
</tr>
<tr>
<td></td>
<td>(.766)</td>
</tr>
<tr>
<td>5.</td>
<td>I find my train of thought interferes with my ability to concentrate on what someone is saying. 38</td>
</tr>
<tr>
<td></td>
<td>(.630)</td>
</tr>
<tr>
<td><strong>Redo: Long Trains of Thought without item 5 (transferred to Distraction Category)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Factor 1- Conceptual/Specific</strong></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>I like thinking of other possible ways of explaining complicated questions including questions about health. 63</td>
</tr>
<tr>
<td>9.</td>
<td>I am interested in looking at new possible ways of explaining things in the world. 95</td>
</tr>
<tr>
<td>1.</td>
<td>I am interested in systems of ideas in politics, religion, philosophy. 13</td>
</tr>
</tbody>
</table>

**Factor 2- Conceptual/General Predispositions**

| 2. | I like plain facts rather than ideas 20 R | (.717) |
| 3. | I get bored when people take ideas too seriously 24 R | (.737) |
| 7. | I prefer to deal with day to day matters rather than dwelling on the future. 55 R | (.493) |

**Factor 3- Awareness of Creative Thought**

| 6. | I have fantasies that can be used as the basis for artistic productions or activities. 48 | (.840) |
| 4. | My thoughts seem to run on by themselves 33 | (.565) |

**Commentary on Long Trains of Thought**

The items in Long Trains of Thought fell into 4 factors in the first round and item 5 “I find my train of thought interferes with my ability to concentrate on what someone is saying” was moved to the distractibility category where it loaded on factor 2 in the redos. Factor 4 was therefore eliminated. This category is an area of function where individuals with schizophrenia are likely to do ‘better’ than usual due to dominance of ‘left hemisphere’ type functions and where the ability to stay with a train of thought, if harnessed, can produce creative results. The strengths in this category are linked to the factor 1 named conceptual-specific. Factor 1 accounts for 20.99% of the variance, factor 2, predisposition to the conceptual, 20.90% variance, and factor 3, awareness of creative thought, 16.41%. No items correlated with items in other factors, showing them to be distinct.

| 14. | Working Memory/Visuo-Spatial/Verbal | |
| 1. | I do not need a shopping list. I am good at remembering what I need. 14 R | (.596) |
| 3. | I need to make a list if I have several things to do in a day. 87 | (.572) |

**Commentary on Working Memory/Visuo-spatial/Verbal**
Items in this category fell into a unitary factor.

<table>
<thead>
<tr>
<th>Factor 1- Ego Strength</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>4. If I am feeling well prepared for an event, one negative comment towards me can weaken my self-confidence 28</td>
<td>(.736)</td>
</tr>
<tr>
<td>6. Things don’t easily upset me. 49 R</td>
<td>(.707)</td>
</tr>
<tr>
<td>3. Unexpected obstacles can embarrass or upset me. 25</td>
<td>(.649)</td>
</tr>
<tr>
<td>1. If a friend does not turn up to a planned meeting with me, I would feel a sense of rejection even if I knew it was probably for a “good” reason. 15</td>
<td>(578)</td>
</tr>
<tr>
<td>8. I have difficulty standing up for myself, when I am in competition or conflict with others. 64</td>
<td>(.526)</td>
</tr>
<tr>
<td>(9. I am not put off by criticism. 71 R)</td>
<td>(.463)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Factor 2- Ego Strength-Subsidiary</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>11. I know my own mind on most things. 88 R</td>
<td>(.692)</td>
</tr>
<tr>
<td>10. I have difficulty taking the initiative in forming new friends (especially with a potential partner). 80</td>
<td>(.641)</td>
</tr>
<tr>
<td>5. Setbacks or obstacles do not put me off what I am doing. 39 R</td>
<td>(.583)</td>
</tr>
<tr>
<td>9. I am not put off by criticism. 71 R</td>
<td>(.557)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Factor 3</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>12. I feel new clothes take a while to feel right. 96</td>
<td>(.730)</td>
</tr>
<tr>
<td>7. I have difficulty in forming opinions which are really “my own”. 56</td>
<td>(.679)</td>
</tr>
<tr>
<td>2. I like acting in a play or skit or acting out another character 18 R</td>
<td>(.421)</td>
</tr>
</tbody>
</table>

**Commentary on Ego Strength**

Factor 1 is named ego strength because all the items refer to ego strength in the sense of summoning one’s sense of self in a moment to respond to a life event. Variance accounted for is 29.42%. Factor 2 was named subsidiary (as an approximation of ego strength) since some of the items refer in less direct ways, with a variance of 12.53.
Factor 3 was kept but item 2 added to the oddballs accounting for only 9.47% variance. There was overlap with correlations between items of different factors.

(16). Overall levels and Stability of Mental Activity

<table>
<thead>
<tr>
<th>Factor 1 – Slow to get moving/Low Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. I sometimes have difficulty waking up. 57 (.765)</td>
</tr>
<tr>
<td>8. I have difficulty working normally in the early part of the day. 72 (.761)</td>
</tr>
<tr>
<td>3. I find it hard to keep up a full day's work. 34 (.746)</td>
</tr>
<tr>
<td>1. I often run out of energy. 16 (.552)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Factor 2 – Excitability/Psychic Momentum</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. I sometimes find I get quite excited about various ideas or events. 29 (.795)</td>
</tr>
<tr>
<td>5. I sometimes lie awake at night with a very active mind. 50 (.701)</td>
</tr>
<tr>
<td>4. Things that don’t affect others much can sometimes leave a big impression on me. 40 (.679)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Factor 3 – Energy and Exhaustion</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. I don’t easily get downhearted or over excited about things that happen to me. 65 R (.697)</td>
</tr>
<tr>
<td>9. I find it hard to make decisions until I am in a good mood (e.g. at certain times of the day). 89</td>
</tr>
</tbody>
</table>

Commentary on Overall levels and Stability of Mental Activity

This category of trait aspects of overall levels of mental activity and stability falls into 3 categories, the first two factors of which support Liddle’s (1987) 3-factor model of schizophrenia. Factor 1 - Slow to get moving/Low Energy - corresponds to his ‘Psychomotor poverty’ factor and Factor 2- Excitability/Psychic Momentum - corresponds to his ‘disorganisation’ factor. Factor 3 - Energy and Exhaustion - contains elements of both factors 1 and 2. In the theory factor 1 corresponds to the high inertia/downstate of the cortex, and factor 2 corresponds to the upstate/high momentum state explained in the literature review and factor 3 displays features of both upstate and downstate of cortical activations. All factors show distinctiveness by their correlational independence from each other. Factor 1 accounts for 28.26% of variance, factor 2, 16.97% and factor 3 for 12.41% with a total of 57.63% variance. This result supports the theory.
<table>
<thead>
<tr>
<th>17. Oddballs</th>
</tr>
</thead>
</table>

### Factor 1

3. ThDis7 I spend a long time planning what I want to say. 60 (.734)
4. ThDis7 I will often rehearse conversations with someone I am going to meet to prepare myself for them. 75 (.703)
12. Gest1 I prefer television to radio. 90 R (-.506)
2. Ego15 I like acting in a play or skit or acting out another character 18 R (-.472)

### Factor 2

1. Mem14 I do not need a shopping list. I am good at remembering what I need. 14 R (.596)
3. Mem14 I need to make a list if I have several things to do in a day. 87 (.572)
1. SpLearn5 I am good at adapting to new situations. 5R (.454)

### Factor 3

9. Working in groups gives me energy. 86 R (.804)
4. I like to be spontaneous. 83 R (.596)
2. Ego15 I like acting in a play or skit or acting out another character 18 R (.471)

3. CrossMod I can keep good time in rapid drumming with two hands. 68 R

### Factor 4

4. SenOver10. Little sounds or lights at night don’t stop me sleeping. 32 R (.671)
1. Gest1 At a pedestrian intersection I can often sum up when it is safe to cross without needing to wait for the buzzer/green man. 1R (.669)

### Factor 5

2. SpLearn5. When I meet someone, I am not good at remembering their name on the first occasion. 43 (.745)
3. Cross4 I can keep good time in rapid drumming with two hands. 68 R (.588)
Commentary on Oddballs

The Oddballs fell into 5 factors and were included in the final Grand Factor Analysis (step 2) in Table 6.5. Factor 1 accounted for 16% of the variance, factor 2, 13.47%, factor 3, 10.02%, factor 4, 8.90% and factor 5, 8.68%.

Table 6.4 tabulates the variances for each factor and sub-factor in each category and how many items have a factor loading of less than 0.3 with items in other factors (to indicate how distinct each factor is from the other factors).

Table 6.4:
Results of Factor Analysis for STQ2: Factors named, showing variance accounted for within factors, and distinctiveness of factors within a priori categories

<table>
<thead>
<tr>
<th>No. of Factors within group</th>
<th>% of Variance in Total and in each Factor (STQ1 – variance)</th>
<th>Distinctiveness of Factor: Correlations below .300</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Gestalt - Difficulty with Gestalt Perception</td>
<td>Total Variance = 49.045</td>
<td>24/24</td>
</tr>
<tr>
<td>1. Perception of Facial Expressions</td>
<td>23.125 (16.745)</td>
<td></td>
</tr>
<tr>
<td>2. Facial Recognition</td>
<td>13.924 (13.918)</td>
<td></td>
</tr>
<tr>
<td>2. Discrimination of the Intensity of Sensory Stimuli – Difficulty distinguishing loud from soft sound</td>
<td>Total Variance = 37.289 (25.572)</td>
<td>N/A</td>
</tr>
<tr>
<td>3. Rapid Co-ordination of Sensory Input and Motor Control</td>
<td>Total Variance = 52.468 (43.395)</td>
<td>N/A</td>
</tr>
<tr>
<td>4. Cross Modal and Interhemispheric Coordination</td>
<td>Total Variance = 80.086</td>
<td>3/3</td>
</tr>
<tr>
<td>1. Cross Modal</td>
<td>46.133 (48.529)</td>
<td></td>
</tr>
<tr>
<td>2. Interhemispheric Co-ordination</td>
<td>33.953</td>
<td></td>
</tr>
<tr>
<td>5. Speed of Learning New Material</td>
<td>Total Variance = 51.990</td>
<td>N/A</td>
</tr>
<tr>
<td>6. Comprehension of Incoming Language</td>
<td>Total Variance = 55.313</td>
<td>7/8</td>
</tr>
<tr>
<td>1. Socially Contextualised Comprehension of</td>
<td>30.972 (33.393)</td>
<td></td>
</tr>
<tr>
<td>Incoming Language</td>
<td>2. Factor 2</td>
<td>24.342</td>
</tr>
<tr>
<td>-------------------</td>
<td>------------</td>
<td>--------</td>
</tr>
<tr>
<td><strong>7. Subjective Experience of Trait</strong></td>
<td><strong>Aspects of Thought Disorder</strong></td>
<td>Total Variance = 53.564</td>
</tr>
<tr>
<td><strong>8. Distractability</strong></td>
<td>Total Variance = 48.106</td>
<td>9/9</td>
</tr>
<tr>
<td>1. Factor 1</td>
<td>24.243</td>
<td>(58.972)</td>
</tr>
<tr>
<td>2. Factor 2</td>
<td>23.862</td>
<td>(26.793)</td>
</tr>
<tr>
<td><strong>9. Sustained Attention</strong></td>
<td>Total Variance = 49.898</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>10. Sensory Overload</strong></td>
<td>Total Variance = 43.096</td>
<td>15/15</td>
</tr>
<tr>
<td>1. Primarily Socially Contextualised Overload</td>
<td>25.345</td>
<td></td>
</tr>
<tr>
<td>2. Sensitivity to Noise and Emotional Overload</td>
<td>17.752</td>
<td></td>
</tr>
<tr>
<td><strong>11. Preference for Solitude/Social Avoidance</strong></td>
<td>Total Variance = 48.187</td>
<td>(37.357)</td>
</tr>
<tr>
<td><strong>12. Attentional Shift</strong></td>
<td>Total Variance = 51.558</td>
<td>5/6</td>
</tr>
<tr>
<td>1. Factor 1</td>
<td>32.328</td>
<td>(52.217)</td>
</tr>
<tr>
<td>2. Factor 2</td>
<td>19.230</td>
<td>(28.268)</td>
</tr>
<tr>
<td><strong>13. Long Trains of Thought</strong></td>
<td>Total Variance = 58.293</td>
<td>16/16</td>
</tr>
<tr>
<td>1. Conceptual - Specific</td>
<td>20.988</td>
<td>(21.327)</td>
</tr>
<tr>
<td>2. Conceptual – General Predispositions</td>
<td>20.896</td>
<td>(18.565)</td>
</tr>
<tr>
<td>3. Awareness of Creative Thought</td>
<td>16.408</td>
<td>(11.486)</td>
</tr>
<tr>
<td><strong>14. Working Memory/Visuo-spatial/Verbal</strong></td>
<td>Total Variance = 46.145</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>15. Ego Strength</strong></td>
<td>Total Variance = 51.424</td>
<td>37/42</td>
</tr>
<tr>
<td>1. Factor 1</td>
<td>29.416</td>
<td>(13.458)</td>
</tr>
<tr>
<td>2. Factor 2</td>
<td>12.534</td>
<td>(12.120)</td>
</tr>
<tr>
<td>3. Factor 3</td>
<td>9.474</td>
<td>(11.475)</td>
</tr>
<tr>
<td><strong>16. Overall levels and Stability of Mental Activity</strong></td>
<td>Total Variance = 57.634</td>
<td>26/26</td>
</tr>
<tr>
<td>1. Slow to get moving/Low energy</td>
<td>28.256</td>
<td>(31.504)</td>
</tr>
<tr>
<td>2. Excitability/Psychic Momentum</td>
<td>16.970</td>
<td>(20.613)</td>
</tr>
<tr>
<td>3. Combination of 1+2</td>
<td>12.408</td>
<td></td>
</tr>
<tr>
<td>Oddball Questions</td>
<td>Total Variance = 57.068</td>
<td></td>
</tr>
</tbody>
</table>
Table 6.5 shows the results of Step 2 of the STQ2 (‘Grand Factor Analysis’). Appendix 12 shows the breakdown of items of each factor including the assigned names for the factors. Factor 3 consists solely of the ‘Slow to get moving/Low Energy’ factor from ‘Overall levels of Mental Activity and Stability’ corresponding to one of the three factors (‘Psychomotor Poverty’ from Liddle (1987). The trait aspects (‘psychomotor poverty’ and ‘disorganisation’) of his study have been factored in our study as independent factors as outlined in Table 6.3.

From STQ1 to STQ2 Grand Factor loadings are generally higher, with greater variance accounted for in STQ2 (48.13%) compared to 33.30% in STQ1. Two factors alone in STQ2 account for more variance (39.41%) than the total variance accounted for in all 3 factors in STQ1. This means the pruning process has produced a better instrument. Results of the Grand Factor Analysis of STQ2 are presented in Table 6.5.

### Table 6.5:
**Grand Factor Analysis for STQ2**

<table>
<thead>
<tr>
<th>Factors</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensory Overload 1</td>
<td>.783</td>
<td>-.035</td>
<td>.209</td>
</tr>
<tr>
<td>Comprehension Language 1</td>
<td>.763</td>
<td>.165</td>
<td>-.058</td>
</tr>
<tr>
<td>Gestalt 1</td>
<td>.723</td>
<td>-.126</td>
<td>-.042</td>
</tr>
<tr>
<td>Thought Disorder 1</td>
<td>.707</td>
<td>-.054</td>
<td>.073</td>
</tr>
<tr>
<td>Oddball 1</td>
<td>.610</td>
<td>-.062</td>
<td>.088</td>
</tr>
<tr>
<td>Ego Strength 1</td>
<td>.594</td>
<td>.214</td>
<td>.135</td>
</tr>
<tr>
<td>Cross modal 1</td>
<td>.577</td>
<td>-.194</td>
<td>.050</td>
</tr>
<tr>
<td>Discrimination of Int S/S</td>
<td>.574</td>
<td>-.286</td>
<td>.151</td>
</tr>
<tr>
<td>Sustained Attention 1</td>
<td>.569</td>
<td>.379</td>
<td>.201</td>
</tr>
<tr>
<td>Co-ordination s/m 1</td>
<td>.546</td>
<td>.202</td>
<td>.172</td>
</tr>
<tr>
<td>Distractibility 1</td>
<td>.516</td>
<td>.239</td>
<td>.017</td>
</tr>
<tr>
<td>Ego Strength 3</td>
<td>.452</td>
<td>-.223</td>
<td>.228</td>
</tr>
<tr>
<td>Long Tr of Thought 2</td>
<td>-.405</td>
<td>.264</td>
<td>-.299</td>
</tr>
<tr>
<td>Long Tr of Thought 3</td>
<td>.345</td>
<td>.095</td>
<td>-.043</td>
</tr>
<tr>
<td>Attentional Shift 1</td>
<td>-.123</td>
<td>.854</td>
<td>.115</td>
</tr>
<tr>
<td>Ego Strength 2</td>
<td>.078</td>
<td>.686</td>
<td>.041</td>
</tr>
<tr>
<td>Distractibility 2</td>
<td>.107</td>
<td>.514</td>
<td>-.143</td>
</tr>
<tr>
<td>Oddball 2</td>
<td>-.015</td>
<td>.480</td>
<td>.018</td>
</tr>
<tr>
<td>Oddball 4</td>
<td>.195</td>
<td>.461</td>
<td>-.126</td>
</tr>
<tr>
<td>Oddball 3</td>
<td>-.021</td>
<td>.328</td>
<td>.211</td>
</tr>
<tr>
<td>Mental Stability 1</td>
<td>.364</td>
<td>.023</td>
<td>.901</td>
</tr>
<tr>
<td>% Variance Explained</td>
<td>24.218</td>
<td>11.388</td>
<td>7.620</td>
</tr>
</tbody>
</table>
6.4. STQ2: Paired T-Tests, Schizophrenia versus Control and Depression participants

Table 6.6 (for items 1-30 and Appendix 13 for items 31-96) lists the results, for all items of the STQ2, from paired T-Tests (Schizophrenia versus Normal). Supplementary data are also provided for each item on factor loading for the Schizophrenia group, the means and standard deviations for the comparison of schizophrenia and normal, as well as t-test ranks for the comparison of schizophrenia versus depression (for which greater detail is provided in table 6.8.). Items in Table 6.6 (and Appendix 13) are ranked by the T-Value for each item. Normally a probability cut-off of 0.05 would be sufficient, where 5 out of 100 would show a significant result by chance. However, as outlined in the method, the Bonferroni correction calls for a more rigorous criterion $p \leq 0.0005$ due to problems of multiple testing of 96 items. For 26/96 items, significance reached $p=0.000$, a further 8, $p<0.001$, a further 10 $p<0.002-0.008$, and a further 11 $p<0.008-0.05$.

The factor loadings along with the sub-factor on which they load are included in the table. Table 6.3 discussed these factor loadings in greater detail. For the purposes of the present table, factor loadings (preferably above 0.400) indicate strong group membership.

Included also in table 6.6 (and Appendix 13) are the rankings of T values for comparisons of schizophrenia versus depression. These data are tabulated in more detail in Table 6.8 to indicate how well each item discriminates between schizophrenia and another mental illness. Thus Table 6.6 shows how far the trait abnormalities identified here characterise schizophrenia rather than mental illness in general.

Means and SDs are also included to show how individual items were answered and the variability in each group. These numbers correspond to the following scale:

1- Strongly agree
2- Agree
3- Not sure
4- Disagree
5- Strongly disagree

Usually a score of “1” indicated strong agreement with a statement supporting the theory of trait abnormality. 2. For some items (indicated by “R”), the direction of the scale was reversed, and it was necessary to reverse the scoring to match the usual direction, in analysing the data. Data for some factors came from ‘redos’. These were items that did not load well in the first run of the factor analysis, so that a better “fit was sought in another category. In addition to this, negative T-values also reverse the relationship between schizophrenia and normal, so that the results obtained contradicted what was expected in terms of trait abnormality. The statistics are better understood when a reversal of the actual item is made mentally. For example, item 84 reads: “I do not like solitude”, the statistics becoming coherent with other items when the opposite sense is articulated i.e. “I like solitude”. The negative t value shows the normal group agrees ‘more’ than the schizophrenia group although it was predicted that the schizophrenia group would ‘like’ solitude ‘more’. This applied especially to items at the lowest rankings of items 83-96, but in this case it was mainly a chance effect, since the group differences did not reach statistical significance. The means differed little, and variability was high in both groups. Variability was generally higher in the
schizophrenia than the normal group, but for these low-ranking items was often higher in the normal group.

Fourteen items came out with negative t-values in STQ2. On analysis, these items probably fail to identify the traits they were intending to represent. Overall, the more directly-worded items, that articulate traits specifically, are the best discriminators of trait abnormalities, e.g. 10. “When I am watching television I have difficulty matching the pictures to the words that someone is speaking”. Items that extrapolate from the theory introduce additional variables. For example, “My home is usually tidy” was intended to identify a lack of awareness of one’s environment as a difficulty in Gestalt perception, but in actual fact may identify a lack of possessions or a need to keep things in order to avoid sensory overload, or any number of other reasons other than representing the intended trait.

12 out of the final combination of 13 items that are the best discriminators (according to Discriminant Function Analysis outlined in table 9c) are within the first 39 items of the table, as ranked by T-values (schizophrenia vs normal), and within the first 32, as ranked in the T-test comparison of schizophrenia versus depression. 12/13 loaded above 0.4, 11 above 0.5, 7 above 0.6, 6 above 0.7, 2 above 0.8), with 9/13 loading in the first factor. 3/13 were new items in STQ2.

Table 6.6:

STQ2 Results for each item, ranked according to T-Values (Schizophrenia versus Comparison participants), including (column 2) a priori category number, item descriptions, no. in questionnaire, reversals, and whether a new item; (column 3) T-statistic, and p-value for Schizophrenia versus Normal comparison; (column 4) factor loadings on each sub-factor (indicated in square brackets), and Depression Vs Schizophrenia t-test ranking; (column 5) means and standard deviations for 75 schizophrenia respondents; (column 6) means and standard deviation for 75 matched normal respondents. Key for means: 1 – tends to agreement with item; 5 – tends to disagreement with item, except when the scale is reversed. The subfactors derived from each a priori category are listed in Table 6.3.

<table>
<thead>
<tr>
<th>No.</th>
<th>Items: a priori category, Item description, no. in questionnaire, reversed (R), (new)</th>
<th>T-Value/ (P-Value)</th>
<th>Factor loading/ Subfactor no. Dep Rank</th>
<th>Sz Mean/ (SD)</th>
<th>Normal Mean/ (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>16. I find it hard to keep up a full day's work. 34</td>
<td>9.149 (0.000)</td>
<td>.746 [16/1] 13</td>
<td>2.51 (1.16)</td>
<td>3.95 (0.89)</td>
</tr>
<tr>
<td>2</td>
<td>16. I have difficulty working normally in the early part of the day. 72</td>
<td>7.027 (0.000)</td>
<td>.761 [16/1] 6</td>
<td>2.91 (1.18)</td>
<td>3.98 (0.72)</td>
</tr>
<tr>
<td></td>
<td>15. If I am feeling well prepared for an event, one negative comment towards me can weaken my self-confidence</td>
<td>6.518 (0.000)</td>
<td>.736 [15/1 60]</td>
<td>2.51 (1.08)</td>
<td>3.45 (0.81)</td>
</tr>
<tr>
<td>---</td>
<td>-----------------------------------------------------------------------------------------------------------------</td>
<td>----------------</td>
<td>----------------</td>
<td>-------------</td>
<td>-------------</td>
</tr>
<tr>
<td>4</td>
<td>15. Unexpected obstacles can embarrass or upset me.</td>
<td>6.293 (0.000)</td>
<td>.649 [15/1 91]</td>
<td>2.55 (1.09)</td>
<td>3.44 (0.73)</td>
</tr>
<tr>
<td>5</td>
<td>3. I have difficulty striking a ball with a bat or racket.</td>
<td>5.506 (0.000)</td>
<td>.785 [3/1 8]</td>
<td>3.43 (1.22)</td>
<td>4.30 (0.75)</td>
</tr>
<tr>
<td>6</td>
<td>6. When I ask for directions in the street, I find it hard to understand the answers I get.</td>
<td>5.482 (0.000)</td>
<td>.637 [6/1 38]</td>
<td>2.74 (1.15)</td>
<td>3.65 (0.82)</td>
</tr>
<tr>
<td>7</td>
<td>12. I have difficulty making quick decisions in new situations.</td>
<td>5.082 (0.000)</td>
<td>.712 [12/2 67]</td>
<td>2.91 (1.07)</td>
<td>3.66 (0.79)</td>
</tr>
<tr>
<td>8</td>
<td>15. If a friend does not turn up to a planned meeting with me, I would feel a sense of rejection even if I knew it was probably for a “good” reason.</td>
<td>5.068 (0.000)</td>
<td>.578 [15/1 22]</td>
<td>2.49 (1.02)</td>
<td>3.27 (0.95)</td>
</tr>
<tr>
<td>9</td>
<td>3. I have difficulty following pictures at the movies when pictures are moving fast across the screen (especially when I am sitting near the front of the movie theatre).</td>
<td>5.050 (0.000)</td>
<td>.637 [3/1 14]</td>
<td>3.11 (1.14)</td>
<td>3.86 (0.79)</td>
</tr>
<tr>
<td>10</td>
<td>4. When I am watching television I have difficulty matching the pictures to the words that someone is speaking.</td>
<td>5.042 (0.000)</td>
<td>.836 [4/1 5]</td>
<td>3.82 (1.01)</td>
<td>4.49 (0.54)</td>
</tr>
<tr>
<td>11</td>
<td>16. I often run out of energy.</td>
<td>4.889 (0.000)</td>
<td>.552 [16/1 62]</td>
<td>2.57 (1.09)</td>
<td>3.31 (0.98)</td>
</tr>
<tr>
<td>12</td>
<td>11. I would prefer to live alone.</td>
<td>4.665 (0.000)</td>
<td>.457 [11/1 3]</td>
<td>2.84 (1.38)</td>
<td>3.69 (0.74)</td>
</tr>
<tr>
<td></td>
<td>Question</td>
<td>Score</td>
<td>T-scores</td>
<td>P-values</td>
<td>Z-scores</td>
</tr>
<tr>
<td>---</td>
<td>-------------------------------------------------------------------------</td>
<td>-------</td>
<td>----------</td>
<td>----------</td>
<td>----------</td>
</tr>
<tr>
<td>13</td>
<td>7. Sometimes I know that I cannot explain what I want to say so I keep quiet.  84 (new)</td>
<td>4.557</td>
<td>.571 [7/1] 54</td>
<td>2.46 (0.99)</td>
<td>3.23 (0.92)</td>
</tr>
<tr>
<td>14</td>
<td>6. I have difficulty understanding what people are really trying to say.  6</td>
<td>4.351</td>
<td>.775 [6/1] 65</td>
<td>3.22 (1.19)</td>
<td>3.94 (0.65)</td>
</tr>
<tr>
<td>15</td>
<td>6. I can easily follow the plot in a film or play.  22 R</td>
<td>4.344</td>
<td>.803 [6/2] 29</td>
<td>3.27 (1.19)</td>
<td>3.96 (0.59)</td>
</tr>
<tr>
<td>16</td>
<td>16. I find it hard to make decisions until I am in a good mood (e.g. at certain times of the day).  89 (new)</td>
<td>4.290</td>
<td>.680 [16/3] 49</td>
<td>2.91 (1.17)</td>
<td>3.61 (0.88)</td>
</tr>
<tr>
<td>17</td>
<td>12. In a classroom (or committee etc) I get confused by the continual change of subject.  23</td>
<td>4.173</td>
<td>.868 [12/2] 85</td>
<td>2.93 (1.15)</td>
<td>3.55 (0.79)</td>
</tr>
<tr>
<td>18</td>
<td>9. I have problems paying attention for any length of time (e.g. television, or other people talking).  9</td>
<td>4.136</td>
<td>.495 [9/1] 79</td>
<td>2.78 (1.23)</td>
<td>3.57 (1.01)</td>
</tr>
<tr>
<td>19</td>
<td>8. I am very sensitive to noise.  52</td>
<td>3.997</td>
<td>.542 [8/1] 9</td>
<td>2.64 (1.24)</td>
<td>3.34 (0.91)</td>
</tr>
<tr>
<td>20</td>
<td>10. Physical contact overwhelms me.  19</td>
<td>3.986</td>
<td>.738 [10/1] 70</td>
<td>3.12 (1.18)</td>
<td>3.75 (0.78)</td>
</tr>
<tr>
<td>21</td>
<td>1. I prefer television to radio.  90 R</td>
<td>3.900</td>
<td>.740 [1/4] 30</td>
<td>2.64 (1.22)</td>
<td>3.25 (0.87)</td>
</tr>
<tr>
<td>22</td>
<td>4. At pedestrian crossings I am confused by the “green man” or “red man” signs telling me when to walk.  42</td>
<td>3.760</td>
<td>.825 [4/1] 12</td>
<td>4.03 (0.99)</td>
<td>4.58 (0.65)</td>
</tr>
<tr>
<td>23</td>
<td>7. When I want to say something, I</td>
<td>3.759</td>
<td>.809 2.90</td>
<td>3.55</td>
<td></td>
</tr>
<tr>
<td></td>
<td>sometimes find that I cannot make my sentences as fast as I need to.  7</td>
<td>(0.000)</td>
<td>[7/1] 39</td>
<td>(1.26)</td>
<td>(0.83)</td>
</tr>
<tr>
<td>---</td>
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<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>24</td>
<td>12. I like jobs where I have to interact with many people. 78</td>
<td>3.742 (0.000)</td>
<td>no loading 2</td>
<td>3.19 (1.08)</td>
<td>3.75 (0.71)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>1. I have been told that I misinterpret people’s facial expressions or get them wrong. 35 (new)</td>
<td>3.661 (0.000)</td>
<td>.764 [1/1] 10</td>
<td>3.26 (1.18)</td>
<td>3.85 (0.67)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>10. When I am in busy streets, the sight of everyone walking in front of me is very distracting. 10</td>
<td>3.647 (0.000)</td>
<td>.725 [10/1] 25</td>
<td>2.55 (1.09)</td>
<td>3.45 (0.73)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>1. At a pedestrian intersection I can often sum up when it is safe to cross without needing to wait for the buzzer/green man. 1</td>
<td>3.515 (0.001)</td>
<td>.693 [1/2] 32</td>
<td>3.70 (1.09)</td>
<td>4.27 (0.63)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>3. I am good at catching a ball. 37</td>
<td>3.458 (0.001)</td>
<td>.785 [3/1] 94</td>
<td>3.49 (1.19)</td>
<td>4.02 (0.70)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>10. When I am emotionally upset, I find it difficult to remember things. 61</td>
<td>3.386 (0.001)</td>
<td>.636 [10/2] 58</td>
<td>2.49 (1.08)</td>
<td>3.03 (0.88)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>2. I have difficulty distinguishing loud from soft sounds. 2</td>
<td>3.376 (0.001)</td>
<td>.760 [2/1] 95</td>
<td>3.70 (1.08)</td>
<td>4.24 (0.64)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 6.7 contains the results of the T-test performed on aggregate scores for each \textit{a priori} category. The Bonferroni correction does not apply here since there is no multiple testing. Accordingly, a criterion of \( p \leq 0.05 \) applies for statistical significance. All categories show significant differences between the 75 participants with verified diagnoses of schizophrenia versus 75 matched normal participants (some matches being an average of several normal participants that matched the schizophrenia participant on the criteria for matching. This gave a better representation of the normals for matching). The means and standard deviations for each group are included.
Table 6.7.
STQ2: Paired T-Tests, aggregate scores, for each \textit{a priori} category: Schizophrenia (verified) versus Comparison Participants. Including Means and Standard Deviations for Schizophrenia and Normal. Means and standard deviations are based on summary scores for all items in that category.

<table>
<thead>
<tr>
<th>No.</th>
<th>\textit{A priori} Category Description</th>
<th>T Value</th>
<th>P Value (2-tailed)</th>
<th>Sz Mean SD</th>
<th>Norm Mean SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Difficulty with Gestalt Perception</td>
<td>4.839</td>
<td>0.000</td>
<td>3.12</td>
<td>0.56</td>
</tr>
<tr>
<td>2</td>
<td>Discrimination of the Intensity of Sensory Stimuli</td>
<td>3.854</td>
<td>0.000</td>
<td>3.16</td>
<td>0.69</td>
</tr>
<tr>
<td>3</td>
<td>Rapid Co-ordination of Sensory Input and Motor Control</td>
<td>7.060</td>
<td>0.000</td>
<td>3.34</td>
<td>0.81</td>
</tr>
<tr>
<td>4</td>
<td>Cross Modal and Inter-hemispheric Co-ordination</td>
<td>5.032</td>
<td>0.000</td>
<td>3.70</td>
<td>0.67</td>
</tr>
<tr>
<td>5</td>
<td>Speed of Learning New Material</td>
<td>3.032</td>
<td>0.003</td>
<td>2.86</td>
<td>0.70</td>
</tr>
<tr>
<td>6</td>
<td>Comprehension Of Incoming Language</td>
<td>6.586</td>
<td>0.000</td>
<td>3.01</td>
<td>0.63</td>
</tr>
<tr>
<td>7</td>
<td>Subjective Experience of Trait Aspects of Thought Disorder</td>
<td>4.646</td>
<td>0.000</td>
<td>2.81</td>
<td>0.76</td>
</tr>
<tr>
<td>8</td>
<td>Distractibility</td>
<td>3.654</td>
<td>0.000</td>
<td>2.73</td>
<td>0.70</td>
</tr>
<tr>
<td>9</td>
<td>Sustained Attention</td>
<td>4.193</td>
<td>0.000</td>
<td>2.80</td>
<td>1.22</td>
</tr>
<tr>
<td>10</td>
<td>Sensory Overload</td>
<td>5.024</td>
<td>0.000</td>
<td>2.98</td>
<td>0.60</td>
</tr>
<tr>
<td>11</td>
<td>Preference for Solitude</td>
<td>4.728</td>
<td>0.000</td>
<td>2.80</td>
<td>1.37</td>
</tr>
<tr>
<td>12</td>
<td>Shift of Attention</td>
<td>7.266</td>
<td>0.000</td>
<td>3.00</td>
<td>0.61</td>
</tr>
<tr>
<td>13</td>
<td>Long Trains of Thought</td>
<td>3.288</td>
<td>0.002</td>
<td>2.74</td>
<td>1.02</td>
</tr>
<tr>
<td>14</td>
<td>Working Memory</td>
<td>1.678</td>
<td>0.098</td>
<td>2.50</td>
<td>1.13</td>
</tr>
<tr>
<td>15</td>
<td>Ego Strength</td>
<td>6.483</td>
<td>0.000</td>
<td>2.94</td>
<td>0.55</td>
</tr>
<tr>
<td>16</td>
<td>Overall levels and Stability of Mental Activity</td>
<td>10.515</td>
<td>0.000</td>
<td>2.68</td>
<td>0.54</td>
</tr>
</tbody>
</table>
6.5. STQ2: Paired T-Tests, Schizophrenia versus participants with Depression.

Table 6.8 tabulates the T-test results comparing 29 matched schizophrenia respondents to 29 depression respondents (some matches being an average of several schizophrenia participants that matched the depression case on the criteria for matching. This gave a better representation of the schizophrenia respondents for matching). These data were sought to test whether the trait abnormalities identified here apply to schizophrenia specifically rather than to mental health service users in general. However, since there were only 29 matched pairs high levels of significance were not expected. Therefore, these statistics provide support for the differences in the direction expected according to the theory, but there is a need to pursue comparison of these two groups in further research. The rankings of T-values from 1 to 35 are listed, beyond which the data are not reliable and do not warrant inclusion here.

Table 6.8.

STQ2: Paired T-Tests, item by item: Schizophrenia versus Depression participants

T-tests, means and standard deviations for 29 verified schizophrenia respondents matched with 29 verified depression respondents.

Key for means: 1 - tends to agreement with item; 5 - tends to disagreement with item, except where they have been reversed (R).

<table>
<thead>
<tr>
<th>Rank</th>
<th>Item</th>
<th>T Value</th>
<th>P Value</th>
<th>(Sz) Mean SD</th>
<th>(Dep) Mean SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>13. I am interested in systems of ideas in politics, religion, philosophy. 13</td>
<td>2.806</td>
<td>0.009</td>
<td>2.16</td>
<td>1.070</td>
</tr>
<tr>
<td>2</td>
<td>4. When I am watching television I have difficulty matching the pictures to the words someone is speaking. 4</td>
<td>2.733</td>
<td>0.011</td>
<td>3.65</td>
<td>1.049</td>
</tr>
<tr>
<td>3</td>
<td>3. I have difficulty striking a ball with a bat or racket. 3</td>
<td>2.579</td>
<td>0.015</td>
<td>2.84</td>
<td>1.506</td>
</tr>
<tr>
<td>4</td>
<td>16. I have difficulty working normally in the early part of the day. 72</td>
<td>2.352</td>
<td>0.026</td>
<td>2.49</td>
<td>1.265</td>
</tr>
<tr>
<td>5</td>
<td>15. I feel new clothes take a while to feel right. 96</td>
<td>2.237</td>
<td>0.033</td>
<td>2.45</td>
<td>1.019</td>
</tr>
<tr>
<td>6</td>
<td>At pedestrian crossings I am confused by the “green man” or “red man” signs</td>
<td>1.933</td>
<td>0.063</td>
<td>4.20</td>
<td>.890</td>
</tr>
<tr>
<td>No.</td>
<td>Statement</td>
<td>Value</td>
<td>Standard Deviation</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>-----</td>
<td>---------------------------------------------------------------------------</td>
<td>-------</td>
<td>--------------------</td>
<td>------</td>
<td>----</td>
</tr>
<tr>
<td>7</td>
<td>12. I like jobs where I interact with many people. 78 R</td>
<td>1.807</td>
<td>0.081</td>
<td>2.97</td>
<td>1.125</td>
</tr>
<tr>
<td>8</td>
<td>13. I am interested in looking at new possible ways of explaining things in the world. 95</td>
<td>1.776</td>
<td>0.087</td>
<td>2.01</td>
<td>1.046</td>
</tr>
<tr>
<td>9</td>
<td>2. I am sometimes told that I have the stereo on too loud. 21</td>
<td>1.720</td>
<td>0.096</td>
<td>2.55</td>
<td>1.328</td>
</tr>
<tr>
<td>10</td>
<td>7. I often rehearse conversations with someone I am going to meet to prepare myself for them. 75</td>
<td>1.672</td>
<td>0.106</td>
<td>2.43</td>
<td>1.385</td>
</tr>
<tr>
<td>11</td>
<td>11. I would prefer to live alone. 77</td>
<td>1.585</td>
<td>0.124</td>
<td>2.59</td>
<td>1.476</td>
</tr>
<tr>
<td>12</td>
<td>13. I have fantasies that could be used as the basis for artistic productions or activities. 48</td>
<td>1.418</td>
<td>0.167</td>
<td>2.71</td>
<td>1.326</td>
</tr>
<tr>
<td>13</td>
<td>3. I have problems following pictures at the movies when pictures are moving fast across the screen (especially when I am sitting near the front of the movie theatre. 67</td>
<td>1.273</td>
<td>0.213</td>
<td>2.90</td>
<td>1.213</td>
</tr>
<tr>
<td>14</td>
<td>1. At a pedestrian intersection I can often sum up when it is safe to cross without needing to wait for the buzzer/green man. 1 R</td>
<td>1.245</td>
<td>0.223</td>
<td>4.11</td>
<td>.949</td>
</tr>
<tr>
<td>15</td>
<td>1. I have been told that I misinterpret people’s facial expressions or get them wrong. 35</td>
<td>1.177</td>
<td>0.249</td>
<td>2.69</td>
<td>1.220</td>
</tr>
<tr>
<td>16</td>
<td>6. I can easily follow a plot in a film or play. 22 R</td>
<td>1.110</td>
<td>0.277</td>
<td>3.19</td>
<td>1.404</td>
</tr>
<tr>
<td>17</td>
<td>1. I sometimes find I have guessed a person is angry from their expression and then find out that they are not. 81</td>
<td>1.077</td>
<td>0.291</td>
<td>2.40</td>
<td>.968</td>
</tr>
<tr>
<td>18</td>
<td>10. Bouncing balls distract me. 27</td>
<td>1.050</td>
<td>0.303</td>
<td>3.07</td>
<td>1.357</td>
</tr>
<tr>
<td>19</td>
<td>13. I prefer to deal with day to day</td>
<td>1.019</td>
<td>0.317</td>
<td>3.32</td>
<td>1.150</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td><strong>1.</strong> It is sometimes easier to recognise someone by their voice rather than by their face. 17</td>
<td>1.007</td>
<td>0.322</td>
<td>3.01</td>
<td>1.170</td>
</tr>
<tr>
<td>21</td>
<td><strong>15.</strong> If a friend does not turn up to a planned meeting with me, I would feel a sense of rejection even if I knew it was probably for a “good” reason. 15</td>
<td>0.990</td>
<td>0.331</td>
<td>2.11</td>
<td>1.056</td>
</tr>
<tr>
<td>22</td>
<td><strong>10.</strong> When I am in busy streets the sight of everyone walking in front of me is very distracting. 10</td>
<td>0.911</td>
<td>0.370</td>
<td>2.79</td>
<td>1.236</td>
</tr>
<tr>
<td>23</td>
<td><strong>1.</strong> When I meet someone I know I find that they can recognise me by my face, but I cannot recognise them by their face. 30</td>
<td>0.835</td>
<td>0.411</td>
<td>2.97</td>
<td>1.404</td>
</tr>
<tr>
<td>24</td>
<td><strong>16.</strong> I find it hard to keep up a full day’s work. 34</td>
<td>0.770</td>
<td>0.448</td>
<td>2.34</td>
<td>1.310</td>
</tr>
<tr>
<td>25</td>
<td><strong>7.</strong> When I want to say something, I sometimes cannot make my sentences as fast as I need to. 7</td>
<td>0.728</td>
<td>0.473</td>
<td>2.90</td>
<td>1.377</td>
</tr>
<tr>
<td>26</td>
<td><strong>3.</strong> I like to be spontaneous. 83 R</td>
<td>0.679</td>
<td>0.503</td>
<td>3.42</td>
<td>.974</td>
</tr>
<tr>
<td>27</td>
<td><strong>7.</strong> My speech sometimes gets mixed up. 31</td>
<td>0.648</td>
<td>0.522</td>
<td>2.50</td>
<td>1.00</td>
</tr>
<tr>
<td>28</td>
<td><strong>16.</strong> I sometimes have difficulty waking up. 57</td>
<td>0.570</td>
<td>0.573</td>
<td>2.44</td>
<td>1.345</td>
</tr>
<tr>
<td>29</td>
<td><strong>1.</strong> I usually notice what someone is wearing or the details of what’s around me. 73 R</td>
<td>0.453</td>
<td>0.654</td>
<td>3.63</td>
<td>.926</td>
</tr>
<tr>
<td>30</td>
<td><strong>8.</strong> I am very sensitive to noise. 52</td>
<td>0.424</td>
<td>0.675</td>
<td>2.59</td>
<td>1.303</td>
</tr>
<tr>
<td>31</td>
<td><strong>1.</strong> I prefer television to radio. 92 R</td>
<td>0.414</td>
<td>0.682</td>
<td>2.83</td>
<td>1.087</td>
</tr>
<tr>
<td>32</td>
<td><strong>1.</strong> I tend to remember people by their faces more than by their names. 58 R</td>
<td>0.358</td>
<td>0.723</td>
<td>3.58</td>
<td>1.127</td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>Factors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>------------------------------------------------------------------------------</td>
<td>---------</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>33</td>
<td><strong>13.</strong> I find my train of thought interferes with my ability to concentrate on what someone is saying. 38</td>
<td>0.320</td>
<td>0.753</td>
<td>2.39</td>
<td>2.14</td>
</tr>
<tr>
<td>34</td>
<td><strong>13.</strong> I like thinking of other possible ways of explaining complicated questions including questions about health. 63</td>
<td>0.245</td>
<td>0.808</td>
<td>2.44</td>
<td>2.52</td>
</tr>
<tr>
<td>35</td>
<td><strong>16.</strong> I find I get quite excited about various ideas or events. 29</td>
<td>0.187</td>
<td>0.853</td>
<td>1.95</td>
<td>2.00</td>
</tr>
<tr>
<td>36</td>
<td><strong>16.</strong> Things that don’t affect others much can leave a big impression on me. 40</td>
<td>0.154</td>
<td>0.879</td>
<td>2.16</td>
<td>2.21</td>
</tr>
</tbody>
</table>

### 6.6. STQ2: Discriminant Function Analysis

The statistics so far used in this research were performed for the following purposes:

1. To understand the underlying correlational structure that supports (or does not support) the theory upon which the STQ is based, using factor analysis,
2. To determine the number of respondents needed for statistical power with power analyses,
3. To find out the statistical significance for differences between the MHU or schizophrenia groups, compared with normal and depression groups.

Each statistic has been chosen to refine and condense the results, and to identify items that can categorically discriminate schizophrenia (on the basis of non-psychotic traits) from normal. The final statistic used is Discriminant Function Analysis which allows one to determine whether the combined predictive power of a set of variables (questionnaire items) is effective in predicting category membership (schizophrenia or normal). This would be the purpose to which a potential early intervention questionnaire might be put. In terms of current data, it tests which group of items in combination best determines whether an individual will fall into the schizophrenia category or the normal category.

In stepwise Discriminant Function Analysis, a model of discrimination is built step-by-step. Specifically, at each step all items (variables) are reviewed and evaluated to determine which one will contribute most to the discrimination between schizophrenia and normal groups. That item will then be included in the model, and the process starts again. Table 6.9a shows the 7 items that were found to be the best combination of discriminators by this method. Table 6.9b uses a Receiver Operating Characteristic (ROC) curve from signal detection theory, which evaluates the trade-off between true and false positive rates in classification. An arbitrary cut-off point can be adjusted according to one’s objective. For instance, if one wants to find all people at risk of schizophrenia, then the false-positive rate would necessarily be increased to include all possibilities. If one wants to identify only the ones *definitely* at risk then exclusion of controls would be more accurate, but some with schizophrenia would necessarily be
missed. In table 6.9b, 87.1% of original grouped cases were correctly classified via the stepwise method.

Table 6.9a:
Discriminant function analysis, Stepwise version: Summary of best seven discriminating items.
Ranking showing corresponding T-tests for Schizophrenia and Normal participants, with means and SDs for schizophrenia, normal and depression groups.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Item</th>
<th>SzVsN T (P)</th>
<th>Sz Vs N</th>
<th>Sz Vs Dep</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>16. I find it hard to keep up a full day’s work. (34)</td>
<td>9.149 (.000)</td>
<td>2.51 (1.16)</td>
<td>3.95 (.89)</td>
</tr>
<tr>
<td>2.</td>
<td>1. At a pedestrian intersection I can often sum up when it is safe to cross without needing to wait for the buzzer/green man. R (1)</td>
<td>3.515 (.000)</td>
<td>3.7 (1.09)</td>
<td>4.27 (.63)</td>
</tr>
<tr>
<td>3.</td>
<td>1. I prefer television to radio. R (90)</td>
<td>3.900 (.000)</td>
<td>2.64 (1.22)</td>
<td>3.25 (.87)</td>
</tr>
<tr>
<td>4.</td>
<td>1. When I meet someone I know I find that they can recognise me by my face, but I cannot recognise them by their face. (30)</td>
<td>3.358 (.001)</td>
<td>2.97 (1.24)</td>
<td>3.55 (.82)</td>
</tr>
<tr>
<td>5.</td>
<td>12. I like jobs where I have to interact with many people. R (78)</td>
<td>3.742 (.000)</td>
<td>3.19 (1.08)</td>
<td>3.75 (.71)</td>
</tr>
<tr>
<td>6.</td>
<td>2. I find music sounds much the same when the volume is turned down (I do not notice it is not so loud). (36)</td>
<td>2.967 (.004)</td>
<td>3.16 (0.14)</td>
<td>3.64 (.77)</td>
</tr>
<tr>
<td>7.</td>
<td>11. I would prefer to live alone. (77)</td>
<td>4.665 (.000)</td>
<td>2.84 (1.38)</td>
<td>3.69 (.74)</td>
</tr>
</tbody>
</table>
Table 6.9b:
Classification of participants (true/false positive or negative identification), based on stepwise Discriminant Function Analysis (Table 6.9.a)
Classification using ROC curve to set criterion for true/false positives, showing results of predicted membership and actual membership in schizophrenia and normal groups using ‘stepwise’ Discriminant Function Analysis. The cut-off point for this table was conservative, with 25.7% of those with the schizophrenia diagnosis predicted to be normal, with 87.1% of original grouped cases (schizophrenia plus normal) correctly classified.

<table>
<thead>
<tr>
<th>Diagnosis: Sz/Norm</th>
<th>Predicted Group Membership</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sz</td>
<td>Norm</td>
</tr>
<tr>
<td>Original Count</td>
<td>55</td>
<td>19</td>
</tr>
<tr>
<td>Norm</td>
<td>10</td>
<td>140</td>
</tr>
<tr>
<td>%</td>
<td>74.3</td>
<td>25.7</td>
</tr>
<tr>
<td></td>
<td>6.7</td>
<td>93.3</td>
</tr>
</tbody>
</table>

87.1% of original grouped cases correctly classified

It is also possible in discriminant function analysis to arrive at a similar result by an alternative approach, as in ‘independents entered together’ or ‘backward stepwise analysis’, where all items are included in the model and then, at each step, the item that contributes least to the prediction of schizophrenia versus normal is eliminated. Thus, as the result of a successful discriminant function analysis, one would keep only the "important" items in the model, that is, those variables that contribute the most to the discrimination between schizophrenia and normal. Table 6.9c shows the 13 items (chosen as the highest ranking of 21 items) as the best combination of discriminators. This includes the 7 from the stepwise method. Table 6.9d shows the ROC curve that was set at a cut-off that assumed similar mistakes made for each group at 14-15%. 85.7% of original grouped cases were correctly classified using this method. This means that, with a combination of these items (with limited help from the remaining 21 items included in the ‘pool’) individuals with schizophrenia could be correctly distinguished as having schizophrenia to 85% accuracy.
Table 6.9c:

Discriminant function analysis, Independents entered together (“backward stepwise”) version: Summary of best thirteen discriminating items.

Ranking showing corresponding T-tests for Schizophrenia and Normal, with means and SDs for Schizophrenia, with Normal, and Depression.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Item</th>
<th>SzVN T (P)</th>
<th>Sz Vs Sz Mean (SD)</th>
<th>N Mean (SD)</th>
<th>Sz Vs Sz Mean (SD)</th>
<th>Dep Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>16. I find it hard to keep up a full day's work. (34)</td>
<td>9.149 (0.000)</td>
<td>2.51 (1.16)</td>
<td>3.95 (.89)</td>
<td>2.34 (1.31)</td>
<td>2.52 (1.24)</td>
</tr>
<tr>
<td>2.</td>
<td>1. I prefer television to radio. R (90)</td>
<td>3.900 (0.000)</td>
<td>2.64 (1.22)</td>
<td>3.25 (.87)</td>
<td>2.83 (1.09)</td>
<td>2.62 (1.05)</td>
</tr>
<tr>
<td>3.</td>
<td>12. I like jobs where I have to interact with many people. R (78)</td>
<td>3.742 (0.000)</td>
<td>3.19 (1.08)</td>
<td>3.75 (.71)</td>
<td>2.97 (1.13)</td>
<td>3.52 (1.24)</td>
</tr>
<tr>
<td>4.</td>
<td>2. I find music sounds much the same when the volume is turned down (I do not notice it is not so loud). (36)</td>
<td>2.967 (0.004)</td>
<td>3.16 (0.14)</td>
<td>3.64 (.77)</td>
<td>2.88 (1.24)</td>
<td>3.07 (1.36)</td>
</tr>
<tr>
<td>4.</td>
<td>11. I would prefer to live alone. (77)</td>
<td>4.665 (0.000)</td>
<td>2.84 (1.38)</td>
<td>3.69 (.74)</td>
<td>2.59 (1.48)</td>
<td>3.17 (1.39)</td>
</tr>
<tr>
<td>6.</td>
<td>1. At a pedestrian intersection I can often sum up when it is safe to cross without needing to wait for the buzzer/green man. R (1)</td>
<td>3.515 (0.000)</td>
<td>3.7 (1.09)</td>
<td>4.27 (.63)</td>
<td>4.11 (.949)</td>
<td>4.38 (.862)</td>
</tr>
<tr>
<td>7.</td>
<td>1. When I meet someone I know I find that they can recognise me by my face, but I cannot recognise them by their face. (30)</td>
<td>3.358 (0.001)</td>
<td>2.97 (1.24)</td>
<td>3.55 (.82)</td>
<td>2.97 (1.40)</td>
<td>3.28 (1.25)</td>
</tr>
<tr>
<td>8.</td>
<td>1. At pedestrian crossings I am confused by the “green man” or “red man” signs telling me when to walk. (42)</td>
<td>3.760 (0.000)</td>
<td>4.03 (.99)</td>
<td>4.58 (.65)</td>
<td>4.20 (.89)</td>
<td>4.62 (.677)</td>
</tr>
<tr>
<td>9.</td>
<td>1. I sometimes find I have</td>
<td>3.021</td>
<td>2.72</td>
<td>3.21</td>
<td>2.40</td>
<td>2.66</td>
</tr>
</tbody>
</table>
Table 6.10b. Please note: items 1 and 12 in this list may be medication effects (see Discussion).

<table>
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<tr>
<th>Item</th>
<th>Description</th>
<th>Schizophrenia</th>
<th>Normal</th>
<th>t-test (Critical t)</th>
<th>p-value</th>
<th>df</th>
<th>Critical t</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>A friend does not turn up to a planned meeting with me, and I would feel a sense of rejection even if I knew it was probably for a “good” reason.</td>
<td>5.042</td>
<td>3.82</td>
<td>2.49</td>
<td>2.11</td>
<td>2.40</td>
<td>1.01</td>
<td>.01</td>
</tr>
<tr>
<td>11</td>
<td>When I am watching television I have difficulty matching the pictures to the words that someone is speaking.</td>
<td>5.042</td>
<td>3.82</td>
<td>4.49</td>
<td>3.65</td>
<td>4.38</td>
<td>1.02</td>
<td>.02</td>
</tr>
<tr>
<td>12</td>
<td>I have difficulty working normally in the early part of the day.</td>
<td>7.027</td>
<td>2.91</td>
<td>3.98</td>
<td>2.49</td>
<td>3.21</td>
<td>1.02</td>
<td>.03</td>
</tr>
<tr>
<td>13</td>
<td>I have fantasies that can be used as the basis for artistic productions or activities.</td>
<td>2.350</td>
<td>3.12</td>
<td>2.96</td>
<td>2.71</td>
<td>3.17</td>
<td>1.02</td>
<td>.04</td>
</tr>
</tbody>
</table>

Please note: items 1 and 12 in this list may be medication effects (see Discussion).

In the last item of the Table 6.10c. “I have fantasies that can be used as the basis for artistic productions or activities” an apparent anomaly occurred. The mean for Schizophrenia shows less agreement to the item than the mean for the normal group, which initially lead the author to assume that there had been a transcription error in the figures. This was investigated and found to not be the case. The only other reason, it appeared, was due to the fact that, for the t-tests, the figures used were for the matched 75 normal and 75 schizophrenia data, but in the discriminant function analysis the 75 schizophrenia group data was used with the whole population data for STQ2 of 150 for the normal group. To confirm this, a mean was taken for the original 150 normal group for this item and the additional data did reverse the result. The mean for the normal group changed from 2.96 to 3.27 (in a direction away from agreement) which put the schizophrenia group in more agreement with the item at a mean of 3.12, which one assumes contributes to its discriminatory power in this statistic for distinguishing schizophrenia.
Table 6.9d:
Classification of participants (true/false positive or negative identification), based on “backward stepwise” Discriminant Function Analysis (Table 6.9c)

Classification using ROC curve to set criterion for true/false positives, showing results of predicted membership and actual membership in schizophrenia and normal groups using ‘backward stepwise’ Discriminant Function Analysis. Cut-off point was set to be an approximately equal proportion of false positives for each group. Around 14-15% were false positive.

<table>
<thead>
<tr>
<th>Diagnosis: Sz/Norm</th>
<th>Predicted Group Membership</th>
<th>Total</th>
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<td></td>
<td>Sz</td>
<td>Norm</td>
</tr>
<tr>
<td>Original Count</td>
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<td></td>
</tr>
<tr>
<td>Sz</td>
<td>63</td>
<td>11</td>
</tr>
<tr>
<td>Norm</td>
<td>21</td>
<td>129</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>%</th>
<th>Sz</th>
<th>Norm</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
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<td>100</td>
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<tr>
<td>Norm</td>
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<td>86.0</td>
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<td></td>
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</tbody>
</table>

85.7% of original grouped cases correctly classified

Table 6.10 is a key to the a priori categories represented in the Discriminant Function Analysis and shows how well each category is represented in the results. Difficulty with Gestalt Perception is the best represented category in both versions and is at the heart of the theory of trait abnormalities.

Table 6.10.
A priori Category Key, for Items featuring in Discriminant Function Analysis (from Table 6.9c).

<table>
<thead>
<tr>
<th>Category No.</th>
<th>A Priori Category Description</th>
<th>No. in Stepwise</th>
<th>No. in Backward</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Difficulty with Gestalt Perception</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>Discrimination of the Intensity of Sensory Stimuli</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>3.</td>
<td>Rapid Co-ordination of Sensory Input and Motor Control</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4.</td>
<td>Cross-modal Co-ordination and Inter-hemispheric Co-ordination</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>5.</td>
<td>Speed of Learning New Material</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6.</td>
<td>Comprehension of Incoming Language</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7.</td>
<td>Subjective Experience of Trait Aspects of Thought Disorder</td>
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<td>0</td>
</tr>
<tr>
<td>8.</td>
<td>Distractibility</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>9.</td>
<td>Sustained Attention</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10.</td>
<td>Sensory Overload</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>11.</td>
<td>Preference for Solitude</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>12.</td>
<td>Attentional Shift</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>13.</td>
<td>Long Trains of Thought</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>14.</td>
<td>Working Memory/Visuo-spatial/Verbal</td>
<td>0</td>
<td>0</td>
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<tr>
<td>15.</td>
<td>Ego Strength/Sense of Self</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>16.</td>
<td>Overall levels of Mental Activity and Stability</td>
<td>1</td>
<td>2</td>
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</tbody>
</table>
6.7. Reliability statistics for repeat questionnaires

Table 6.11 shows the percentage of agreement between repeats for 62 respondents, repeating the STQ with a gap of from 6 and 12 months between trials. This serves to assess the reliability of the instrument. Shifts of up to one point difference would not take a person to an opposite position, i.e. from agreeing to disagreeing or visa versa. It would only take an individual to or from a ‘not sure’ or ‘agree’ to ‘strongly agree’ and visa versa. Overall, only 3 items had more than 25 % of respondents with an average of two or more points difference. Therefore 93/96 items had 75% and mostly higher agreement of one point or less difference. The boxes that are empty mean the kappa statistic could not be computed according to SPSS.

Table 6.11: Reliability: Kappa statistics for repeat questionnaires.

This Table shows the degree of agreement between 62 repeat questionnaires filled out over period of a 6 to 12 month time delay. Kappa Statistic showing agreement over the 5 point Likert scale, and the same, when the data were condensed to a 3-point scale, with values for percentage of total agreement, percentage of one point and two point difference between trials on the 5-point scale.

<table>
<thead>
<tr>
<th>Question No.</th>
<th>Kappa Statistic 5 Point Scale</th>
<th>Kappa Statistic 3 Point Scale</th>
<th>Percentage of total agreement between trials</th>
<th>Percentage of one point difference between trials</th>
<th>Percentage Two or more points difference between trials</th>
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<tr>
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Discussion

The objective of this research is to provide a basis from which an eventual first screening tool for risk of developing schizophrenia can be developed, which is practical, accessible and inexpensive, yet based on a rigorous research-based theory. The eventual aim is that it be adapted for a longitudinal study of at-risk young people. This thesis is the first step towards that goal. Two interlocking theories form the basis from which the STQ arises, and the results obtained here are broadly supportive of this theoretical base, if not a fully rigorous test of them. These are the psychobiological explanations for normal left and right differences, and of the enduring non-psychotic trait abnormalities of schizophrenia and related conditions.

The methods used have been discussed with researchers in the area of early intervention. Every effort was made both to be faithful to the data, and to give the participants in this study an experience which was positive and even empowering. In practical terms, this meant allowing for as much time as was required by the respondent to talk through any related or unrelated issues that came up from the questionnaire items, or the process itself, in a climate of respect and ‘equal ground’. This was an important aspect to the author since it was a privileged position to gain the trust and respect of individuals who are disclosing personal information, which may in a historical context not have been safe.

7.1. Critique of Methods

7.1.1. The Questionnaire

Presenting the questionnaire on an individual basis, did reveal specific problems some participants had with some of the language used, in terms of vocabulary, length of sentence, ambiguity, etc. Many of the items that posed problems were eliminated due to their performance in the statistical results. An example is, “I like contact sports such as rugby or wrestling etc”. This could have referred to either playing or watching sport, although it was meant to address a crucial underlying concept, about being physically overwhelmed by others as an issue of sensory overload. In terms of vocabulary, the item “I do not like solitude” was unclear to several participants who were unsure of the meaning of solitude. Double negatives presented a problem for a few participants such as in, “Sudden noises like a person coughing or a dog barking, don’t make me jump”. The expectation is that the phrases themselves would be agreed or disagreed to, but adding the negative version was disorientating. Some items were ambiguous, such as the item “I get bored when people take ideas too seriously”. This could imply a reaction either to personality characteristics of a person with the ideas, rather than (as intended) whether the participant likes to engage in ‘long trains of thought’. Some items were obviously too long to process, especially when they are part of a long questionnaire requiring constant switch of attention, itself a problem in schizophrenia. An example is, “I have difficulty following pictures at the movies when pictures are moving fast across the screen (especially when I am near the front of the movie theatre)”. Some phrasing was not particularly easy to relate to, such as the eliminated item from STQ1, “I tend to make judgments on first impulse rather than after careful analysis”. “Careful analysis” may have been better replaced by thinking about it”. The ability to make judgments on first impulse involves the ability to quickly and efficiently ‘sum up’ the various elements of an interaction, which can be viewed as perceiving a Gestalt. In the same way the reasoning behind “I tend to buy on impulse rather than after careful consideration”, is that to buy impulsively may imply
the ability to ‘sum up’ rapidly the suitability of a garment in its many parts, (along with the cost etc), and thus may be viewed as an example of a Gestalt. However, such abstractions also introduce ‘noise’ into the system when it is not directly accessing the concept. Both items were eliminated, partly because of the poor statistical results obtained.

Some experiences may not have been easy to relate to for some participants, for example, the eliminated item, “When I take a trip I prefer to use a map rather than write down instructions”. The reasoning behind this item is the assumption that map reading includes elements to be perceived instantaneously, in comparison to written instructions that are sequential, not requiring Gestalt perception. This is another example where abstractions of the concept proved not to be discriminated well.

Several eliminated ‘ego strength’ items with similar sentence structure were ambiguous such as, “My sense of personal strength is supported by ignoring peer pressure” and “My sense of personal strength is supported by a belief that there is an underlying order or purpose in the world”. These were intended to refer to the section on sense of self, although they were not very specific to the theory, with no expectations about how they would feature in the statistical analysis. Regardless of an underlying concept, the intended meaning of the sentences was not clear, nor was it clear how they were to be answered. In the one-on-one situation, the queries that were raised above could easily be clarified. However, for those who filled them out in small groups, this may not have been so easy. However, most of the participants who were happy to fill them in unaided, appeared to have no trouble, although occasionally a question was raised in that setting.

In terms of the Likert Scale used, there was some discussion on whether to use a three- or a five-point scale. In some cases the 5 point scale (particularly the ‘strongly’, agree and disagree points) added extra detail to the decision-making, over and above just agreeing or disagreeing (which proved difficult). Some participants only used 3 points of the scale and some used the extremes only. One participant answered “not sure” to all the items. However, these issues applied to a minority of cases only. During the statistical analysis, experimenting with the results by reducing 5 points to 3 was trialed but the loss of detail gave no compensation in terms of clarity or understanding.

7.1.2. Use of Statistics

Factor analysis was used to compress the data into manageable proportions to find the combinations of items whose measures are mutually associated within a factor, and as far as possible statistically independent from other factors. Limitations of factor analysis are in the fact that the factor structure depends on the range and groupings of items. As discovered in the current results, when a priori groups are set, the items remain in those groups (unless manually removed as in the redos). The number of items covering a category determines the importance of that category in the factor structure when the items may be semantically variant rather than separate aspects of the category.

Use of the ‘guided interview’ approach, and the decision to leave detailed assessment of inter-rater reliability to future work followed similar practices in the study of Stip et al (2003). Ideally, it would have been beneficial to use the reliability statistics in the ‘pruning’ of STQ1 to produce STQ2. However, the sequence in which the different stages were performed did not make this possible. Averaged over all 96 items the mean percent of participants showing total agreement between the two trials was 58.94%. The mean percent of participants differing
by one point and averaged over items was 25.9%. The mean percent of participants differing by two points or more and averaged over items was 15%. Thirty-six percent of the items with lowest ranking t-values in STQ2, represented 47% of the lowest reliability items. It should also be noted that the repeat questionnaires were carried out by non-MHUs since it was not possible, or practically feasible to pay 62 MHUs another $10.00 each to do a repeat questionnaire for reliability purposes. The repeats were carried out by volunteers who had previously filled one in and graciously were willing to fill out another. For methodological improvement in a later instrument it would be preferable to repeat the questionnaire with MHUs, looking at which items are most reliable, to act as a guide for the researchers towards the most ‘reliably’ distinguishing items.

7.2 Significance of Results

In this section important conclusions are made beyond those presented in the results section from survey of the ‘big’ picture they reveal. The complexity of the results arises from the number of items in the questionnaire and the number of statistics in which they are represented. This means some of this section is another level of results, necessary to illustrate the conclusions more clearly.

7.2.1. Elimination of Items from STQ1 to STQ2

Since the questionnaire is based on a theory of trait abnormalities with a neurobiological basis, assessing the results in the light of that theory is necessary. In STQ1 there were 10/96 items which gave t-test results opposite to the expectations from the theory. 5/10 of those were eliminated. (“I tend to buy on impulse rather than after careful consideration”, “When I take a trip I prefer to use a map rather than write down instructions”, “I like day-dreaming or fantasising”, “My sense of personal strength is supported by ignoring peer pressure”, “My sense of personal strength is supported by a belief that my life has value and meaning”). Since this was the first version, and therefore part of the development of the instrument, rather than one to get good results, further comment on these items will not be made. The first two of the retained items (for STQ2), which gave results opposite of expectation were from ‘Gestalt Perception’ (1) “I prefer face-to-face conversations to telephone conversations” and 2) “I tend to remember people by their faces more than by their names.” However, these were also found not to discriminate between schizophrenia and normal in STQ2. For item no. 1) (which is reversed), both groups preferred face-to-face conversations but the MHU group on average slightly more so than non-MHU. This was opposite to expectations (albeit a small difference in means of 3.46 to 3.59) based on the reasoning behind gestalt perception. However there are likely to be many other reasons why face-to-face is preferred by the target group, outweighing any gestalt difficulties there might be associated with understanding facial expressions etc. Item no. 2 was intended to address the gestalt abnormality of not easily remembering faces, expecting the statement to be disagreed with (item is reversed) more strongly by MHUs than by comparison subjects. However, the item also accesses another separate abnormality, in that of lack of memory for names which could well be a more salient experience if one is required to choose between remembering a face as opposed to remembering a name.

Item no.3) is from the category ‘Discrimination of the Intensity of Sensory Stimuli’ (“I am sometimes told that I have the radio or stereo on too loud”). This was marginally opposed to expectations from theory (with means of 3.21, in MHUs and 3.24 in non-MHUs) which again
may have been answered this way for other reasons. When the trait itself is clearly stated in “I have difficulty distinguishing loud from soft sounds” the difference is significant (t=3.705, p=0.000).

Items no. 4) and 5) which gave results in a direction contradictory to the theory are in the category ‘Overall levels and Stability of Mental Activity. These were “I sometimes lie awake at night with a very active mind” and “I sometimes have difficulty waking up”. Item no.4) is, in theory, associated with the ‘upstate’ of the cortex. However, since most of the MHU respondents would be medicated, this would affect this item considerably. For item no. 5) the results changed in STQ2 (where the t-test analyses were limited to respondents with confirmed diagnoses of schizophrenia): the t value, for comparison with the matched normal group reached a significance of p= 0.008 (t= 2.724). In the t-test with the Depression group the ranking was 21. It also had a high factor loading in the first factor of 0.765. The item is characteristic of the ‘downstate’ of the cortex, which matches one of the factor dimensions of Liddle (1987) of ‘psychomotor poverty’. It may also however have been influenced by medication.

Eleven of the 96 items had negative factor loadings. Since factor analysis is testing the correlational structure of traits rather than comparing participants, they cannot be regarded in the same way as the negative t-values. To make the step to classify participants based on the concept, summary scores for each category would have to be compared for each participant. T-tests for this reason were performed on each participant for each of the 16 categories, the results of which are tabulated in Table 6.7. An example of an item in the gestalt category with a negative factor loading, which correlated with the rest of the items in the factor, but in an opposite way to that expected from the theory of trait abnormalities is, “When I listen to music, I am more aware of the beat than the melody”. This item is an auditory abstraction of a gestalt, where the perception of melody is dependent on listening to a complex array of chord structures strung together and constantly changing, similar to a series of semantic gestalts in a sentence, but instead they are musical rather than verbal. This is in contrast to the beat which is more predictable due to its repetitive nature. The t-test difference was not significant but the negative loading in the factor analysis may have arisen for other reasons, such as an aversion to heavy beats, which causes a preference for melody as the only other choice (given in the item). It may also be just another example of the ‘noise’ introduced through abstracted examples not accessing well the intended concept. This appears a more accurate assessment, since items which directly access the gestalt concept distinguish and load well in comparison.

Overall, none of the items giving results in a direction opposite to the expectations from theory challenges it in any significance way. In retrospect it is easy to see the flaws in these items in accessing the traits they are attempting to target. In most cases they reflected imprecision of the items rather than of the concept being tested, and this was especially true of the eliminated items. In fact, in STQ1 84 of the items are in a direction that supports the theory, 26/96 at the level of p=0.000, a further 17 at p=0.001 to p=0.008, and a further 11 with between p=0.010 to p<0.05, which is the usual acceptable cut-off for significance if the more stringent Bonferroni correction was not being used for multiple testing. This accounts for 54 of the items of STQ1 from the t-tests alone, lending support to the theory and identifying potentially a pool of items that warrant being tested further with other statistical approaches.

As previously mentioned STQ1 was pruned using not only t-tests but also the power analysis results, the factor loadings from factor analysis, and also with added subjective judgments regarding specificity of items to the theory and their overall relevance.
7.2.2 Factor Analyses for STQ1 and STQ2.

Factor analysis is the process by which the correlational structure of results on numerous variables (questionnaire items) is condensed in terms of a lower number of unobserved variables or factors. It can reveal an underlying structure (potentially, in this case, with a biological basis) from which the variables in each factor arise, initially encapsulated in the characteristics of the *a priori* categories and formally tested in an exploratory factor analysis (as here). The theory upon which this questionnaire is based is a biological one. It would be expected that a similar structure or similarity in clustering of items would emerge in both non-MHU and MHU groups, since for the relevant traits, all persons are thought to be on a continuum defined by similar biology, but expressing different biological parameter values. It would however be expected that the scoring would be more towards one end of the scale in schizophrenia, as a variant on ‘normal’ as revealed in *t*-tests. Factor analyses were performed separately on MHU and non-MHU groups, but the latter are included in Appendix 6 but not referred to in detail here.

The ‘first stage’ factor analyses from STQ1 and STQ2 will be discussed together. The aim in adapting STQ1 to produce STQ2, in the factor analyses was to reduce ‘noise’ or increase the variance accounted for as a result of the pruning. This aim was successfully achieved as outlined in the results in Appendix 6 and Table 6.3 for step I of STQ1 to STQ2, and in Table 6.1 and Table 6.5 for the Grand Factor Analyses of STQ1 to STQ2. Most of the factors increased the variance for which they accounted in moving from STQ1 to STQ2, in both steps.

The aspects of the factor analyses most needing discussion here are the two factors whose items were most important in the final results, using Discriminant Function Analyses. These are Gestalt perception, and, to a lesser extent, Overall Levels of Mental Activity and Stability.

In Gestalt perception for STQ2, 3 distinct sub-factors emerged which are also separated in the existing literature. *Factor 1* named ‘Perception of Facial Expressions’ was totally coherent with all items pertaining to the title accounting for 23% of the variance as opposed to STQ1’s corresponding factor 2, which explained only 13.9% of variance. All items loaded well on the factor and none loaded on any other factors. This means that they describe a distinct, and coherent characteristic. The impairment in recognising or matching emotion in faces in this factor is found in Borod *et al* (1993), Novic *et al* (1984) and Kucharska-Pietura *et al* (2005). Feinberg *et al* (1986) showed the impairment in recognising facial expressions to be a right hemisphere dysfunction. *Factor 2*, named ‘Facial Identity’ or recognition of faces in STQ2 contained 5 items, all loading well, with no cross-loading on other subfactors. This factor did not emerge as a separate one in STQ1. Although one item did not relate specifically to facial identity, there were still 4 strongly correlated and coherent items that had no counterpart in STQ1 and accounted for 13.924% of the variance. Impairment in perception of facial identity, as separate from that in perceiving facial expression was shown by Borod *et al* (1993) in a basic facial recognition task in schizophrenia, also by Novic *et al* (1984) where dysfunction is found in a facial matching task amongst an array in schizophrenia. Feinberg *et al* (1986) found deficits in facial identity matching, independent of emotion expressed in schizophrenia and Doniger *et al* (2001) found that when subjects were presented with fragmented pictures with increasing clarity of form, in schizophrenia, a greater degree of intact image was required for recognition. Archer *et al* (1992) found a generalised face processing deficit associated with schizophrenia when familiar and unfamiliar faces were to be matched to a profession. *Factor 3* in STQ2 named ‘gestalt awareness of environment’ contains 2 items
loading well with no cross-loading on other subfactors, and accounting for just under 12% variance. There was no clear counterpart to this in STQ1.

Overall, the gestalt category factorised well, gave support to the underlying theory and proved to be a potentially promising trait discriminator. Four Gestalt items become part of the final 13 Discriminant Function Analysis items, identified as the culmination of this study whose combination could predict if an individual was part of the schizophrenia or normal groups to 85% accuracy. Two were gestalt ‘oddballs’ which ranked consecutively at 26 and 21 in the t-tests (for schizophrenia versus normal). These were: “At a pedestrian intersection I can often sum up when it is safe to cross without needing to wait for the buzzer/green man” (reversed) and “I prefer TV to radio” (reversed). The other two appear to correspond to each of factors 1 and 2 (above) respectively in assessing difficulty with ‘Perception of Facial Expressions’ and difficulty with ‘Face Recognition’, these ranked at 31 and 38 in the same t-tests. They are “I sometimes have guessed a person is angry from their expression and then find out that they are not” and “When I meet someone I know, I find that they can recognise me by my face, but I cannot recognise them by their face”.

The a priori category of Overall Levels of Mental Activity and Stability was another factor emerging from the factor analysis. Not only did this give overall support to the theory of trait abnormalities, but it also fitted well into Liddle’s (1987) study. That study identified 3 main factors in an exploratory factor analysis, challenging the existing positive/negative symptom divide in previous definitions of schizophrenia. In both STQ1 and STQ2, 2 factors emerged with almost identical item-content while STQ2 produced a third factor.

**Factor 1** named ‘Slow to get Moving/Low Energy’ corresponds, according to the theory, to the cortical ‘downstate’. In theory this should correspond to the state where principle cells of the cortex operate with membrane potentials far negative of firing threshold. The items in factor 1 are behavioural consequences of this ‘downstate’ including: “I sometimes have difficulty waking up”, “I have difficulty working normally in the early part of the day”, “I find it hard to keep up a full day’s work” and “I often run out of energy”. They all load well on the factor and account for 28.26% of the variance and correspond to Liddle’s ‘psychomotor poverty’ factor. The second and third items become discriminating items of the 13 discriminant function analysis items, and rank first and second in the t-tests (discriminating schizophrenia from normal) and thirteenth and sixth in the t-tests discriminating schizophrenia from depression. The third factor in the grand factor analysis consists of this factor alone, accounting for 7.62% of the variance.

**Factor 2** named ‘Excitability/Psychic Momentum’ should correspond in theory to the cortical ‘upstate’ where the membrane potential of cortical principle neurones is poised not far below firing threshold. Items in factor 2 that are behavioural consequences of this ‘upstate’ include: “I sometimes find I get quite excited about various ideas or events”, “I sometimes lie awake at night with a very active mind”, and “Things that don’t affect others much can sometimes leave a big impression on me”. They also are associated with excessive ease of association, the difficulty of shutting out distracting stimuli and a reduction in ‘processing resources’ as outlined in the literature review. According to the theory, in persons with schizophrenia traits, the cortical up-state facilitates detection of associations between extraneous stimuli and a target, and impairs performance when a person is required to exclude awareness of extraneous stimuli, with focus on the target. This factor accounts for 16.9% of the variance and features in the 4th factor of the grand analysis in STQ1 but did not emerge as separate in STQ2. This appears to be because the items in the two factors (‘Slow to get Moving/Low Energy’ and
‘Excitability/Psychic Momentum’) identified in STQ1 came together in STQ2, both being different aspects of ‘Instability’. The single factor in STQ2 corresponds, more importantly, with Liddle’s ‘disorganisation’ factor. The fact that factors 1 and 2 of this study, factorise in the same way as Liddle’s Disorganisation factor is an important finding which also supports trait abnormality theory.

Factor 3 contains elements of both the ‘upstate’ and ‘downstate’, hence the category name of ‘stability’ of mental activity. The items do not load with either factor 1 or 2, as would be expected, because it is a reflection of the total person in an unstable overall state. This factor contains the items, “I don’t easily get downhearted or over excited about things that happen to me” and “I find it hard to make decisions until I am in a good mood (e.g. at certain times of the day)” and accounts for 12.4% of the variance in the category.

As mentioned earlier, the third factor of Liddle (1987) is ‘reality distortion’, which refers more to the psychotic aspect of schizophrenia, or its aftermath, rather than the trait abnormalities which are the focus of this study.

An important issue here is the effect of medication. Most of the patients participating were on medications, some of which may be sedating, others with cognitive effects and other more modern atypical medications may be cognitive enhancing. In the current study, a section was included on the personal details form inviting disclosure of details of medication and dosage, but these could not be used as reliable information for assessment. Despite official attempts made to attain more reliable information, in the end this was not possible. The items: “I find it hard to keep up a full day’s work” and “I have difficulty working normally in the early part of the day”, may well have been related to sedating effects of older ‘typical’ medications. However, these items would fit into Liddle’s ‘psychomotor poverty’ factor and the fact that they factorised with the dominant first factor is similar to the factorisation in Liddle’s factor analysis, and many other factor analyses since. Liddle did investigate the relationship of medication type and dose and found that the ratings for items in his “Psychomotor poverty” factor did not correlate with either type or dose of antipsychotic medications. In the years up to 1987 when Liddle’s data were collected, antipsychotic medication consisted mostly of ‘typical’ sedating medications. In the literature, although some of the negative symptoms are related to medication effects they are also considered to be valid symptoms existing independent of such effects.

Non-sedative (usually high potency) medications of the older type may have cognitive effects other than sedation. Goldberg et al (2000) reported that semantic priming was low in patients off medication but improved after medication with antipsychotics. The details are unclear because there are no control groups. However, these effects on semantic priming imply that group differences in some STQ items such as distractibility and sensory overload may be partly medication effects.

An additional point is that modern ‘atypical’ medications appear to have ‘cognitive enhancing’ effects which may reduce group differences. Malla et al (1999) found that switching from typical medications to risperidone (an atypical medication) reduced Psychomotor Poverty, and also caused a highly significant reduction in Disorganisation factor scores.

7.2.3. STQ2 Grand Factor Analysis.

The Grand Factor Analyses (GFA) further reduced the factors from step 1 (factor analyses from within a priori categories) to encapsulate overall structure into 3 factors. From STQ1 to
STQ2, as a result of pruning items from analysis of t-tests, power analysis and step1 of factor analysis, the overall variance accounted for increased from 33.34% to 43.23% which is a good result considering the ‘noise’ in the system. This means the pruning process produced a better instrument.

Surveying the sub-factors of Factor 1 (of GFA), almost all subfactors with a cut-off point of 0.400 fit into the ‘downstate’ of the cortex, which also corresponds to Liddle’s ‘psychomotor poverty’ factor. These are: ‘sensory overload 1’, ‘comprehension of language 1’, ‘gestalt 1’, ‘thought disorder 1’, ‘oddball 1’, ‘ego strength 1’, ‘cross modal 1’, ‘discrimination of intensity of sensory stimuli’, ‘sustained attention 1’, ‘co-ordination s/m 1’, ‘distractibility 1’, ‘ego strength 3’, ‘long trains of thought 2’, ‘long trains of thought 3’.

Three out of five of the sub-factors in Factor 2 (of GFA) using the same cut-off point, fit into the ‘upstate’ of the cortex, which corresponds to Liddle’s ‘disorganisation’ factor. These are: ‘attentional shift 1’, ‘distractibility 2’, and ‘oddball 4’.

The one sub-factor that makes up Factor 3 (of GFA) loading at 0.901 is ‘mental stability 1’, and directly characterises the ‘downstate’ where all the individual items that make up the sub-factor are about states that can be characterised as ‘low energy’, ‘high inertia’, and ‘slow to get moving’. This Factor 3 corresponds in a more direct way to Liddle’s ‘psychomotor poverty’ factor whereas in Factor 1 the connections to it are explained less directly by the theory of trait abnormalities and are not as immediately obvious.

Therefore the important conclusion here is that while the factor analyses were generally supportive of the theory of trait abnormalities, the GFA clearly demonstrates the fundamental basis of the theory from which each trait is derived, which is based on the principle that the cortex has two functional states, the ‘upstate’ and ‘downstate’ of the cortex, which, in schizophrenia, due to the unusual repertoire of axonal conduction times, coincide respectively with Liddle’s ‘disorganisation’ and ‘psychomotor poverty’ factors. This dichotomy is not to be confused with positive and negative symptoms of schizophrenia as they are sometimes described. These factors in the present study are for the traits that arise from an unstable cortex, the ‘upstate’ of which causes a vulnerability to psychosis, a ‘mediating state’ between one dominated by negative symptoms, and actual psychosis, but one that is distinct from active psychosis (with positive symptoms). This instability of ‘upstate’ and ‘downstate’ is instead derived from the hypothesis of slower-than-normal axonal conduction and the interplay of reduced summation of signals (with the resultant reduction of rebound inhibition to maintain equilibrium) and the residual unresolved signals, which all impact on the cortex to produce a “bistability” between ‘upstate’ and ‘downstate’ as explained more fully in the literature review. This particular result lends strong support to further testing and refining of the more discriminating items in the STQ2.

Overall, Liddle’s “three factor” solution to describe the enduring symptoms of schizophrenia receives independent confirmation from two sources described in this thesis: (i) The reasoning, which underlies the large-scale structure of Miller’s (2008) theory of trait abnormalities separates most trait abnormalities which are characteristics of the cortical down-state from some trait abnormalities (facility with associative processes, distractibility, and a tendency to “long trains of thought”), which are characteristic, in schizophrenia, of the cortical up-state. (ii) The correlational structure revealed in the Grand Factor Analysis of empirical data collected using STQ2 shows broadly the same separation.
7.2.4. Representation of a priori Categories in Discriminant Function Analysis.

To understand the significance of the data presented we will now look at the remaining items and categories that make up the 13 final discriminators and how they relate to the literature.

The first two items of the final 13 items in the discriminant function analysis final 13 have already been discussed above. The 3rd item is reversed: “I like jobs where I interact with many people”. This belongs to the category relating to difficulties in ‘Shift of Attention’. It was a new item for STQ2 but did not load on either of the two factors under this heading. This may mean it may fit better with ‘Sensory Overload’, and it would have been good to have placed it there in the redos. However, it discriminated well in the t-tests between schizophrenia and normal at t=3.742, p=0.000 and ranked second in the t-tests between schizophrenia and depression. There was 67.7% total agreement in the reliability kappa statistic for this item. Evidence for impairment in shift of attention in schizophrenia is investigated in the Wisconsin Card Sort Test (WCST) and the Stroop Test. Tam et al (1998) found schizophrenia patients to be significantly impaired compared to bipolar patients and control groups. They also performed a discriminant function analysis on a battery of eight tests with respect to groups of schizophrenia and bipolar patients, and normal controls. The WCST was the best discriminator of schizophrenia from bipolar disorder. This suggests that there are valid reasons for an item depicting shift of attention to be included in the final 13. In a study by Hagh-Shenas et al, (2002), the interference effects in the Stroop test are found to be higher than normal in schizophrenia and effects of medication and/or clinical improvement did not change the results. If this item loaded on the ‘Sensory Overload’ factors, the studies investigating it might target more measurable domains than whole-person interactions captured by the “shift of attention” concept. However, whichever category it fits, it is an item that has been identified as a discriminator of schizophrenia. As far as the theory is concerned, the concept of ‘shift of attention’ is derived in a more indirect way from the fundamental assumptions of the theory than the concept of ‘sensory overload’.

The 4th equal item in the discriminant function analysis final 13 is, “I find music sounds much the same when the volume is turned down (I do not notice it is so loud)”. This belongs to the category ‘Discrimination of the Intensity of Sensory Stimuli’. As previously outlined, this category did not originate from the theory, although it can be explained by it, but came from phenomenology of accounts of people’s personal experience in schizophrenia. In STQ1 and STQ2 this item loads well on its factor at 0.665 and 0.593 respectively. In the t-tests between schizophrenia and normal, t=2.967 (p=0.004) and it ranked at number 11 in the t-tests comparing depression and schizophrenia. In the reliability kappa statistic total agreement between repeats was obtained in 58% of the respondents. Levine and Whitney (1970) found the absolute auditory threshold for detection of auditory stimuli was higher in schizophrenia than normal, but the threshold for unpleasantness to be much lower, so that there is a narrower working range. This means there needs to be greater stimulus intensity for detection of auditory stimuli accounting for a relative lack of sensitivity to low-intensity sounds.

Item no. 13 was assigned to the category ‘Long Trains of Thought’. This is grouped together with ‘Shift of Attention’ in the literature review, as the complementary advantage of a difficulty in shift of attention. This item is: “I have fantasies that can be used as the basis for artistic productions or activities”. This item also ranked at no. 24 in the t-tests between schizophrenia and depression. In the reliability kappa statistic, total agreement between normal respondents on repeat questionnaires for this item was 54.8%. Both categories (“Shift
of attention” and “Long trains of thought”) according to trait abnormality theory come under
the ‘upstate’ of the cortex where membrane potential is poised not far below firing threshold.
This allows for excessive ease of association of mental association, the difficulty in shutting out
distracting stimuli and ultimately reducing processing resources shown in dual task
performance experiments. Therefore, a potential outcome of the ability to stay with an
internally initiated thought is artistic endeavour.

It may seem paradoxical that being better than normal at staying with an idea is one of the
trait abnormalities, as well as, the impairment in vigilance or sustained attention. However,
the latter requires a person to attend to an external stimulus, while the former requires an
ability to stay with a thought or idea as initiated from within the person, as a thought that has
captured attention. The presence of both factors as traits is moreover entirely consistent with
the theory, since the vigilance impairment is a feature of the down-state, correlating with
negative symptoms, while the difficulty in shift of attention is a feature of the cortical up-
state, correlating with disorganization symptoms.

The eighth and eleventh items on the list belong to cross-modal co-ordination and they are:
“At pedestrian crossings I am confused by the ‘green man’ or ‘red man’ signs telling me
when to walk” and “When I am watching television I have difficulty matching the pictures to
the words that someone is saying”. In the STQ1 each loaded well on the unitary factor at
0.513 and 0.446, and in STQ2 they both loaded well at 0.825 and 0.836 respectively. They
discriminated well in the t-tests between schizophrenia and normal, the first at t=3.760
(p=0.000) and t=5.042 (p=0.000) and ranked at no. 12 and 5 on the t-tests between
schizophrenia and depression. In the reliability kappa statistic there was total agreement
67.7% and 69% of respondents on repeat questionnaires. The main cross-modal evidence
comes from anecdotal accounts from McGhie and Chapman (1961) of patients noticing that
they cannot concentrate on television by watching the screen and listening to what is being
said at the same time. The information from different modes of communication of visual and
auditory is difficult to assimilate together.

The fourth item: “I would prefer to live alone” from ‘Preference for Solitude’ loaded on both
STQ1 and STQ2 at loadings 0.752 and 0.457 consecutively. It showed high discrimination in
the t-test between schizophrenia and normal at t=4.665, (p=0.000) and ranked third in the
depression versus schizophrenia t-tests. In the reliability kappa statistic, it has a 70.9% total
agreement of normal respondents between repeats. A preference for solitude is easily
connected to the over-stimulating world produced by other people, and the noise, and sensory
overloading stimuli in the environment reported in first-hand accounts from McGhie and
Chapman (1961) where a patient recounts how even a noise can interrupt thought and cau-
se them to “get lost”. This item features very strongly throughout the results and has proved to
be a strong discriminating item of schizophrenia. The tenth and last item to discuss amongst
the 13 top discriminators is, “If a friend does not turn up to a planned meeting with me, I
would feel a sense of rejection even if I know it was probably for a good reason”. This is from
the operational title ‘Ego Strength’ as a corollary of ‘Sense of Self’. This item loads well on
STQ1 and STQ2 in the first factor for both at 0.306 and 0.578. In the STQ2 t-tests it is
significant at t=5.068, (p=0.000) and ranks at 22 between schizophrenia and depression t-
tests. It has total agreement between repeat questionnaires in 61.3% of the normal
respondents. This item represents a situation in which a person is required to ‘call’ upon a
sense of him/herself in which he/she does not let the challenging moment define him/her.
8. Summary, Conclusions and Future Directions

8.1. Summary and Conclusions

A preliminary question in developing the questionnaire was whether schizophrenia consists of a number of general impairments spanning several areas, representing a fundamental heterogeneity in origin. Or, conversely, whether the different areas of impairment are an indication of different expressions of the same disorder with the same neuronal basis, in which case, schizophrenia is a homogeneous disorder. Miller’s theory proposes the latter, the structure of which was tested in this study and supported. The reason for the question, is the depth it extends to the items in the questionnaire that have the potential to be reliable and stable predictors of schizophrenia, which if understood in biological terms can become better explained, anticipated and treated.

The factor structure overall was supportive of the underlying theory. The closer the item was able to articulate the essence of the category of trait abnormality, the higher the significance of differences between schizophrenia and normal groups. Thirteen of the items in combination were able to predict whether an individual would fall into the schizophrenia or normal group to 85% accuracy. Although two of the items may be due to medication effects, Liddle (1987), with similar results did not find that antipsychotic drugs by type or dosage were a factor in the corresponding ‘psychomotor poverty’ factor.

There are several strengths to this questionnaire that makes it stand apart from other early intervention instruments: (1) It is based on a neurodynamic/psychobiological theory which is backed by empirical literature (2) The theory defines and explains the trait abnormalities from which the STQ is derived. As such the STQ provides the first step in assessment of the theory, from the perspective of personal insight of individuals, who identify these traits on a continuum. (3) These trait abnormalities are believed to be present before, during and after a psychotic episode and are not dependent on prodromal symptoms, but on everyday activities, behaviours and preferences that are not associated with definite symptoms such as hearing voices or having strange thoughts. Evidence that these traits are present prior to onset of illness is discussed by Miller (2008). However it remains to be demonstrated that the STQ could reveal these traits in adolescents or young adults prior to illness onset. (4) The questionnaire is potentially easily administered and inexpensive. Items appear to be innocuous, and therefore probably lead to fewer confounding effects brought about by suspicion and self-protection. This may make it, or a modified version of it, suitable for screening of young people (5) Thirteen of the items were able to accurately predict schizophrenia to 85% accuracy for this sample population, with no mention of psychotic symptoms.

In terms of validity of the STQ, the fact that it is based on a literature-derived psychobiological theory makes for a validation in fundamental terms. However, there is still much work to be done to further validate the STQ through comparing it with other psychological and psychophysiological research. The aim in the future is to compare with a wide variety of such tests. This might include comparison of STQ results with measures of face recognition, semantic priming, dual task performance to mention a few. Since completing the thesis, work has been initiated to validate many of the STQ items by comparing results...
with those obtained using the Schizotypy Questionnaire. This is currently in progress with the help of G. Grimshaw at the Psychology Department, Victoria University, Wellington.

In a previous work of the author (Smith, 1998) sense of self in schizophrenia was articulated as an imbalance in the now experiencing ‘I’ and the objectified ‘me’. The ‘I/me’ split was supported by the EASE study (Parnas et al., 2005), where they found that in schizophrenia, symbols are used to access the self by transforming experience into conceptual format, in order to be grasped by the reflecting subject. Therefore the symbolisation process operates as a linguistic vehicle through which experience first articulates itself and becomes reflectively accessible. This process replaces ‘purely’ experiencing ‘in the now’ (as subject ‘I’), of one’s world, which has been extended in this thesis to equate to the impaired right hemisphere processing. Compensating for this, is the strength of the left hemisphere adept at conceptualising ‘long trains of thought’ and through the use of symbolism and conceptualising, is able to transform experience of the ‘self interacting’ as the ‘self as object’ (the ‘me’) that can then reflect on itself. This is an example of trait abnormality theory stretched conceptually to the maximum to account for the complexity of a concept of self, but also how well it brings together the biological to ‘whole person’ psychology.

An underlying tension that exists in this project is the mechanistic reduction of whole persons to be determined by biology while holding the view that all life has meaning including the experience of schizophrenia. Is the determining factor on living a life of ‘meaning’ (at whole person level) biologically determined or psychologically determined? Is it mechanism versus meaning? The biologically based trait abnormality theory brings understanding to the concept of sense of self as a biological mechanism, while also being a psychological issue. In the practice of psychiatry there is the tension between hard science and the translation of it into dealing with the experience of human beings at a holistic level. Victor Frankl, (Professor of Neurology and Psychiatry, University of Vienna until aged 85,) a survivor of Auschwitz concentration camp, pioneered Logotherapy with a philosophy that “…life has unconditional meaning, which cannot vanish under any circumstance ... in other words, that life holds a meaning in any situation, even the most miserable” (Lukas, 1998, p. 6). Frankl explains that “everything can be taken from a man but... the last of the human freedoms [is] – to choose one’s attitude in any given set of circumstances (Frankl, 1963, p104). This attitude of ‘will to meaning’ is expressed in the belief that “the whole of the world has meaning and purpose to it, and therefore, every particle, every life, and every life experience potentially hide meaning in themselves” (Marshall, 2009 p9). Frankl also understood schizophrenia to be based in a physiological dysfunction leading a person to “experiencing himself as an object rather than a subject” that while normally we ‘own’ our thoughts, in schizophrenia a passive perspective on those thoughts causes them to be perceived as voices actually being a separation of the self as viewer and the self as viewed. The viewing self, devoid of content, seems barely real, while the viewed self seems alien. While Frankl’s view virtually echoes the argument made here in section 4.3.15 (on ‘sense of self’), it was arrived at independently. Frankl’s ideas on schizophrenia were more in terms of severe psychosis rather than the enduring traits that manifest long before. For progress to go forward in schizophrenia research there has to be a meeting point on a philosophical level between a mechanistic approach and meaning-based...
whole person psychology. In other words, a collaborative, inter-disciplinary model that addresses the mechanism and meaning question.

8.2 Future Directions

It is the intention, in the future to develop another version of the questionnaire appropriate to teenagers, to target those already identified at-risk, and those with risk factors (such as family members with schizophrenia, cannabis use in adolescence (Zammit et al, 2002), second generation immigrant (Harrison et al, 1988), of Maori descent (Kake et al, 2008)), and predict whether according to the questionnaire, they may develop the disorder, with follow-up in a longitudinal study. Even at onset of psychiatric illness, distinguishing what is illness is unclear, “The lack of a clear boundary between normality and psychiatric disorder... is especially relevant during onset, as syndromes emerge and progress from the origins which are indistinguishable from normal experience” (McGorry et al, 2001). The gains from detection of early warning signs of developing schizophrenia are clear. The purpose, therefore, of developing a first screening tool to identify at-risk teenagers is to intervene as early as possible. A sense of having arrived too late on the scene to really help is all too prevalent in chronic schizophrenia, despite the overall severity of schizophrenia having lessened over the 20th century through what is believed to be better care, intervention and rehabilitation (McGlashan and Johannsen, 1996). With very early screening, there is an opportunity to develop good quality support, better education about potential challenges and strengths, in an effort to shed light and normalise rather than stigmatise.

An interesting and important aspect from this research and trait abnormality theory (Miller, 2008) are the potential strengths inherent in the forms of information processing that emerges as a result of slower-than-normal axonal conduction. This processing is more conducive to the concept introduced here of ‘long trains of thought’, which enhances the ability to stay with an idea or concept and therefore with focus, can be productive and creative. Emphasis on strengths and abilities with spaces that foster this type of endeavour can develop skills and build self-esteem and self understanding, setting achievable goals in an empowering environment. Such specialist programmes could cater for this style of information processing which may benefit other groups of people with similar personality styles, ultimately developing resource and community support for any future challenges that come as a result of development of illness. In a personal interaction with a psychiatrist/researcher successfully pioneering this field of early intervention, the author asked the question, whether he believed a psychotic episode can be avoided that otherwise was likely. He said he believed that it could be. This answer makes the importance of early intervention very ‘real’, worthwhile, and far-reaching. Not only does the individual avoid the devastating harm to confidence and self esteem, but also the likelihood of suicide. The suicide rate in psychosis is greatest earlier in the course. In a study by Melle et al (2006) where four catchment areas were compared, two with early detection centres and two without. “The rate of severe suicidality (plans or attempts) was significantly higher in subjects from communities without the early detection program relative to those from early detection communities, even after adjustments for known predictors of suicidality” (Melle et al, 2006, p800). In addition to averting harm, the
implications for reduced health-care costs and social benefits are an important motivation for early intervention programmes.

Claridge (1972) put forward the idea that schizophrenia is not a categorical illness, but emerges out of a personality that merges with normal psychology and range of personality types distributed in the general population. Trait abnormality theory supports this view. Overlap of schizophrenia with other disorders or information processing styles such as ADHD and dyslexia (to name a couple) may fall on a continuum of ‘normal’. In the future, potentially a global map of personality style and information processing may be developed, in collaboration with interested parties, from research into disorders that fit into a continuum of normal with the view of creating supportive education environments that better cater to the varying requirements of the population before the inevitable ‘need’ to pathologise.

In the light of slower-than-normal axonal conduction, as hypothetically is the case in schizophrenia along defined pathways in the anterior and temporal regions of the cortex, a suggestion for future research (made by Miller in conversation) is investigation into slower-than-normal axonal conduction in pathways of other brain regions that may affect disorders with some overlap of abnormality such ADHD and dyslexia.
References


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Appendices

Appendix Ia:

Information Sheet for Non-Mental Health Service Users.

Information Sheet: STQ1

Left or right sides of the brain: How do people differ?

Contact details:  
Kate Ball  03 479 5407
Robert Miller  03 479 5142
These numbers may change, if so, please phone 03 479 7362

You are invited to complete this questionnaire. It asks about a number of everyday activities and habits. I think the answers may give information about the left and right sides of the brain. For example the left side of the brain is believed to be involved more in language processing, whereas the right side may be involved in processing of visual and spatial information. I want to know how people differ in these respects. I am also interested in this in regard to some aspects of mental health.

This is part of a 3 year research project leading to a PhD degree. There will be 300 participants involved in this stage of the project. I include an identification form with the questionnaire. The questionnaire is likely to take between 10 to 30 minutes to complete and I ask you to choose the answer that best fits, without too much thought.

All information provided is completely confidential and participants can withdraw at any time. The information will be stored in a locked cabinet and any identifying information will be kept separately from the questionnaires. Identifying information will be destroyed after 10 years.

As the study progresses I will give progress reports on the findings on the following website www.anatomy.otago.ac.nz/research/left-right-brain/. If you would prefer a written version please indicate on the attached form (“Information about person completing the questionnaire”).

I appreciate very much the time you spend completing this questionnaire and would like to recompense you for this with a $10.00 petrol voucher. To receive this I ask you to give your name and contact address below. I assure you that all information in the questionnaire will be kept strictly confidential and will be accessible only to myself and my PhD supervisors. It would be much appreciated if all the questions could be answered.

Version 1: Sept 2004
Form No

**Information about person completing the questionnaire**

We would appreciate your name and contact address to recompense you with a $10.00 petrol voucher, and to contact you for future research connected to this project. However if you do not wish to be identified I would appreciate if you would fill in the rest of this information sheet with the completed questionnaire.

**Name (Optional) .................................................................**

**Contact Address (Optional) ...............................................**

........................................................................................

Age ..................

Gender M / F (please circle)

Education 1 2 3 4 5 (please circle)
(No. of years of secondary school)

Tertiary Education
Certificate Diploma Degree Postgraduate Degree (please circle, if applicable)

Have you ever been prescribed:
  Anti-depressant medication? Yes / No
  If so, please specify .........................................................

  Anti-psychotic medication? Yes / No
  If so, please specify .........................................................

  Medication for nervous disorders? Yes / No
  If so, please specify .........................................................

Are you currently taking any such medication? Yes / No

____________________________________
Version 1: Sept 2004
Is English your first language? Yes / No (please circle)

What ethnic group do you identify with?
Please tick box/boxes that apply and specify where relevant

☐ NZ European

☐ Maori Iwi affiliations ____________________________________________

☐ Samoan

☐ Cook Island Maori

☐ Tongan

☐ Niuean

☐ Chinese

☐ Indian

☐ Other (such as Dutch, Japanese, Tokolauan). Please state

__________________________________________________________

Please post in the reply paid envelope back to:
Kate Ball
Anatomy and Structural Biology Dept
University of Otago
P.O. Box 913
Dunedin, 9015
Appendix Ib:

Information Sheet for Mental Health Service Users.

Information Sheet: STQ1
Left or right sides of the brain: How do people differ?

Contact details:  
Kate Ball  03 479 5407  
Robert Miller  03 479 5169  
These numbers may change, if so, please phone 03 479 7362

You are invited to complete this questionnaire. It asks about a number of everyday activities and habits. I think the answers may give information about the left and right sides of the brain. For example the left side of the brain is believed to be involved more in language processing, whereas the right side may be involved in processing of visual and spatial information. I want to know how people differ in these respects. I am also interested in this in regard to some aspects of mental health.

This is part of a 3 year research project leading to a PhD degree. There will be 300 participants involved in this stage of the project. I include an identification form with the questionnaire. The questionnaire is likely to take between 15 to 30 minutes to complete and I ask you to choose the answer that best fits, without too much thought.

All information provided is completely confidential and participants can withdraw at any time. The information will be stored in a locked cabinet and any identifying information will be kept separately from the questionnaires. Identifying information will be destroyed after 10 years.

As the study progresses I will give progress reports on the findings on the following website http://anatomy.otago.ac.nz/research/left-right-brain/. If you would prefer a written version please indicate on the attached form (“Information about person completing the questionnaire”).

I appreciate very much the time you spend completing this questionnaire and would like to recompense you for this with a $10.00 petrol voucher. To receive this I ask you to give your name and contact address below. I assure you that all information in the questionnaire will be kept strictly confidential and will be accessible only to myself and my PhD supervisors. It would be much appreciated if all the questions could be answered.

If you have any queries or concerns about your rights as a participant in this study you may wish to contact a Health and Disability Services Consumer Advocate, telephone: (03) 479 0265 or 0800 377 766. If there is a specific Maori issue/concern please contact Linda Grennell at 0800 377 766
Information about person completing the questionnaire

We would appreciate your name and contact address to recompense you with a $10.00 petrol voucher, and to contact you for future research connected to this project. However if you do not wish to be identified I would appreciate if you would fill in the rest of this information sheet with the completed questionnaire.

Name (Optional) ........................................................................................................

Contact Address (Optional) ......................................................................................
............................................................................

Age ................

Gender M / F (please circle)

Secondary School Education 1 2 3 4 5 (please circle)
(No. of years of secondary school)

Tertiary Education
Certificate Diploma Degree Postgraduate Degree (please circle, if applicable)

Have you ever been prescribed:
  Anti-depressant medication? Yes / No
  If so, please specify.........................................................

  Anti-psychotic medication? Yes / No
  If so, please specify .........................................................

  Medication for nervous disorders? Yes / No
  If so, please specify .........................................................

Are you currently taking any such medication? Yes / No

Is English your first language? Yes / No (please circle)

What ethnic group do you identify with?

Version 2: May 2005
Please tick box/boxes that apply and specify where relevant

☐ NZ European

☐ Maori  Iwi affiliations __________________________________________ 

☐ Samoan

☐ Cook Island Maori

☐ Tongan

☐ Niuean

☐ Chinese

☐ Indian

☐ Other (such as Dutch, Japanese, Tokolauan). Please state __________________________________________

Please post in the reply paid envelope back to:
Kate Ball
Anatomy and Structural Biology Dept
University of Otago
P.O. Box 913
Dunedin, 9015

Version 2: May 2005
Appendix 1c
Consent Form

Left and right sides of the brain: What is the relation to schizophrenia?

We would like to invite you to participate further in our research. In 2004 you helped us in research using a questionnaire asking about a number of everyday activities and habits. This questionnaire was completed by 300 people, including 150 with various mental health problems. It was designed to provide information about abilities normally carried out by the left or right sides of the brain. We are also interested in using this questionnaire to find out about aspects of mental health, particularly schizophrenia and related disorders. Eventually we hope that this research may help in recognizing young people at risk of such disorders, so that support and treatment can be offered before serious illness arises. When you completed the questionnaire we also asked if you would be willing for us to contact you for the next stage of the research project. You were one of those who said you would be willing to help in this way.

In order to continue this research, we would like to compare the responses you gave to the questionnaire with some details from your medical history. We therefore seek your permission to obtain such details.

What are the details we require?

(1) Diagnosis;
(2) If the diagnosis at any time has been schizophrenia or schizoaffective disorder we also wish to know the age at which this problem started;
(3) If you have been in hospital, for a mental health problem, we wish to know the date of the most recent admission to hospital.
(4) We also wish to confirm that your mental health problem is not associated with problems with street drugs or alcohol.

We will not need to see your medical records. However, we ask your permission to contact your case worker, who will be able to provide us with the above information.

For a small number of the people who have completed our questionnaire we also wish to conduct a tape-recorded interview. The purpose of this interview would be to explore in more detail other everyday activities and habits, not mentioned in our questionnaire, which may be related to mental health problems you have. Such interviews would take place in the offices of Supporting Families Otago (SF Otago). We anticipate that each interview will take one to one-and-a-half hours. You may stop the interview at any time. When the tape recording of the interview has been typed out, you will be invited to check and edit the typescript of the interview. The tape-recording and typescript will be stored under lock and key, identified only by number.

Information for personal identification will be kept separate from the tapes and typescripts, and will be destroyed after 10 years. No material which could personally identify you will be

Version 2: May 2005
used in any reports on this study. If you are selected as one of those to be interviewed we would like to recompense you for the time you spend, with a $25 petrol voucher.

Your participation in this part of our study is entirely voluntary. If you choose not to take part, this will not affect any future care or treatment. If you do agree to take part, you are free to withdraw from the study at any time, without having to give a reason. More information about this study is provided at the following website: www.anatomy.otago.ac.nz/research/left-right-brain/. Conclusions of the study will be updated on the website when results have been analysed.

This study has received ethical approval from the Lower South Ethics Committee

Persons involved in this research:

*Principal investigator:* Kate Ball, Ph.D. student, Department of Anatomy and Structural Biology, University of Otago (phone 03 479 5407)
*Ph.D.Supervisor:* Robert Miller, Department of Anatomy and Structural Biology, University of Otago, (phone 03 479 5142)

If you have any queries or concerns regarding your rights as a participant in this study you may wish to contact a Health and Disability Advocate, telephone (03) 479 0265 or 0800 377 766. If there is a specific Maori issue/concern please contact Linda Grennell at 0800 377 766
Appendix 2

STQ1: Items as they appear chronologically in categories from Questionnaire

1. Difficulty with Gestalt perception

1. When I meet people I know, I have difficulty recognising them by their face.
2. It is sometimes easier to recognise someone by their voice.
3. My home is usually tidy.
4. I tend to make judgments on first impressions rather than after careful analysis.
5. I tend to buy on impulsive rather than after careful consideration.
6. I prefer face-to-face conversations to telephone conversations.
7. When I meet someone I know, I find that they can recognise me by my face, but I cannot recognise them by their face.
8. When I listen to music, I am more aware of the beat than the melody.
9. I tend to remember people by their faces more than by their names.
10. Sometimes I am unaware of the visual world around me.
11. I prefer television to radio.
12. When I am taking a trip I prefer to use a map rather than write down instructions.

2. Discrimination of the intensity of sensory stimuli

1. I have difficulty distinguishing loud from soft sounds.
2. I am sometimes told that I have the radio or stereo on too loud.
3. I find music sounds much the same when the volume is turned down.
4. I like communal singing.
5. When I am singing with others, I find that other people’s voices are so loud that I cannot hear my own voice.

3. Rapid coordination of sensory (e.g. visual) input and motor (e.g. ocular) control.

1. In games like cricket or softball I prefer to bowl rather than bat.
2. I have difficulty following pictures at the movies when pictures are moving fast across the screen (especially when I am sitting near the front of the movie theatre).
3. I have difficulty catching a ball.
4. I have difficulty striking a ball with a bat or racket.

4. Cross-modal coordination

1. When I am watching television I have difficulty matching the pictures to the words that someone is speaking.
2. At pedestrian crossings I am confused by the “green man” or “red man” signs telling me when to walk.
3. I have difficulty in rapid coordination of both hands, such as in rapid drumming with two hands

5. Speed of learning new material

1. I have difficulty adapting to new situations.

6. Comprehension of incoming language

1. I have difficulty understanding what people are really trying to say.
2. I like taking part in debates.
3. I have difficulty understanding people when they only suggest or imply their meaning, but do not say it directly.
4. I find it difficult to get the point of a joke.
5. I can easily follow the plot in a film or play.

7. Subjective experience of trait aspects of thought disorder

1. I get tongue-tied.
2. Sometimes I do not say the things I want to, especially in places like committees or the classroom.
3. When I want to say something, I sometimes find that I cannot make my sentences as fast as I need to.
4. My speech gets mixed up when I am embarrassed.
5. I spend a long time planning what I want to say.

8. Distractibility

1. Sudden noises make me jump.
2. I am very sensitive to noise.
3. I am more sensitive to noise when I am trying to concentrate on something else or when I am anxious.

9. Vigilance/Sustained attention:

1. I have problems paying attention for any length of time (e.g. television, or other people talking).

10. Sensory Overload

1. Working in groups quickly wears me out.
2. I am irritable or jumpy when there is a lot of noise around me.
3. I am distracted by things moving in the side of my field of view, especially when I am thinking about something else.
4. Physical contact overwhelms me.
5. The slightest sound or light can keep me awake at night.
6. I am not sensitive to background noises.
7. I get overwhelmed by emotional people, even if they are expressing friendly and positive emotions.
8. I get easily rattled or upset when lots of things are going on at once.
9. When I am in busy streets, the sight of everyone walking in front of me is very distracting.
10. I find continual company exhausting.
11. I am sensitive to temperature changes.
12. When I am emotionally upset, I find it difficult to remember things.
13. I like contact sports such as rugby or wrestling etc.

11. Preference for solitude/Avoidance of social activity

1. I like time with my own thoughts.
2. I would prefer to live alone.
3. I do not like solitude.
4. I prefer to work with other people.

12. Attentional shift.

1. In a classroom (or committee etc) I get confused by the continual change of subject.
2. I have difficulty making quick decisions in new situations.
3. I find it easy to make a sudden change of plans.

13. Long trains of thought

1. I am interested in systems of ideas in politics, religion, philosophy.
2. I have a good imagination.
3. I spend a long time thinking through questions before I form opinions.
4. Tunes, rhythms and music run through my head.
5. I like day-dreaming or fantasising.
6. I like inventing or writing stories.
7. My thoughts seem to run on by themselves.
8. I am able to let go and think strange thoughts without being upset or frightened.
9. I find my train of thought interferes with my ability to concentrate.
10. I have fantasies that can be used as the basis for artistic productions or activities.

14. Spontaneity

1. I prefer to plan carefully future events.
2. I like to be spontaneous.
3. I like being asked out on the spur of the moment.

15. “Ego strength”

1. If a friend does not turn up to a planned meeting with me, I would feel a sense of rejection even if I knew it was probably for a “good” reason.
2. Setbacks or obstacles do not put me off the task at hand.
3. Things don’t easily upset me.
4. Unexpected obstacles can embarrass or upset me.
5. My sense of personal strength is supported by ignoring peer pressure.
6. If I am feeling well prepared for an event, one negative comment towards me can weaken my self-confidence.
7. I have difficulty in forming opinions which are really “my own”.
8. I feel I am thick-skinned.
9. My sense of personal strength is supported by a belief that there is an underlying order or purpose in the world.
10. I have difficulty standing up for myself, when I am in competition or conflict with others.
11. I have difficulty taking the initiative in forming new friends (especially with the opposite sex).
12. I feel parts of my body don’t belong to me.
13. My sense of personal strength is supported by a belief that my life has value and meaning.
14. I feel rejected if someone important to me is not giving me all his or her attention.
15. My sense of personal strength is supported by a belief that there is a higher power or God guiding and protecting me.
16. It is important to how I see myself, to know my whakapapa or about my ancestors (parents, grandparents, great grandparents etc)
17. I cope well with criticism.

16. **Overall levels and stability of mental activity.**

1. I often run out of energy.
2. I sometimes find I get quite excited.
3. I find it hard to keep up a full day's work.
4. Things that don’t affect others much can sometimes leave a big impression on me.
5. I sometimes lie awake at night with a very active mind.
6. I sometimes have difficulty waking up.
7. I have difficulty working normally in the early part of the day.
## Appendix 3

*STQ1, as Used*

**Questionnaire of Activities Related to the Left and Right Brain**

<table>
<thead>
<tr>
<th></th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Not Sure</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td></td>
<td><strong>When I meet people I know, I have difficulty recognizing them by their face.</strong></td>
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<td>2.</td>
<td></td>
<td></td>
<td><strong>I have difficulty distinguishing loud from soft sounds.</strong></td>
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<td>3.</td>
<td></td>
<td></td>
<td><strong>In games like cricket or softball I prefer to bowl rather than bat.</strong></td>
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<td>4.</td>
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<td>5.</td>
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<td></td>
<td><strong>I have difficulty adapting to new situations.</strong></td>
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<td>6.</td>
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<td><strong>I have difficulty understanding what people are really trying to say.</strong></td>
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<td><strong>I get tongue-tied.</strong></td>
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<td>9.</td>
<td>I have problems paying attention for any length of time (e.g. television, or other people talking).</td>
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<td>16.</td>
<td>Things don’t easily upset me.</td>
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<td>17.</td>
<td>I often run out of energy.</td>
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<td>18.</td>
<td>It is sometimes easier to recognise people by their voice.</td>
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<td>19.</td>
<td>Sometimes I do not say the things I want to, especially in places like committees or the classroom.</td>
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<td>20.</td>
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<td>21.</td>
<td>My home is usually tidy.</td>
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<td>22.</td>
<td>Unexpected obstacles can embarrass or upset me.</td>
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<td>23.</td>
<td>I tend to make judgments on first impressions rather than after careful analysis.</td>
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<td>24.</td>
<td>I have been told that I have the TV or stereo on too loud.</td>
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<td>25.</td>
<td>I tend to buy on impulse rather than after careful consideration.</td>
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<td>26.</td>
<td>When I am watching television I have difficulty matching the pictures to the words that someone is speaking.</td>
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<td>27.</td>
<td>I prefer face-to-face conversations to telephone conversations.</td>
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<td>28.</td>
<td>I like taking part in debates.</td>
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<td>I am distracted by things moving in the side of my field of view, especially when I am thinking about something else.</td>
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<td>Physical contact overwhelms me.</td>
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</table>
32. The slightest sound or light can keep me awake at night.

33. My sense of personal strength is supported by ignoring peer pressure.

34. In a classroom (or committee etc) I get confused by the continual change of subject.

35. I am more sensitive to noise when I am trying to concentrate on something else or when I am anxious.

36. I have a good imagination.

37. I spend a long time thinking through questions before I form opinions.

38. Tunes, rhythms and music run through my head.

39. If I am feeling well prepared for an event, one negative comment towards me can weaken my self-confidence.

40. I like being asked out on the spur of the moment.

41. I have difficulty in forming opinions which are really “my own”.

42. I feel I am thick-skinned.
<table>
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<th></th>
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<th>Strongly Agree</th>
<th>Agree</th>
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<tbody>
<tr>
<td>43</td>
<td>I sometimes find I get quite excited.</td>
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<td>44</td>
<td>I am not sensitive to background noises.</td>
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<td>45</td>
<td>When I meet someone I know, I find that they can recognise me by my face, but I cannot recognise them by their face.</td>
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<td>46</td>
<td>My sense of personal strength is supported by a belief that there is an underlying order or purpose in the world.</td>
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<td>47</td>
<td>When I listen to music, I am more aware of the beat than the melody.</td>
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<td>I have difficulty understanding people when they only suggest or imply their meaning, but do not say it directly.</td>
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<td>49</td>
<td>I would prefer to live alone.</td>
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<td>50</td>
<td>I get overwhelmed by emotional people, even if they are expressing friendly and positive emotions.</td>
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<td>I get easily rattled or upset when lots of things are going on at once.</td>
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<td>52</td>
<td>I have difficulty making quick decisions in new situations.</td>
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<td>53.</td>
<td>I like day-dreaming or fantasising.</td>
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<td>54.</td>
<td>I have difficulty standing up for myself when I am in competition or conflict with others.</td>
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<td>55.</td>
<td>I have difficulty taking the initiative in forming new friends (especially with the opposite sex).</td>
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<td>56.</td>
<td>I do not like solitude.</td>
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<td>57.</td>
<td>I feel parts of my body don’t belong to me.</td>
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<td>My sense of personal strength is supported by a belief that my life has value and meaning.</td>
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<td>62.</td>
<td>I tend to remember people by their faces more than by their names.</td>
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<td>63.</td>
<td>I have difficulty following pictures at the movies when pictures are moving fast across the screen (especially when I am sitting near the front of the movie theatre).</td>
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<td></td>
<td>Statement</td>
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<td>64.</td>
<td>I prefer to work with other people.</td>
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<td>65.</td>
<td>At pedestrian crossings I am confused by the “green man” or “red man” signs telling me when to walk.</td>
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<td>66.</td>
<td>I find it difficult to get the point of a joke.</td>
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<td>70.</td>
<td>I have difficulty catching a ball.</td>
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<td>71.</td>
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<td>I find music sounds much the same when the volume is turned down.</td>
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<td>I sometimes have difficulty waking up.</td>
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<td>77.</td>
<td>Sometimes I am unaware of the visual world around me.</td>
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<td>78.</td>
<td>My speech gets mixed up when I am embarrassed.</td>
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<td>higher power or God guiding and protecting me.</td>
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<td>80.</td>
<td>I prefer television to radio.</td>
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<td>81.</td>
<td>I have difficulty striking a ball with a bat or racket</td>
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<td>82.</td>
<td>When I am taking a trip I prefer to use a map rather than write down</td>
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<td>instructions.</td>
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<td>83.</td>
<td>I find continual company exhausting.</td>
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<td>84.</td>
<td>I find my train of thought interferes with my ability to concentrate.</td>
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<td>85.</td>
<td>I am sensitive to temperature changes.</td>
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<td>86.</td>
<td>I can easily follow the plot in a film or play.</td>
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<td>87.</td>
<td>When I am emotionally upset, I find it difficult to remember things.</td>
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<td>89.</td>
<td>I find it easy to make a sudden change of plans.</td>
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<td>90.</td>
<td>I have fantasies that can be used as the basis for artistic productions or activities.</td>
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<tr>
<td>91.</td>
<td>It is important for how I see myself to know my whakapapa or to know about my ancestors (grandparents, great grandparents etc).</td>
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<tr>
<td>92.</td>
<td>I have difficulty in rapid co-ordination of both hands, such as in rapid drumming with two hands.</td>
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<td>93.</td>
<td>I cope well with criticism.</td>
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<td>94.</td>
<td>I like communal singing.</td>
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<tr>
<td>95.</td>
<td>When I am singing with others, I find that other people’s voices are so loud that I cannot hear my own voice.</td>
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<td>96.</td>
<td>I spend a long time planning what I want to say.</td>
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Appendix 4
Synopsis of Grand Factor Analysis factors for STQ1

Items that make up factors - MHU (4 factors)

Factor 1

Sensory Overload sub factor 1

Gets rattled with lots of things going on and lots of noise
When emotionally upset there are memory difficulties
Get overwhelmed by emotional people
Distracted by busy streets and moving things
Sounds keep on awake
Group work is tiring

Thought Disorder

Get tongue-tied, can’t make sentences as fast as I need to and speech gets mixed up when embarrassed.

Ego Strength 1

Difficulty forming opinions, and initiating friendship, standing up for myself.
Getting embarrassed from unexpected obstacles
Feel like parts of my body don’t belong
A negative comment weakens my self-confidence
Would feel rejection if friend does not show

Sustained Attention

Trouble paying attention for length of time

Cross modal

Confused at pedestrian crossings, difficulty drumming and watching TV

Co-ordination of sensory motor

Difficulty catching and striking a ball

Long thought

Thoughts run on and interfere with concentration
Music runs through head
Think a long time before forming opinions

Mental Stability (Unstable levels of energy)
Run out of energy, hard to keep up a full day’s work, especially working in the mornings, difficulty waking up, active mind at night

**Language Comprehension (Socially contextualised comprehension of Incoming Language)**

Difficulty understanding people when they imply their meaning, or what they are really trying to say, or the point of a joke,

**Gestalt (Abstract/Visual Gestalt)**

Tend to buy after careful consideration, and judgements after careful analysis, not aware of visual world, prefer radio, tend to remember names to faces.

**Speed of learning new material**

Difficulty adapting to new situations

**Gestalt (face recognition)**

Difficulty recognising faces, often recognise me before me them, tend to remember names over faces.

**List without headings for Factor 1**

- Gets rattled with lots of things going on and lots of noise
- When emotionally upset there are memory difficulties
- Get overwhelmed by emotional people
- Distracted by busy streets and moving things
- Sounds keep one awake
- Group work is tiring
- Get tongue-tied, can’t make sentences as fast as I need to and speech gets mixed up when embarrassed.
- Difficulty forming opinions, and initiating friendship, standing up for myself.
- Getting embarrassed from unexpected obstacles
- Feel like parts of my body don’t belong
- A negative comment weakens my self-confidence
- Would feel rejection if friend does not show
- Trouble paying attention for length of time
- Confused at pedestrian crossings, difficulty drumming and watching TV
- Difficulty catching and striking a ball
- Thoughts run on and interfere with concentration
- Music runs through head
- Think a long time before forming opinions
- Run out of energy, hard to keep up a full day’s work, especially working in the mornings, difficulty waking up, active mind at night
- Difficulty understanding people when they imply their meaning, or what they are really trying to say, or the point of a joke,
- Tend to buy after careful consideration, and judgements after careful analysis, not aware of visual world, prefer radio, tend to remember names to faces.
Difficulty adapting to new situations
Difficulty recognising faces, often recognise me before me them, tend to remember names over faces.

Further summary - Factor 1

Difficulties with noise, movements, emotion and groups
Gets tongue tied
Lacking self assertion and confidence, prone to rejection
Bad concentration
Confused demanded of cross modally and interhemispheric
Can’t catch or bat a ball
Thoughts and music running on and interfering with concentration
Think long before making opinions
Low energy, mind active at nights
Bad at implied meaning
Trouble with Abstract/visual gestalts, new situations and recognising faces.

Factor 2 - Loner by Preference to develop own thoughts

Preference for Solitude

Prefers to work with other people but needs time with own thoughts

Long trains of thought

Has artistic fantasies
Good imagination
Likes inventing stories and day dreaming
Music runs through ones head
Interested in systems of ideas, religion, philosophy

Comprehension of language

Can follow a plot in a play
Does get a joke
Likes debating

Ego Strength

Sense of personal strength is supported by a belief in God, underlying purpose in the world, that life has value and meaning
Important to know whakapapa
Feel thinskinned

Gestalt 3

Easier to recognise someone by their voice,
Prefer face to face conversations
Aware of visual world
More aware of beat than melody.

*Sensory Overload 4*

Like contact sports
Distracted by things in peripheral vision
Physical contact overwhelms

**Further summary - Factor 2**

Prefers to work with other people but needs time with own thoughts
Has artistic fantasies
Good imagination
Likes inventing stories and day dreaming
Music runs through ones head
Interested in systems of ideas, religion, philosophy
Can follow a plot in a play
Does get a joke
Likes debating
Sense of personal strength is supported by a belief in God, underlying purpose in the world, that life has value and meaning
Important to know whakapapa
Feel thin skinned
Easier to recognise someone by their voice,
Prefer face to face conversations
Aware of visual world
More aware of beat than melody.
Like contact sports
Distracted by things in peripheral vision
Physical contact overwhelms

**Factor 3 - Loner for different reasons: Needs quietness to avoid threat**

*Spontaneity*

Does not like to be spontaneous

*Sensory Overload 2*

Finds continual company exhausting
Physical contact overwhelming
Groups are wearying
Sounds and light keep one awake

*Distractibility - Sensitive to noise*

Sensitive to noise, more so if concentrating, makes jump
Preference for Solitude

Prefer to live and work alone, needs solitude,

Sensory Overload 3

Sensitive to temp changes, noises, which also make one jump

Further summary - Factor 3

Does not like to be spontaneous
Finds continual company exhausting
Physical contact overwhelming
Groups are wearying
Sounds and light keep one awake
Sensitive to noise
Prefer to live and work alone, needs solitude,
Sensitive to temp changes, noises, which also make one jump

Factor 4

Ego Strength 3

Things easily upset me
Don’t cope well with criticism
Thin skinned

 Discrimination 2 - Difficulty distinguishing loud from soft sound

Other voices loud when communal singing
Music sounds similar when up or down
Doesn’t like communal singing
Has difficulty distinguishing loud from soft sounds
Appendix 5
STQ1: Factors in Factor Analysis
MHU Results (5pt scale)

Please note: All questions that, when agreed to, are opposite to theory of trait abnormality, have been reversed and I will indicate with asterisk *
Where a name for a collection of questions seems to encapsulate the meaning of the factor, it is given a name

1. **Gestalt** - Difficulty with gestalt perception

**Factor 1** - Abstract/Visual Gestalt

5. I tend to buy on impulsive rather than after careful consideration.* (0.703)
4. I tend to make judgments on first impressions rather than after careful analysis.* (0.689)
10. Sometimes I am unaware of the visual world around me. (-0.527)
11. I prefer television to radio.* (0.532)
9. I tend to remember people by their faces more than by their names.* (0.444)

**Factor 2** - Face Recognition

1. When I meet people I know, I have difficulty recognising them by their face. (0.813)
7. When I meet someone I know, I find that they can recognise me by my face, but I cannot recognise them by their face. (0.744)
9. I tend to remember people by their faces more than by their names.* (0.584)

**Factor 3**

2. It is sometimes easier to recognise someone by their voice. (-0.731)
6. I prefer face-to-face conversations to telephone conversations.* (0.696)
10. Sometimes I am unaware of the visual world around me. (0.436)
3. My home is usually tidy.* (0.389)
8. When I listen to music, I am more aware of the beat than the melody. (-0.312)

**Factor 4**

12. When I am taking a trip I prefer to use a map rather than write down instructions.* ((0.796)
8. When I listen to music, I am more aware of the beat than the melody. (-0.633)
3. My home is usually tidy.* (0.318)
2. Discrimination of the intensity of sensory stimuli

Factor 1

2. I am sometimes told that I have the radio or stereo on too loud. (0.680)
1. I have difficulty distinguishing loud from soft sounds. (0.663)
4. I like communal singing.* (-0.633)

Factor 2 - Difficulty distinguishing loud from soft sound

5. When I am singing with others, I find that other people’s voices are so loud that I cannot hear my own voice. (0.713)
3. I find music sounds much the same when the volume is turned down. (0.665)
4. I like communal singing.* (0.442)
1. I have difficulty distinguishing loud from soft sounds. (0.352)

3. Rapid Co-ordination of sensory input and motor control

Factor 1 Eye/Hand Co-ordination

3. I have difficulty catching a ball. (0.488)
4. I have difficulty striking a ball with a bat or racket. (0.465)

4. Cross-modal Co-ordination

Factor 1 Cross modal Co-ordination

2. At pedestrian crossings I am confused by the “green man” or “red man” signs telling me when to walk. (0.513)
3. I have difficulty in rapid coordination of both hands, such as in rapid drumming with two hands (0.474)
1. When I am watching television I have difficulty matching the pictures to the words that someone is speaking. (0.446)

5. Speed of learning new material

1. I have difficulty adapting to new situations.

5. Comprehension of Incoming Language

Factor 1 Socially contextualised comprehension of Incoming Language

3. I have difficulty understanding people when they only suggest or imply their meaning, but do not say it directly. (0.797)
1. I have difficulty understanding what people are really trying to say. (0.708)
4. I find it difficult to get the point of a joke. (0.412)
Factor 2

5. I can easily follow the plot in a film or play.* (0.821)
4. I find it difficult to get the point of a joke. (0.634)
2. I like taking part in debates.* (0.446)

7. Thought Disorder

1. I get tongue-tied. (0.320)
3. When I want to say something, I sometimes find that I cannot make my sentences as fast as I need to. (0.310)
4. My speech gets mixed up when I am embarrassed. (0.301)

8. Distractibility

2. I am very sensitive to noise. (0.485)
3. I am more sensitive to noise when I am trying to concentrate on something else or when I am anxious. (0.456)
1. Sudden noises make me jump. (0.349)

10. Sustained Attention

1. I have problems paying attention for any length of time (e.g. television, or other people talking).
   Only One question

11. Sensory Overload

Factor 1

8. I get easily rattled or upset when lots of things are going on at once. (0.778)
12. When I am emotionally upset, I find it difficult to remember things. (0.684)
7. I get overwhelmed by emotional people, even if they are expressing friendly and positive emotions. (0.626)
9. When I am in busy streets, the sight of everyone walking in front of me is very distracting. (0.625)
5. The slightest sound or light can keep me awake at night. (0.493)
1. Working in groups quickly wears me out. (0.324)
2. I am irritable or jumpy when there is a lot of noise around me. (0.471)
3. I am distracted by things moving in the side of my field of view, especially when I am thinking about something else. (0.386)

Factor 2

10. I find continual company exhausting. (0.743)
4. Physical contact overwhelms me. (0.629)
1. Working in groups quickly wears me out. (0.324)
5. The slightest sound or light can keep me awake at night. (0.303)
Factor 3

11. I am sensitive to temperature changes (0.724)
6. I am not sensitive to background noises.* (0.689)
2. I am irritable or jumpy when there is a lot of noise around me. (0.484)

Factor 4

13. I like contact sports such as rugby or wrestling etc.* (0.841)
3. I am distracted by things moving in the side of my field of view, especially when I am thinking about something else. (-0.451)
4. Physical contact overwhelms me. (-0.331)

12. Preference for Solitude

Factor 1

2. I would prefer to live alone. (0.752)
3. I do not like solitude.* (0.723)
4. I prefer to work with other people.* (0.580)

Factor 2

1. I like time with my own thoughts. (0.881)
4. I prefer to work with other people.* (-0.623)

13. Attentional Shift

Factor 1

2. I have difficulty making quick decisions in new situations.(0.518)
1. In a classroom (or committee etc) I get confused by the continual change of subject. (0.456)
3. I find it easy to make a sudden change of plans. (0.403)

14. Long Trains of thought

Factor 1 - Concrete/Imagination/Visual

10. I have fantasies that can be used as the basis for artistic productions or activities. (0.799)
2. I have a good imagination. (0.650)
6. I like inventing or writing stories. (0.633)
5. I like day-dreaming or fantasising. (0.528)
4. Tunes, rhythms and music run through my head. (0.413)
1. I am interested in systems of ideas in politics, religion, philosophy. (0.411)
Factor 2 - Thoughts Capture Attention

7. My thoughts seem to run on by themselves. (0.779)
9. I find my train of thought interferes with my ability to concentrate. (0.736)
4. Tunes, rhythms and music run through my head. (0.513)
5. I like day-dreaming or fantasising. (0.365)
3. I spend a long time thinking through questions before I form opinions. (-0.541)

Factor 3

8. I am able to let go and think strange thoughts without being upset or frightened. (0.858)
6. I like inventing or writing stories. (-0.451)

15. Spontaneity

Factor 1

2. I like to be spontaneous* (0.582)
3. I like being asked out on the spur of the moment.* (0.560)

16. Ego Strength

Factor 1 - Self Confidence (Active Self Esteem)

7. I have difficulty in forming opinions which are really “my own”. (0.704)
11. I have difficulty taking the initiative in forming new friends (especially with the opposite sex). (0.634)
10. I have difficulty standing up for myself, when I am in competition or conflict with others. (0.558)
4. Unexpected obstacles can embarrass or upset me. (0.534)
12. I feel parts of my body don’t belong to me. (0.492)
6. If I am feeling well prepared for an event, one negative comment towards me can weaken my self-confidence. (0.473)
1. If a friend does not turn up to a planned meeting with me, I would feel a sense of rejection even if I knew it was probably for a “good” reason. (0.306)

Factor 2 - Universal Sense of Purpose

15. My sense of personal strength is supported by a belief that there is a higher power or God guiding and protecting me. (0.729)
9. My sense of personal strength is supported by a belief that there is an underlying order or purpose in the world. (0.706)
13. My sense of personal strength is supported by a belief that my life has value and meaning. (0.599)
16. It is important to how I see myself, to know my whakapapa or about my ancestors (parents, grandparents, great grandparents etc) (0.436)
8. I feel I am thick-skinned* (-0.348)
Factor 3 - Resilience/Mask of Toughness (reactive - ability to respond to provocations)

3. Things don’t easily upset me.* (0.751)
17. I cope well with criticism.* (0.716)
8. I feel I am thick-skinned* (0.584)

Factor 4

5. My sense of personal strength is supported by ignoring peer pressure. (0.736)
1. If a friend does not turn up to a planned meeting with me, I would feel a sense of rejection even if I knew it was probably for a “good” reason. (0.725)

Factor 5

2. Setbacks or obstacles do not put me off the task at hand.* (0.628)
14. I feel rejected if someone important to me is not giving me all his or her attention. (0.619)
16. It is important to how I see myself, to know my whakapapa or about my ancestors (parents, grandparents, great grandparents etc) (0.499)
12. I feel parts of my body don’t belong to me. (-0.367)

17. Mental Stability

Factor 1 - Slow to get moving

1. I often run out of energy. (0.790)
3. I find it hard to keep up a full day's work. (0.747)
7. I have difficulty working normally in the early part of the day. (0.717)
6. I sometimes have difficulty waking up. (0.612)
5. I sometimes lie awake at night with a very active mind. (0.344)

Factor 2 - Excitability/Psychic Momentum

4. Things that don’t affect others much can sometimes leave a big impression on me. (0.758)
2. I sometimes find I get quite excited. (0.703)
5. I sometimes lie awake at night with a very active mind. (0.568)
Appendix 6

STQ1: Normal Population
Factors in Factor Analysis

1. Gestalt - Difficulty with Gestalt Perception

Factor 5 - Face Recognition (Q 7, 2, 9)

7. When I meet someone I know, I find that they can recognise me by my face, but I cannot recognise them by their face. (0.702)
2. It is sometimes easier to recognise someone by their voice. (0.695)
9. I tend to remember people by their faces more than by their names. (0.341)

2. Discrimination of the intensity of sensory stimuli

Factor 1 - Discrimination of intensity of sound (Q 1, 3)

1. I have difficulty distinguishing loud from soft sounds. (0.804)
3. I find music sounds much the same when the volume is turned down. (0.763)

3. Rapid coordination of sensory (e.g. visual) input and motor (e.g. ocular) control.

Factor 1 - Eye/hand co-ordination

4. I have difficulty striking a ball with a bat or racket. (0.910)
3. I have difficulty catching a ball. (0.853).

4. Cross-modal coordination

Factor 1 - Cross-modal Co-ordination

Unitary factor -

5. Speed of learning new material

Factor 1 - Speed of learning new material Include score in final factor analysis (only 1 question)

1. I have difficulty adapting to new situations.

6. Comprehension of incoming language

Factor 1 - Comprehension of Incoming Language (Unitary factor)
1. I have difficulty understanding what people are really trying to say. (0.763)
2. I like taking part in debates. (0.436)
3. I have difficulty understanding people when they only suggest or imply their meaning, but do not say it directly. (0.715)
4. I find it difficult to get the point of a joke. (0.508)
5. I can easily follow the plot in a film or play. (0.397)

7. Subjective experience of trait aspects of thought disorder

Factor 1 - *Disordered Speech* (Q’s 4, 1, 3)

4. My speech gets mixed up when I am embarrassed. (0.831)
1. I get tongue-tied. (0.822)
3. When I want to say something, I sometimes find that I cannot make my sentences as fast as I need to. (0.689)

Factor 2 - *Reluctance to Speak/Defense Mechanism* (Q’s 5, 2)

(Implies a degree of self-knowledge)

5. I spend a long time planning what I want to say. (0.928)
2. Sometimes I do not say the things I want to, especially in places like committees or the classroom. (0.545)

8. Distractibility:

Factor 1 - *Sensitivity to Noise* (Unitary Component) Include Q’s 2, 1, 3

2. I am very sensitive to noise. (0.797)
1. Sudden noises make me jump. (0.727)
3. I am more sensitive to noise when I am trying to concentrate on something else or when I am anxious. (0.673).

9) Vigilance/Sustained attention:

Factor 1 - *Sustained Attention* (1 Q)

1. I have problems paying attention for any length of time (e.g. television, or other people talking).

10) Sensory Overload:

Factor 1 - *Sensory Overload/Social* (Q 1, 10, 8, 9, 2)

1. Working in groups quickly wears me out. (0.779)
10. I find continual company exhausting. (0.743)
*8. I get easily rattled or upset when lots of things are going on at once. (0.489)
9. When I am in busy streets, the sight of everyone walking in front of me is very distracting. (0.441)
*2. I am irritable or jumpy when there is a lot of noise around me. (0.410)

Factor 2 - Sensory Overload/Misc (Q’s 13, 12, 11, 6, 2)

13. I like contact sports such as rugby or wrestling etc. (0.699)
12. When I am emotionally upset, I find it difficult to remember things. (0.643)
11. I am sensitive to temperature changes (0.596)
6. I am not sensitive to background noises. (0.509)
*2. I am irritable or jumpy when there is a lot of noise around me. (0.417)

Factor 3 - Sensory Overload/Emotional (Q’s 4, 7, 5, 3, 8)

4. Physical contact overwhelms me. (0.701)
7. I get overwhelmed by emotional people, even if they are expressing friendly and positive emotions. (0.659)
5. The slightest sound or light can keep me awake at night. (0.509)
3. I am distracted by things moving in the side of my field of view, especially when I am thinking about something else. (0.499)
*8. I get easily rattled or upset when lots of things are going on at once. (0.470)

11. Preference for solitude/Avoidance of social activity

Factor 1 - Preference for Solitude (Unitary component) Q’s 3, 4, 1, 2

3. I do not like solitude. (0.803)
4. I prefer to work with other people (0.654)
1. I like time with my own thoughts (0.624)
2. I would prefer to live alone. (0.584)

12. Attentional shift

Factor 1 - Attentional Shift (Unitary component) Q’s 2, 3, 1)

2. I have difficulty making quick decisions in new situations. (0.838)
3. I find it easy to make a sudden change of plans. (0.727)
1. In a classroom (or committee etc) I get confused by the continual change of subject. (0.606)

13. Long trains of thought

Factor 1 - Concrete Imagination/Visual (Q’s 2, 6, 10, 5)

Accounts for highest variance

2. I have a good imagination. (0.742)
6. I like inventing or writing stories. (0.739)
10. I have fantasies that can be used as the basis for artistic productions or activities. (0.722)
5. I like day-dreaming or fantasising. (0.562)
Factor 2 - *Thoughts Capture Attention* (Q’s 9, 7, 5)

9. I find my train of thought interferes with my ability to concentrate. (0.758)  
7. My thoughts seem to run on by themselves. (0.730)  
5. I like day-dreaming or fantasising. (0.418)

Factor 3 - *Abstract Imagination/Auditory/Conceptual* Q’s 8, 4, 1  
Music/Ideas - more abstract/auditory/conceptual

8. I am able to let go and think strange thoughts without being upset or frightened. (0.688)  
4. Tunes, rhythms and music run through my head. (0.671)  
1. I am interested in systems of ideas in politics, religion, philosophy. (0.489)

14. **Spontaneity**

2. I like to be spontaneous (0.766)  
3. I like being asked out on the spur of the moment. (0.730)  
1. I prefer to plan carefully future events. (0.557)

15. **“Ego strength”**

Factor 1 - **“Self Confidence”** (Active self-esteem) Q’s 10, 6, 7, 4, 11

10. I have difficulty standing up for myself, when I am in competition or conflict with others. (0.774)  
6. If I am feeling well prepared for an event, one negative comment towards me can weaken my self-confidence. (0.712)  
7. I have difficulty in forming opinions which are really “my own”. (0.663)  
4. Unexpected obstacles can embarrass or upset me. (0.580)  
11. I have difficulty taking the initiative in forming new friends (especially with the opposite sex). (0.547)

Factor 2 - **“Universal Sense of Purpose”**

9. My sense of personal strength is supported by a belief that there is an underlying order or purpose in the world. (0.818)  
15. My sense of personal strength is supported by a belief that there is a higher power or God guiding and protecting me. (0.777)  
13. My sense of personal strength is supported by a belief that my life has value and meaning. (0.743)  
16. It is important to how I see myself, to know my whakapapa or about my ancestors (parents, grandparents, great grandparents etc) (0.470)

Factor 3 - **“Resilience/Mask of Toughness** (Reactive - ability to respond to provocations)

3. Things don’t easily upset me. (0.769)  
8. I feel I am thick-skinned (0.674)  
17. I cope well with criticism. (0.670)  
14. I feel rejected if someone important to me is not giving me all his or her attention. (0.357)
Factor 4 - “Emotional Security/Vulnerability of Rejection. Q’s 14, 1, 16.

14. I feel rejected if someone important to me is not giving me all his or her attention. (0.684)
1. If a friend does not turn up to a planned meeting with me, I would feel a sense of rejection even if I knew it was probably for a “good” reason. (0.578)
16. It is important to how I see myself, to know my whakapapa or about my ancestors (parents, grandparents, great grandparents etc) (0.378)

16. Overall levels and stability of mental activity.

Factor 1 - “Slow to get moving”

7. I have difficulty working normally in the early part of the day. (0.851)
6. I sometimes have difficulty waking up. (0.719)
3. I find it hard to keep up a full day's work. (0.543)

Factor 2 - “Excitability/Psychic Momentum”

5. I sometimes lie awake at night with a very active mind. (0.800)
2. I sometimes find I get quite excited. (0.754)
4. Things that don’t affect others much can sometimes leave a big impression on me. (0.404)

Factor 3 - Energy and Exhaustion

1. I often run out of energy. (0.835)
4. Things that don’t affect others much can sometimes leave a big impression on me. (0.666)
Wait for MHU results.
Appendix 7

Statistics performed in STQ1 data leading to elimination, change, or retention of items for STQ2.

The statistics presented were used to identify items which failed to measure up as good predictors of trait abnormality. The criteria used were Factor Analysis for STQ1 (including factor loadings), T-test (MHU vs Non-MHU), Power calculations and Effect Size. Items are grouped according to their *a priori* category, and within each category, subfactors and items are ranked by the value of their strength of loading. Also included are the judgements made on whether an item was specific to the theory (S/NS) and its relevance (R/NR). An * indicates reversal. Two ** indicate the item that has been retained despite less stringent probabilities because they were deemed to be still relevant and worthy of scrutiny in terms of other statistics. Together, these criteria were used to decide whether to eliminate, change, or retain an item for STQ2, or to relocate it to another *a priori* category.

<table>
<thead>
<tr>
<th><em>a priori</em> category</th>
<th>“Factor sub-heading”</th>
<th>Factor loading</th>
<th>T-value</th>
<th>Power Calculation</th>
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</thead>
<tbody>
<tr>
<td>Empirical factor</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Gestalt**

**Factor 1: “Misc 1 Gestalt”**

<table>
<thead>
<tr>
<th></th>
<th>Item in STQ1</th>
<th>Factor loading</th>
<th>T-value</th>
<th>Power Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a.</td>
<td>5. I tend to buy on impulse rather than after careful consideration * (eliminated)</td>
<td>0.703 NS+NR</td>
<td>-0.575 0.566</td>
<td>none -0.07</td>
</tr>
<tr>
<td>1b.</td>
<td>4. I tend to make judgements on first impressions rather than after careful consideration (eliminated) *</td>
<td>0.689 NS+NR</td>
<td>0.918 0.359</td>
<td>None 0.11</td>
</tr>
<tr>
<td>1c.</td>
<td>10. Sometimes I am unaware of the visual world around me (changed)</td>
<td>-0.527 S+R</td>
<td>4.796 0.000</td>
<td>99 0.59</td>
</tr>
<tr>
<td>1d.</td>
<td>11. I prefer television to radio *</td>
<td>0.532 S+R</td>
<td>2.326 0.021</td>
<td>393** 0.29</td>
</tr>
<tr>
<td>1e.</td>
<td>9. I tend to remember people by their faces more than by their names *</td>
<td>0.444 NS+R</td>
<td>-0.169 0.866</td>
<td>None** -0.02</td>
</tr>
</tbody>
</table>

Variance explained – 16.745%

**Gestalt**

**Factor 2: “Face Recognition”**

<table>
<thead>
<tr>
<th></th>
<th>Item in STQ1</th>
<th>Factor loading</th>
<th>T-value</th>
<th>Power Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2a.</td>
<td>1. When I meet people I know, I have difficulty recognising them by their face</td>
<td>0.813 S+R</td>
<td>4.504 0.000</td>
<td>26 -0.88</td>
</tr>
<tr>
<td>2b.</td>
<td>7. When I meet someone I know, I find that they can recognise me by my face, but I cannot recognise them by their face</td>
<td>0.744 R+S</td>
<td>5.36</td>
<td>45</td>
</tr>
<tr>
<td>2c.</td>
<td>9. I tend to remember people by their faces more than by their names *</td>
<td>0.584 NS+R</td>
<td>-0.169</td>
<td>None**</td>
</tr>
</tbody>
</table>

Variance explained – 13.918%

Gestalt Factor 3: “Misc 2 Gestalt”

| 3a.  | 2. It is sometimes easier to recognise someone by their voice (changed). | -0.731 S+R | 5.325 | 45 | 0.70 |
| 3b.  | 6. I prefer face-to-face conversations to telephone conversations * | 0.696 NS+R | -0.931 | None** | -0.11 |
| 3c.  | 10. Sometimes I am unaware of the visual world around me (changed) | 0.436 S+R | 4.796 | 99 | 0.59 |
| 3d.  | 3. My home is usually tidy * | 0.389 NS+NR | 5.36 | None | 0.000 |
| 3e.  | 8. When I listen to music, I am more aware of the beat than the melody (eliminated) | -0.312 NS+R | 0.353 | None | 0.04 |

Variance explained – 12.649%

Gestalt (eliminated) Factor 4: Misc 3 Gestalt

| 4a.  | 12. When I am taking a trip I prefer to use a map rather than write down instructions*(eliminated) | 0.796 NS | -0.186 | None | -0.03 |
| 4b.  | 8. When I listen to music, I am more aware of the beat than the melody (eliminated) | -0.633 NS+R | 0.353 | None | 0.04 |
| 4c.  | 3. My home is usually tidy * | 0.318 NS+NR | 5.360 | None | 0.000 |

Variance explained – 10.814%

2. Discrim Discrimination of the Intensity of Sensory Stimuli

| 1a.  | 2. I am sometimes told that I have the radio or stereo on too loud | 0.680 NS+NR | -0.177 | None** | -0.02 |
| 1b. | 1. I have difficulty distinguishing loud from soft sounds. | 0.663 | 3.705 | 99 | -0.52 |
| 1c. | 4. I like communal singing *(eliminated)* | -0.633 | 0.918 | None | -0.17 |
| Variance explained – 26.446% |

**Discrim Factor 2**

| 2a. | 5. When I am singing with others, I find that other people’s voices are so loud that I cannot hear my own voice | 0.713 | 2.906 | 393 | 0.37 |
| 2b. | 3. I find music sounds much the same when the volume is turned down | 0.665 | 2.962 | 393 | 0.38 |
| 2c. | 4. I like communal singing *(eliminated)* | 0.442 | 0.918 | None | -0.17 |
| 2d. | 1. I have difficulty distinguishing loud from soft sounds | 0.352 | 3.705 | 99 | 0.52 |
| Variance explained – 25.572% |

**3. Rapid Coord**

Rapid Co-ordination of Sensory Input and Motor Control

Unitary factor

| 1a. | 3. I have difficulty catching a ball | 0.488 | 3.730 | 99 | 0.46 |
| 1b. | 4. I have difficulty striking a ball with a bat or racket | 0.465 | 4.402 | 99 | 0.55 |
| Variance explained – 43.395% |

**4. Cross-modal**

Cross-modal Co-ordination

Unitary factor

| 1a. | 2. At pedestrian crossings I am confused by the “green man” or “red man” signs telling me when to walk | 0.513 | 5.366 | 45 | 0.76 |
| 1b. | 3. I have difficulty in rapid co-ordination of both hands, such as in rapid drumming with two hands *(changed)* | 0.474 | 4.290 | 99 | 0.55 |
| 1c. | 1. When I am watching television I have difficulty matching the pictures to the | 0.446 | 7.837 | 17 | 1.34 |
| 1a. | 1. I have difficulty adapting to new situations | n/a | 6.359 | 45 | -0.80 |
| 1b. | 3. I have difficulty understanding people when they only suggest or imply their meaning, but do not say it directly | 0.797 | 6.194 | 45 | 0.74 |
| 1c. | 4. I find it difficult to get the point of a joke | 0.412 | 5.287 | 45 | 0.66 |

**6. Inc Lang**  
**Factor 1**

| 2a. | 5. I can easily follow the plot in a film or play * | 0.821 | 4.832 | 45 | 0.69 |
| 2b. | 4. I find it difficult to get the point of a joke | 0.412 | 5.287 | 45 | 0.66 |
| 2c. | 2. I like taking part in debates * (eliminated) | 0.446 | 0.946 | None | 0.12 |

**7. Out Lang**  
**Subjective Experience of Trait Aspects of Thought Disorder: Language Output Unitary factor**

<p>| 1a. | 1. I get tongue-tied (eliminated) | 0.320 | 1.628 | 0.20 |
| 1b. | 3. When I want to say something, I sometimes find that I cannot make my sentences as fast as I need to | 0.310 | 3.512 | 99 | 0.42 |
| 1c. | 4. My speech sometimes gets mixed up when I am embarrassed (changed) | 0.301 | 1.015 | None | 0.11 |</p>
<table>
<thead>
<tr>
<th>8. Distract</th>
<th>Distractibility Unitary Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a.</td>
<td>2. I am very sensitive to noise</td>
</tr>
<tr>
<td></td>
<td>3. I am more sensitive to noise when I am trying to concentrate on something else or when I am anxious</td>
</tr>
<tr>
<td></td>
<td>1c. Sudden noises make me jump (changed)</td>
</tr>
</tbody>
</table>

Variance explained – 58.972%

<table>
<thead>
<tr>
<th>9. Sus Att</th>
<th>Sustained Attention/Vigilance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a.</td>
<td>1. I have problems paying attention for any length of time (e.g. television, or other people talking). Only item S+R 6.915 0.000 26 0.88</td>
</tr>
</tbody>
</table>

10 Sensory Overload Sensory Overload Factor 1:

<p>| 1a.         | 8. I get easily rattled or upset when lots of things are going on at once (eliminated) | 0.778 NS+R 7.431 0.000 26 0.85 |
|             | 12. When I am emotionally upset, I find it difficult to remember things. | 0.684 S+R 4.959 0.000 99 0.59 |
|             | 7. I get overwhelmed by emotional people, even if they are expressing friendly and positive emotions. | 0.626 S+R 3.954 0.001 99 0.47 |
|             | 9. When I am in busy streets, the sight of everyone walking in front of me is very distracting. | 0.625 S+R 8.423 0.000 17 1.07 |
|             | 5. The slightest sound or light can keep me awake at night (changed) | 0.493 S+R 3.725 0.000 99 0.44 |
|             | 1. Working in groups quickly wears me out (changed) | 0.324 S+R 5.699 0.000 45 -0.75 |
|             | 2. I am irritable or jumpy when there is a lot of noise around me (changed) | 0.471 S+R 4.142 0.000 99 |
|             | 1h. I am distracted by things moving in the | 0.386 3.306 393 |</p>
<table>
<thead>
<tr>
<th>Sens Over</th>
<th>Factor 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>2a.</td>
<td>10 I find continual company exhausting 0.743 S+R 2.459 NS+R 393** 0.28</td>
</tr>
<tr>
<td>2b.</td>
<td>4. Physical contact overwhelms me 0.629 S+R 5.575 45</td>
</tr>
<tr>
<td>2c.</td>
<td>1. Working in groups quickly wears me out (changed) 0.324 S+R 5.699 45</td>
</tr>
<tr>
<td>2d.</td>
<td>5. The slightest sound or light can keep me awake at night (changed) 0.303 S+R 3.725 99</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sens Over</th>
<th>Factor 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>3a.</td>
<td>11. I am sensitive to temperature changes (changed) 0.724 S+R 3.050 393 0.37</td>
</tr>
<tr>
<td>3b.</td>
<td>6. I am not sensitive to background noises 0.689 S+R 2.492 393** 0.31</td>
</tr>
<tr>
<td>3c.</td>
<td>2. I am irritable or jumpy when there is a lot of noise around me (changed) 0.484 S+R 4.142 99</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sens Over</th>
<th>Factor 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>4a.</td>
<td>13. I like contact sports like such as rugby or wrestling etc (eliminated) 0.841 NS 0.042 0.966 None 0.01</td>
</tr>
<tr>
<td>4b.</td>
<td>3. I am distracted by things moving in the side of my field of view, especially when I am thinking about something else (changed + moved to distractibility) -0.451 S+R 3.306 393 0.39</td>
</tr>
<tr>
<td>4c.</td>
<td>2. Physical contact overwhelms me -0.331 S+R 5.575 45</td>
</tr>
</tbody>
</table>

11. Pref Sol Preference for Solitude/Avoidance of Social Activity Factor 1

| 1a.       | 2. I would prefer to live alone 0.752 S+R 6.636 26 |

197
<table>
<thead>
<tr>
<th></th>
<th>Question</th>
<th>Scale</th>
<th>Mean</th>
<th>SD</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>1b.</td>
<td>3. I do not like solitude*</td>
<td></td>
<td>0.723</td>
<td>0.712</td>
<td>None**</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>NS+NR</td>
<td>0.447</td>
<td>0.09</td>
</tr>
<tr>
<td>1c.</td>
<td>4. I prefer to work with other people * (eliminated)</td>
<td></td>
<td>0.580</td>
<td>1.093</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>NS+NR</td>
<td>0.275</td>
<td>0.13</td>
</tr>
<tr>
<td></td>
<td>Variance explained -37.064%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Att Shift</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1a.</td>
<td>2. I have difficulty making quick decisions in new situations</td>
<td></td>
<td>0.528</td>
<td>6.796</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>S+R</td>
<td>0.000</td>
<td>0.81</td>
</tr>
<tr>
<td>1b.</td>
<td>1. In a classroom (or committee etc) I get confused by the continual change of subject</td>
<td></td>
<td>0.456</td>
<td>7.996</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>S+R</td>
<td>0.000</td>
<td>-1.07</td>
</tr>
<tr>
<td>1c.</td>
<td>3. I find it easy to make a sudden change of plans *</td>
<td></td>
<td>0.403</td>
<td>3.792</td>
<td>99</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>S+R</td>
<td>0.000</td>
<td>0.47</td>
</tr>
<tr>
<td></td>
<td>Variance explained – 52.217%</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>13.</td>
<td>Long Thought</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1a.</td>
<td>10. I have fantasies that can be used as the basis for artistic productions or activities</td>
<td></td>
<td>0.799</td>
<td>4.218</td>
<td>393</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>S+R</td>
<td>0.000</td>
<td>0.28</td>
</tr>
<tr>
<td>1b.</td>
<td>2. I have a good imagination (eliminated)</td>
<td></td>
<td>0.650</td>
<td>0.435</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>NS+NR</td>
<td>0.664</td>
<td>0.06</td>
</tr>
<tr>
<td>1c.</td>
<td>6. I like inventing or writing stories (eliminated)</td>
<td></td>
<td>0.633</td>
<td>1.290</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>NS+NR</td>
<td>0.198</td>
<td>-0.16</td>
</tr>
<tr>
<td>1d.</td>
<td>5. I like day-dreaming or fantasising (eliminated)</td>
<td></td>
<td>0.528</td>
<td>0.726</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>NS+NR</td>
<td>0.469</td>
<td>-0.09</td>
</tr>
<tr>
<td>1e.</td>
<td>4. Tunes rhythms and music run through my head (eliminated)</td>
<td></td>
<td>0.413</td>
<td>0.221</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>NS+NR</td>
<td>0.825</td>
<td>-0.03</td>
</tr>
<tr>
<td>1f.</td>
<td>1. I am interested in systems of ideas in politics, religion, philosophy</td>
<td></td>
<td>0.411</td>
<td>2.795</td>
<td>393</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>S+R</td>
<td>0.006</td>
<td>0.33</td>
</tr>
</tbody>
</table>
### Long Thought

<table>
<thead>
<tr>
<th>Factor 2</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2a.</td>
<td>7. My thoughts seem to run on by themselves</td>
<td>0.779</td>
<td>1.866</td>
<td>393**</td>
<td>0.22</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Trend to S</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2b.</td>
<td>9. I find my train of thought interferes with my ability to concentrate on what someone is saying</td>
<td>0.736</td>
<td>2.194</td>
<td>393**</td>
<td>0.26</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>S+R</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2c.</td>
<td>4. Tunes rhythms and music run through my head (eliminated)</td>
<td>0.513</td>
<td>0.221</td>
<td>None</td>
<td>-0.03</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>NS+NR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2d.</td>
<td>5. I like day-dreaming or fantasising (eliminated)</td>
<td>0.365</td>
<td>-0.726</td>
<td>None</td>
<td>-0.09</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>NS+NR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2e.</td>
<td>3. I spend a long time thinking through questions before I form opinions (eliminated)</td>
<td>-0.541</td>
<td>0.446</td>
<td>None</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>NS+NR</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Variance explained – 21.327%**

### Factor 3

<table>
<thead>
<tr>
<th>Factor 3</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3a.</td>
<td>8. I am able to let go and think strange thoughts without being upset of frightened (eliminated)</td>
<td>0.858</td>
<td>3.328</td>
<td>None</td>
<td>-0.43</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>S+R</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3b.</td>
<td>6. I like inventing or writing stories (eliminated)</td>
<td>-0.451</td>
<td>1.290</td>
<td>None</td>
<td>-0.16</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>NS+NR</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Variance explained – 18.565%**

### Spontaneity

<table>
<thead>
<tr>
<th>Factor 1</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1a. 14. Spontaneity</td>
<td>2. I like to be spontaneous * (moved category)</td>
<td>0.582</td>
<td>0.611</td>
<td>None</td>
<td>0.07</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>NS+NR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1b. 15. Ego Strength</td>
<td>3. I like being asked out on the spur of the moment * (eliminated)</td>
<td>0.560</td>
<td>1.981</td>
<td>393</td>
<td>0.23</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>S+R</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Variance explained – 11.489%**
<table>
<thead>
<tr>
<th></th>
<th>Statement</th>
<th>Score</th>
<th>P</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1a.</td>
<td>7. I have difficulty in forming opinions which are really “my own”</td>
<td>0.704</td>
<td>4.581</td>
<td>99</td>
<td>0.58</td>
</tr>
<tr>
<td>1b.</td>
<td>11. I have difficulty taking the initiative in forming new friends (especially with a potential partner).</td>
<td>0.634</td>
<td>5.106</td>
<td>45</td>
<td>0.62</td>
</tr>
<tr>
<td>1c.</td>
<td>10. I have difficulty standing up for myself, when I am in competition or conflict with others</td>
<td>0.558</td>
<td>6.131</td>
<td>45</td>
<td>0.75</td>
</tr>
<tr>
<td>1d.</td>
<td>4. Unexpected obstacles can embarrass or upset me</td>
<td>0.534</td>
<td>5.027</td>
<td>45</td>
<td>0.62</td>
</tr>
<tr>
<td>1e.</td>
<td>12. I feel parts of my body don’t belong to me (eliminated)</td>
<td>0.492</td>
<td>4.431</td>
<td>99</td>
<td>0.60</td>
</tr>
<tr>
<td>1f.</td>
<td>6. If I am feeling well prepared for an event, one negative comment towards me can weaken my self-confidence</td>
<td>0.473</td>
<td>5.248</td>
<td>45</td>
<td>0.64</td>
</tr>
<tr>
<td>1g.</td>
<td>1. If a friend does not turn up to a planned meeting with me, I would feel a sense of rejection even if I knew it was probably for a “good” reason</td>
<td>0.306</td>
<td>3.546</td>
<td>393</td>
<td>0.40</td>
</tr>
<tr>
<td></td>
<td>Variance explained – 13.458%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ego Strength</td>
<td>Factor 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2a.</td>
<td>15. My sense of personal strength is supported by a belief that there is a higher power or God guiding and protecting me (eliminated)</td>
<td>0.729</td>
<td>5.956</td>
<td>45</td>
<td>0.66</td>
</tr>
<tr>
<td>2b.</td>
<td>9. My sense of personal strength is supported by a belief that there is an underlying order or purpose in the world (eliminated)</td>
<td>0.706</td>
<td>2.277</td>
<td>393</td>
<td>0.26</td>
</tr>
<tr>
<td>2c.</td>
<td>13. My sense of personal strength is supported by a belief that my life has value and meaning (eliminated)</td>
<td>0.599</td>
<td>-0.057</td>
<td>None</td>
<td>-0.01</td>
</tr>
<tr>
<td>2d.</td>
<td>16. It is important to how I see myself, to know my whakapapa or about my ancestors (parents, grandparents, great grandparents etc) (eliminated)</td>
<td>0.436</td>
<td>5.205</td>
<td>99</td>
<td>0.59</td>
</tr>
<tr>
<td></td>
<td>Statement</td>
<td>Factor 3</td>
<td>Factor 4</td>
<td>Factor 5</td>
<td></td>
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<tr>
<td>---</td>
<td>---------------------------------------------------------------------------</td>
<td>-------------------------------</td>
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<td>-------------------------------</td>
<td></td>
</tr>
<tr>
<td>2e.</td>
<td>8. I feel I am thick-skinned * (eliminated)</td>
<td>-0.348 NS+NR 1.384 0.167 None 0.18</td>
<td>-0.337 NS+NR -0.337 0.736 None -0.04</td>
<td>-0.367 S+R 4.431 0.000 99 0.60</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Variance explained -12.120%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Ego Strength</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Factor 3</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3a.</td>
<td>3. Things don’t easily upset me *</td>
<td>0.751 S+R 3.520 0.000 99 0.45</td>
<td>0.725 S+R 3.546 0.000 393 0.40</td>
<td>0.628 S+R 3.512 0.001 99 0.43</td>
<td></td>
</tr>
<tr>
<td>3b.</td>
<td>17. I cope well with criticism * (changed)</td>
<td>0.716 NS+NS 0.311 0.756 None 0.04</td>
<td>0.619 NS 1.375 0.170 None 0.16</td>
<td>0.499 S+R 5.205 0.000 99 0.59</td>
<td></td>
</tr>
<tr>
<td>3c.</td>
<td>8. I feel I am thick-skinned * (eliminated)</td>
<td>0.584 NS+NR 1.384 0.167 None 0.18</td>
<td>0.584 NS+NR 1.384 0.167 None 0.18</td>
<td>0.584 NS+NR 1.384 0.167 None 0.18</td>
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</tr>
<tr>
<td></td>
<td>Variance explained – 11.475%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Ego Strength (eliminated)</strong></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Factor 4</strong></td>
<td></td>
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</tr>
<tr>
<td>4a.</td>
<td>5. My sense of personal strength is supported by ignoring peer pressure *(eliminated)</td>
<td>0.736 NS+NR -0.337 0.736 None -0.04</td>
<td>0.725 S+R 3.546 0.000 393 0.40</td>
<td>0.628 S+R 3.512 0.001 99 0.43</td>
<td></td>
</tr>
<tr>
<td>4b.</td>
<td>1. If a friend does not turn up to a planned meeting with me, I would feel a sense of rejection even if I knew it was probably for a “good” reason</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Variance explained – 8.678%</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td><strong>Ego Strength (eliminated)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Factor 5</strong></td>
<td></td>
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</tr>
<tr>
<td>5a.</td>
<td>2. Setbacks or obstacles do not put me off the task at hand * (changed)</td>
<td>0.628 S+R 3.512 0.001 99 0.43</td>
<td>0.619 NS 1.375 0.170 None 0.16</td>
<td>0.499 S+R 5.205 0.000 99 0.59</td>
<td></td>
</tr>
<tr>
<td>5b.</td>
<td>14. I feel rejected if someone important to me is not giving me all his or her attention *(eliminated)</td>
<td>0.619 NS 1.375 0.170 None 0.16</td>
<td>0.619 NS 1.375 0.170 None 0.16</td>
<td>0.499 S+R 5.205 0.000 99 0.59</td>
<td></td>
</tr>
<tr>
<td>5c.</td>
<td>16. It is important to how I see myself, to know my whakapapa or about my ancestors (parents, grandparents, great grandparents etc) *(eliminated)</td>
<td>0.499 S+R 5.205 0.000 99 0.59</td>
<td>0.499 S+R 5.205 0.000 99 0.59</td>
<td>0.499 S+R 5.205 0.000 99 0.59</td>
<td></td>
</tr>
<tr>
<td>5d.</td>
<td>12. I feel parts of my body don’t belong to me *(eliminated)</td>
<td>-0.367 S+R 4.431 0.000 99 0.60</td>
<td>-0.367 S+R 4.431 0.000 99 0.60</td>
<td>-0.367 S+R 4.431 0.000 99 0.60</td>
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</table>
### Mental Stability

**Factor 1: “Unstable levels of energy”**

<table>
<thead>
<tr>
<th></th>
<th>Question</th>
<th>Factor Load</th>
<th>t Stat</th>
<th>p Value</th>
<th>Variance Explained</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>1. I often run out of energy</td>
<td>0.790 S+R</td>
<td>7.112</td>
<td>0.000</td>
<td>8.220%</td>
</tr>
<tr>
<td>1b</td>
<td>3. I find it hard to keep up a full day's work</td>
<td>0.747 S+R</td>
<td>12.301</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>1c</td>
<td>7. I have difficulty working normally in the early part of the day</td>
<td>0.717 S+R</td>
<td>3.742</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>1d</td>
<td>6. I sometimes have difficulty waking up</td>
<td>0.612 NS+NR</td>
<td>-1.252</td>
<td>0.211</td>
<td></td>
</tr>
<tr>
<td>1e</td>
<td>5. I sometimes lie awake at night with a very active mind</td>
<td>0.344 NS+NR</td>
<td>-1.391</td>
<td>0.165</td>
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</table>

**Factor 2: “Excitability”**

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<tr>
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<th>Question</th>
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<th>t Stat</th>
<th>p Value</th>
<th>Variance Explained</th>
</tr>
</thead>
<tbody>
<tr>
<td>2a</td>
<td>4. Things that don’t affect others much can sometimes leave a big impression on me</td>
<td>0.758 S+R</td>
<td>3.150</td>
<td>0.002</td>
<td>20.613%</td>
</tr>
<tr>
<td>2b</td>
<td>2. I sometimes find I get quite excited (changed)</td>
<td>0.703 NS+NR</td>
<td>0.949</td>
<td>0.343</td>
<td></td>
</tr>
<tr>
<td>2c</td>
<td>5. I sometimes lie awake at night with a very active mind</td>
<td>0.568 NS+NR</td>
<td>-1.391</td>
<td>0.165</td>
<td></td>
</tr>
</tbody>
</table>
Appendix 8

*Items replaced or modified from STQ1 to STQ2*

**STQ2 Questionnaire**

Containing the 30 replaced questions (with 1 asterix *), 16 modified questions, including two moved to a different a priori subject category (with 2 asterix **), and 50 unchanged questions (angle brackets <...>):

(R - Reversal of direction away from trait abnormality)

1. **Difficulty with Gestalt perception**

1. At a pedestrian intersection I can often sum up when it is safe to cross without needing to wait for the buzzer/green man. 1 R *

2. It is sometimes easier to recognise someone by their voice than by their face. 17 **
   <3. My home is usually tidy. 26 R>

   <4. When I meet someone I know, I find that they can recognise me by my face, but I cannot recognise them by their face. 30>

5. I have been told that I misinterpret people’s facial expressions or get them wrong. 35 *

   <6. I prefer face-to-face conversations to telephone conversations. 41 R>

7. I sometimes find I have misjudged people on the basis of their facial expression. 51 *

   <8. I tend to remember people by their faces more than by their names. 58 R>

   <9. When I meet people I have only met once or twice, I sometimes have difficulty recognising them by their face. 66>

10. I usually notice what someone is wearing or the details of what’s around me. 73 R *

11. I sometimes find I have guessed a person is angry from their expression and then find out that they are not. 81 *

   <12. I prefer television to radio. 90 R>

2. ** Discrimination of the intensity of sensory stimuli**

   <1. I have difficulty distinguishing loud from soft sounds. 2>
2. I am sometimes told that I have the radio or stereo on too loud. 21>

3. I find music sounds much the same when the volume is turned down (I do not notice it is not so loud). 36**

<4. When I am singing with others, I find that other people’s voices are so loud that I cannot hear my own voice. 82>

3. **Rapid coordination of sensory (e.g. visual) input and motor (e.g. ocular) control.**

1. I have difficulty following pictures at the movies when pictures are moving fast across the screen (especially when I am sitting near the front of the movie theatre). 3>

2. I am good at catching a ball. 37 R**

<3. I have difficulty striking a ball with a bat or racket. 67>

4. I like to be spontaneous 83 R ** (moved from previously included category of “Spontaneity”, which was replaced in STQ2 with “Working Memory”)

4. **Cross-modal and Interhemispheric coordination**

1. At pedestrian crossings I am confused by the “green man” or “red man” signs telling me when to walk. 4>

<2. When I am watching television I have difficulty matching the pictures to the words that someone is speaking. 42>

3. I can keep good time in rapid drumming with two hands. 68 R**

5. **Speed of learning new material**

1. I am good at adapting to new situations. 5 R**

2. When I meet someone, I am not good at remembering their name on the first occasion. 43*

6. **Comprehension of incoming language**

1. I have difficulty understanding what people are really trying to say. 6>

<2. I can easily follow the plot in a film or play. 22 R>

<3. I have difficulty understanding people when they only suggest or imply their meaning, but do not say it directly. 44>

<4. I find it difficult to get the point of a joke. 59>
5. When I ask for directions in the street, I find it hard to understand the answers I get. 74 *

6. I am a fast reader. 91 R *

7. Subjective experience of trait aspects of thought disorder

<1. When I want to say something, I sometimes find that I cannot make my sentences as fast as I need to. 7>

2. My speech sometimes gets mixed up. 31 **

3. I spend a long time planning what I want to say. 60>

4. I will often rehearse conversations with someone I am going to meet to prepare myself for them. 75 *

5. Sometimes I know that I cannot explain what I want to say so I keep quiet. 84 *

8. Distractibility

1. Sudden noises like a person coughing, or dog barking don’t make me jump. 8 R **

2. I am very sensitive to noise. 52>

3. I am more sensitive to noise when I am trying to concentrate on something else or when I am anxious. 69>

4. Sudden drafts or changes of temperature don’t worry me 85 R ** (moved from Sensory Overload)

5. I am distracted by things moving in the side of my field of view. 92 ** (moved from Sensory Overload)

9. Vigilance/Sustained attention:

<1. I have problems paying attention for any length of time (e.g. television, or other people talking). 9>

2. I find my mind wanders when I am doing boring tasks. 53 *

3. In repetitive tasks I am good at staying alert. 70 R *

10. Sensory Overload

<1. When I am in busy streets, the sight of everyone walking in front of me is very distracting. 10>
2. Physical contact overwhelms me. 19

3. Bouncing balls distract me. 27 *

4. Little sounds or lights at night don’t stop me sleeping. 32 R **

5. I get overwhelmed by emotional people, even if they are expressing friendly and positive emotions. 45

6. I find continual company exhausting. 54

7. When I am emotionally upset, I find it difficult to remember things. 61

8. I don’t get upset when there is a lot of noise around me. 76 R *

9. Working in groups gives me energy. 86 R **

10. I am not sensitive to background noises. 93 R

11. Preference for solitude/Avoidance of social activity

1. I like time with my own thoughts. 11

2. I do not like solitude. 46 R

3. I would prefer to live alone. 77

12. Attentional shift.

1. I find it easy to make a sudden change of plans. 12 R

2. In a classroom (or committee etc) I get confused by the continual change of subject. 23

3. I have difficulty making quick decisions in new situations. 47

4. I am good at doing several things at once. 62 R *

5. I like jobs where I have to interact with many people. 78 R *

6. I like having to make quick decisions on a wide variety of topics. 94 R *

13. Long trains of thought

1. I am interested in systems of ideas in politics, religion, philosophy. 13

2. I like plain facts rather than ideas 20 R *

3. I get bored when people take ideas too seriously 24 R *
4. My thoughts seem to run on by themselves. 33

5. I find my train of thought interferes with my ability to concentrate on what someone is saying. 38

6. I have fantasies that can be used as the basis for artistic productions or activities. 48

7. I prefer to deal with day to day matters rather than dwelling on the future. 55

8. I like thinking of other possible ways of explaining complicated questions including questions about health. 63

9. I am interested in looking at new possible ways of explaining things in the world. 95

14. Working memory/Visuo-spatial/Verbal
(replaced “Spontaneity” with this category)

1. I do not need a shopping list. I am good at remembering what I need. 14

2. I am a good dancer

3. I need to make a list if I have several things to do in a day.

15. “Ego strength”

1. If a friend does not turn up to a planned meeting with me, I would feel a sense of rejection even if I knew it was probably for a “good” reason.

2. I like acting in a play or skit or acting out another character

3. Unexpected obstacles can embarrass or upset me.

4. If I am feeling well prepared for an event, one negative comment towards me can weaken my self-confidence.

5. Setbacks or obstacles do not put me off what I am doing.

6. Things don’t easily upset me.

7. I have difficulty in forming opinions which are really “my own”.

8. I have difficulty standing up for myself, when I am in competition or conflict with others.

9. I am not put off by criticism.
10. I have difficulty taking the initiative in forming new friends (especially with a potential partner). 80

11. I know my own mind on most things. 88 R *

12. I feel new clothes take a while to feel right. 96 *

16. **Overall levels and stability of mental activity.**

1. I often run out of energy. 16

2. I sometimes find I get quite excited about various ideas or events. 29 **

3. I find it hard to keep up a full day's work. 34

4. Things that don’t affect others much can sometimes leave a big impression on me. 40

5. I sometimes lie awake at night with a very active mind. 50

6. I sometimes have difficulty waking up. 57

7. I don’t easily get downhearted or over excited about things that happen to me. 65 R *

8. I have difficulty working normally in the early part of the day. 72

9. I find it hard to make decisions until I am in a good mood (e.g. at certain times of the day). 89 *
Appendix 9

STQ 2: Items as they appear chronologically in categories from Questionnaire
(R - Reversal of direction away from trait abnormality)

1. Difficulty with Gestalt perception

1. At a pedestrian intersection I can often sum up when it is safe to cross without needing to wait for the buzzer/green man. 1 R
2. It is sometimes easier to recognise someone by their voice than by their face. 17
3. My home is usually tidy. 26 R
4. When I meet someone I know, I find that they can recognise me by my face, but I cannot recognise them by their face. 30
5. I have been told that I misinterpret people’s facial expressions or get them wrong. 35
6. I prefer face-to-face conversations to telephone conversations. 41 R
7. I sometimes find I have misjudged people on the basis of their facial expression. 51
8. I tend to remember people by their faces more than by their names. 58 R
9. When I meet people I have only met once or twice, I sometimes have difficulty recognising them by their face. 66
10. I usually notice what someone is wearing or the details of what’s around me. 73 R
11. I sometimes find I have guessed a person is angry from their expression and then find out that they are not. 81
12. I prefer television to radio. 90 R

2. Discrimination of the intensity of sensory stimuli

1. I have difficulty distinguishing loud from soft sounds. 2
2. I am sometimes told that I have the radio or stereo on too loud. 21
3. I find music sounds much the same when the volume is turned down (I do not notice it is not so loud). 36
4. When I am singing with others, I find that other people’s voices are so loud that I cannot hear my own voice. 82

3. Rapid coordination of sensory (e.g. visual) input and motor (e.g. ocular) control.

1. I have difficulty striking a ball with a bat or racket. 3
2. I am good at catching a ball. 37 R
3. I have difficulty following pictures at the movies when pictures are moving fast across the screen (especially when I am sitting near the front of the movie theatre). 67
4. I like to be spontaneous 83 R

4. Cross-modal and Inter-hemispheric coordination

1. When I am watching television I have difficulty matching the pictures to the words that someone is speaking. 4
2. At pedestrian crossings I am confused by the “green man” or “red man” signs telling me when to walk. 42
3. I can keep good time in rapid drumming with two hands. 68 R

5. Speed of learning new material

1. I am good at adapting to new situations. 5 R
2. When I meet someone, I am not good at remembering their name on the first occasion. 43

6. Comprehension of incoming language

1. I have difficulty understanding what people are really trying to say. 6
2. I can easily follow the plot in a film or play. 22 R
3. I have difficulty understanding people when they only suggest or imply their meaning, but do not say it directly. 44
4. I find it difficult to get the point of a joke. 59
5. When I ask for directions in the street, I find it hard to understand the answers I get. 74
6. I am a fast reader. 91 R

7. Subjective experience of trait aspects of thought disorder

1. When I want to say something, I sometimes find that I cannot make my sentences as fast as I need to. 7
2. My speech sometimes gets mixed up. 31
3. I spend a long time planning what I want to say. 60
4. I will often rehearse conversations with someone I am going to meet to prepare myself for them. 75
5. Sometimes I know that I cannot explain what I want to say so I keep quiet. 84

8. Distractibility

1. Sudden noises like a person coughing, or dog barking don’t make me jump. 8 R
2. I am very sensitive to noise. 52
3. I am more sensitive to noise when I am trying to concentrate on something else or when I am anxious. 69
4. Sudden drafts or changes of temperature don’t worry me 85 R
5. I am distracted by things moving in the side of my field of view. 92

9. Vigilance/Sustained attention:

1. I have problems paying attention for any length of time (e.g. television, or other people talking). 9
2. I find my mind wanders when I am doing boring tasks. 53
3. In repetitive tasks I am good at staying alert. 70 R
10. Sensory Overload

1. When I am in busy streets, the sight of everyone walking in front of me is very distracting. 10
2. Physical contact overwhelms me. 19
3. Bouncing balls distract me. 27
4. Little sounds or lights at night don’t stop me sleeping. 32 R
5. I get overwhelmed by emotional people, even if they are expressing friendly and positive emotions. 45
6. I find continual company exhausting. 54
7. When I am emotionally upset, I find it difficult to remember things. 61
8. I don’t get upset when there is a lot of noise around me. 76 R
9. Working in groups gives me energy. 86 R
10. I am not sensitive to background noises. 93 R

11. Preference for solitude/Avoidance of social activity

1. I like time with my own thoughts. 11
2. I do not like solitude. 46 R
3. I would prefer to live alone. 77

12. Attentional shift.

1. I find it easy to make a sudden change of plans. 12 R
2. In a classroom (or committee etc) I get confused by the continual change of subject. 23
3. I have difficulty making quick decisions in new situations. 47
4. I am good at doing several things at once. 62 R
5. I like jobs where I have to interact with many people. 78 R
6. I like having to make quick decisions on a wide variety of topics. 94 R

13. Long trains of thought

1. I am interested in systems of ideas in politics, religion, philosophy. 13
2. I like plain facts rather than ideas 20 R
3. I get bored when people take ideas too seriously 24 R
4. My thoughts seem to run on by themselves 33
5. I find my train of thought interferes with my ability to concentrate on what someone is saying. 38
6. I have fantasies that can be used as the basis for artistic productions or activities. 48
7. I prefer to deal with day to day matters rather than dwelling on the future. 55 R
8. I like thinking of other possible ways of explaining complicated questions including questions about health. 63
9. I am interested in looking at new possible ways of explaining things in the world. 95
14. Working memory/Visuo-spatial/Verbal

1. I do not need a shopping list. I am good at remembering what I need. 14 R
2. I am a good dancer 79 R
3. I need to make a list if I have several things to do in a day. 87

15. “Ego strength”

1. If a friend does not turn up to a planned meeting with me I would feel a sense of rejection even if I knew it was probably for a “good” reason. 15
2. I like acting in a play or skit or acting out another character 18 R
3. Unexpected obstacles can embarrass or upset me. 25
4. If I am feeling well prepared for an event, one negative comment towards me can weaken my self-confidence 28
5. Setbacks or obstacles do not put me off what I am doing. 39 R
6. Things don’t easily upset me. 49 R
7. I have difficulty in forming opinions which are really “my own”. 56
8. I have difficulty standing up for myself, when I am in competition or conflict with others. 64
9. I am not put off by criticism. 71 R
10. I have difficulty taking the initiative in forming new friends (especially with a potential partner). 80
11. I know my own mind on most things. 88 R
12. I feel new clothes take a while to feel right. 96

16. Overall levels and stability of mental activity.

1. I often run out of energy. 16
2. I sometimes find I get quite excited about various ideas or events. 29
3. I find it hard to keep up a full day's work. 34
4. Things that don’t affect others much can sometimes leave a big impression on me. 40
5. I sometimes lie awake at night with a very active mind. 50
6. I sometimes have difficulty waking up. 57
7. I don’t easily get downhearted or over excited about things that happen to me. 65 R
8. I have difficulty working normally in the early part of the day. 72
9. I find it hard to make decisions until I am in a good mood (e.g. at certain times of the day). 89
Appendix 10

*STQ2, as used*

**Schizophrenia Trait Questionnaire (STQ2)**

<p>| | | | | |</p>
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<tbody>
<tr>
<td></td>
<td>Strongly Agree</td>
<td>Agree</td>
<td>Not Sure</td>
<td>Disagree</td>
</tr>
<tr>
<td>1.</td>
<td>At a pedestrian intersection I can often sum up when it is safe to cross without needing to wait for the buzzer/green man.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>I have difficulty distinguishing loud from soft sounds.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>I have difficulty striking a ball with a bat or racket.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>When I am watching television I have difficulty matching the pictures to the words that someone is speaking.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>I am good at adapting to new situations.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>I have difficulty understanding what people are really trying to say.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>7.</td>
<td>When I want to say something, I sometimes find that I cannot make my sentences as fast as I need to.</td>
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<td>8.</td>
<td>Sudden noises like a person coughing, or a dog barking don’t make me jump.</td>
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</table>
9. I have problems paying attention for any length of time (e.g. television, or other people talking).

10. When I am in busy streets, the sight of everyone walking in front of me is very distracting.

11. I like time with my own thoughts.

12. I find it easy to make a sudden change of plans.

13. I am interested in systems of ideas in politics, religion, philosophy.

14. I do not need a shopping list, I am good at remembering what I need.

15. If a friend does not turn up to a planned meeting with me, I would feel a sense of rejection even if I knew it was probably for a “good” reason.

16. I often run out of energy.

17. It is sometimes easier to recognise someone by their voice than by their face.

18. I like acting in a play or skit or acting out another character.
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<tr>
<th></th>
<th>Question</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Not Sure</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
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<tbody>
<tr>
<td>19</td>
<td>Physical contact overwhelms me.</td>
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<td>20</td>
<td>I like plain facts rather than ideas.</td>
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<td>21</td>
<td>I am sometimes told that I have the radio or stereo on too loud.</td>
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<td>22</td>
<td>I can easily follow the plot in a film or play.</td>
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<td>23</td>
<td>In a classroom (or committee etc) I get confused by the continual change of subject.</td>
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<td>24</td>
<td>I get bored when people take ideas too seriously.</td>
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<td>25</td>
<td>Unexpected obstacles can embarrass or upset me.</td>
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<td>26</td>
<td>My home is usually tidy.</td>
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<td>27</td>
<td>Bouncing balls distract me.</td>
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<td>28</td>
<td>If I am feeling well prepared for an event, one negative comment towards me can weaken my self-confidence.</td>
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<td>29</td>
<td>I sometimes find I get quite excited about various ideas or events.</td>
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<td>30</td>
<td>When I meet someone I know, I find that they can recognise me by my face, but I cannot recognise them by their face.</td>
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<td>31.</td>
<td>My speech sometimes gets mixed up.</td>
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<td>32.</td>
<td>Little sounds or lights at night don’t stop me sleeping.</td>
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<td>33.</td>
<td>My thoughts seem to run on by themselves.</td>
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<td>34.</td>
<td>I find it hard to keep up a full day’s work.</td>
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<td>35.</td>
<td>I have been told that I misinterpret people’s facial expressions or get them wrong.</td>
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<td>36.</td>
<td>I find music sounds much the same when the volume is turned down (I do not notice it is not so loud).</td>
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<td>37.</td>
<td>I am good at catching a ball.</td>
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<td>38.</td>
<td>I find my train of thought interferes with my ability to concentrate on what someone is saying.</td>
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<td>39.</td>
<td>Setbacks or obstacles do not put me off what I am doing.</td>
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<td>40.</td>
<td>Things that don’t affect others much can sometimes leave a big impression on me.</td>
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<td>41.</td>
<td>I prefer face-to-face conversations to telephone conversations.</td>
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</table>
42. At pedestrian crossings I am confused by the “green man” or “red man” signs telling me when to walk.

43. When I meet someone, I am not good at remembering their name on the first occasion.

44. I have difficulty understanding people when they only suggest or imply their meaning, but do not say it directly.

45. I get overwhelmed by emotional people, even if they are expressing friendly and positive emotions.

46. I do not like solitude.

47. I have difficulty making quick decisions in new situations.

48. I have fantasies that can be used as the basis for artistic productions or activities.

49. Things don’t easily upset me.

50. I sometimes lie awake at night with a very active mind.

51. I sometimes find I have misjudged people on the basis of their facial expression.

52. I am very sensitive to noise.
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<tr>
<th></th>
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<th>Strongly Agree</th>
<th>Agree</th>
<th>Not Sure</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
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<tbody>
<tr>
<td>53.</td>
<td>I find my mind wanders when I am doing boring tasks.</td>
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<td>54.</td>
<td>I find continual company exhausting.</td>
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<td>55.</td>
<td>I prefer to deal with day to day matters rather than dwelling on the future.</td>
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<td>56.</td>
<td>I have difficulty in forming opinions which are really “my own”.</td>
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<td>57.</td>
<td>I sometimes have difficulty waking up.</td>
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<td>58.</td>
<td>I tend to remember people by their faces more than by their names.</td>
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<td>59.</td>
<td>I find it difficult to get the point of a joke.</td>
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<td>60.</td>
<td>I spend a long time planning what I want to say.</td>
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<td>61.</td>
<td>When I am emotionally upset, I find it difficult to remember things.</td>
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<td>62.</td>
<td>I am good at doing several things at once.</td>
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<td>63.</td>
<td>I like thinking of other possible ways of explaining complicated questions including questions about health.</td>
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<td>64.</td>
<td>I have difficulty standing up for myself, when I am in competition or conflict with others.</td>
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<td>65.</td>
<td>I don’t easily get downhearted or over excited about things that happen to me.</td>
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<td>66.</td>
<td>When I meet people I have only met once or twice, I sometimes have difficulty recognising them by their face.</td>
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<td>67.</td>
<td>I have difficulty following pictures at the movies when pictures are moving fast across the screen (especially when I am sitting near the front of the movie theatre).</td>
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<td>68.</td>
<td>I can keep good time in rapid drumming with two hands.</td>
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<td>69.</td>
<td>I am more sensitive to noise when I am trying to concentrate on something else or when I am anxious.</td>
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<td>70.</td>
<td>In repetitive tasks I am good at staying alert.</td>
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<td>71.</td>
<td>I am not put off by criticism.</td>
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<td>72.</td>
<td>I have difficulty working normally in the early part of the day.</td>
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<td>73.</td>
<td>I usually notice what someone is wearing or the details of what’s around me.</td>
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<td>74.</td>
<td>When I ask for directions in the street, I find it hard to understand the answers I get.</td>
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<td>75.</td>
<td>I will often rehearse conversations with someone I am going to meet to prepare myself for them.</td>
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<td>76.</td>
<td>I don’t get upset when there is a lot of noise around me.</td>
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<td>77.</td>
<td>I would prefer to live alone.</td>
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<td>78.</td>
<td>I like jobs where I have to interact with many people.</td>
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<td>79.</td>
<td>I am a good dancer</td>
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<td>80.</td>
<td>I have difficulty taking the initiative in forming new friends (especially with a potential partner).</td>
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<td>81.</td>
<td>I sometimes find I have guessed a person is angry from their expression and then find out that they are not.</td>
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<td>82.</td>
<td>When I am singing with others, I find that other people’s voices are so loud that I cannot hear my own voice.</td>
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<td>83.</td>
<td>I like to be spontaneous</td>
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<td>84.</td>
<td>Sometimes I know that I cannot explain what I want to say so I keep quiet.</td>
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85. Sudden drafts or changes of temperature don’t worry me. □ □ □ □ □
86. Working in groups gives me energy. □ □ □ □ □
87. I need to make a list if I have several things to do in a day. □ □ □ □ □
88. I know my own mind on most things. □ □ □ □ □
89. I find it hard to make decisions until I am in a good mood (e.g. at certain times of the day). □ □ □ □ □
90. I prefer television to radio. □ □ □ □ □
91. I am a fast reader. □ □ □ □ □
92. I am distracted by things moving in the side of my field of view. □ □ □ □ □
93. I am not sensitive to background noises. □ □ □ □ □
94. I like having to make quick decisions on a wide variety of topics. □ □ □ □ □
95. I am interested in looking at new possible ways of explaining things in the world. □ □ □ □ □
96. I feel new clothes take a while to feel right. □ □ □ □ □
Appendix 11

STQ2 - Grand Factor Analysis with Oddballs

10. Sensory Overload 1: (.783)
Mostly socially contextualised overload

5. I get overwhelmed by emotional people, even if they are expressing friendly and positive emotions. 45 (.747)
2. Physical contact overwheels me. 19 (.738)
1. When I am in busy streets, the sight of everyone walking in front of me is very distracting. 10 (.725)
3. Bouncing balls distract me. 27 (.681)
6. I find continual company exhausting. 54 (.583)

6. Comprehension of Incoming Language 1: (.763)

Socially contextualised comprehension of Incoming Language

1. I have difficulty understanding what people are really trying to say. 6 (.775)
3. I have difficulty understanding people when they only suggest or imply their meaning, but do not say it directly. 44 (.652)
5. When I ask for directions in the street, I find it hard to understand the answers I get. 74(.637)
4. I find it difficult to get the point of a joke. 59 (.607)

1. Gestalt 1: (.723)

Perception of facial expressions and recognition of faces

7. I sometimes find I have misjudged people on the basis of their facial expression. 51 (.828)
5. I have been told that I misinterpret people’s facial expressions or get them wrong. 35 (.764)
11. I sometimes find I have guessed a person is angry from their expression and then find out that they are not. 81 (.673)
4. When I meet someone I know, I find that they can recognise me by my face, but I cannot recognise them by their face. 30 (.528)

7. Thought Disorder: (.707)

1. When I want to say something, I sometimes find that I cannot make my sentences as fast as I need to. 7 (.776)
2. My speech sometimes gets mixed up. 31 (.757)
5. Sometimes I know that I cannot explain what I want to say so I keep quiet. 84 (.658)
18. Oddball1: (.610)

3. ThDis7 I spend a long time planning what I want to say. 60 (.734)
4. ThDis7 I will often rehearse conversations with someone I am going to meet to prepare myself for them. 75 (.703)
12. Gest1 I prefer television to radio. 90 R (-.506)
2. Ego15 I like acting in a play or skit or acting out another character 18 R (-.472)

15. Ego Strength (.594)

4. If I am feeling well prepared for an event, one negative comment towards me can weaken my self-confidence 28 (.736)
6. Things don’t easily upset me. 49 R (.707)
3. Unexpected obstacles can embarrass or upset me. 25 (.649)
1. If a friend does not turn up to a planned meeting with me, I would feel a sense of rejection even if I knew it was probably for a “good” reason. 15 (578)
8. I have difficulty standing up for myself, when I am in competition or conflict with others. 64 (.526)
(9. I am not put off by criticism. 71 R (.463))

4. Cross-modal Co-ordination: (.577)

1. When I am watching television I have difficulty matching the pictures to the words that someone is speaking. 4 (.836)
2. At pedestrian crossings I am confused by the “green man” or “red man” signs telling me when to walk. 42 (.825)

2. Discrimination of the intensity of sensory stimuli: (.574)

**Difficulty distinguishing loud from soft sound**

1. I have difficulty distinguishing loud from soft sounds. 2 (.760)
3. I find music sounds much the same when the volume is turned down (I do not notice it is not so loud). 36 (.593)
2. I am sometimes told that I have the radio or stereo on too loud. 21 (.581)
4. When I am singing with others, I find that other people’s voices are so loud that I cannot hear my own voice. 82 (.474)

9. Sustained Attention 1 (.569)

1. I have problems paying attention for any length of time (e.g. television, or other people talking). 9 (.495)
2. I find my mind wanders when I am doing boring tasks. 53 (.477)
3. In repetitive tasks I am good at staying alert. 70 R (.442)
3. Rapid Co-ordination of sensory input and motor control 1: (.546)

1. I have difficulty striking a ball with a bat or racket. 3 (.765)
2. I have difficulty following pictures at the movies when pictures are moving fast across the screen (especially when I am sitting near the front of the movie theatre). 67 (673)
3. I have difficulty following pictures at the movies when pictures are moving fast across the screen (especially when I am sitting near the front of the movie theatre). 67 (673)
4. I am good at catching a ball. 37 R (.526)
4. I like to be spontaneous 83 R (.385)

8. Distractibility 1: (516)

3. I am more sensitive to noise when I am trying to concentrate on something else or when I am anxious. 69 (.782)
5. I am distracted by things moving in the side of my field of view. 92 (.682)
2. I am very sensitive to noise. 52 (.563)

Ego 3: (.452)

12. I feel new clothes take a while to feel right. 96 (.730)
7. I have difficulty in forming opinions which are really “my own”. 56 (.679)
2. I like acting in a play or skit or acting out another character 18 R (-.421)

13. Long Trains of thought 2 : (-.405)

Conceptual

2. I like plain facts rather than ideas 20 R (.717)
3. I get bored when people take ideas too seriously 24 R (.737)
7. I prefer to deal with day to day matters rather than dwelling on the future. 55 R (.493)

13. Long Trains of thought 3: (.345)

Creative Emphasis to thought?

6. I have fantasies that can be used as the basis for artistic productions or activities. 48 (.840)
4. My thoughts seem to run on by themselves 33 (.565)

Factor 2

12. Attentional Shift 1: (.854)

6. I like having to make quick decisions on a wide variety of topics. 94 R (.798)
1. I find it easy to make a sudden change of plans. 12 R (.786)
4. I am good at doing several things at once. 62 R (.558)
15. Ego Strength 2: (.686)

11. I know my own mind on most things. 88 R (.692)
10. I have difficulty taking the initiative in forming new friends (especially with a potential partner). 80 (.641)
5. Setbacks or obstacles do not put me off what I am doing. 39 R (.583)
9. I am not put off by criticism. 71 R (.557)

8. Distractibility2: (.514)

4. Sudden drafts or changes of temperature don’t worry me 85 R (.799)
1. Sudden noises like a person coughing, or dog barking don’t make me jump. 8 R (.662)
5. LongTh I find my train of thought interferes with my ability to concentrate on what someone is saying. 38 (.508)

18. Oddball: 2 (.480)

1. Mem14 I do not need a shopping list. I am good at remembering what I need. 14 R (.596)
3. Mem14 I need to make a list if I have several things to do in a day. 87 (.572)
1. SpLearn5 I am good at adapting to new situations. 5 R (.454)

18. Oddball: 4 (.461)

4. SenOver10. Little sounds or lights at night don’t stop me sleeping. 32 R (.671)
1. Gest1 At a pedestrian intersection I can often sum up when it is safe to cross without needing to wait for the buzzer/green man. 1 R (.669)

18. Oddball: 3 (.328)

9. Working in groups gives me energy. 86 R (.804)
4. I like to be spontaneous 83 R (.596)
2. Ego15 I like acting in a play or skit or acting out another character 18 R (.471)
3. I can keep good time in rapid drumming with two hands. 68 R

Factor 3

17. Mental Stability 1: (.901)

6. I sometimes have difficulty waking up. 57 (.765)
8. I have difficulty working normally in the early part of the day. 72 (.761)
3. I find it hard to keep up a full day’s work. 34 (.746)
1. I often run out of energy. 16 (.552)
Factor 4

18. Oddball 5: (.666)

2. SpLearn5. When I meet someone, I am not good at remembering their name on the first occasion. 43 (.745)
3. Cross4 I can keep good time in rapid drumming with two hands. 68 R (.588)

13. Long Trains of thought: (-.461)

Conceptual/Philosophical/Focused

8. I like thinking of other possible ways of explaining complicated questions including questions about health. 63 (.766)
9. I am interested in looking at new possible ways of explaining things in the world. 95 (.760)
1. I am interested in systems of ideas in politics, religion, philosophy. 13 (.677)

11. Preference for Solitude 1: (-.426)

2. I do not like solitude. 46 R (.500)
1. I like time with my own thoughts. 11 (.483)
3. I would prefer to live alone. 77 (.457)
Appendix 12

STQ2: Factor Analysis Factors
MHU Results

Please note: All questions that, when agreed to, are opposite to theory of trait abnormality, have been reversed and I will indicate with asterisk
Where a name for a collection of questions seems to encapsulate the meaning of the factor, I have given the variable a name

1. Gestalt - Difficulty with gestalt perception

Factor 1 - Perception of facial expressions and recognition of faces

7. I sometimes find I have misjudged people on the basis of their facial expression. 51 (.828)
5. I have been told that I misinterpret people’s facial expressions or get them wrong. 35 (.764)
11. I sometimes find I have guessed a person is angry from their expression and then find out that they are not. 81 (.673)
4. When I meet someone I know, I find that they can recognise me by my face, but I cannot recognise them by their face. 30 (.528)

Factor 2 - Face Recognition

1. At a pedestrian intersection I can often sum up when it is safe to cross without needing to wait for the buzzer/green man. 1 R (.693)
2. It is sometimes easier to recognise someone by their voice than by their face. 17 (.518)
9. When I meet people I have only met once or twice, I sometimes have difficulty recognising them by their face. 66 (.509)
(8. I tend to remember people by their faces more than by their names. 58 R (.459))
4. When I meet someone I know, I find that they can recognise me by my face, but I cannot recognise them by their face. 30 (.528)

Factor 3 Gestalt awareness of environment

10. I usually notice what someone is wearing or the details of what’s around me. 73 R (.789)
3. My home is usually tidy. 26 R (.754)

Redo:w/o Q1 and Q12

1. Gestalt
Factor 1 - Perception of facial expressions

5. I have been told that I misinterpret people’s facial expressions or get them wrong. 35 (.822)
7. I sometimes find I have misjudged people on the basis of their facial expression. 51 (.814)
4. When I meet someone I know, I find that they can recognise me by my face, but I cannot recognise them by their face. 30 (.561)
11. I sometimes find I have guessed a person is angry from their expression and then find out that they are not. 81 (.553)
(9. When I meet people I have only met once or twice, I sometimes have difficulty recognising them by their face. 66 (.433))

Factor 2 Gestalt awareness of environment

3. My home is usually tidy. 26 R (.722)
10. I usually notice what someone is wearing or the details of what’s around me. 73 R (.703)

Factor 3 - Face Recognition

8. I tend to remember people by their faces more than by their names. 58 R (.767)
2. It is sometimes easier to recognise someone by their voice than by their face. 17 (.537)
(4. When I meet someone I know, I find that they can recognise me by my face, but I cannot recognise them by their face. 30 (.397))

Factor 4 -

6. I prefer face-to-face conversations to telephone conversations. 41 R (.862)
9. When I meet people I have only met once or twice, I sometimes have difficulty recognising them by their face. 66 (.442)

2. Discrimination of the intensity of sensory stimuli

Factor 1 Difficulty distinguishing loud from soft sound

1. I have difficulty distinguishing loud from soft sounds. 2 (.760)
3. I find music sounds much the same when the volume is turned down (I do not notice it is not so loud). 36 (.593)
2. I am sometimes told that I have the radio or stereo on too loud. 21 (.581)
4. When I am singing with others, I find that other people’s voices are so loud that I cannot hear my own voice. 82 (.474)
3. Rapid Co-ordination of sensory input and motor control

Factor 1 Rapid co-ordination of incoming stimuli and motor control

1. I have difficulty striking a ball with a bat or racket. 3 (.785)
2. I am good at catching a ball. 37 R (.743)
3. I have difficulty following pictures at the movies when pictures are moving fast across the screen (especially when I am sitting near the front of the movie theatre). 67 (.637)

Factor 2

4. I like to be spontaneous 83 R (.931)

Redo w/o Q4
3. Rapid Co-ordination of sensory input and motor control

Factor 1
Rapid co-ordination of incoming stimuli and motor control

1. I have difficulty striking a ball with a bat or racket. 3 (.786)
2. I am good at catching a ball. 37 R (.730)
3. I have difficulty following pictures at the movies when pictures are moving fast across the screen (especially when I am sitting near the front of the movie theatre). 67 (.650)

4. Cross-modal Co-ordination

Factor 1 Cross modal Co-ordination

1. When I am watching television I have difficulty matching the pictures to the words that someone is speaking. 4 (.836)
2. At pedestrian crossings I am confused by the “green man” or “red man” signs telling me when to walk. 42 (.825)

Factor 2 Interhemispheric Co-ordination

3. I can keep good time in rapid drumming with two hands. 68 R (.984)

5. Speed of learning new material

1. I am good at adapting to new situations. 5 R (.693)
2. When I meet someone, I am not good at remembering their name on the first occasion. 43 (-.693)
6. Comprehension of Incoming Language

Factor 1 Socially contextualised comprehension of Incoming Language

1. I have difficulty understanding what people are really trying to say. 6 (.775)
2. I have difficulty understanding people when they only suggest or imply their meaning, but do not say it directly. 44 (.652)
3. I find it difficult to get the point of a joke. 59 (.607)
4. When I ask for directions in the street, I find it hard to understand the answers I get. 74 (.637)

Factor 2

1. I can easily follow the plot in a film or play. 22 R (.803)
2. I am a fast reader. 91 R (.702)

7. Thought Disorder

Factor 1

1. When I want to say something, I sometimes find that I cannot make my sentences as fast as I need to. 7 (.809)
2. My speech sometimes gets mixed up. 31 (.727)
3. I spend a long time planning what I want to say. 60 (.691)
4. I will often rehearse conversations with someone I am going to meet to prepare myself for them. 75 (.449)
5. Sometimes I know that I cannot explain what I want to say so I keep quiet. 84 (.571)

Factor 2

1. I will often rehearse conversations with someone I am going to meet to prepare myself for them. 75 (.885)
2. I spend a long time planning what I want to say. 60 (.691)
3. Sometimes I know that I cannot explain what I want to say so I keep quiet. 84 (.348)

Redo: w/o Q3 and Q4

7. Thought Disorder

Factor 1

1. When I want to say something, I sometimes find that I cannot make my sentences as fast as I need to. 7 (.776)
2. My speech sometimes gets mixed up. 31 (.757)
3. Sometimes I know that I cannot explain what I want to say so I keep quiet. 84 (.658)
8. Distractibility

Factor 1

3. I am more sensitive to noise when I am trying to concentrate on something else or when I am anxious. 69 (.777)
5. I am distracted by things moving in the side of my field of view. 92 (.714)
2. I am very sensitive to noise. 52 (.542)

Factor 2

4. Sudden drafts or changes of temperature don’t worry me 85 R (.770)
1. Sudden noises like a person coughing, or dog barking don’t make me jump. 8 R (.744)
(2. I am very sensitive to noise. 52 (.382))

Redo: Distractibility W Q5 of LongTh

8. Distractibility

Factor 1

3. I am more sensitive to noise when I am trying to concentrate on something else or when I am anxious. 69 (.782)
5. I am distracted by things moving in the side of my field of view. 92 (.682)
2. I am very sensitive to noise. 52 (.563)

Factor 2

4. Sudden drafts or changes of temperature don’t worry me 85 R (.799)
1. Sudden noises like a person coughing, or dog barking don’t make me jump. 8 R (.662)
5 LongTh I find my train of thought interferes with my ability to concentrate on what someone is saying. 38 (.508)

9. Sustained Attention

Factor 1

1. I have problems paying attention for any length of time (e.g. television, or other people talking). 9 (.495)
2. I find my mind wanders when I am doing boring tasks. 53 (.477)
3. In repetitive tasks I am good at staying alert. 70 R (.442)

10. Sensory Overload

Factor 1- Mostly socially contextualised overload

5. I get overwhelmed by emotional people, even if they are expressing friendly and positive emotions. 45 (.747)
2. Physical contact overwhelms me. 19 (.738)
1. When I am in busy streets, the sight of everyone walking in front of me is very distracting. 10 (.725)
3. Bouncing balls distract me. 27 (.681)
6. I find continual company exhausting. 54 (.583)

Factor 2- General sensitivity to noise and emotional overload

8. I don’t get upset when there is a lot of noise around me. 76 R (.815)
10. I am not sensitive to background noises. 93 R (.779)
7. When I am emotionally upset, I find it difficult to remember things. 61 (.636)

Factor 3

4. Little sounds or lights at night don’t stop me sleeping. 32 R (.786)
9. Working in groups gives me energy. 86 R (.574)

11. Preference for Solitude

Factor 1

2. I do not like solitude. 46 R (.500)
1. I like time with my own thoughts. 11 (.483)
3. I would prefer to live alone. 77 (.457)

12. Attentional Shift

Factor 1

6. I like having to make quick decisions on a wide variety of topics. 94 R (.798)
1. I find it easy to make a sudden change of plans. 12 R (.786)
4. I am good at doing several things at once. 62 R (.558)

Factor 2

2. In a classroom (or committee etc) I get confused by the continual change of subject. 23 (.868)
3. I have difficulty making quick decisions in new situations. 47 (.712)

13. Long Trains of thought

Factor 1- Conceptual/Philosophical/Focused

8. I like thinking of other possible ways of explaining complicated questions including questions about health. 63 (.765)
9. I am interested in looking at new possible ways of explaining things in the world. 95 (.735)
1. I am interested in systems of ideas in politics, religion, philosophy. 13 (.686)
Factor 2- Conceptual

2. I like plain facts rather than ideas 20 R (.791)
3. I get bored when people take ideas too seriously 24 R (.702)

Factor 3- Creative Emphasis to thought?

6. I have fantasies that can be used as the basis for artistic productions or activities. 48 (.770)
4. My thoughts seem to run on by themselves 33 (.743)

Factor 4- Daydreaming/Unfocused thought?

7. I prefer to deal with day to day matters rather than dwelling on the future. 55 R (.766)
5. I find my train of thought interferes with my ability to concentrate on what someone is saying. 38 (.630)

Redo: Long Thought w/o Q5

13. Long Trains of thought

Factor 1- Conceptual/Philosophical/Focused

8. I like thinking of other possible ways of explaining complicated questions including questions about health. 63 (.766)
9. I am interested in looking at new possible ways of explaining things in the world. 95 (.760)
1. I am interested in systems of ideas in politics, religion, philosophy. 13 (.677)

Factor 2- Conceptual

2. I like plain facts rather than ideas 20 R (.717)
3. I get bored when people take ideas too seriously 24 R (.737)
7. I prefer to deal with day to day matters rather than dwelling on the future. 55 R (.493)

Factor 3- Creative Emphasis to thought?

6. I have fantasies that can be used as the basis for artistic productions or activities. 48 (.840)
4. My thoughts seem to run on by themselves 33 (.565)

14. Working Memory/Visuo-spatial/Verbal

1. I do not need a shopping list. I am good at remembering what I need. 14 R (.596)
3. I need to make a list if I have several things to do in a day. 87 (.572)
15. Ego Strength

Factor 1

4. If I am feeling well prepared for an event, one negative comment towards me can weaken my self-confidence 28 (.736)
6. Things don’t easily upset me. 49 R (.707)
3. Unexpected obstacles can embarrass or upset me. 25 (.649)
1. If a friend does not turn up to a planned meeting with me, I would feel a sense of rejection even if I knew it was probably for a “good” reason. 15 (578)
8. I have difficulty standing up for myself, when I am in competition or conflict with others. 64 (.526)
(9. I am not put off by criticism. 71 R (.463))

Factor 2

11. I know my own mind on most things. 88 R (.692)
10. I have difficulty taking the initiative in forming new friends (especially with a potential partner). 80 (.641)
5. Setbacks or obstacles do not put me off what I am doing. 39 R (.583)
9. I am not put off by criticism. 71 R (.557)

Factor 3

12. I feel new clothes take a while to feel right. 96 (.730)
7. I have difficulty in forming opinions which are really “my own”. 56 (.679)
2. I like acting in a play or skit or acting out another character 18 R (-.421)

16. Mental Stability

Factor 1

6. I sometimes have difficulty waking up. 57 (.765)
8. I have difficulty working normally in the early part of the day. 72 (.761)
3. I find it hard to keep up a full day’s work. 34 (.746)
1. I often run out of energy. 16 (.552)

Factor 2

2. I sometimes find I get quite excited about various ideas or events. 29 (.795)
5. I sometimes lie awake at night with a very active mind. 50 (.701)
4. Things that don’t affect others much can sometimes leave a big impression on me. 40 (.679)
Factor 3

7. I don’t easily get downhearted or over excited about things that happen to me. 65 \( \text{R} (.697) \)
9. I find it hard to make decisions until I am in a good mood (e.g. at certain times of the day). 89 (.680)

18. Oddballs

Factor 1

3. ThDis7 I spend a long time planning what I want to say. 60 (.734)
4. ThDis7 I will often rehearse conversations with someone I am going to meet to prepare myself for them. 75 (.703)
12. Gest1 I prefer television to radio. 90 \( \text{R} (-.506) \)
2. Ego15 I like acting in a play or skit or acting out another character 18 \( \text{R} (-.472) \)

Factor 2

1. Mem14 I do not need a shopping list. I am good at remembering what I need. 14 \( \text{R} (.596) \)
3. Mem14 I need to make a list if I have several things to do in a day. 87 (.572)
5. SpLearn5 I am good at adapting to new situations. 5 \( \text{R} (.454) \)

Factor 3

9. Working in groups gives me energy. 86 \( \text{R} (.804) \)
2. Ego15 I like acting in a play or skit or acting out another character 18 \( \text{R} (.471) \)
3. I can keep good time in rapid drumming with two hands. 68 \( \text{R} \)

Factor 4

4. SenOver10. Little sounds or lights at night don’t stop me sleeping. 32 \( \text{R} (.671) \)
1. Gest1 At a pedestrian intersection I can often sum up when it is safe to cross without needing to wait for the buzzer/green man. 1 \( \text{R} (.669) \)

Factor 5

2. SpLearn5. When I meet someone, I am not good at remembering their name on the first occasion. 43 (.745)
3. Cross4 I can keep good time in rapid drumming with two hands. 68 \( \text{R} (.588) \)
Appendix 13.

STQ2: Paired T-Tests, item by item (31-97, 1-30 in Table 6.6): Schizophrenia versus Comparison participants.

<table>
<thead>
<tr>
<th>No.</th>
<th>Items: <em>a priori</em> category, Item description, no. in questionnaire, reversed (R), (new)</th>
<th>T-Value/ (P-Value)</th>
<th>Factor loading/ Subfactor no. Dep Rank</th>
<th>Sz Mean/ (SD)</th>
<th>Normal Mean/ (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>31</td>
<td>1. When I meet someone I know I find that they can recognise me by my face, but I cannot recognise them by their face. 30</td>
<td>3.358 (0.001)</td>
<td>.561 [1/1] redo</td>
<td>2.97 (1.24)</td>
<td>3.55 (0.82)</td>
</tr>
<tr>
<td>32</td>
<td>15. I have difficulty standing up for myself, when I am in competition or conflict with others. 64</td>
<td>3.324 (0.001)</td>
<td>.526 [15/1] 45</td>
<td>2.84 (1.26)</td>
<td>3.53 (1.13)</td>
</tr>
<tr>
<td>33</td>
<td>12. I am good at doing several things at once. 62 R (new)</td>
<td>3.322 (0.001)</td>
<td>.558 [12/1] 90</td>
<td>2.97 (1.12)</td>
<td>3.47 (0.88)</td>
</tr>
<tr>
<td>34</td>
<td>5. I am good at adapting to new situations. 5 R</td>
<td>3.222 (0.002)</td>
<td>.693 [5/1] 72</td>
<td>3.50 (1.02)</td>
<td>3.93 (0.58)</td>
</tr>
<tr>
<td>35</td>
<td>16. Things that don’t affect others much can sometimes leave a big impression on me. 40</td>
<td>3.221 (0.002)</td>
<td>.679 [16/2] 17</td>
<td>2.36 (0.93)</td>
<td>2.90 (1.07)</td>
</tr>
<tr>
<td>36</td>
<td>13. I find my train of thought interferes with my ability to concentrate on what someone is saying. 38</td>
<td>3.136 (0.002)</td>
<td>.630 [13/3] 89</td>
<td>2.64 (1.20)</td>
<td>3.21 (0.99)</td>
</tr>
<tr>
<td>37</td>
<td>6. I find it difficult to get the point of a joke. 59</td>
<td>3.053 (0.003)</td>
<td>.607 [6/2]</td>
<td>3.28 (1.08)</td>
<td>3.76 (0.89)</td>
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<tr>
<td>38</td>
<td>1. I sometimes find I have guessed a person is angry from their expression and then find out that they are not. 81(new)</td>
<td>3.021 (0.003)</td>
<td>.553 [38/1] redo .673/1 16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>2. I find music sounds much the same when the volume is turned down (I do not notice it is not so loud). 36</td>
<td>2.967 (0.004)</td>
<td>.593 [2/1] 11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>10. I get overwhelmed by emotional people, even if they are expressing friendly and positive emotions. 45</td>
<td>2.865 (0.005)</td>
<td>.747 [10/1] 81</td>
<td></td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>15. Setbacks or obstacles do not put me off what I am doing. 39 R</td>
<td>2.820 (0.006)</td>
<td>.730 [15/3] 20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>15. I feel new clothes take a while to feel right. 96 (new)</td>
<td>2.772 (0.007)</td>
<td>.765 [15/3] 20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>16. I sometimes have difficulty waking up. 57</td>
<td>2.724 (0.008)</td>
<td>.765 [16/1] 21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>10. Working in groups gives me energy. 86 R (new)</td>
<td>2.663 (0.010)</td>
<td>.574 [10/1] 71</td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>15. I have difficulty in forming opinions which are really “my own”. 56</td>
<td>2.533 (0.013)</td>
<td>.679 [15/3] 96</td>
<td></td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>16. I don’t easily get downhearted or over excited about things that happen to me. 65 R (new)</td>
<td>2.443 (0.017)</td>
<td>.697 [16/3] 48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>15. I know my own mind on most things. 88 R (new)</td>
<td>2.353 (0.021)</td>
<td>.692 [15/2] 66</td>
<td></td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>13. I have fantasies that can be used as the basis for artistic productions</td>
<td>2.350 (0.021)</td>
<td>.770 [13/3]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
or activities. 48

<p>| 49 | 13. My thoughts seem to run on by themselves 33 | 2.345 (0.022) | .743 [13/3] 82 | 2.59 (1.23) | 3.11 (1.58) |
| 50 | 1. It is sometimes easier to recognise someone by their voice than by their face. 17 | 2.250 (0.027) | .518 [1/2] .537 [1/3] redo 31 | 2.77 (1.10) | 3.15 (0.89) |
| 51 | 7. My speech sometimes gets mixed up. 31 | 2.248 (0.028) | .727 [7/1] 34 | 2.51 (1.16) | 3.95 (0.89) |
| 52 | 7. I spend a long time planning what I want to say. 60 | 2.238 (0.028) | .691 [7/2] 83 | 3.09 (1.17) | 3.47 (0.87) |
| 53 | 15. I have difficulty taking the initiative in forming new friends (especially with a potential partner). 80 | 2.108 (0.038) | .641 [15/2] 88 | 2.84 (1.23) | 3.23 (0.99) |
| 54 | 15. Things don’t easily upset me. 49 R | 2.102 (0.039) | .707 [15/1] 43 | 3.05 (1.16) | 3.38 (0.88) |
| 55 | 12. I like having to make quick decisions on a wide variety of topics. 94 R | 1.841 (0.070) | .798 [12/1] 50 | 2.99 (1.12) | 3.26 (0.68) |
| 56 | 6. I have difficulty understanding people when they only suggest or imply their meaning, but do not say it directly. 44 | 1.838 (0.07) | .652 [6/1] 75 | 2.55 (1.09) | 2.84 (0.88) |
| 57 | 10. I find continual company exhausting. 54 | 1.794 (0.077) | .583 [10/1] 92 | 2.50 (1.13) | 2.76 (1.00) |
| 58 | 1. When I meet people I have only met once or twice, I sometimes have difficulty recognising them by their face. 66 | 1.707 (0.092) | .509 [1/2] .442 [1/4] redo | 3.15 (1.14) | 3.43 (0.67) |</p>
<table>
<thead>
<tr>
<th></th>
<th>Item</th>
<th>Value 1</th>
<th>Value 2</th>
<th>Value 3</th>
<th>Value 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>59</td>
<td>8. I am more sensitive to noise when I am trying to concentrate on something else or when I am anxious. 69</td>
<td>1.668</td>
<td>0.782</td>
<td>2.32</td>
<td>2.55</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.100)</td>
<td>[8/1]</td>
<td>(1.04)</td>
<td>(0.77)</td>
</tr>
<tr>
<td>60</td>
<td>14. I need to make a list if I have several things to do in a day. 87 (new)</td>
<td>1.656</td>
<td>0.572</td>
<td>2.47</td>
<td>2.76</td>
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<td></td>
<td></td>
<td>(0.102)</td>
<td>[14/1]</td>
<td>(1.14)</td>
<td>(0.92)</td>
</tr>
<tr>
<td>61</td>
<td>4. I can keep good time in rapid drumming with two hands. 68 R</td>
<td>1.595</td>
<td>0.984</td>
<td>3.26</td>
<td>3.52</td>
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<td></td>
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<td>(0.115)</td>
<td>[4/2]</td>
<td>(1.15)</td>
<td>(0.72)</td>
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<tr>
<td>62</td>
<td>8. Sudden drafts or changes of temperature don’t worry me 85 R (new)</td>
<td>1.552</td>
<td>0.799</td>
<td>3.12</td>
<td>3.37</td>
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<td></td>
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<td>(0.125)</td>
<td>[8/2]</td>
<td>(1.25)</td>
<td>(0.83)</td>
</tr>
<tr>
<td>63</td>
<td>5. When I meet someone, I am not good at remembering their name on the first occasion. 43 (new)</td>
<td>1.534</td>
<td>-0.693</td>
<td>2.23</td>
<td>2.49</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.129)</td>
<td>[5/1]</td>
<td>(0.96)</td>
<td>(0.89)</td>
</tr>
<tr>
<td>64</td>
<td>2. When I am singing with others, I find that other people’s voices are so loud that I cannot hear my own voice. 82</td>
<td>1.462</td>
<td>0.474</td>
<td>2.96</td>
<td>3.20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.148)</td>
<td>[2/1]</td>
<td>(1.10)</td>
<td>(0.68)</td>
</tr>
<tr>
<td>65</td>
<td>1. I sometimes find I have misjudged people on the basis of their facial expression. 51 (new)</td>
<td>1.427</td>
<td>0.828</td>
<td>2.99</td>
<td>3.20</td>
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<td></td>
<td></td>
<td>(0.158)</td>
<td>[1/1]</td>
<td>(1.04)</td>
<td>(0.76)</td>
</tr>
<tr>
<td>66</td>
<td>2. I am sometimes told that I have the radio or stereo on too loud. 21</td>
<td>1.387</td>
<td>0.581</td>
<td>2.82</td>
<td>3.07</td>
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<tr>
<td></td>
<td></td>
<td>(0.170)</td>
<td>[2/1]</td>
<td>(1.29)</td>
<td>(0.93)</td>
</tr>
<tr>
<td>67</td>
<td>15. I am not put off by criticism. 71 R</td>
<td>1.384</td>
<td>0.463</td>
<td>2.96</td>
<td>3.19</td>
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<tr>
<td></td>
<td></td>
<td>(0.170)</td>
<td>[15/1]</td>
<td>(1.23)</td>
<td>(0.88)</td>
</tr>
<tr>
<td>68</td>
<td>10. Bouncing balls distract me. 27 (new)</td>
<td>1.322</td>
<td>0.681</td>
<td>3.36</td>
<td>3.58</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.190)</td>
<td>[10/1]</td>
<td>(1.17)</td>
<td>(0.92)</td>
</tr>
<tr>
<td>69</td>
<td>10. I don’t get upset when there is a</td>
<td>1.305</td>
<td>0.815</td>
<td>3.04</td>
<td>3.25</td>
</tr>
<tr>
<td>ID</td>
<td>Question</td>
<td>Value</td>
<td>[10/2]</td>
<td>(1.21)</td>
<td>(0.95)</td>
</tr>
<tr>
<td>----</td>
<td>-----------------------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>70</td>
<td>I am distracted by things moving in the side of my field of view. 92 (new)</td>
<td>1.298</td>
<td>[8/1]</td>
<td>2.82</td>
<td>3.02</td>
</tr>
<tr>
<td>71</td>
<td>I tend to remember people by their faces more than by their names. 58 R</td>
<td>1.014</td>
<td>[1/4]</td>
<td>3.66</td>
<td>3.80</td>
</tr>
<tr>
<td>72</td>
<td>Sudden noises like a person coughing, or dog barking don’t make me jump. 8 R</td>
<td>0.915</td>
<td>[8/2]</td>
<td>3.26</td>
<td>3.43</td>
</tr>
<tr>
<td>73</td>
<td>I am interested in systems of ideas in politics, religion, philosophy. 13</td>
<td>0.902</td>
<td>[13/1]</td>
<td>2.49</td>
<td>2.62</td>
</tr>
<tr>
<td>74</td>
<td>I am a fast reader. 91 R (new)</td>
<td>0.872</td>
<td>[6/2]</td>
<td>2.92</td>
<td>3.08</td>
</tr>
<tr>
<td>75</td>
<td>I find I get quite excited about various events 29 R</td>
<td>0.809</td>
<td>[16/1]</td>
<td>2.15</td>
<td>2.24</td>
</tr>
<tr>
<td>76</td>
<td>I prefer to deal with day to day matters rather than dwelling on the future. 55 R (new)</td>
<td>0.663</td>
<td>[13/4]</td>
<td>3.42</td>
<td>3.51</td>
</tr>
<tr>
<td>77</td>
<td>I am interested in looking at new possible ways of explaining things in the world. 95 (new)</td>
<td>0.512</td>
<td>[13/1]</td>
<td>2.31</td>
<td>2.39</td>
</tr>
<tr>
<td>78</td>
<td>I prefer face-to-face conversations to telephone conversations. 41 R</td>
<td>0.427</td>
<td>[1/4]</td>
<td>3.55</td>
<td>3.63</td>
</tr>
<tr>
<td>79</td>
<td>I am not sensitive to background noises. 93 R</td>
<td>0.436</td>
<td>[10/2]</td>
<td>2.92</td>
<td>2.99</td>
</tr>
<tr>
<td>80</td>
<td>I find my mind wanders when I am doing boring tasks. 53 (new)</td>
<td>0.307</td>
<td>[9/1]</td>
<td>2.31</td>
<td>2.35</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>56</td>
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</tr>
<tr>
<td>81</td>
<td>12. I find it easy to make a sudden change of plans. 12 R</td>
<td>0.237 (0.814)</td>
<td>.786 [12/1] 47</td>
<td>3.49 (0.97)</td>
<td>3.52 (0.79)</td>
</tr>
<tr>
<td>82</td>
<td>16. I sometimes lie awake at night with a very active mind. 50</td>
<td>0.114 (0.909)</td>
<td>.701 [16/2] 86</td>
<td>2.61 (1.23)</td>
<td>2.63 (1.04)</td>
</tr>
<tr>
<td>83</td>
<td>1. I usually notice what someone is wearing or the details of what's around me. 73 R</td>
<td>-3.550 (0.001)</td>
<td>.789 [1/3] 703 [1/2] redo 7</td>
<td>3.68 (0.89)</td>
<td>3.12 (0.90)</td>
</tr>
<tr>
<td>84</td>
<td>11. I do not like solitude. 46 R</td>
<td>-2.945 (0.004)</td>
<td>.500 [11/1] 64</td>
<td>2.86 (1.25)</td>
<td>2.29 (0.88)</td>
</tr>
<tr>
<td>85</td>
<td>15. I like acting in a play or skit or acting out another character 18 R (new)</td>
<td>-2.654 (0.01)</td>
<td>-.421 [15/3] 76</td>
<td>2.69 (1.32)</td>
<td>2.24 (0.87)</td>
</tr>
<tr>
<td>86</td>
<td>3. I like to be spontaneous 83 R</td>
<td>-1.847 (0.069)</td>
<td>26 .931 [3/2]</td>
<td>3.62 (0.95)</td>
<td>3.32 (0.96)</td>
</tr>
<tr>
<td>87</td>
<td>11. I like time with my own thoughts. 11</td>
<td>-1.589 (0.116)</td>
<td>.483 [11/1] 33</td>
<td>2.01 (0.77)</td>
<td>1.84 (0.57)</td>
</tr>
<tr>
<td>88</td>
<td>9. In repetitive tasks I am good at staying alert. 70 R (new)</td>
<td>-1.531 (0.130)</td>
<td>.442 [9/1] 69</td>
<td>3.39 (1.00)</td>
<td>3.17 (0.90)</td>
</tr>
<tr>
<td>89</td>
<td>7. I will often rehearse conversations with someone I am going to meet to prepare myself for them. 75 (new)</td>
<td>-1.305 (0.196)</td>
<td>.449 [7/1] 15</td>
<td>2.93 (1.24)</td>
<td>2.74 (0.79)</td>
</tr>
<tr>
<td>90</td>
<td>1. My home is usually tidy. 26 R</td>
<td>-1.206 (0.232)</td>
<td>.754 [1/3] 722 [1/2] redo 80</td>
<td>3.64 (1.12)</td>
<td>3.42 (1.11)</td>
</tr>
<tr>
<td>91</td>
<td>13. I get bored when people take ideas too seriously 24 R (new)</td>
<td>-1.024 (0.309)</td>
<td>.737 [13/2] 74</td>
<td>3.12 (1.12)</td>
<td>2.96 (0.85)</td>
</tr>
<tr>
<td>92</td>
<td>13. I like plain facts rather than ideas 20 R (new)</td>
<td>-1.020 (0.311)</td>
<td>.717 [13/2] 87</td>
<td>3.26 (1.11)</td>
<td>3.09 (0.121)</td>
</tr>
<tr>
<td>93</td>
<td>10. Little sounds or lights at night don’t stop me sleeping. 32 R</td>
<td>-0.994 (0.323)</td>
<td>.786 [10/3] 44</td>
<td>3.55 (1.21)</td>
<td>3.38 (0.89)</td>
</tr>
<tr>
<td>94</td>
<td>14. I am a good dancer 79 R (new)</td>
<td>-0.569 (0.571)</td>
<td>no loading 55</td>
<td>2.84 (1.27)</td>
<td>2.73 (1.01)</td>
</tr>
<tr>
<td>95</td>
<td>13. I like thinking of other possible ways of explaining complicated questions including questions about health. 63 (new)</td>
<td>-0.548 (0.585)</td>
<td>.766 [13/1] 27</td>
<td>2.55 (1.04)</td>
<td>2.48 (0.69)</td>
</tr>
<tr>
<td>96</td>
<td>14. I do not need a shopping list. I am good at remembering what I need. 14 R (new)</td>
<td>-0.431 (0.668)</td>
<td>.596 [14/1] 42</td>
<td>3.07 (1.14)</td>
<td>2.99 (0.88)</td>
</tr>
</tbody>
</table>