NEUROPHYSIOLOGICAL RESPONSES AND BEHAVIOURAL INTENTIONS TO SCHIZOPHRENIA-ASSOCIATED COMMUNICATION ABNORMALITIES

By

Michael W Best

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Abstract

**Background:** Little is known about how abnormal communication from someone with schizophrenia is perceived by those interacting with the individual. The N400 event-related potential (ERP) is an index of how difficult it is to process incongruent words and is sensitive to context about the identity of the speaker. Knowledge of an individual’s diagnosis provides such context, and responses to a diagnosis have typically been examined from a stigma framework.

**Purpose:** The current study aimed to examine the effect of context regarding the speaker, on the N400 ERP in the listener in response to speech that contained schizophrenia-associated communication abnormalities, and the relationship between the N400 and stigma.

**Methods:** 73 first year undergraduate students listened to segments of conversation between two people while continuous EEG was recorded. Participants were told that the responder in the conversation was either a university student, had a stroke, had schizophrenia (and had recovered), or had schizophrenia (and symptoms were emphasized). The last word of the response in the conversation was varied to be a typical ending, a word approximation, or a neologism.

**Results:** A significant N400 was observed over centro-parietal electrode sites in response to word approximations and neologisms when participants were told that the responder was a university student, but not in the other conditions. The amplitude of the N400 was significantly greater in response to neologisms than in response to word approximations. Participants also rated that they would be more likely to continue speaking to someone using typical words, than word approximations, and in both cases, more like than someone using neologisms. There was no significant relationship between the amplitude of the N400 and any of the stigma measures.
**Discussion:** Telling participants either about the functional symptoms of schizophrenia, the diagnosis, or both resulted in a significantly reduced N400. This suggests a processing bias in which knowledge of either the symptoms or diagnosis of schizophrenia reduces the difficulty of integrating atypical speech. This does not appear to be a result of stigmatizing attitudes per se, but may be the result of an expectancy for someone with schizophrenia to communicate in abnormal ways.
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Chapter I
Introduction

Overview

This project was designed to examine the processes that occur in a healthy individual in response to being exposed to someone exhibiting the symptoms of schizophrenia and as a function of the information they possess about the individual. Traditionally these responses have been conceptualized as stigma and have been examined as independent pathways: either as responses to the diagnosis of schizophrenia or as responses to the symptoms associated with schizophrenia. Few studies to date have examined the interaction between diagnosis awareness and the presentation of symptoms, and none have done so using an objective measurement technique.

Because communication is integral to interpersonal interactions, and individuals with schizophrenia can use abnormal communication, the interaction between the communication abnormality and the knowledge the listener has about the speaker is essential to understanding how that communication is processed. The stigma associated with the diagnostic label of schizophrenia is one factor that may affect how subsequent communication is processed. This study examined a novel method for examining the interaction between diagnosis awareness and knowledge, and is the first to study to examine how abnormal communication from someone with schizophrenia is processed.

The section that succeeds this overview presents a review of schizophrenia, the prevalence of communication abnormalities in people with the disorder, and the functional importance of understanding how knowledge about the person with schizophrenia affects subsequent processing of abnormal communication. The remaining sections discuss the
methodology employed, the results of the study, and a discussion of the limitations, implications, and future directions for this line of research.

**Schizophrenia**

Schizophrenia is a severe mental illness characterized by symptoms such as perceptual abnormalities, restrictions in motivation and emotional expressivity, disorganized thinking and behaviour, and disturbances in social and adaptive functioning. Symptoms can be broadly classified into two categories: positive symptoms represent an excess in behavioural or perceptual experiences such as hallucinations, delusions, and disorganized speech/behaviour; negative symptoms represent a deficiency in typical thoughts, behaviours, feelings, or motivational drive. General diagnostic criteria for schizophrenia, according to the American Psychiatric Association’s (APA), Diagnostic and Statistical Manual (DSM-IV-TR; APA, 2000) include the presence of two or more of delusions, hallucinations, disorganized speech, disorganized or catatonic behaviour, or negative symptoms, present for a significant portion of one month (Criterion A); a significant impairment in social or adaptive functioning (Criterion B) for at least 6 months (Criterion C); the symptoms cannot be better accounted for by another psychiatric condition (Criterion D) or pervasive developmental disorder (Criterion F); or the direct physiological result of a substance or general medical condition (Criterion E).

Despite achieving symptomatic remission, many individuals with schizophrenia continue to experience deficits in social and vocational functioning (Green, 1996; Beck, 2009; Bowie & Harvey, 2005). As a result, symptomatic remission is no longer considered the sole treatment goal for schizophrenia, and returning individuals to a normative level of functioning is deemed to be equally important (Harvey & Bellack, 2009; Robinson et al., 2004). Individuals who functionally recover have better quality of life, and fewer costs associated with their treatment
Neurocognition has been consistently demonstrated to be the best predictor of functioning in people with schizophrenia (Bowie et al., 2006, 2008, 2010), however, recent work has begun to identify factors external to the individual that affect whether those with schizophrenia use the skills they possess in everyday community settings (Gupta et al., 2012). Opportunity to use those skills in the real world is one factor that may moderate whether people actually use the skills they possess, and other people’s reactions to someone with schizophrenia can affect those opportunities (Berge & Ranney, 2005).

Neurocognitive deficits have also been linked to the manifestation of communication abnormalities (Bowie et al., 2011). It is possible that a component of the functional predictive value of neurocognition occurs through an indirect pathway in which abnormal communication is perceived by others, and the individual with schizophrenia is excluded from functional opportunities. In this way, others’ responses to hearing abnormal communication could be a factor, external to the individual, which affects whether they are able to use their functional skills in everyday life. Although schizophrenia is not a highly prevalent disorder in society, the functional deficits associated with the disorder are costly to both the individual and society.

The established prevalence of schizophrenia in the general population is approximately 1% (Regier et al., 1993; Goeree et al., 2005). Despite such low rates, it is estimated that approximately 3% of total disease burden worldwide can be attributed to schizophrenia (Murray & Lopez, 1996) with a yearly $6.85 billion CAD being spent in Canada (Goeree et al., 2005) and $62.7 billion USD being spent in the United States (Wu et al., 2005). More than half of this cost ($32.4 billion USD) in the United States was due to indirect costs such as unemployment, reduced productivity at work, and premature mortality (Wu et al., 2005). Symptoms such as communication abnormalities represent important factors for addressing these costs to society,
and the individual, because they disrupt social interactions, leading to this difficulty attaining employment, and reducing productivity in the workplace.

**Communication Abnormalities**

Communication abnormalities have long been understood to be core features of schizophrenia and were described in original conceptualizations of the disorder (Bleuler, 1911; Kraepelin, 1919). Like all symptoms of the disorder, they are not universal, but they are common, occurring in 20-50% of people with schizophrenia (Andreasen & Black, 2005; Breier & Berg, 2003) and can persist even when other symptoms have remitted (Harrow et al., 1972, 1973; Marengo & Harrow, 1987).

Communication abnormalities are generally accepted to be the observable manifestation of formal thought disorder (Andreasen, 1979; Andreasen & Grove, 1986), which can be broadly classified into positive and negative thought disorder. Positive thought disorder is characterized by overproduction or disorganization of speech, whereas negative thought disorder is characterized by a reduction in the production and output of speech. These subtypes are distinct from one another (Andreasen, 1979; Harvey et al., 1992; Bowie et al, 2005) and have been differentially associated with social functioning and behaviours (Bowie et al., 2011). Underproductive speech is a significant predictor of social behaviour, whereas disconnected speech (as well as neurocognition) predicts socially unacceptable behaviour (Bowie et al., 2011). This relationship between communication abnormalities and ratings of socially unacceptable behaviour illustrates how abnormal communication from someone with schizophrenia is perceived by others as being socially unacceptable. This could then result in distancing behaviours towards the individual with schizophrenia and subsequent exclusion from functional opportunities.
Some of the most common communication abnormalities include poverty of speech: restriction in the amount of speech generated; poverty of content: a pattern of speech that may contain the appropriate amount of speech, but that contains very little meaningful content; tangentiality: a response that deviates from the question asked, and that continues to deviate further as a function of the length of response; derailment: a pattern of spontaneous speech in which the communication deviates from the central topic being discussed and is transferred to other topics only distantly related to the original topic, and; circumstantiality: speech that follows a central theme, but that takes an indirect approach to reaching the point and brings in many unnecessary details along the way (Andreasen, 1986). More severe forms of communication abnormalities include the use of neologisms: a completely new word whose derivation cannot be understood, and word approximations: the use of a common word in an inappropriate context (Andreasen, 1982, 1986).

Communication abnormalities are generally considered a proxy measure for the internal thought disordered processes in schizophrenia (Barch & Berenbaum, 1996; Docherty et al., 2003; Radanovic et al., 2013; Sans-Sansa et al., 2013), and it is important to consider how these forms of communication are perceived during a social interaction. During such interactions the use of abnormal communication may mark someone as being socially undesirable. Once an individual is marked as being socially undesirable, others will seek to distance themselves from them and the individual may find themselves being excluded from vocational opportunities (Goffman, 1963).

Social judgments regarding intent to communicate with someone are made through a number of pathways. There is a great deal of research suggesting that appearance (Ballew & Todorov, 2007; Eberhardt et al., 2006) and nonverbal behaviour (Dolcos et al., 2013; Fiedler,
2007) are key components in determining the judgments and subsequent behaviours towards individuals. Communication styles have also been implicated in making these social judgments (Fiedler, 2007), such that more articulate communication is associated with more positive social judgments. It thus follows that the communication abnormalities typical of those with schizophrenia may result in more negative attributions about the individual and greater avoidance behaviour.

**Language Processing**

In order to understand how abnormal communication from someone with schizophrenia may affect their social interactions, it is important to understand how that abnormal communication is processed by the listener, and how integration between the communication abnormality and prior knowledge about the speaker occurs.

An essential component to discourse comprehension is the ability to integrate each novel component (word) of an incoming verbal message into a coherent whole (McKoon & Ratcliff, 1992). Each individual idea or proposition is combined during the incoming discourse to form an integrated representation of the message being conveyed. This representation results from the combination of individual ideas or propositions into meaningful and coherent units. At the sentential level, this is referred to as the microstructure of a discourse (van Dijk & Kintsch, 1983). Sentences are rarely processed in isolation, however, and previous knowledge regarding the content of a conversation, or about the speaker himself or herself, is essential for sentence processing. The macrostructure of a discourse refers to the global coherence of a particular sentence, in relation to an overarching theme of the discourse, or world-knowledge (van Dijk & Kintsch, 1983). Successful integration of both microstructure and macrostructure is necessary for comprehension.
General knowledge about the world is a component of the discourse macrostructure. This knowledge is thought to consist of an extensive set of beliefs and expectations regarding the world (St. George et al., 1994). As a person has continued and diverse experiences, world expectations are shaped into mental constructs of prototypical events and behaviours that are known as schemata (Schank & Abelson, 1977). Comprehension is facilitated at a global level when schemata are activated by general knowledge regarding the discourse, which subsequently activates related information in long term memory (Sharkey & Mitchell, 1985). This activation occurs when relevant general knowledge lowers the threshold for other nodes in the associative network and increases the likelihood that related information will be activated (Kintsch, 1988). This results in expectations regarding the content of the subsequent discourse, and these expectations can aid in semantic processing (St. George et al., 1994).

For an individual with schizophrenia two potential types of information could be available about them prior to an actual interaction. First, one could have knowledge of the person’s diagnosis of schizophrenia. Second, it is also possible that one could be aware of the symptoms that the person tends to experience (e.g. abnormal communication). Either of these pieces of information could influence the processing of the person’s subsequent discourse, and each type of information could exert its influence in a different way.

**Event-Related Potentials**

Event-Related Potentials (ERPs) are derived from scalp-recorded electroencephalograms (EEGs), which are measures of differences in electrical potentials over the scalp. ERPs in response to sensory and cognitive events are isolated by averaging elicited neural activity, in response to multiple examples of the event of interest, compared to baseline activity (Luck, 2005).
Neurons transmit information in the form of electrical action potentials, and these potentials can be detected at the scalp through EEG. Neurons maintain a resting state electrical potential of approximately -60mV across their membranes due to the selective permeability of cell membranes to potassium [K⁺] and sodium [Na⁺] ions (Hodgkin & Huxley, 1952). When external stimuli cause information to be transmitted along the neuron, the cell depolarizes, resulting in an action potential of approximately 100mV being propagated along the axon. This voltage change across the cell membrane results in the generation of a tiny dipole within the scalp. Although this dipole is not strong enough to be detected at the surface of the scalp, if many neurons are generating action potentials, and dipoles, in synchrony, then this electrical activity may be strong enough to be detected by scalp-recorded EEG. It is estimated that a minimum of 1000-10 000 neurons must be activated in synchrony in order to be detected at the scalp (Luck, 2005; Kutas et al., 2006)

Propagation of neuronal electrical activity depends on the position and orientation of the neuronal tracts generating the dipole. The shape, and conductivity, of the brain, skull, and scalp are all important factors in the strength of the signal that can be detected at the scalp. The low electrical conductivity of the skull also results in attenuation of the signal and can result in lateral spreading (Koles, 1998). These facts, in conjunction with individual differences in head size and shape, make it difficult to identify the neuronal generator within the brain (source estimation; Koles, 1998). As a result, ERP methodology is limited with regards to identifying precise brain regions responsible for neuronal activity, but provides temporally sensitive measurement, at the millisecond level, that is able to identify the time course of response to specific target events.

ERPs are observed in the EEG as a pattern of changing voltages over time and consist of a series of positive and negative waves, plotted compared to a baseline interval (typically 100ms)
immediately prior to the event in question. ERP components are labelled according to their typical physical characteristics. For example, the P100 is a positive wave that peaks approximately 100ms after stimulus onset, and the N400 is a negative wave that peaks approximately 400ms after stimulus onset.

Two types of ERP components have been identified: exogenous components and endogenous components. Exogenous components are early ERP components elicited in response to physical, sensory characteristics of the stimuli, whereas endogenous components are later ERP components that reflect perceptual and cognitive processing (Fabiani et al., 2000; Luck, 2005).

**N400 ERP**

The N400 ERP is an endogenous ERP component observed as a negative wave that peaks in amplitude approximately 400ms post-stimulus onset and reflects the processing and integration of linguistic information (Kutas & Hillyard, 1980a, 1980b, 1980c; Van Berkum et al., 1999; Besson et al., 1997; Van Petten 1999; McCallum et al., 1984; Hagoort & Brown, 2000; Holcomb & Neville, 1991; Friederici et al., 1993). It is generally accepted that the N400 is an index of integration difficulty of a target word into the context in which it is presented. This process is dependent on the individual’s stored representation of that specific word, and on both the microstructural and macrostructural constraints imposed by the interpretive context (Kutas et al., 2006).

At the sentential level, the amplitude of the N400 has been found to be related to the frequency with which the word is used in the language in question (Hauk & Pulvermuller, 2004), and non-words have been found to elicit a greater N400 than real words (Coch et al., 2013). The N400 amplitude is also related to the predictability of the word in the sentential context (Kutas & Hillyard, 1984) as measured by a cloze-probability test. Cloze probability is defined as the
percentage of people spontaneously producing the target word in a sentence completion task, and is a measure of the semantic fit of the word within the sentence. The more difficult it is to predict a word in a sentence, the greater the N400 that is observed in response to that word (Kutas & Hillyard, 1984; St. George et al., 1994).

At the discourse level, this effect has been found to exist in the context of prosody (tone of voice; Schirmer et al., 2002), and semantics (linguistic meaning; McCarley et al., 1997). The semantic context of preceding discourse also provides linguistic context, which affects the N400 (Federmeier & Kutas, 1999; Nieuwland & Van Berkum, 2006; Van Berkum et al., 2003; Van Berkum et al., 2005). For example, Van Berkum et al. (2003) found that isolated sentences (1a) did not elicit an N400 whereas when the same sentence was presented following discourse that rendered one of the sentence endings incongruent (1b), an N400 was found in response to the incongruent ending.

(1a) Jane told her brother that he was exceptionally *quick / slow*

(1b) Jane was to wake her brother at five o’clock in the morning. But the brother had already dressed. Jane told her brother that he was exceptionally *quick / slow*

Unlike the sentences presented in isolation, the incongruent words (*slow*) that followed a higher level discourse resulted in an N400 compared to the congruent words (*quick*).

The N400 is also sensitive to pragmatic information about the speaker (Filik & Leuthold, 2008). Such pragmatic information can come from world knowledge contained in semantic memory (Hagoort et al., 2004; Hald et al., 2007; Federmeier & Kutas, 1999) or from information about the speaker that is experimentally presented (Nieuwland & Van Berkum, 2006; Filik &
Leuthold, 2008). Hagoort et al. (2004) provided participants with sentences containing facts that participants would know were false (2). In this example, the Dutch participants in the study all were familiar with the fact that Dutch trains are actually yellow. Hagoort et al. (2004) found that violations to world knowledge (white) produced an equivalent N400 effect to that produced by semantic incongruities (sour).

(2) Dutch trains are yellow / white / sour and very crowded

Filik and Leuthold (2008) placed a sentence with an incongruent ending such as “the cat picked up the chainsaw” into the context of the cartoon Tom and Jerry and found that the incongruent final word “chainsaw” only produced an N400 when not in a cartoon context. Placing the sentence into the context of a cartoon significantly reduced the N400 compared to when the sentence was presented without pragmatic context. Knowing that the cat was a cartoon made the action of picking up a chainsaw expected, and this expectation was reflected in the reduction of the N400.

The N400 has been studied in response to stimuli that are presented in both the visual and auditory modalities. The first studies by Kutas and Hillyard (1980a, 1980b, 1980c) to illustrate the N400 effect used serial presentation of written words. Word-by-word presentation of written sentences allows for a clear separation of the ERPs in response to each word and provided a good starting point for examining the N400. Word-by-word presentation of stimuli in the auditory modality has also been used as a method to simulate speech processing while simultaneously controlling for the carryover effects found between words in continuous speech (Karniski et al., 1993). Although this method allows for a clear separation of ERPs, it does not
account for the cues that are present in continuous speech (Sanders & Neville, 2003). Continuous speech is more ecologically valid and provides insight into processing of natural speech. Unfortunately, the segmentation problem in linguistics (Cole & Jakimik, 1980) means that in natural speech the words flow together and it is virtually impossible to distinguish where one word ends and the next begins. This results in a less defined N400 component characterized by a broader peak that is slower to return to baseline amplitude. The N400 in response to natural speech can onset as early as 50-100ms post-stimulus presentation and can persist for up to 700-800ms (Holcomb & Neville, 1991). Although this component is less well defined than typical ERPs it is still a reliable and documented waveform that can be expected to be seen under the same conditions as the N400 in response to written words (Holcomb & Neville, 1991; MacGregor et al., 2009; Sanders & Neville, 2003)

**The Role of Stigma**

As noted above, there are two types of information that a person could have about someone with schizophrenia that could affect how their speech is processed: diagnostic information, and symptom information. Traditionally, this type of information has been studied from a stigma and discrimination framework. Under this framework, simply knowing a person’s diagnosis can result in a negative attitudinal shift towards them and can be sufficient to cause one to exclude them. (Crisp et al., 2000; Gonzalez-Torres et al., 2007; Norman et al., 2012; Stuart 2004).

Stigma and discrimination are negative attitudinal and behavioural responses, respectively, to a specific characteristic of a person that is perceived as undesirable (Link & Phelan, 2001). In Goffman’s (1963) seminal work he described stigma as being a response to a single deviant attribute that a person possesses, that then causes the person as a whole to be
devalued and socially rejected. This deviant attribute is the explicit signal indicating that a
person will be a poor social partner and could be an observable characteristic (Stafford & Scott,
1986), such as abnormal communication in schizophrenia, or could simply be the diagnostic
label of schizophrenia (Goffman, 1963). Research into stigma and discrimination has largely
focused on the role of diagnosis knowledge without concurrent examination of the role that the
actual symptoms play. Examining the interaction between knowledge of a schizophrenia
diagnosis and the actual presentation of symptoms is necessary to fully understand the process by
which people with schizophrenia are socially excluded.

A great deal of research has examined the prevalence of stigmatization and the different
ways it can result in discrimination. (Corrigan et al., 2004; Ertugrul & Uluğ, 2004; Stier &
Hinshaw, 2007). Structural stigma refers to the negative normative attitudes within a society
toward individuals with the disorder (Link et al., 1987). It has been posited that as a result of
these attitudes, individuals with the disorder are discriminated against, internalize these attitudes,
and subsequently stigmatize themselves. Structural stigma can be observed in societal
organizations such as newspapers, television programs, and governmental policy (Corrigan et al.,
2004). News stories in particular serve to bias the public’s attitudes towards individuals with
schizophrenia. An analysis of over 3300 news articles in major U.S. newspapers during 2002 that
focused on mental illness found that thirty-nine percent of these stories focused on
dangerousness and violence of individuals with severe mental illness (Corrigan et al., 2005). In
contrast to the theme of these reports, individuals with schizophrenia are more likely to be the
victims of violence than to be violent themselves (Teplin et al., 2005).

The general population is not alone in being exposed to negative portrayals of
schizophrenia; medical health care professionals are besieged by them in scientific publications
(Thomas et al., 2004). Advertisements for antipsychotic medications represent a minority of advertisements, however, they are more likely to be larger, use more pages, and portray individuals with schizophrenia as leading meaningless lives, compared to advertisements for other mental disorders (Thomas et al., 2004). It is possible that these images contribute to the tendency for individuals in the mental health profession to hold stigmatizing attitudes towards those with the disorder (Fabrega, 1995; Gray, 2002).

Structural stigma manifests with knowledge about a person’s diagnosis to result in social exclusion and discrimination. Not only does such discrimination interfere with a person’s ability to maintain employment (Seeman, 2009), it is also inversely associated with self-esteem (González-Torres et al., 2007). Associated with this impact on self-esteem is a reported decreased quality of life compared to individuals who do not experience discrimination (González-Torres et al., 2007; Seeman, 2009), and stigma is one of the largest barriers to functional recovery for people with schizophrenia (Berge & Ranney, 2005). It is possible that this reduced quality of life, and functioning, may be a result of the reduced opportunities available to people who are being excluded.

Particularly during episodes of psychosis, people with schizophrenia experience major disruptions to regular daily activities due to hospitalization, the symptoms associated with the disorder and the accompanying functional impairments. One of the main goals of treatment is to return individuals to their pre-morbid level of functioning so that they are once again able to perform regular daily activities. Discrimination serves as a barrier to participating in such activities (Berge & Ranney, 2005) and may actually serve to prolong the course of an episode by reducing social and functional opportunities for someone with schizophrenia (Seeman, 2009). Competitive employment has been found to be a good predictor of recovery for individuals with
schizophrenia (Bond et al., 2001), but discrimination, limits these opportunities for people with schizophrenia.

From an evolutionary perspective, one of humans’ primary evolutionary advantages has been cognitive adaptations that promote social cooperation (Heyes, 2003), allowing us to solve complex problems as a group. Because social cooperation provides a mechanism for solving many different forms of recurrent problems, it is a complex adaptation with many different components (Jones et al., 1984). One of these components is a mechanism that causes individuals to join and value cooperative groups and to alienate potentially poor social partners (Cosmides & Tooby, 1992; Gintis, 2000; Jones, 1984). Natural selection (Darwin, 1859; Spencer, 1864) operates to promote these traits that support social cooperation and results in the alienation of those perceived as potentially poor social partners.

Distancing one’s self from people who are potentially poor social partners would prevent one from spending time and resources on relationships that may not increase one’s evolutionary fitness. This could happen as a result of what is traditionally termed stigma (a higher order, judgmental, attribution regarding the individual), but also as a natural, and automatic, response to behaviours that are suggestive of a poor social partner. In this way, individuals without psychiatric diagnoses can also be socially excluded as a result of their behaviour and not as a result of stigma associated with a label. This is a natural and adaptive response, and is not necessarily a moral failing, as stigma is viewed to be.

As a result of this stigma, awareness of a person’s schizophrenia diagnosis can result in negative social consequences for them that are similar to those that result when they use abnormal communication during a social interaction. Simply knowing that a person has schizophrenia could change subsequent processing of their behaviour and could create
expectancy within the perceiver for them to behave abnormally. Therefore it is possible that through the stigma associated with the diagnosis of schizophrenia, simply knowing that someone has schizophrenia could influence how his or her speech is processed. Likewise, the evolutionary distancing response could influence how speech is processed as a function of knowledge regarding the symptoms a person may exhibit.

**Measuring Stigma**

The measurement of stigma has largely focused on self-report questionnaires pertaining to attitudes towards schizophrenia and few studies have employed objective measurements (Graves et al., 2005; Lavelle et al., 2012). These self-report questionnaires can take a number of forms but can be broadly divided into explicit and implicit measures. Explicit attitude questionnaires ask participants to make ratings regarding their beliefs about people with schizophrenia (Link et al., 2004) and these can range from beliefs about forced institutionalization to dangerousness to deserving pity (Taylor & Dear, 1981). Social distance scales are explicit measures that examine behavioural intentions towards someone with schizophrenia (Link et al., 2004). These scales ask how a person would behave towards someone with schizophrenia in a given situation (e.g. sitting next to someone on the bus, or if a sibling married someone with schizophrenia). Although these scales ask questions regarding behaviour, they are not behavioural measures. They only assess behavioural intentions, which can be tainted by any number of response biases (Arnold & Feldman, 1981; Howard & Dailey, 1979; Meleis & Dagenais, 1980).

For research on stigma and discrimination one of the most problematic response biases is the social desirability bias – a pattern of responding that presents a distorted, favourable, image of the respondent (Orne, 1962; Johnson & Fendrich, 2005; Mortel, 2008). Social desirability
biases may be the result of self-deception or an overt response to fake good in response to societal norms (King & Bruner, 2000; Huang et al., 1998). This pattern of responding is most likely to occur in response to socially sensitive questions (King & Bruner, 2000) and as a result is especially problematic in stigma research. It has been estimated that up to 75% of the variance in participants’ responses on self-report scales can be explained by the social desirability bias (Nederhof et al., 1985). This may be a reason why only 10% of the variance in a person’s discriminatory behaviour can be accounted for by their stigmatizing attitudes as measured by self-report questionnaires (Schutz & Six, 1996).

In order to circumvent this social desirability bias, the semantic differential test was developed in an attempt to measure implicit attitudes (Nunnally & Kittross, 1958; Graves et al., 1970). One form of this questionnaire provides pairs of antonyms that anchor a seven point scale, and participants are asked to rate individuals, such as “mental patients”, on a number of these dimensions. Ratings towards the negative antonym are thought to represent greater stigma towards the individual being rated. Computerized implicit measures have also been used to examine stigma. The most commonly employed are the Implicit Association Test (IAT; Greenwald et al., 1998) and the Concept Association Task (CAT; Steffens et al., 2008) which use reaction time as a measure of stigma when classifying words / images into categories such as positive and negative. Although such implicit tests have been widely used, there is some debate regarding their validity (De Houwer et al., 2009).

We conducted an analysis of 195 published papers examining stigma between the years of 1995 – 2012 (including articles from a previous review by Link et al., 2004) and categorized the methodological approach employed as being either subjective or objective, and either non-experimental, quasi-experimental, or experimental (Best & Bowie, in preparation). Subjective
methodologies employed the use of subjective measurement techniques such as self-report questionnaires, whereas objective methodologies employed the use of objective measurement techniques such as behavioural observation or psychophysiological measurement. The majority of studies (55.4%) employed a non-experimental and subjective approach, compared to only one study that employed a strictly objective experimental approach (Figure 1).

Figure 1: Breakdown of studies examining the stigma of schizophrenia, between 1995-2012, by experimental design and measurement method

This emphasis on non-experimental designs and subjective measurement has been a starting point for the examination of stigma and social exclusion in schizophrenia; however, it is time for a methodological shift to experimental designs and objective measurements. Without such measurements and experimental methods, the results thus far cannot be verified, and the
understanding of why people with schizophrenia are socially excluded cannot advance. Objective techniques such as EEG (discussed above) may be able to circumvent social desirability biases, and shed light on how behaviour from someone with schizophrenia is processed by others. There is no research specifically examining whether the N400 ERP is susceptible to social desirability biases, however, the ERP occurs within the same timeframe as it takes for the word to be spoken so it is reasonable to assume that this occurs before higher order conscious processing involved in presenting one’s self in a socially desirable manner. Nonetheless it is possible that over repeated trials, social desirability biases could manifest within the EEG waveform and affect the observed ERP.

**Current Study**

Stigma research has focused on the self-reported attitudes of the general public towards the diagnostic label of schizophrenia (Link et al., 2004) with little emphasis on objective measures of the internal processes occurring in response to knowledge about the person with the diagnosis. The current study aimed to examine these internal processes through the use of ERPs in response to knowledge of the schizophrenia diagnosis, knowledge about schizophrenia symptoms, and processing of schizophrenia-associated symptoms.

For this study, communication abnormalities, specifically word approximations and neologisms, were chosen as the schizophrenia-associated symptom to be examined. As discussed above, communication is an integral component of social interactions and disrupted communication can potentially result in disrupted social interactions (Smith, 2010). Research into the stigma of schizophrenia has also suggested the possibility that knowledge of a person’s schizophrenia diagnosis could result in disruption of the social interaction, and could affect the perceptual processing of symptoms by the perceiver.
Undergraduate students listened to segments of conversation that consisted of someone asking a question and someone else responding to that question. Participants were told that the responder was either a university student (University), was diagnosed with schizophrenia but had recovered from the illness (Schizophrenia Recovery), had a stroke and was suffering from symptoms (Stroke), or had schizophrenia and was suffering from symptoms (Schizophrenia Symptoms). The last word of each response was varied to be a typical ending, a word approximation, or a neologism. The N400 ERP, and other self-report questionnaires were examined in response to these endings.

The goals of the present study were three-fold:

1) Examine the N400 response to communication abnormalities as a function of the information participants were given regarding the speaker.
2) Examine whether self-report measures of stigma (both implicit and explicit) were differentially related to the information participants were given regarding the speaker.
3) Examine relationships between the magnitude of N400 response and self-reported stigma as measured by both implicit and explicit measures.

This is the first study to examine neurophysiological responses to communication abnormalities as a function of schizophrenia diagnosis awareness and symptom awareness. It is also one of the first studies to employ an objective methodology in examining the effects of diagnosis awareness. This study provides important information regarding the early perceptual processes occurring in the listener when communication abnormalities are used, and how the
communication abnormality is processed differently depending on what the listener knows about the speaker.

**Hypotheses**

**EEG**

Based on previous studies examining the N400 ERP, I hypothesized that participants who were told that the individual responding was a university student, would have a typical N400 ERP response, broadly distributed - with maximum activity over centro-parietal regions - to the neologism and word approximation conditions relative to the normal ending condition.

I expected the neologism would elicit a greater amplitude response than the word approximation because the neologism is more abnormal than the word approximation. This would be consistent with previous work by Coch et al., 2013.

I expected that participants in the Stroke condition would show a similar N400 response to word approximations and neologisms as participants in the University condition. This would reflect the fact that the term stroke does not carry the same negative (stigmatizing) connotation as schizophrenia, and therefore does not provide context in which to understand abnormal speech. I expected that participants in the Schizophrenia (Recovery) and Schizophrenia (Symptoms) conditions would show a significantly reduced N400 in response to abnormal communication compared to the University and Stroke conditions. This would reflect the hypothesis that the diagnosis of schizophrenia overpowers other information about the individual and results in a globally coherent structure that reduces the N400 in response to abnormal communication.
**Behavioural Questions**

I expected that participants would be most likely to rate that they would continue speaking to the responder when he used normal words than when he used word approximations or neologisms. I also expected that participants would be more likely to continue the conversation when the responder used word approximations than neologisms.

Based on social desirability biases, I expected that participants would indicate that they would be most likely to continue a conversation with someone they thought had schizophrenia compared to when they thought the speaker had a stroke or was a university student. I also expected that participants would indicate they would be more likely to continue speaking to someone they thought had a stroke than a university student, due to the fact that there may be social desirability response biases to not discriminate against someone with any diagnosis, although this would be less than the bias expected for a schizophrenia diagnosis. This would reflect an attempt by participants to not appear discriminatory and would result in an overcompensation compared to the control condition.

The same pattern of results was expected for the ratings of the value of the individual’s opinion and the stigma questionnaires.

**Relationships with Stigma**

Based on research examining stigmatizing attitudes and discriminatory reactions to people with schizophrenia, I hypothesized that stigma would be a mechanism underlying the reduction in the N400 in the Schizophrenia conditions compared to the University and Stroke conditions. As a result, I hypothesized that there would be a significant interaction between diagnosis condition, symptom condition, and implicit stigma in predicting the amplitude of the N400 in response to word approximations and neologisms such that greater scores on the implicit
measures of stigma (semantic differential and CAT) would be associated with greater N400 amplitude in the University and Stroke conditions, and reduced amplitude in the Schizophrenia conditions. The same relationship could be expected from the explicit stigma questionnaires if they were an objective measure, however, socially desirable responding make detection of this effect unlikely for the explicit measures.
Chapter II
Methods

Participants were randomized to one of four groups: University Student, Schizophrenia (Symptom), Schizophrenia (Recovery) and Stroke. In the University Student condition, participants were told that the person responding to the question was a university student; in the Schizophrenia (Symptom) condition, participants were told that the person responding had schizophrenia and were told some symptoms of the disorder; in the stroke condition participants were told the same symptoms as in the Schizophrenia (Symptom) condition except they were told that the individual had a stroke instead of schizophrenia; and in the Schizophrenia (Recovery) condition, participants were told the responder had schizophrenia and that many people with schizophrenia fully recover from the disorder. The message given to participants in each condition is included in Appendix A. These four groups were meant to represent a 2 (diagnosis) x 2 (message) matrix of conditions as illustrated in Table 1. The Stroke condition was designed to determine whether there is a different response to the same symptom information depending on whether the participant is told the individual has schizophrenia or that they had a stroke. The stroke condition was selected because medical conditions tend to have less stigma associated with them than psychiatric conditions (Link et al., 2004) and it is reasonable to assume that someone who has suffered a stroke may communicate abnormally. The Schizophrenia (Recovery) condition is designed to determine whether the message the participant receives with the diagnosis of schizophrenia affects their N400 response to the communication abnormalities.
Table 1: 2 x 2 matrix of the contextual conditions within the study

<table>
<thead>
<tr>
<th>Message</th>
<th>Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Not Schizophrenia</td>
</tr>
<tr>
<td>Neutral Message</td>
<td>University Student</td>
</tr>
<tr>
<td>Abnormal Communication Message</td>
<td>Stroke Patient</td>
</tr>
</tbody>
</table>

Participants

83 (20 male, 63 female) undergraduate students in a first year psychology course were recruited to complete the study. Ten participants were excluded from analyses, resulting in a final sample of 73 (17 male, 56 female) participants who were included in analyses. See Figure 2 for a description of why participants were excluded. Comparisons between those subjects who were included and those who were excluded are included in Table 2. Participants who were excluded were significantly less likely to have known someone with a mental illness and held significantly less stigma as measured by the CAMI CMHI subscale.

Measures

All participants completed an EEG task, a concept association task (CAT), questionnaires relating to stigmatizing attitudes and behaviours towards individuals with schizophrenia, and a demographics interview form. The CAT and stigma questionnaires were used to examine whether stigmatizing attitudes change as a function of the message they receive about the speaker.
Figure 2: Flow Chart of Participant Inclusion / Exclusion in Final Data Analysis

- 83 Participants Recruited
- 1 Participant did not Complete EEG Task due to Discomfort with the EEG net
- 82 Participants Completed EEG Portion of Study
- 1 Participant did not Believe the Speaker Actually had Schizophrenia
- 81 Participants Believed Manipulation
- 1 Participant’s Data File was Corrupted
- 80 Participants with EEG Data Files
- 7 Participants had Fewer than 80% Good Trials for at Least One Category of Sentence Ending
- 73 Participants with useable EEG data
Table 2: Comparisons between those included in analysis and those excluded on demographics characteristics and measures of stigma

<table>
<thead>
<tr>
<th></th>
<th>Included (n=73)</th>
<th>Excluded (n=10)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males: Females</td>
<td>17 : 56</td>
<td>3 : 7</td>
<td>.697</td>
</tr>
<tr>
<td>Age (Mean (SD))</td>
<td>18.34 (.79)</td>
<td>18.00 (.67)</td>
<td>.202</td>
</tr>
<tr>
<td>Race (White : Asian : Black)</td>
<td>15 : 3 : 47</td>
<td>1 : 0 : 9</td>
<td>.638</td>
</tr>
<tr>
<td>Ever diagnosed with a Psychiatric Disorder (%)</td>
<td>8 (11.3)</td>
<td>2 (20.0)</td>
<td>.604</td>
</tr>
<tr>
<td>Family Member Diagnosed with Schizophrenia (%)</td>
<td>2 (2.8)</td>
<td>0 (0)</td>
<td>.591</td>
</tr>
<tr>
<td>Ever Known Someone with Schizophrenia (%)</td>
<td>2 (2.8)</td>
<td>0 (0)</td>
<td>.591</td>
</tr>
<tr>
<td>Ever Known Someone with a Mental Illness (%)</td>
<td>57 (80.3)</td>
<td>5 (50.0)</td>
<td>.034*</td>
</tr>
<tr>
<td>Semantic Differential (Psychiatrist)</td>
<td>2.79 (.58)</td>
<td>2.72 (.55)</td>
<td>.722</td>
</tr>
<tr>
<td>Semantic Differential (Mental Patient)</td>
<td>4.50 (.50)</td>
<td>4.47 (.56)</td>
<td>.872</td>
</tr>
<tr>
<td>Semantic Differential (Mental Hospital)</td>
<td>3.63 (.71)</td>
<td>3.57 (.76)</td>
<td>.818</td>
</tr>
<tr>
<td>Semantic Differential (Lawyer)</td>
<td>3.20 (.53)</td>
<td>3.09 (.61)</td>
<td>.597</td>
</tr>
<tr>
<td>CAMI (Authoritarianism)</td>
<td>2.29 (.37)</td>
<td>2.25 (.52)</td>
<td>.772</td>
</tr>
<tr>
<td>CAMI (Benevolence)</td>
<td>2.06 (.32)</td>
<td>1.89 (.44)</td>
<td>.144</td>
</tr>
<tr>
<td>CAMI (Social Restrictiveness)</td>
<td>2.18 (.42)</td>
<td>2.04 (.31)</td>
<td>.310</td>
</tr>
<tr>
<td>CAMI (CMHI)</td>
<td>2.46 (.45)</td>
<td>2.14 (.41)</td>
<td>.036*</td>
</tr>
<tr>
<td>Social Distance Scale</td>
<td>2.31 (.45)</td>
<td>2.20 (.37)</td>
<td>.462</td>
</tr>
<tr>
<td>Concept Association Task Index</td>
<td>.71 (.51)</td>
<td>.64 (.59)</td>
<td>.683</td>
</tr>
</tbody>
</table>

* p < .05
EEG Paradigm

EEG was recorded using a HydroCel 64-channel, Geodesic Sensor Net at a sampling rate of 250 samples/s. Impedences for each electrode were kept below 40kΩ upon commencement of the study and were not allowed to rise above 70kΩ for the duration of the study. EEG data was processed offline and any segments containing artifacts or eye blinks were excluded from further analyses. Segments were averaged by condition to create grand ERPs, corrected to the 100ms prior to stimulus onset, and re-referenced using an average reference.

The EEG task followed a typical N400 paradigm (Friederici et al., 1993) but modified to include specific aspects of speech that are characteristic of thought disorder in schizophrenia. Thirty unique sentences were paired with four unique sentence-final words per sentence for a total of one hundred twenty sentences that were auditorily presented to participants. Sentence final words fell into one of four categories: regular, word approximation, neologism, and filler. The word approximation and neologism endings represent communication abnormalities that occur in individuals with schizophrenia and are incongruent with the rest of the sentence because they are unexpected. The regular ending was a sentence final word that was congruent with the rest of the sentence, and the filler endings consisted of more than one word that changed the meaning of the sentence ending. Filler endings were used to provide equal number of congruent and incongruent endings, as well as to distract participants from guessing that the sentence-final word was the study target.

The stimuli simulated a conversation between two people and as a result consisted of two components: a person asking a question and a person responding to that question. Four different questions were asked, depending on the specific answer to the question, with two of the questions having 7 possible responses and the other two having 8 possible responses. Participants
were asked to place themselves into the position of the person asking the question and pretend that they were part of the conversation. The gender of the speaker asking the question in the audio clip was varied to match the gender of the participant in order to facilitate ease of imagining they were the person asking the question. The person responding to the question was always male, and responses were always two sentences long.

All neologisms, and corresponding regular words, were based on those documented and defined by a caseworker and the individual with schizophrenia who used the words (LeVine & Conrad, 1979). Syllables were eliminated from the neologisms so that all sentence final words were equal lengths. Sentences were constructed around the typical words such that they served as a congruent sentence-final word for the sentence. Word approximations and filler endings were created based on a pseudo-cloze probability test to determine if the ending was congruent or not with the rest of the sentence. Word approximations were incongruent with the rest of the sentence, whereas filler endings were congruent. In a pilot study, seven participants listened to all segments of conversation and rated how abnormal the communication was on a scale from 1-7 with 1 being the least abnormal and 7 being the most abnormal. For the normal ending, and filler conditions, lower scores were expected and for the neologism and word approximation conditions, higher scores were expected. Thirty-two sentences were tested and total scores for each sentence were calculated based on how well the sentence stem fit with each of the endings and provided the appropriate degree of abnormality. Two sentences received substantially lower scores on average than the rest and were not included in the study. The final 30 sentences are included in Appendix B. Sentences were presented in a randomized order, that was fixed for all participants, such that no sentence beginning was presented consecutively, and no sentence
ending (typical, word approximation, neologism, filler) was presented more than twice consecutively.

All sentences were recorded by actors who were instructed to speak in a neutral tone. Sentence beginnings and sentence final words were parsed together using the phonetic analysis software PRAAT (Boersma, 2001), such that all sentences have the same acoustic beginning and only differ in the sentence final word. All sentences were adjusted using PRAAT to an intensity level of 70db. Original recordings of sentences ranged in length from 7.5s to 10.0s with an average sentence length of 8.7s.

After hearing each segment of conversation, the participant rated on a 7-point scale (ranging from Definitely Not to Definitely) how likely they would be to continue conversing with someone who was communicating like the individual responding to the question. This scale is presented in Appendix C. Participants were also asked to make a subjective rating of the value of the individual’s opinion on a 7-point scale (ranging from Not Valuable at All to Very Valuable) presented in Appendix D. The segments of conversation were presented in 6 blocks, and participants were given a break after each block.

**Concept Association Task (CAT)**

The concept association task (CAT) is a computerized task used as a measure of implicit stigma towards individuals with schizophrenia (Norman et al, 2010). The CAT is very similar to the implicit association task (IAT) in which images are classified into one of two categories – the stigmatized group or a control group – except that the concepts themselves are used as opposed to images. For example, the word schizophrenia is used instead of a picture of someone with schizophrenia. There are two problems with using a picture of someone with schizophrenia. The
first, specific to schizophrenia, is that it is extremely difficult to tell that someone has schizophrenia just by looking at them (Norman et al., 2010). It is possible that some healthcare professionals might be able to hazard a guess that the person has a mental illness, but there is no way to know that the illness is schizophrenia specifically. Secondly, the images chosen in typical IAT tasks are completely arbitrary and are assumed to represent the concept without any empirical proof (Steffens et al., 2008). For example, if images of a dog are going to be used you could choose a small lap dog or a large aggressive dog and that choice is arbitrary, yet they are different types of dogs with different emotions associated with them for different people. Using the concepts themselves removes these stimuli confounds found in typical IAT tasks, and allows the participant to use their own perception of the concept while completing the task (Steffens et al, 2008).

In the first 20 trials of the CAT, the terms healthy and schizophrenia appear on opposite sides of the screen. Participants are required to classify the terms healthy, health, schizophrenia, and schizophrenic into either the left side of the screen (healthy) or the right side of the screen (schizophrenia), by pressing either the right or left button on a keypad. This initial set of trials is followed by 20 trials in which the categories on the screen change to represent positive and negative. Participants must then classify the terms unpleasant, dangerous, nasty, hostile, pleasant, safe, nice, and friendly as either positive or negative.

In the third block of 60 trials, the categories healthy and positive appear on one side of the screen together, and the categories schizophrenia and negative appear on the other side of the screen. Participants must classify all of the words listed above into either the right or the left side of the screen. In the fourth block of 20 trials, the same categories and words are used as in the first block, except the location of the healthy and schizophrenia categories are reversed. The final
block requires participants to classify all the words, as had been previously done in block 3, except now the categories schizophrenia and positive appear on one side of the screen together, and the categories healthy and negative appear on the opposite side of the screen together.

The CAT was scored according to the D2 algorithm outlined in Greenwald et al., (2003) as being the most efficient scoring system for an implicit or concept association task. Trials were excluded if reaction time was less than 400ms or greater than 10 000ms based on evidence that these reaction times are the result of insufficient processing of the stimulus. Errors were included in reaction times by summing the error reaction time and the correction reaction time. A CAT index was then calculated by taking the difference between block 5 (incongruent) and block 3 (congruent) and dividing by the grand standard deviation (standard deviation of all reaction times regardless of block). The resulting index provides a measure, in standard deviation units, whereby higher scores indicate greater implicit negative attitudes towards schizophrenia.

**Stigma Questionnaires**

Four self-report questionnaires were used to assess individuals’ attitudes toward schizophrenia: the semantic differential, the community attitudes toward the mentally ill (CAMI), the social distance scale, and a “knowledge about schizophrenia” questionnaire. All questionnaires are included in Appendix E.

The semantic differential is a measure of implicit attitudes towards mental illness (Graves et al., 1970; Crisp et al., 2000). It consists of 7-point dimensional ratings of different individuals or objects. For example, one dimension ranges from foolish at one extreme to wise at the other extreme. Participants must mark where along that dimension they feel the person or object lies. There are four different pages for the participant to complete, each consisting of 17 dimensional
ratings. Participants must make a rating for a psychiatrist, a mental patient, a mental hospital, and a lawyer. The concept of a lawyer is not included in the original measure, but I included it as a control condition to view the participant’s implicit attitudes toward a potentially stigmatized, non-psychiatric concept. A total score is calculated for each set of ratings to determine implicit attitudes toward each individual. The scale has good reliability, with demonstrated intercorrelations between adjective pairs being reported as ranging from $r = .95$ to $r = .99$ (Olmstead & Durham, 1976). Although there is no statistically reported significance for the semantic differential, construct validity is provided by the finding that concepts including mental illness labels are rated substantially more negatively than concepts without such labels (Olmstead & Durham, 1976).

The CAMI is a measure of explicit attitudes toward mental illness and has been used widely as a measure of stigma (Taylor & Dear, 1981). The CAMI consists of 40 items pertaining to opinions about mental illness. Each item is rated on a 5-point scale anchored with strongly disagree and strongly agree. Four subscales are calculated from the CAMI: Authoritarianism, Benevolence, Social Restrictiveness, and Community Mental Health Ideology. These scales have moderate to good reliability (Cronbach’s Alphas = .68-.88; Taylor & Dear, 1981), and are widely used (Link et al., 2004).

The social distance scale is a 6 item scale designed to assess desired social distance from individuals with schizophrenia and is an explicit measure of stigma (Stuart & Arboleda-Florez, 2001). Each item relates to how one would feel if someone with schizophrenia had a specific relationship to them and whether they would choose that relationship if they had a choice. For example, one item asks: Would you marry someone with schizophrenia? Each item is rated on a 4-point rating scale anchored with definitely not and definitely. Although there are no reliability
or validity statistics for this particular version of the social distance scale, these scales have shown good reliability (Cronbach’s alpha = .75 to .90) and are some of the most commonly used scales in the stigma literature (Link et al., 2004).

The last questionnaire pertains to knowledge that the individual has about schizophrenia and consists of 8 yes/no/don’t know questions and 2 questions pertaining to the causes and treatment of schizophrenia (Leiderman et al., 2011). This questionnaire yields a total score indicating the amount of accurate knowledge a person has about schizophrenia. There are no reliability or validity statistics available for this scale, however, similar questions are commonly included as a measure of knowledge (Link et al., 2004), and are typically used for descriptive purposes only.

Demographics Interview

Participants were also administered a demographics questionnaire through an interview format. The demographics form consisted of questions pertaining to the participant’s gender, age, place of birth, place of residence, current or history of psychiatric illness, medications the participant is currently taking, and the extent to which the participant has had contact with someone who has a mental illness. The demographics interview form is included in Appendix F.

Procedure

Upon entering the lab, participants were provided with an opportunity to give written informed consent before the study began. All participants consented and underwent the EEG portion of the study first. Participants were randomized to one of four conditions: University, Stroke, Schizophrenia (Recovery), or Schizophrenia (Symptoms). Randomization was stratified according to gender so that equal numbers of males and females were included in each condition.
In each condition, participants read a message regarding the speaker, while the experimenter also read it to them. As discussed above, this message either informed the participant that the speaker in the conversation was a university student, had a stroke, had schizophrenia (and recovery was emphasized), or had schizophrenia (and symptoms were emphasized). These messages are included in Appendix A. Upon completion of the EEG portion of the study, participants completed the computerized CAT and then the questionnaires in the order that they were described above. When the participant finished the questionnaires, the experimenter administered the demographics interview to them. When demographics data collection was completed, the experimenter orally debriefed the participant in addition to giving the participant a written debriefing form that they could take with them. Part of the debriefing process was a manipulation check in which the participant was verbally asked if he or she believed that the speaker in the sound clips actually had the disorder.

Data Analysis

EEG Processing

In order to extract the event related potentials (ERPs) in response to the target word, the continuous EEG was processed using Net Station v. 4.4.1. The continuous EEG was filtered using a 0.1 Hz highpass filter and a 30 Hz low pass filter before segmenting the continuous waveform into the segments of interest. The EEG data was segmented into 1000ms segments, beginning 100ms prior to the onset of the target word, and ending 900ms post-stimulus onset.
Next, artifacts were identified according to the following standard criteria. Bad channels were defined as channels in which the difference between the minimum and the maximum amplitude within the segment exceeded 200µV; eye blinks were defined as a difference between minimum and maximum amplitude exceeding 140 µV within a 640ms time window; and eye movements were defined as a difference between minimum and maximum amplitude exceeding 55 µV within a 640ms time window.

Segments were excluded from further analysis if it contained more than 10 bad or contained an eye blink or eye movement. If more than 80% of the segments were excluded within a sentence ending category (i.e. typical, word approximation, neologism) for a participant, then that participant was excluded from further analyses due to the difficulty in observing an ERP from small numbers of trials.

Next, trials for each participant within each category of sentence ending were averaged, corrected based on the amplitude in the 100ms prior to baseline, and re-referenced using an average reference. Data were then extracted based on the time intervals of interest: 300-500ms post-stimulus onset and 600-900ms post-stimulus onset.

**ERP Analysis**

**ERP Amplitude**

After data processing, a 2 (diagnosis condition) X 2 (symptom condition) X 3 (sentence ending) mixed-model factorial Analysis of Variance (ANOVA) was conducted. Diagnosis condition and symptom condition were between-subject factors, and sentence ending was a within-subjects factor. To follow-up a significant 3-way interaction, symptom condition was held constant and the interaction between diagnosis condition and sentence ending was examined.
Symptom condition was held constant because we are interested in examining the differences between the University and Schizophrenia (Recovery) conditions, and the Stroke and Schizophrenia (Symptoms) conditions. The messages given to participants were matched for these comparisons. To follow-up significant 2-way interactions between diagnosis condition and sentence ending, individual repeated measures ANOVAs examining sentence ending in each of the conditions were examined. To follow-up a significant repeated measures ANOVA, paired samples t-tests were conducted to examine differences between each of the sentence endings.

This data analytic process was conducted for each region (centro-parietal, left parietal, right parietal) and for two different time points: 300-500ms and 600-900ms. The 300-500ms is a typical N400 time window, and the 600-900ms timeframe is designed to examine the late positivity that often accompanies the N400 (MacGregor et al., 2009). To correct for Type I error inflation as a result of multiple comparisons, a Bonferroni correction was applied to analyses run over the 300-500ms time frame and analyses run over the 600-900ms time frame. Timeframes are separated because each timeframe represents a different component in the EEG, and thus a different family of analyses. To maintain an alpha level of .05, the new critical \( p \) value for the 3-way ANOVAs was set at \( p = .0167 \) (\( p = .05 / 3 \)).

**ERP Latency**

The latency for the auditory N400 in response to continuous speech cannot be statistically analyzed because there is no discernible peak with which to calculate the latency, as a result of the carry-over effects from previous words in natural sentence processing (Holcomb & Neville, 1991). Instead, the latency can be calculated for descriptive purposes as the first 50ms interval in which the experimental ending statistically differs from the control ending (Holcomb & Neville, 1991).
**Behavioural and Value Questions**

A 2 (diagnosis condition) X 2 (symptom condition) X 3 (sentence ending) mixed model factorial ANOVA was conducted for the behavioural question and the value question separately. These ANOVAs were followed up according to the same procedure as outlined for the EEG amplitude analyses.

**Stigma Questionnaires and CAT**

Total scores on the stigma questionnaires and the CAT were calculated as outlined above for analysis. 2 (diagnosis condition) X 2 (symptom condition) between subjects ANOVAs were conducted for each measure to determine whether any conditions significantly differed from each other. If there was a significant interaction between diagnosis and symptom conditions, then one-way ANOVAs were conducted to examine differences between diagnosis condition for each level of symptom condition.

**Relationships Between Stigma and N400**

To examine the relationship between the objective EEG measurement of the N400 and the subjective measurement of stigma (both implicit and explicit), and to account for differences in this relationship as a function of condition, regression analyses were conducted with an interaction between diagnosis condition, symptom condition, and each stigma measure predicting the N400 in response to word approximations and neologisms. Because multiple analyses were conducted, a Bonferroni correction was applied so that the new critical alpha value was $p = .003$ ($p = .05 / 18$).
Chapter III:  
Results

Participants

73 undergraduate students in a first year psychology course (17 male, 56 female) between the ages of 17 – 21 participated in the study. Demographics information, and information regarding personal experiences with mental illness, is presented in Table 3. There were no significant differences between any of the groups on any demographics variables. All participants were native English speakers, had normal, or corrected to normal, vision, and were right handed.
Table 3: Demographic characteristics of the sample

<table>
<thead>
<tr>
<th></th>
<th>University Student (n=19)</th>
<th>Stroke (n=19)</th>
<th>Schizophrenia (Recovery) (n=18)</th>
<th>Schizophrenia (Symptoms) (n=17)</th>
<th>Test Statistic</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males: Females</td>
<td>5 : 14</td>
<td>4 : 15</td>
<td>4 : 14</td>
<td>4 : 13</td>
<td>$\chi^2 = 0.16$</td>
<td>.983</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$F = 0.45$</td>
<td>.720</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>18.21 (.713)</td>
<td>18.42 (.902)</td>
<td>18.47 (.717)</td>
<td>18.25 (.856)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$\chi^2 = 12.64$</td>
<td>.396</td>
</tr>
<tr>
<td>Ever diagnosed with a Psychiatric Disorder (%)</td>
<td>4 (21.1)</td>
<td>1 (5.3)</td>
<td>3 (17.6)</td>
<td>0 (0)</td>
<td>$\chi^2 = 5.23$</td>
<td>.156</td>
</tr>
<tr>
<td>Family Member Diagnosed with Schizophrenia (%)</td>
<td>0 (0)</td>
<td>1 (5.3)</td>
<td>1 (5.9)</td>
<td>0 (0)</td>
<td>$\chi^2 = 2.01$</td>
<td>.570</td>
</tr>
<tr>
<td>Ever Known Someone with Schizophrenia (%)</td>
<td>1 (5.3)</td>
<td>3 (15.8)</td>
<td>1 (5.9)</td>
<td>0 (0)</td>
<td>$\chi^2 = 3.56$</td>
<td>.313</td>
</tr>
<tr>
<td>Ever Known Someone with a Mental Illness (%)</td>
<td>15 (78.9)</td>
<td>16 (84.2)</td>
<td>13 (76.5)</td>
<td>13 (81.2)</td>
<td>$\chi^2 = 0.37$</td>
<td>.946</td>
</tr>
</tbody>
</table>
The ERP response to sentence-final words was examined over three electrode sites: centro-parietal, right parietal, and left parietal; and at two time points: 300-500ms post-stimulus onset (the typical N400 window), and 600-900ms post-stimulus onset (to examine the late positivity that often follows the N400; Macgregor et al., 2009).

**N100**

The N100 was examined to determine whether participants were attending to the stimuli. Due to the carryover effects that occur during natural sentence processing the N100 was calculated using the first word of each conversation because there were no prior words to distort the effect. The amplitude of the N100 was calculated as the average of the peak amplitude between 50ms and 150ms post-stimulus onset. A 2 (Diagnosis Condition) x 2 (Symptom Condition) ANOVA was conducted to examine differences between groups on the N100 amplitude. There were no significant interactions or main effects over any electrode sites, $p_s > .151$. Means and standard deviations are presented in Table 4.

<table>
<thead>
<tr>
<th></th>
<th>University (n=19)</th>
<th>Stroke (n=19)</th>
<th>Schizophrenia (Recovery) (n=18)</th>
<th>Schizophrenia (Symptoms) (n=16)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centro-Parietal</td>
<td>-2.84 (1.56)</td>
<td>-1.92 (1.33)</td>
<td>-2.65 (2.80)</td>
<td>-2.22 (2.11)</td>
</tr>
<tr>
<td>Left Parietal</td>
<td>-0.88 (0.73)</td>
<td>-0.90 (0.72)</td>
<td>-0.68 (0.63)</td>
<td>-0.61 (0.77)</td>
</tr>
<tr>
<td>Right Parietal</td>
<td>-1.28 (1.01)</td>
<td>-1.00 (0.64)</td>
<td>-1.34 (0.74)</td>
<td>-1.31 (0.97)</td>
</tr>
</tbody>
</table>
Scalp topographies by condition and ending at 400ms post-stimulus onset are presented in Figure 3.
Figure 3: Topographic maps at 400ms post-stimulus onset
Amplitude

Over centro-parietal electrode sites there were significant 2-way interactions between diagnosis condition and ending, $F(2,136) = 3.13, p = .05$, partial $\eta^2 = .086$, and symptom condition and ending, $F(2,136) = 4.08, p = .021$, partial $\eta^2 = .109$. There was also a significant 3-way interaction between symptom condition, diagnosis condition, and sentence ending, $F(2, 136) = 4.42, p = .016$, partial $\eta^2 = .117$ which qualified the significant two-way interactions (Figure 4). To follow-up the significant 3-way interaction, 2-way interactions between diagnosis condition, and ending were examined at each level of symptom condition. For conditions in which symptoms were discussed, there was no significant interaction between diagnosis condition and sentence ending, $F(2,66) = .55, p = .581$, partial $\eta^2 = .016$. For conditions in which no symptoms were discussed, there was a significant interaction between diagnosis condition and sentence ending, $F(2,70) = 6.24, p = .003$, partial $\eta^2 = .151$. To follow-up this interaction, the effect of sentence ending was examined for each level of diagnosis condition for individuals in the no symptom information condition. Follow-up analyses revealed that an N400 effect was observed for participants in the University Student condition (no symptom information, no diagnosis information), $F(2,36) = 11.86, p < .001$, partial $\eta^2 = .528$, but not in the Schizophrenia (Recovery; no symptom information, given diagnosis information) condition, $F(2,34) = .031, p = .970$, partial $\eta^2 = .005$. For participants in the university student condition, word approximations resulted in a greater amplitude than normal endings, $t(18) = 2.17, p = .043$, and neologisms had greater amplitude than either normal endings, $t(18) = 4.47, p < .001$, or word approximations, $t(18) = 2.82, p = .011$. Means and standard deviations are presented in Table 5.
Figure 4: Grand mean ERPs from the three final word conditions in the four experimental conditions.
Table 5: Means and Standard Deviations (SD) of N400 amplitude between 300-500ms post-stimulus onset over centro-parietal electrode sites measured in µV

<table>
<thead>
<tr>
<th></th>
<th>Normal</th>
<th>Word Approximation</th>
<th>Neologism</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>University</td>
<td>1.84</td>
<td>1.88</td>
<td>0.99</td>
</tr>
<tr>
<td>(n=19)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stroke</td>
<td>0.86</td>
<td>1.65</td>
<td>0.45</td>
</tr>
<tr>
<td>(n=19)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schizophrenia</td>
<td>1.27</td>
<td>2.11</td>
<td>1.28</td>
</tr>
<tr>
<td>(Recovery) (n=18)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schizophrenia</td>
<td>2.14</td>
<td>1.53</td>
<td>2.18</td>
</tr>
<tr>
<td>(Symptoms) (n=16)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Over left-parietal sites there were no significant 2- or 3-way interactions but there was a significant main effect of ending, $F(2, 136) = 10.78, p < .001$, partial $\eta^2 = .137$, such that word approximations were more negative than normal endings, $t(71) = 3.05, p = .003$, and neologisms were more negative than normal endings, $t(71) = 4.90, p < .001$. There were no significant differences between word approximations and neologisms, $t(71) = 1.26, p = .213$. Means and standard deviations are presented in Table 6.

Over right-parietal sites there were no significant 2- or 3-way interactions but there was a significant main effect of ending, $F(2, 136) = 10.08, p < .001$, partial $\eta^2 = .129$, such that word approximations were more negative than normal endings, $t(71) = 4.47, p < .001$, and neologisms, $t(71) = -2.10, p = .039$. Neologisms were more negative than normal endings, $t(71) = 2.38, p = .020$. Means and standard deviations are presented in Table 6.
Table 6: Means (SD) of N400 amplitude between 300-500ms post-stimulus onset over lateralized electrode sites measured in µV

<table>
<thead>
<tr>
<th></th>
<th>Left-Parietal</th>
<th></th>
<th>Right-Parietal</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal</td>
<td>Word Approximation</td>
<td>Neologism</td>
<td>Normal</td>
</tr>
<tr>
<td>University (n=19)</td>
<td>0.07 (1.02)</td>
<td>-0.37 (0.99)</td>
<td>-0.63 (0.78)</td>
<td>1.11 (1.06)</td>
</tr>
<tr>
<td>Stroke (n=19)</td>
<td>0.66 (1.14)</td>
<td>-0.10 (1.21)</td>
<td>-0.16 (0.80)</td>
<td>0.26 (1.17)</td>
</tr>
<tr>
<td>Schizophrenia (Recovery) (n=18)</td>
<td>0.45 (0.93)</td>
<td>-0.02 (0.94)</td>
<td>0.08 (0.70)</td>
<td>0.74 (1.33)</td>
</tr>
<tr>
<td>Schizophrenia (Symptoms) (n=16)</td>
<td>0.54 (1.0)</td>
<td>0.32 (0.95)</td>
<td>-0.19 (0.85)</td>
<td>1.09 (1.24)</td>
</tr>
</tbody>
</table>

600-900ms

There were no significant interactions between ending and condition over centro-parietal, left parietal, or right parietal sites, \( ps > .349 \). There was, however, a significant 2-way interaction between diagnosis condition and sentence ending over centro-parietal electrode sites, \( F(2,136) = 3.46, \ p = .034, \) partial \( \eta^2 = .048 \). To follow-up the interaction, the effect of sentence ending was examined for each level of diagnosis condition. For individuals in the schizophrenia diagnosis condition (both Schizophrenia conditions) there was no significant effect of sentence ending, \( F(2,66) = .96, \ p = .390, \) partial \( \eta^2 = .028 \). For individuals in the no diagnosis condition (University and Stroke conditions) there was a significant effect of sentence ending, \( F(2,74) = \)
4.92, \( p = .010 \), partial \( \eta^2 = .117 \), such that both word approximations, \( t(37) = 3.55, p = .001 \), and neologisms, \( t(37) = 2.45, p = .019 \), were significantly more negative than normal endings. There was no difference between word approximations and neologisms, \( p = .929 \). Means and standard deviations are presented in Table 7.

**Latency**

Latency results are presented in Table 8. No statistical comparisons were conducted due to the difficulty in calculating latency for the N400 in response to natural auditory sentence processing. Latencies are presented for descriptive purposes only.
Table 7: Means (SD) of N400 amplitude between 600-900ms post-stimulus onset over parietal regions measured in µV.

<table>
<thead>
<tr>
<th></th>
<th>Left-Parietal</th>
<th>Centro-Parietal</th>
<th>Right-Parietal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal</td>
<td>Word Approximation</td>
<td>Neologism</td>
</tr>
<tr>
<td>University (n=19)</td>
<td>1.17 (1.83)</td>
<td>1.14 (1.52)</td>
<td>0.25 (1.14)</td>
</tr>
<tr>
<td>Stroke (n=19)</td>
<td>2.05 (1.85)</td>
<td>1.12 (1.72)</td>
<td>1.28 (1.64)</td>
</tr>
<tr>
<td>Schizophrenia (Recovery) (n=18) \</td>
<td>2.11 (1.48)</td>
<td>2.49 (1.24)</td>
<td>1.43 (1.34)</td>
</tr>
<tr>
<td>Schizophrenia (Symptoms) (n=16) \</td>
<td>1.90 (1.68)</td>
<td>1.90 (1.02)</td>
<td>1.35 (1.14)</td>
</tr>
</tbody>
</table>
Table 8: Latency of the N400 in milliseconds post-stimulus onset by Condition.

<table>
<thead>
<tr>
<th></th>
<th>University</th>
<th>Stroke</th>
<th>Schizophrenia (Recovery)</th>
<th>Schizophrenia (Symptoms)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Word</td>
<td>Neologism</td>
<td>Word</td>
<td>Neologism</td>
</tr>
<tr>
<td>Centro-Parietal</td>
<td>450</td>
<td>150</td>
<td>500</td>
<td>-</td>
</tr>
<tr>
<td>Left Parietal</td>
<td>450</td>
<td>400</td>
<td>400</td>
<td>350</td>
</tr>
<tr>
<td>Right Parietal</td>
<td>250</td>
<td>350</td>
<td>500</td>
<td>550</td>
</tr>
</tbody>
</table>

Note: Latency is calculated as the first 50ms interval, post-stimulus onset, that there is a significant ($p < .05$) difference between the experimental sentence ending and the typical ending. Latencies are presented for descriptive purposes only.
**Behavioural Questions**

For the question pertaining to likelihood that the participant would continue the conversation, there were no significant 2- or 3-way interactions between symptom condition, diagnosis condition, and sentence ending, but there was a significant main effect of sentence ending, $F(2, 138) = 185.2, p < .001$, partial $\eta^2 = .729$, such that participants were more likely to continue speaking to someone using normal endings than word approximations, $t(72) = 13.24, p < .001$, or neologisms, $t(72) = 13.98, p < .001$, and more likely to continue speaking to someone using word approximations than neologisms, $t(72) = 9.14, p < .001$ (Figure 5).

Figure 5: Mean (Standard Error) ratings of likelihood to continue the conversation by condition and sentence ending. Higher scores indicate greater likelihood to continue the conversation.

For the question pertaining to the value of the speaker’s opinion, there were no significant 2- or 3-way interactions between symptom condition, diagnosis condition, and sentence ending, but there was a significant main effect of sentence ending, $F(2, 136) = 323.04, p < .001$, partial $\eta^2 = .826$, such that participants thought the speaker’s opinion had greater value when he used normal endings than word approximations, $t(72) = 18.19, p < .001$, or neologisms,
\( t(72) = 18.69, p < .001, \) and greater value when he used a word approximation compared to a neologism, \( t(72) = 8.19, p < .001 \) (Figure 6).

Figure 6. Mean (Standard Error) rating of the value of the speaker’s opinion by condition and sentence ending. Higher scores indicate greater value

---

**Concept Association Task**

There was a trend for a significant 2-way interaction between symptom condition and diagnosis condition for the Concept Association Task (CAT), \( F(1, 67) = 3.12, p = .082, \) partial \( \eta^2 = .044 \) (Figure 7). Although this was only a trend, I still conducted follow-up analyses to determine whether any groups significantly differed on their performance on the CAT. Follow-up analyses did not reveal any significant differences between groups.
Figure 7: Mean (Standard Error) score on the Concept Association Task (CAT) Index by Condition. Higher scores indicate greater implicit negative attitudes towards schizophrenia.

Stigma Questionnaires

Knowledge about Schizophrenia

There were no differences between groups on the “knowledge about schizophrenia” questionnaire, \( p > .213 \). Descriptive statistics for the overall sample are presented in Figure 8. Participants in this sample were, qualitatively, more knowledgeable than other studies that have used a similar knowledge questionnaire (see Leiderman et al., 2011; Stuart & Arboleda-Florez, 2001).
Social Distance

There were no significant main effects or interactions between groups for the social distance task, $p_s > .359$. Descriptive statistics are presented in Table 9.

Community Attitudes Toward the Mentally Ill (CAMI)

There were no significant main effects or interactions between groups for any of the subscales on the CAMI, $p_s > .07$. Descriptive statistics are presented in Table 9.

Table 9: Means (SD) of the Social Distance Scale and Community Attitudes Towards the Mentally Ill (CAMI) subscales by condition. Higher scores indicate greater stigmatizing attitudes.

<table>
<thead>
<tr>
<th></th>
<th>University</th>
<th>Stroke</th>
<th>Schizophrenia (Recovery)</th>
<th>Schizophrenia (Symptoms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Distance Scale</td>
<td>2.34 (0.49)</td>
<td>2.34 (0.48)</td>
<td>2.37 (0.45)</td>
<td>2.17 (0.39)</td>
</tr>
<tr>
<td>CAMI Authoritarianism</td>
<td>2.26 (0.37)</td>
<td>2.19 (0.31)</td>
<td>2.32 (0.44)</td>
<td>2.41 (0.34)</td>
</tr>
<tr>
<td>CAMI Benevolence</td>
<td>1.96 (0.24)</td>
<td>2.10 (0.24)</td>
<td>2.02 (0.40)</td>
<td>2.16 (0.35)</td>
</tr>
<tr>
<td>CAMI Social Restrictiveness</td>
<td>2.16 (0.34)</td>
<td>2.11 (0.27)</td>
<td>2.19 (0.61)</td>
<td>2.28 (0.41)</td>
</tr>
</tbody>
</table>
Semantic Differential Test

There were no significant main effects or interactions between conditions on the Lawyer page of the semantic differential, $p > .222$ (Figure 9). As a result all other pages were analyzed without applying corrections.

There were no significant main effects or interactions for the mental patient page of the semantic differential, $p > .566$ (Figure 9). For the psychiatrist page, there was a significant interaction between symptom and diagnosis conditions, $F(3, 64) = 9.30, p = .003$, partial $\eta^2 = .127$ (Figure 9). Follow-up analyses revealed that participants in the Schizophrenia (Symptoms) condition held more stigmatizing attitudes towards psychiatrists than participants in the Stroke condition, $t(31) = -2.74, p = .010$, or the Schizophrenia (Recovery) condition, $t(30) = -3.29, p = .003$ (Figure 9).

For the mental hospital page, there was a significant interaction between symptom and diagnosis conditions, $F(1,64) = 5.98, p = .017$ (Figure 9). Follow-up analyses revealed that participants in the Schizophrenia (Symptoms) condition held more stigmatizing attitudes towards mental hospitals than participants in the Stroke condition, $t(31) = -2.01, p = .043$, or the Schizophrenia (Recovery) condition, $t(30) = -2.31, p = .024$ (Figure 9).
Figure 9: Mean (Standard Error) rating on the four pages of the Semantic Differential Test by Condition. Higher scores indicate more negative attitudes.

Relationships Between N400 and Stigma

There were no significant interactions between symptom condition, diagnosis condition, and any of the stigma measures, after alpha level adjustment, in predicting the N400 in response to either word approximations or neologisms (Table 10).
Table 10: Regression coefficients and significance for the 3-way interaction term between symptom condition, diagnosis condition, and stigma measures predicting amplitude of the N400 in response to word approximations and neologisms.

<table>
<thead>
<tr>
<th></th>
<th>Word Approximation</th>
<th></th>
<th></th>
<th>Neologism</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>t</td>
<td>p</td>
<td>B</td>
<td>t</td>
<td>p</td>
</tr>
<tr>
<td>Social Distance</td>
<td>-.21</td>
<td>-.08</td>
<td>.939</td>
<td>-433</td>
<td>-.161</td>
<td>.872</td>
</tr>
<tr>
<td>CAT</td>
<td>.30</td>
<td>.13</td>
<td>.898</td>
<td>-.028</td>
<td>-.012</td>
<td>.990</td>
</tr>
<tr>
<td>CAMI Authoritarianism</td>
<td>-6.96</td>
<td>-2.48</td>
<td>.016</td>
<td>-3.89</td>
<td>-1.33</td>
<td>.189</td>
</tr>
<tr>
<td>CAMI Benevolence</td>
<td>6.06</td>
<td>1.53</td>
<td>.130</td>
<td>5.45</td>
<td>1.35</td>
<td>.183</td>
</tr>
<tr>
<td>CAMI Social Restrictiveness</td>
<td>4.32</td>
<td>1.36</td>
<td>.179</td>
<td>3.53</td>
<td>1.09</td>
<td>.281</td>
</tr>
<tr>
<td>CAMI CMHI</td>
<td>.004</td>
<td>.001</td>
<td>.999</td>
<td>2.63</td>
<td>.94</td>
<td>.349</td>
</tr>
<tr>
<td>Semantic Differential (Psychiatrist)</td>
<td>-.212</td>
<td>-.09</td>
<td>.926</td>
<td>-.372</td>
<td>-.166</td>
<td>.869</td>
</tr>
<tr>
<td>Semantic Differential (Mental Patient)</td>
<td>2.03</td>
<td>.86</td>
<td>.395</td>
<td>2.44</td>
<td>1.02</td>
<td>.314</td>
</tr>
<tr>
<td>Semantic Differential (Mental Hospital)</td>
<td>2.18</td>
<td>1.08</td>
<td>.286</td>
<td>3.68</td>
<td>.177</td>
<td>.860</td>
</tr>
</tbody>
</table>
Chapter IV: Discussion

The aim of the current study was to examine participants’ neurophysiological and behavioural responses to hearing schizophrenia-associated communication abnormalities as a function of diagnosis and symptom knowledge about the speaker. In general, results suggest that participants’ neurophysiological responses to communication abnormalities are modulated when they are told about the symptoms that the speaker may exhibit or that the speaker has a diagnosis of schizophrenia. Neither the knowledge of symptoms nor the knowledge of diagnostic label appears to be more important for modulating this response.

This is the first study to examine responses in the listener to speech characterized by communication abnormalities related to schizophrenia. The modulation of this neurophysiological response may represent neurophysiological evidence for an expectancy effect when the individual knows about a diagnosis, or symptoms of the speaker, that affects subsequent processing of linguistic stimuli. This expectancy could be related to beliefs regarding people with schizophrenia being unpredictable that has been found in previous studies (Angermeyer & Matschinger, 2004).

Group Differences in N400

My hypotheses were only partially supported by the findings. I hypothesized that I would see differential reductions in the N400 depending on the message participants received about the speaker. The N400 was significantly reduced in the conditions with a message regarding either symptoms or diagnosis compared to the University condition. Contrary to my hypothesis, the N400 was also significantly reduced in the Stroke condition. This may mean that knowledge about symptoms and knowledge about diagnosis may actually function the same way to bias the processing of linguistic stimuli, instead of diagnosis overshadowing all other information as was
hypothesized. This could also mean that any diagnosis can result in a reduction in the N400 if symptoms are presented as well, and it is not specific to a diagnosis of schizophrenia.

There was a significant interaction between diagnosis condition, symptom condition, and sentence ending such that participants who were told that the speaker was a university student exhibited an N400 response to both word approximations and neologisms but participants in each of the other conditions did not exhibit the N400 response. In the other conditions participants were given information regarding the speaker that included functional symptoms of schizophrenia but with the less stigmatized diagnosis of a stroke, a diagnosis of schizophrenia without information regarding functional symptoms, or functional symptoms of schizophrenia with a diagnosis of schizophrenia, suggesting that either knowledge about symptoms the speaker may exhibit, or their schizophrenia diagnosis, is sufficient to affect a person’s N400 in response to hearing communication abnormalities.

I also found a significantly greater N400 effect in response to neologisms than in response to word approximations, reflecting the degree of semantic incongruity (Coch et al., 2013). This result suggests that the more severe the communication abnormality is, the greater the difficulty that the listener has integrating that communication into the broader discourse. For both types of communication abnormality, however, the N400 was significantly reduced when participants were told about either a diagnosis or symptoms.

The fact that the N100 in response to the first word of the conversation was not significantly different between conditions suggests that the reductions in the N400 observed were not simply the result of participants failing to attend to the conversation segments in the experimental conditions. It is possible that participants may cease attending at some point during
the conversation, however, it is not possible to validly examine the N100 in response to sentence final words due to the carry-over effects of previous words in natural sentence processing.

Although it does not appear that the reduction in the N400 is the result of inattention to the stimuli, the N400 finding is limited because it was only observed over centro-parietal sites. Although the N400 has been demonstrated to be maximal over centro-parietal sites, it would still be expected to be observed over lateralized sites in the university student condition. The fact that the effect was not observed over lateralized sites may mean that the observed effect is not actually an N400 but a different neurological process – such as slow wave activity. It is also possible that the study design resulted in an N400 that was only observable over centro-parietal sites because this is where the N400 is maximal. The design included a paragraph at the beginning of the study to provide context, and then a segment of conversation consisting of multiple sentences from two different people. Typical N400 paradigms provide a single sentence context at the beginning of the study and a single experimental sentence per trial. The cognitive complexity of the task in this study (remembering the information from the paragraph in addition to the multi-sentence conversation) may have added error to the N400 that resulted in an observable effect only over sites where the effect was already maximal.

This reduction in the N400 indicates that placing the abnormal speech into the context of either someone with schizophrenia, or someone who may speak abnormally (or both), eases the integration of that communication abnormality into the broader discourse. This integration may occur because knowledge of either the schizophrenia diagnosis, or the symptoms, may activate schemas in the listener, which causes an expectation of abnormal communication. This expectancy effect influences linguistic stimulus processing within 400ms of hearing an abnormal word. This result is congruent with previous findings that suggest that contextual knowledge
produces an expectancy effect, and reduced N400, in response to incongruent words. In the case of schizophrenia, this expectancy effect may be related to beliefs regarding people with schizophrenia being unpredictable which has been found in previous studies (Angermeyer & Matschinger, 2004).

Expectancy of abnormal speech from individuals with schizophrenia may be indicative of an overall schema in the listener that individuals with schizophrenia will behave abnormally. This expectancy may not be a result of conscious processing on the part of the observer, but instead may be a subtle neurophysiological bias that exists when listening to individuals believed to have the disorder. Such biases may not even be purposeful, often presupposed for behaviors to be considered stigma; yet, if the present findings extend to real world interpersonal behaviour, this early processing effect could potentially result in some of the social exclusion experienced by those with schizophrenia.

Although it was hypothesized that the expectancy for abnormal speech would be the result of stigma, there was no relationship between the measures of stigma and the amplitude of the N400. This lack of a relationship suggests that there may be a mechanism other than stigma underlying the observed reduction in the N400, and there are many possibilities. It is possible that the reduction could be a function of compassion towards people with schizophrenia, or empathy towards people with the disorder, however, there were no measures included that directly assess these constructs. It is also possible that the schema activated in the listener by the message, is not a negative schema (such as one pertaining to stigma), but a positive one (such as a schema that prepares the individual to interact appropriately with someone who may behave atypically).
By giving participants information about the speaker before they actually hear the communication, schemata were activated in the listener, which they subsequently use to help process the speech (Sharkey & Mitchell, 1985). Giving participants information about the symptoms that may be displayed (in the Stroke and Schizophrenia – Symptoms) conditions was enough context to make comprehension of communication abnormalities easier for the speaker. This contextual information may be a result of the fact that participants are primed to expect abnormal communication, and therefore are expecting it. Likewise, giving participants information regarding the schizophrenia diagnosis of the speaker (Schizophrenia – Recovery) was enough to make comprehension of the abnormal communication easier, even though there was no reason for participants to expect abnormal speech. Simply being told that the speaker had a diagnosis of schizophrenia was sufficient to bias subsequent processing and result in abnormal communication being expected.

**Group Differences in Stigma Measures**

There were no significant differences between groups on the behavioural or value questions asked after each conversation segment during the EEG task. There was a significant main effect of ending, however, whereby participants indicated that they would be more likely to continue speaking to someone using a normal ending than word approximation, and more likely in both cases to continue the conversation than with someone using a neologism. The same pattern was found with participants’ ratings of the value of the speaker’s opinion. This result suggests that the information a person has about someone else is not as important as his or her actual behaviour. Thus, the more abnormal the communication, the less likely a person would be to keep talking to them and the less value was ascribed to their opinion.
These results may be misleading however. The self-report nature of these questions means that it is possible that social desirability impacted participant responses. I had hypothesized that participants would indicate a greater likelihood to continue speaking to someone with schizophrenia than a university student as a result of social desirability biases, however, it is possible that this bias is appearing as participants reporting that they would not treat someone with schizophrenia differently than anyone else. This explanation is especially likely in this sample of university students taking a psychology course. There have been a great number of mental illness stigma reduction efforts on campus, and it is becoming more widely accepted that stigmatizing and discriminating against people with schizophrenia is unacceptable. This training may have placed social pressure on participants to respond in a non-stigmatizing manner on subjective and explicit measures. It is also possible however, that these results are accurate, and knowledge about the speaker does not actually have any effect on ratings of behaviour. Because these participants were taking a psychology course, it is possible that they were more compassionate than the typical person and potentially interested in entering a health-related profession, leading to less overt stigma towards people with schizophrenia. It is important to realize that these ratings are not actual behavioural measures, though, and participants’ actual behaviour in a situation with someone who has schizophrenia could be very different from what they report (Schutz & Six, 1996).

On the social distancing and community attitudes toward mental illness questionnaires there were no significant differences between conditions. There were also no significant differences between groups on the concept association task. On the semantic differential test (an implicit measure of stigma) participants in the Schizophrenia (Symptoms) condition possessed more stigmatizing attitudes towards a mental patient and a mental hospital than did participants
in the Stroke and Schizophrenia (Recovery) conditions. The University condition did not significantly differ from any of the other conditions.

These findings suggest that the type of information that is given to people regarding schizophrenia is important when considering stigma reduction techniques. The condition that was most akin to stigma reduction programs was the Schizophrenia (Symptom) condition where it could be considered that we educated people about schizophrenia. This effect, however, was the condition in which stigmatizing attitudes were the greatest. This result is consistent with other findings suggesting that the stigma towards schizophrenia actually increases after education-based reduction programs (Pescosolido et al., 2010).

The type of information that is provided during a stigma reduction program will be important to consider for the effectiveness of such programs. As we found in this study, information regarding schizophrenia and recovery resulted in the least amount of stigma, whereas information about symptoms and schizophrenia resulted in the greatest amount stigma.

**Relationships Between N400 and Stigma**

There were no significant relationships between the magnitude of the N400 for word approximations or neologisms and either the implicit or explicit stigma measures. This finding was contrary to my hypothesis that stigmatizing schemas of schizophrenia would be activated and result in a reduced N400. An important consideration with these analyses is that we were underpowered to detect relationships with the N400 (power ranged from .050 - .685 for regression analyses). Although our sample consisted of 73 participants, this number may not be enough to overcome the error associated with ERP measurement and the large number of variables included in the matrix in this exploratory area. Additionally, participants were split into four groups, with fewer than twenty participants per group, which makes the study
underpowered to detect any interaction between group membership and stigma when trying to predict the amplitude of the N400. Although significant relationships were not detected between the stigma measures and the N400, a greater sample size is necessary to better understand the relationships among these measures.

If there truly is no relationship between the N400 and stigma measures, then the fact that there were no significant relationships for even the implicit measures (presumably free from social desirability biases) suggests that stigma may not be the mechanism underlying the observed reduction in N400, or that the experimental paradigm used here did not elicit these schemas. Stigma is generally considered to be a conscious, cognitively complex, and negatively valenced judgment about a person based on their diagnosis, without actually knowing anything about them. The N400 represents an early processing effect in linguistics, in many cases occurring before the target word has finished being spoken, and may occur before stigmatizing attitudes have an opportunity to influence processing.

If this is the case, then it may not be stigma per se that is causing the reduction in the N400, but a more automatic process in response to schemas that are activated when participants are given information about the speaker. When participants are told that the speaker may speak abnormally, this may prime them to expect abnormal communication and result in the reduced N400. Likewise, when the participants are told that the speaker has schizophrenia (and he is in recovery and functioning typically) the same reduction in the N400 is observed, possibly indicating that a similar priming effect to expect abnormal communication from the speaker is occurring in response to the diagnosis alone. Although not stigma per se, this priming effect could potentially result in stigma and, as these results indicate, can affect subsequent processing of someone with schizophrenia’s behaviour at a very early phase.
An important factor to consider when conducting correlations with an ERP is that ERPs are extremely variable between individuals, with little evidence that a greater amplitude in one individual compared to another represents processing differences (Luck et al., 2005). For this reason ERP studies tend to examine group differences as opposed to correlations with the ERP amplitude. The ERP is not readily observed in individuals but requires the averaging of group data to detect. The N400 may be too gross a measure to detect any significant relationships with measures of stigma, and may only be able to provide information at the group level.

Utility of Different Stigma Measures

In general the participants in this sample had fairly low levels of stigmatizing attitudes, although, as discussed above, this could be a result of social desirability bias. This is especially a possibility because the participants were all undergraduate students taking a first year psychology course. Since many of these individuals are likely interested in health related professions, they may have tried to portray themselves as holding more positive attitudes towards someone with schizophrenia than they actually possess.

In general, the implicit measures of stigma appeared to perform better than the explicit measures. There was a trend towards a significant interaction with the concept association task and a significant interaction was observed on parts of the semantic differential test. This suggests that there is some element of social desirability occurring, and that the implicit measures may be able to circumvent that bias to some extent.

The findings on the semantic differential were especially interesting because no significant differences were observed for the page relating to a mental patient, however, significant differences were observed for both the mental hospital and the psychiatrist. This
could be a result of the term mental patient being too explicit, and eliciting a social desirability response from participants, whereas mental hospital and psychiatrist may less explicitly indicate the purpose of the questions.

In general, the stigma questionnaires did not capture condition differences, whereas the different conditions did result in a differential N400 response. Although it is unclear whether the observed reduction in the N400 is a result of stigma, objective measures such as EEG may be more sensitive to experimental manipulations, and change over time, than traditional self-report questionnaires.

Limitations and Future Directions

This study has a number of limitations. First and foremost, although there is a great deal of evidence to suggest that diagnosis awareness is a core component to stigmatization, there is no evidence from this study that the reduction in the N400 is occurring as a result of stigmatizing attitudes held by the participants. There are other possible explanations for this reduction in the N400 as noted above and future research is needed to determine the mechanism underlying the reduction in the N400 that we observed. Replicating these results in a sample of the general population who may have less knowledge of schizophrenia, and potentially comparing those with high and low knowledge, would aid in determining whether the amplitude of the N400 is dependent on the knowledge that someone has about schizophrenia. Experimental designs such as this can help rule out other possible explanations for the observed effect.

It is also unclear whether the reduction in the N400 we observed is a result of an expectancy for people with schizophrenia to behave atypically, or whether it is a result of a bias to not attend at all to what someone with the disorder is saying. Future research could examine this by asking participants to answer a question regarding the content of the communication after
listening to each segment. This design will ensure that they are actually attending to the conversation being presented and not ignoring it because the person has schizophrenia. If a reduction in the N400 is still observed in this situation then it would provide evidence for an expectancy of abnormal behaviour from someone with schizophrenia. If the reduction in the N400 is no longer observed then this may mean that there is a bias to not attend to what someone with schizophrenia is saying.

Another major limitation of this study is that our sample consisted entirely of undergraduate students in a first year psychology course. First, undergraduate students represent a population with a restricted range of age, socio-economic status and education, any of which may have affected our results. If stigma were the mechanism underlying the reduction of the N400 then I would expect older individuals would show a greater effect due to greater stigma in older individuals (Stuart & Arboleda-Florez, 2001). Less educated individuals may also show a greater effect as a result of greater stigma compared to more educated individuals.

These students were also all taking a psychology course, which may indicate that they have an interest in healthcare. People interested in entering the healthcare field may be more empathic towards individuals suffering from a disorder and this could influence their processing of the individual’s behaviour, including their N400 response to atypical speech in schizophrenia. It will be important to replicate these findings in a sample that is more representative of the general population to determine whether the findings are generalizable outside of a university setting.

It should be noted also, that the speech samples used in this study were from actors, and therefore may not be representative of how someone with schizophrenia actually speaks. The actor portraying someone with schizophrenia was instructed to speak with flat affect, but this
may not be representative of people with schizophrenia. There may be nuances to the speech of someone who actually has the disorder that would improve the believability of the manipulation, and affect how that speech is processed. As a result it will also be important to replicate this finding using actual speech from someone with schizophrenia.

This study also only employed the use of the verbal modality for the presentation of schizophrenia-associated symptoms. Verbal information is rarely processed in isolation; during social interactions there are usually nonverbal behaviours that convey meaning in addition to the verbal message being communicated. It is likely that this visual information is also important for providing context to social interactions, and could affect how speech is processed during an interaction. Similarly, abnormal communication is unlikely to be the sole symptom that someone with schizophrenia presents with. In order for someone to have a diagnosis of schizophrenia, other symptoms, positive or negative, must be present, and it is possible that the combination of these symptoms with abnormal communication may result in a greater social distancing response than abnormal communication alone. Examining the role of symptom combinations in the perception of someone with schizophrenia is an essential future direction for this line of research.

This study is also limited by the lack of a condition in which participants are told the speaker has had a stroke (but not told any symptoms associated with the stroke), and a condition in which participants are told that the speaker is a university student who uses communication abnormalities. With the inclusion of a Stroke (No Symptom) condition a comparison could be made between this condition and the Schizophrenia (Recovery) condition to determine whether a reduction in the N400 is the result of being told the speaker has any diagnosis, or whether it is specific to schizophrenia. With the inclusion of a University (Symptom) condition it could be examined whether the symptoms of schizophrenia alone are sufficient to result in a reduction of
the N400, or whether those symptoms need to be combined with a diagnostic term in order to result in the reduction. Including both of these conditions, in spite of methodological rigour, presents additional power issues as well as questionable validity, since it is presumable that participants would be most familiar with the fact that university students would not use communication abnormalities and that trouble generating speech is a core symptom of a stroke. Thus the manipulation could be less believable to participants, and could result in misleading findings.

It is also possible that other mental illnesses may have been better control conditions than a stroke. Other mental illnesses would have allowed a direct comparison to other constructs in the mental health field, to determine whether there are different responses to someone with schizophrenia compared to other disorders, and whether communication is processed differently when it comes from someone with schizophrenia compared to someone with a different disorder.

Stigma measurement techniques consist almost entirely of self-report measures with content that is explicit in what it is measuring. The few implicit measures are poorly validated and pseudo-implicit measures, such as the semantic differential, still rely heavily on self-report. This lack of other implicit and objective measures to compare the N400 ERP to means that even if stigma is the mechanistic reason underpinning the reduction in N400 amplitude, relationships with stigma may not be found as a result of the self-report nature of the questionnaires. Being able to compare the reduction in the N400 to objective measures of stigma would provide more compelling evidence as to the nature of that relationship.

Lastly, neologisms and word approximations were chosen as the communication abnormalities to examine due to the fact that they are single word anomalies. A single word anomaly is consistent with the N400 paradigm, however neologisms and word approximations
are not the most common forms of communication abnormalities. Communication abnormalities such as tangentiality, circumstantiality, and poverty of speech are more commonly observed in people with schizophrenia and thus are important forms of abnormal communication to study. These communication abnormalities are more of a slow process over the course of discourse, as opposed to single word anomalies, which may make using an N400 paradigm more difficult, however, examining these more common communication abnormalities may be more directly applicable to individuals with schizophrenia.

**Implications**

The findings from this study have implications for the understanding of how healthy individuals process speech from someone with schizophrenia. The reduction in the N400 observed when participants were told about a diagnosis, or symptoms associated with the disorder, suggests that processing of speech from someone with schizophrenia is influenced by the knowledge that the listener has about them. This bias is observable 400ms after the onset of abnormal communication and may precede conscious processing of the speech. This processing bias may then also affect processing of other information regarding someone with schizophrenia without the individual even being aware of it.

Social interactions are an integral component in our everyday lives, and disruptions to those interactions are likely to cause problems for the individual involved. People with schizophrenia who use abnormal communication experience these disruptions to their social interactions, and understanding the effect that knowledge about the person has on the processing of their speech, is essential to understanding the nature of these disruptions. If we can understand what pre-conscious biases exist towards individuals with schizophrenia then this will be an important target for stigma reduction programs.
The fact that we also demonstrated that the likelihood of a participant continuing a conversation with someone who has schizophrenia is dependent on the degree of abnormal communication being used highlights the importance of considering actual behaviours when examining social exclusion. Research into social exclusion has focused almost exclusively on how diagnosis awareness results in social exclusion, but these results suggest that the actual behaviour of the person with the disorder may be more important for social exclusion than knowledge of their diagnosis.

Lastly, these results also highlight the importance of using objective measurement techniques instead of, or in conjunction with, self-report questionnaires. The objective measurement of the N400 ERP detected differences between groups based on the message participants were given, however, these differences were not detected on the stigma questionnaires. Objective measurement will be important to confirm the current understanding of stigma, and for the field to progress.

**Conclusion**

The knowledge that people have regarding someone with schizophrenia, before they interact with the person, has a significant effect on the subsequent processing of their speech. Both knowledge regarding the symptoms of schizophrenia (in the context of someone who has had a stroke), and knowledge of the schizophrenia diagnosis are sufficient to result in an altered neurophysiological processing of the person’s speech. Understanding these automatic processes in response to knowledge about someone with schizophrenia, and in response to witnessing their symptoms, are essential for understanding why people with schizophrenia experience reduced functional opportunities.
Traditional stigma measurement instruments were not effective at detecting differences between conditions on stigmatizing attitudes. The differences detected on the psychiatrist and mental hospital pages of the semantic differential may indicate that these pages are able to bypass the social desirability biases plaguing self-report instruments and capture more of the true variance in attitudes. Further use of implicit measures such as these, and the development of objective stigma measures, is essential for the valid measurement of stigma.

The reduction in the N400 amplitude was not associated with either implicit or explicit measures of stigma, suggesting that stigma may not be the underlying mechanism for this effect. This linguistic processing effect may occur before the conscious stigma process has had an opportunity to effect processing, or other factors, such as knowledge regarding the symptoms of schizophrenia, and previous experience with the disorder may be responsible for the N400 reduction. The lack of validity of self-report questionnaires and the lack of true implicit measures to compare the N400 to, however, limit confidence in these conclusions and highlight the necessity of further work in this area.

People process abnormal communication differently as a function of the knowledge they have about the speaker, and despite the lack of a relationship with stigma, these processing differences could have significant results for how someone with schizophrenia is perceived. Understanding these processes is essential to understanding the exclusion of people with schizophrenia and for developing effective programs that reduce the barriers to functional recovery that are faced by individuals with disorder.
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Thank you for agreeing to participate in this study.

In this study you will be listening to two people talking while they are out for coffee. The first individual will be asking a question and the second individual will be responding. Please place yourself into the position of the first individual (the individual asking the question) and pretend that you are actually a part of this conversation. Remember, YOU are the one asking the question.

Click to Continue
University

The second person (the one responding to the question) is a student who is currently in university. Individuals in university may have active social lives, go to the gym regularly, hold part-time jobs, and may be above average intelligence. In addition, individuals in university may be extremely busy volunteering at organizations, studying for exams, and giving presentations in their classes.

OR

Schizophrenia (Symptoms)

The second person (the one responding to the question) has schizophrenia. Individuals who have schizophrenia may have difficulty performing everyday activities and maintaining full time employment, and sometimes may have to be hospitalized due to the symptoms of psychosis. In addition, individuals with schizophrenia may have a difficult time looking after themselves and may sometimes communicate in abnormal ways.

OR

Stroke

The second person (the one responding to the question) has had a stroke. Individuals who have had a stroke may have difficulty performing everyday activities and maintaining full time employment, and sometimes may have to be hospitalized due to the symptoms of a stroke. In addition, individuals who have had a stroke may have a difficult time looking after themselves and may sometimes communicate in abnormal ways.

OR

Schizophrenia (Recovery)

The second person (the one responding to the question) has schizophrenia. Individuals who have schizophrenia often recover from the symptoms of the disorder and return to performing everyday tasks, and working full time. Many individuals with schizophrenia maintain active social lives and show no indication of having the disorder. You would never even know they have schizophrenia from talking to them.
Before you hear the segment of conversation you will see a cross on the screen. Immediately before the conversation begins, an audio picture will replace the cross. Please focus on the cross and picture and try not to move your eyes from that area of the screen. After listening to each segment of conversation, you will be asked to rate on a scale from 1-7 how likely you would be to carry on a conversation with someone communicating like the individual answering the questions.

After making your rating, a screen will come up telling you that you can blink. Please try to only blink when this screen is up. If you have to, you can blink while the first person is speaking, but DO NOT blink during the second person’s part of the conversation.

Click to Continue
The segments of conversation will be presented in 6 blocks and in between each block you will be given a quick break.

When you are ready,
Click to Begin
Appendix B: Conversation Segments for EEG Task  
(Only the part of the response stem indicated in italics is part of the filler segment)

<table>
<thead>
<tr>
<th>Question</th>
<th>Response Stem</th>
<th>Normal (Congruent)</th>
<th>Word Approximation (Incongruent)</th>
<th>Neologism (Incongruent)</th>
<th>Filler (Congruent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>So what have you</td>
<td><em>I didn’t get a lot of sleep last night so I’m tired. I woke up to the sound</em></td>
<td>Bell</td>
<td>Gun</td>
<td>Climp</td>
<td><em>The fire alarm</em></td>
</tr>
<tr>
<td>been up to lately?</td>
<td>of a church…</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>So what have you</td>
<td><em>I’ve just been relaxing so far today. I’ve just been watching TV and lying</em></td>
<td>Couch</td>
<td>Car</td>
<td>Clepp</td>
<td><em>In bed</em></td>
</tr>
<tr>
<td>been up to lately?</td>
<td>on the…</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>So what have you</td>
<td><em>I went out and did some shopping earlier. I bought some shoes, a shirt,</em></td>
<td>Coat</td>
<td>Dog</td>
<td>Pyew</td>
<td><em>Pair of Pants</em></td>
</tr>
<tr>
<td>been up to lately?</td>
<td><em>and a new…</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>So what have you</td>
<td><em>My mother is coming to visit later today. I have to go pick her up from the</em></td>
<td>Terminal</td>
<td>Ticketer</td>
<td>Jamoono</td>
<td><em>She is going to get here around dinner time</em></td>
</tr>
<tr>
<td>been up to lately?</td>
<td><em>train…</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question</td>
<td>Response Stem</td>
<td>Normal (Congruent)</td>
<td>Word Approximation (Incongruent)</td>
<td>Neologism (Incongruent)</td>
<td>Filler (Congruent)</td>
</tr>
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<td>-------------------------------------------------------------------------------</td>
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<td>----------------------------------</td>
<td>------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>So what have you</td>
<td>Actually I just got news that I got accepted into university. I'm going to be studying…</td>
<td>Chemistry</td>
<td>Libraries</td>
<td>Gooliga</td>
<td>Going to Queen’s</td>
</tr>
<tr>
<td>been up to lately?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>So what have you</td>
<td>I've always wanted a pet. So today I went to the pet store and bought myself a new…</td>
<td>Dog</td>
<td>Cage</td>
<td>Pip</td>
<td>I went to the pet store to buy one, but I couldn’t find one I liked.</td>
</tr>
<tr>
<td>been up to lately?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>So what have you</td>
<td>Well, it’s my girlfriend’s birthday today. I went and picked out a really expensive…</td>
<td>Perfume</td>
<td>Toaster</td>
<td>Geefoo</td>
<td>Am going to take her out for dinner tonight</td>
</tr>
<tr>
<td>been up to lately?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>So what have you</td>
<td>I stayed inside this morning because it was raining. But once it stopped there was a great…</td>
<td>Rainbow</td>
<td>Snowstorm</td>
<td>Podo</td>
<td>I went for a walk</td>
</tr>
<tr>
<td>been up to lately?</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Question</td>
<td>Response Stem</td>
<td>Normal (Congruent)</td>
<td>Word Approximation (Incongruent)</td>
<td>Neologism (Incongruent)</td>
<td>Normal (Congruent)</td>
</tr>
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<td>-------------------------------------------------------------------------------</td>
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<td>--------------------</td>
</tr>
<tr>
<td>Are you still interested in going out for dinner later?</td>
<td>Yes, <em>I am going to be very hungry. I’m looking forward to a good bowl of chicken…</em></td>
<td>Pasta</td>
<td>Mustard</td>
<td>Bliscot</td>
<td>Getting a good steak</td>
</tr>
<tr>
<td>Are you still interested in going out for dinner later?</td>
<td>Yes, <em>around 7 should be good. And then afterwards maybe we can go out for a…</em></td>
<td>Beer</td>
<td>Toast</td>
<td>Brig</td>
<td>Check out a movie</td>
</tr>
<tr>
<td>Are you still interested in going out for dinner later?</td>
<td><em>Actually how would you like to stay in instead? I’ll make us some steak and…</em></td>
<td>Potatoes</td>
<td>Tomatoes</td>
<td>Bowempsky</td>
<td><em>I was thinking of making some pork chops</em></td>
</tr>
<tr>
<td>Are you still interested in going out for dinner later?</td>
<td><em>Would you be ok with staying in instead? I’m trying hard to save…</em></td>
<td>Cash</td>
<td>Pies</td>
<td>Doon</td>
<td><em>Not in the mood to go out tonight</em></td>
</tr>
<tr>
<td>Question</td>
<td>Response Stem</td>
<td>Normal (Congruent)</td>
<td>Word Approximation (Incongruent)</td>
<td>Neologism (Incongruent)</td>
<td>Normal (Congruent)</td>
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<td>--------------------</td>
</tr>
<tr>
<td>Are you still interested in going out for dinner later?</td>
<td>Yes, I’m looking forward to it. I have a craving for something with lots of…</td>
<td>Cabbage</td>
<td>Chlorine</td>
<td>Pingbrag</td>
<td>Been having cravings for a good piece of meat lately</td>
</tr>
<tr>
<td>Are you still interested in going out for dinner later?</td>
<td>Actually I just got back from a hunting trip. If we stay in I could cook us up some…</td>
<td>Deer</td>
<td>Peas</td>
<td>Pook</td>
<td>I’m kind of tired so I think I’d rather stay in</td>
</tr>
<tr>
<td>Are you still interested in going out for dinner later?</td>
<td>Yes, but it will have to be a bit later. I was hungry so I just ate an entire bag of…</td>
<td>Grapes</td>
<td>Pork</td>
<td>Gange</td>
<td>Just ate so I’m not that hungry right now</td>
</tr>
<tr>
<td>Are you still interested in going out for dinner later?</td>
<td>Sure that sounds good. As long as we can go somewhere that I can get a glass of…</td>
<td>Beer</td>
<td>Meat</td>
<td>Gliill</td>
<td>Nice hot meal</td>
</tr>
<tr>
<td>Question</td>
<td>Response Stem</td>
<td>Normal (Congruent)</td>
<td>Word Approximation (Incongruent)</td>
<td>Neologism (Incongruent)</td>
<td>Normal (Congruent)</td>
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</tr>
<tr>
<td>What do you think about this weather we’ve been having?</td>
<td><em>It’s been terrible, I hate it. I was going to go out this morning but there was too much…</em></td>
<td>Rain</td>
<td>Tree</td>
<td>Vaype</td>
<td><em>It was raining pretty hard</em></td>
</tr>
<tr>
<td>What do you think about this weather we’ve been having?</td>
<td><em>It’s been terrible lately hasn’t it? I heard the wind yesterday uprooted an entire…</em></td>
<td>Tree</td>
<td>Cow</td>
<td>Pax</td>
<td><em>That wind yesterday was so strong I was scared to go out</em></td>
</tr>
<tr>
<td>What do you think about this weather we’ve been having?</td>
<td><em>It’s been so cold and rainy this week, I hate getting up. I wish I could just stay in my…</em></td>
<td>Bed</td>
<td>Car</td>
<td>Bont</td>
<td><em>I hate needing to dress warm and carry an umbrella</em></td>
</tr>
<tr>
<td>What do you think about this weather we’ve been having?</td>
<td><em>I hate it. I got caught outside yesterday when it started raining and I couldn’t find…</em></td>
<td>Cover</td>
<td>Glasses</td>
<td>Lookies</td>
<td><em>Didn’t have an umbrella</em></td>
</tr>
<tr>
<td>Question</td>
<td>Response Stem</td>
<td>Normal (Congruent)</td>
<td>Word Approximation (Incongruent)</td>
<td>Neologism (Incongruent)</td>
<td>Normal (Congruent)</td>
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</tr>
<tr>
<td>What do you think about this weather we’ve been having?</td>
<td>I can’t wait for this heat wave to end. I can’t sleep at night, so I think I need to buy a…</td>
<td>Comfortable</td>
<td>Modulated</td>
<td>Poelybleblow</td>
<td>It’s been so uncomfortable I can’t even sleep</td>
</tr>
<tr>
<td>What do you think about this weather we’ve been having?</td>
<td>It’s been too cold lately. Everytime I go outside I need to wear my mitts, scarf, and…</td>
<td>Boots</td>
<td>Belt</td>
<td>Toos</td>
<td>I hate going outside because my hands and feet always get cold</td>
</tr>
<tr>
<td>What do you think about this weather we’ve been having?</td>
<td>I can’t believe how icy it is outside. I fell yesterday and chipped a couple…</td>
<td>Teeth</td>
<td>Backs</td>
<td>Stens</td>
<td>I have to walk really slow to make sure I don’t fall</td>
</tr>
<tr>
<td>What do you think about this weather we’ve been having?</td>
<td>It’s been nice lately. It was a little cold yesterday but I was still outside wearing just a…</td>
<td>Jacket</td>
<td>Bracelet</td>
<td>Zornus</td>
<td>Still worked outside most of the day</td>
</tr>
<tr>
<td>Question</td>
<td>Response Stem</td>
<td>Normal (Congruent)</td>
<td>Word Approximation (Incongruent)</td>
<td>Neologism (Incongruent)</td>
<td>Normal (Congruent)</td>
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</tr>
<tr>
<td>Do you have any plans for the weekend?</td>
<td>I’m going to visit my parents. Before I leave, I have to remember to fill my car with…</td>
<td>Gas</td>
<td>Tar</td>
<td>Chelf</td>
<td>It should be a good visit because I haven’t seen them in a while</td>
</tr>
<tr>
<td>Do you have any plans for the weekend?</td>
<td>I’m going to a concert in the city on Friday. I’m really excited to see my favourite…</td>
<td>Band</td>
<td>Drum</td>
<td>Demb</td>
<td>My friend lives there and she got us tickets</td>
</tr>
<tr>
<td>Do you have any plans for the weekend?</td>
<td>Actually I’m flying out west for a conference tomorrow. It will be my first time on a…</td>
<td>Plane</td>
<td>Boat</td>
<td>Zonc</td>
<td>Should be pretty interesting</td>
</tr>
<tr>
<td>Do you have any plans for the weekend?</td>
<td>Not really. I have some new pictures I want to hang up, but first I have to go buy a…</td>
<td>Nails</td>
<td>Trip</td>
<td>Perfs</td>
<td>That’s about all I have going on</td>
</tr>
<tr>
<td>Question</td>
<td>Response Stem</td>
<td>Normal (Congruent)</td>
<td>Word Approximation (Incongruent)</td>
<td>Neologism (Incongruent)</td>
<td>Normal (Congruent)</td>
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</tr>
<tr>
<td>Do you have any plans for the weekend?</td>
<td>I’m just going to rest. I’ve been sick lately, but the doctor told me to rest and take my…</td>
<td>Pills</td>
<td>Time</td>
<td>Blakes</td>
<td>So I just want to take it easy and try to get better</td>
</tr>
<tr>
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<td></td>
<td></td>
</tr>
<tr>
<td>Do you have any plans for the weekend?</td>
<td>I’m going to the city with my girlfriend for the weekend.</td>
<td>Train</td>
<td>Clock</td>
<td>Clonk</td>
<td>I’ve never been there before so I’m excited</td>
</tr>
<tr>
<td></td>
<td>We’re leaving tomorrow on the…</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you have any plans for the weekend?</td>
<td>I have to buy my brother a birthday. He’s a writer and he really wants a new…</td>
<td>Pencil</td>
<td>Guitar</td>
<td>Pusall</td>
<td>He never tells me what he wants so it might take a while</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question</td>
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</tr>
<tr>
<td>Do you have any plans for the weekend?</td>
<td><em>I’m camping this weekend with some friends. I’m hoping I can go climb a big…</em></td>
<td>Tree</td>
<td>Creek</td>
<td>Trell</td>
<td><em>Looking forward to relaxing in nature</em></td>
</tr>
</tbody>
</table>
Appendix C: Behavioural Rating Scale Used in EEG Task

On the following scale please rate how likely you would be to continue talking to an individual who spoke like this.

Appendix D: Value of Opinion Rating Scale Used in EEG Task

Based on what you know about this person, and the sentence you just heard, please rate how much you would value this person’s opinion.

1 Not Valuable at all  2 Not Very Valuable  3 Somewhat Not Valuable  4 Neutral  5 Somewhat Valuable  6 Valuable  7 Very Valuable
Appendix E: Questionnaires

The Semantic Differential Test

You are being asked to participate in a study of word meanings. The object of the study is to find out how you like to describe different kinds of persons. On each of the following pages there is a different person for you to describe. Your description can be made by marking the list of words on the page. Take a look to see how this is done. Each pair of words forms a scale. By making an X along the scale you can indicate what you associate with the particular kind of person.

If you feel that the issue or person named at the top of the page is highly related with one end of the scale you would place an X as follows:

fair__:__:__:__:__:__:_X_:__ unfair OR fair_X_:__:__:__:__:__:__unfair

If you feel that the person or issue is moderately related to one or the other end of the scale, you would place your X as follows:

strong__:_X_:__:__:__:__:__weak OR strong__:__:__:__:__:_X_:__weak

If the issue or person seems only slightly related to one side as opposed to the other, you would place an X as follows:

active__:__:_X_:__:__:__:__passive OR active__:__:__:__:_X_:__:__passive

If you considered both sides equally related, you would place an X in the middle space on the scale:

safe__:__:__:_X_:__:__:__dangerous

Do not put more than one X on the scale, and please ensure that you place the X only in the blank and not between two blanks. For example DO NOT do the following:

foolish__:__:_X_:__:_X_:__:__:__wise OR foolish__:__:__:_X_:__:__:__:__wise

Remember: never put more than one X on any scale. And also be sure to mark every item. If you feel that a pair of adjectives does not apply, or if you are undecided, place an X in the centre space. Do not leave the line blank.

Do not spend more than a few seconds marking each scale. Your first impression is what we would like to learn about. We have found you can work quicker if you first form a picture in your mind of the person mentioned at the top of each page, and after that mark each scale rapidly. There will be three different pages after this one, each with a different issue or person at the top of the page.

We do not need your name on the questionnaire for this study. Thank you very much for your cooperation.
Psychiatrist

foolish___:___:___:___:___:___:___wise
intelligent___:___:___:___:___:___:___ignorant
strange___:___:___:___:___:___:___familiar
active___:___:___:___:___:___:___passive
sincere___:___:___:___:___:___:___insincere
predictable___:___:___:___:___:___:___unpredictable
weak___:___:___:___:___:___:___strong
slow___:___:___:___:___:___:___fast
understandable___:___:___:___:___:___:___mysterious
rugged___:___:___:___:___:___:___delicate
warm___:___:___:___:___:___:___cold
clean___:___:___:___:___:___:___dirty
safe___:___:___:___:___:___:___dangerous
relaxed___:___:___:___:___:___:___tense
valuable___:___:___:___:___:___:___worthless
sick___:___:___:___:___:___:___healthy
good___:___:___:___:___:___:___bad
Mental Patient

foolish___:___:___:___:___:___:wise
intelligent___:___:___:___:___:ignorant
strange___:___:___:___:___:___:familiar
active___:___:___:___:___:___:passive
sincere___:___:___:___:___:___:insincere
predictable___:___:___:___:___:___:unpredictable
weak___:___:___:___:___:___:strong
slow___:___:___:___:___:___:fast
understandable___:___:___:___:___:___:mysterious
rugged___:___:___:___:___:___:delicate
warm___:___:___:___:___:___:cold
clean___:___:___:___:___:___:dirty
safe___:___:___:___:___:___:dangerous
relaxed___:___:___:___:___:___:tense
valuable___:___:___:___:___:___:worthless
sick___:___:___:___:___:___:healthy
good___:___:___:___:___:___:bad
Mental Hospital

foolish___:___:___:___:___:___:___wise
intelligent___:___:___:___:___:___:___ignorant
strange___:___:___:___:___:___:___familiar
active___:___:___:___:___:___:___passive
sincere___:___:___:___:___:___:___insincere
predictable___:___:___:___:___:___:___unpredictable
weak___:___:___:___:___:___:___strong
slow___:___:___:___:___:___:___fast
understandable___:___:___:___:___:___:___mysterious
rugged___:___:___:___:___:___:___delicate
warm___:___:___:___:___:___:___cold
clean___:___:___:___:___:___:___dirty
safe___:___:___:___:___:___:___dangerous
relaxed___:___:___:___:___:___:___tense
valuable___:___:___:___:___:___:___worthless
sick___:___:___:___:___:___:___healthy
good___:___:___:___:___:___:___bad
Lawyer

foolish____wise
intelligent____ignorant
strange____familiar
active____passive
sincere____insincere
predictable____unpredictable
weak____strong
slow____fast
understandable____mysterious
rugged____delicate
warm____cold
clean____dirty
safe____dangerous
relaxed____tense
valuable____worthless
sick____healthy
good____bad
Community Attitudes Toward the Mentally Ill

Please answer the following questions as honestly as you can. Answer by circling the number that best corresponds to how you feel about the statement. The scale you should use when deciding on your answer is given below.

1  2  3  4  5
1 Strongly Disagree  2 Disagree  3 Neutral  4 Agree  5 Strongly Agree

1. One of the main causes of mental illness is a lack of self-discipline and will power

2. The mentally ill have for too long been the subject of ridicule

3. The mentally ill should not be given any responsibility

4. Residents should accept the location of mental health facilities in their neighbourhood to serve the needs of the local community

5. The mentally ill should be isolated from the rest of the community
6. The best way to handle the mentally ill is to keep them behind locked doors.


7. More tax money should be spent on the care and treatment of the mentally ill


8. The best therapy for many mental patients is to be part of a normal community


9. We need to adopt a far more tolerant attitude toward the mentally ill in our society


10. There is something about the mentally ill that makes it easy to tell them from normal people


11. As far as possible, mental health services should be provided through community based facilities

12. A woman would be foolish to marry a man who has suffered from mental illness, even though he seems fully recovered

<table>
<thead>
<tr>
<th></th>
<th>1 Strongly Disagree</th>
<th>2 Disagree</th>
<th>3 Neutral</th>
<th>4 Agree</th>
<th>5 Strongly Agree</th>
</tr>
</thead>
</table>

13. As soon as a person shows signs of mental disturbance, he should be hospitalized

<table>
<thead>
<tr>
<th></th>
<th>1 Strongly Disagree</th>
<th>2 Disagree</th>
<th>3 Neutral</th>
<th>4 Agree</th>
<th>5 Strongly Agree</th>
</tr>
</thead>
</table>

14. Our mental hospitals seem more like prisons than like places where the mentally ill can be cared for

<table>
<thead>
<tr>
<th></th>
<th>1 Strongly Disagree</th>
<th>2 Disagree</th>
<th>3 Neutral</th>
<th>4 Agree</th>
<th>5 Strongly Agree</th>
</tr>
</thead>
</table>

15. I would not want to live next door to someone who has been mentally ill

<table>
<thead>
<tr>
<th></th>
<th>1 Strongly Disagree</th>
<th>2 Disagree</th>
<th>3 Neutral</th>
<th>4 Agree</th>
<th>5 Strongly Agree</th>
</tr>
</thead>
</table>

16. Locating mental health services in residential neighbourhoods does not endanger local residents

<table>
<thead>
<tr>
<th></th>
<th>1 Strongly Disagree</th>
<th>2 Disagree</th>
<th>3 Neutral</th>
<th>4 Agree</th>
<th>5 Strongly Agree</th>
</tr>
</thead>
</table>

17. Anyone with a history of mental problems should be excluded from taking public office

<table>
<thead>
<tr>
<th></th>
<th>1 Strongly Disagree</th>
<th>2 Disagree</th>
<th>3 Neutral</th>
<th>4 Agree</th>
<th>5 Strongly Agree</th>
</tr>
</thead>
</table>
18. Residents have nothing to fear from people coming into their neighbourhood to obtain mental health services

   1  2  3  4  5
   Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

19. Mental patients need the same kind of control and discipline as a young child

   1  2  3  4  5
   Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

20. We have a responsibility to provide the best possible care for the mentally ill

   1  2  3  4  5
   Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

21. The mentally ill should not be denied their individual rights

   1  2  3  4  5
   Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

22. Mental health facilities should be kept out of residential neighbourhoods

   1  2  3  4  5
   Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree

23. The mentally ill don’t deserve our sympathy

   1  2  3  4  5
   Strongly Disagree  Disagree  Neutral  Agree  Strongly Agree
24. Mental illness is an illness like any other

<table>
<thead>
<tr>
<th></th>
<th>1 Strongly Disagree</th>
<th>2 Disagree</th>
<th>3 Neutral</th>
<th>4 Agree</th>
<th>5 Strongly Agree</th>
</tr>
</thead>
</table>

25. Local residents have good reason to resist the location of mental health services in their neighbourhood

<table>
<thead>
<tr>
<th></th>
<th>1 Strongly Disagree</th>
<th>2 Disagree</th>
<th>3 Neutral</th>
<th>4 Agree</th>
<th>5 Strongly Agree</th>
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</table>

26. Mental patients should be encouraged to assume the responsibilities of normal life

<table>
<thead>
<tr>
<th></th>
<th>1 Strongly Disagree</th>
<th>2 Disagree</th>
<th>3 Neutral</th>
<th>4 Agree</th>
<th>5 Strongly Agree</th>
</tr>
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</table>

27. The mentally ill are a burden on society

<table>
<thead>
<tr>
<th></th>
<th>1 Strongly Disagree</th>
<th>2 Disagree</th>
<th>3 Neutral</th>
<th>4 Agree</th>
<th>5 Strongly Agree</th>
</tr>
</thead>
</table>

28. The mentally ill should not be treated as outcasts of society

<table>
<thead>
<tr>
<th></th>
<th>1 Strongly Disagree</th>
<th>2 Disagree</th>
<th>3 Neutral</th>
<th>4 Agree</th>
<th>5 Strongly Agree</th>
</tr>
</thead>
</table>

29. Less emphasis should be placed on protecting the public from the mentally ill

<table>
<thead>
<tr>
<th></th>
<th>1 Strongly Disagree</th>
<th>2 Disagree</th>
<th>3 Neutral</th>
<th>4 Agree</th>
<th>5 Strongly Agree</th>
</tr>
</thead>
</table>
30. Increased spending on mental health services is a waste of tax dollars

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Neutral</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
</tbody>
</table>

31. No one has the right to exclude the mentally ill from their neighbourhood

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Neutral</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
</tbody>
</table>

32. Having mental patients living within residential neighbourhoods might be good therapy but the risks to residents are too great

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<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Neutral</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
</tbody>
</table>

33. The mentally ill are far less of a danger than most people suppose

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Neutral</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
</tbody>
</table>

34. It is frightening to think of people with mental problems living in residential neighbourhoods

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Neutral</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
</tbody>
</table>

35. Mental hospitals are an outdated means of treating the mentally ill

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<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Neutral</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
</tbody>
</table>
36. There are sufficient existing services for the mentally ill

   1  2  3  4  5
Strongly Disagree Disagree Neutral Agree Strongly Agree

37. It is best to avoid anyone who has mental problems

   1  2  3  4  5
Strongly Disagree Disagree Neutral Agree Strongly Agree

38. Locating mental health facilities in a residential area downgrades the neighbourhood

   1  2  3  4  5
Strongly Disagree Disagree Neutral Agree Strongly Agree

39. Most women who were once patients in a mental hospital can be trusted as babysitters

   1  2  3  4  5
Strongly Disagree Disagree Neutral Agree Strongly Agree

40. Virtually anyone can become mentally ill

   1  2  3  4  5
Strongly Disagree Disagree Neutral Agree Strongly Agree
Social Distance Scale

The following six questions relate to possible hypothetical relationships you may have with people who have schizophrenia. Answer the questions by circling the response that indicates the way you feel. Please answer as honestly as possible. Your personal information will not be linked to your responses in any way.

<table>
<thead>
<tr>
<th>Question</th>
<th>Definitely</th>
<th>Probably</th>
<th>Probably</th>
<th>Definitely</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  Would you feel ashamed if people knew someone in your family was diagnosed with schizophrenia?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Definitely</td>
<td>Not</td>
<td>Not</td>
<td>Not</td>
<td>Not</td>
</tr>
<tr>
<td>2  Would you feel afraid to have a conversation with someone who has schizophrenia?</td>
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<td>Definitely</td>
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<tr>
<td>3  Would you be upset or disturbed about working on the same job with someone who has schizophrenia?</td>
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<td>Definitely</td>
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<td>4  Would you be unable to maintain a friendship with someone who has schizophrenia?</td>
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<td>Definitely</td>
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<tr>
<td>5  Would you feel upset or disturbed about rooming with someone who has schizophrenia?</td>
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<tr>
<td>Definitely</td>
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<tr>
<td>6  Would you marry someone with schizophrenia?</td>
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<tr>
<td>Definitely</td>
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Knowledge about Schizophrenia

Please answer the following questions to the best of your ability. There are no right or wrong answers, simply answer with whatever knowledge you have. Place a circle around whichever answer you believe is correct. Try to pick either Yes or No but if you have no idea as to the answer then pick Don’t Know.

People with Schizophrenia:

1. Suffer from split or multiple personalities
   - YES
   - NO
   - DON’T KNOW

2. Listen to non-existent voices
   - YES
   - NO
   - DON’T KNOW

3. Tend to socially withdraw
   - YES
   - NO
   - DON’T KNOW

4. Can have lack of will
   - YES
   - NO
   - DON’T KNOW

5. Are mentally retarded
   - YES
   - NO
   - DON’T KNOW

6. The majority are dangerous to others or have violent behaviour
   - YES
   - NO
   - DON’T KNOW

7. Have bizarre or inadequate behaviour
   - YES
   - NO
   - DON’T KNOW

8. Have a cure
   - YES
   - NO
   - DON’T KNOW

9. The causes of schizophrenia are…
   - GENETIC
   - ENVIRONMENTAL
   - BOTH

10. The most adequate treatment for schizophrenia is…
    - MEDICATION
    - PSYCHOTHERAPY
    - BOTH
    - NEITHER
Appendix F: Demographics Interview Record Form

Date of Informed Consent:  __ / __ / ______ Age at Consent:  ____

Year in University:  __ __

Ethnicity:  1. Hispanic or Latino  Race:  1. American Indian/Alaska Native
          2. Not Hispanic or Latino  2. Asian
          3. Unknown or not reported  3. Native Hawaiian or other Pacific Islander
          4. Black
          5. White
          6. More than one race
          7. Not reported

City/Province of Birth: _______ Country of Birth: _________ If not Canada, year of immigration: _ _ _

City/Province of residence: __________


Native Language:  1. English  2. French  3. Other ___________

Psychiatric Diagnosis:  YES  NO  Diagnosis:__________________  Date:_______
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