

Psychopathology of schizophrenia: the role of synaptic plasticity

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ABSTRACT

This article examines more ethical descriptions of language production in schizophrenia as well as clinical descriptions of language output and the phenomenon of positive thought disorder. It also provides a summary of the data supporting the widely accepted notion that language impairment in schizophrenia results from abnormalities in either working memory and executive function or abnormalities in semantic memory. The companion

article focuses on the online psycholinguistic approaches used to study language in schizophrenia and discusses how knowing schizophrenia may help us understand how regular language processing works.

Keywords: Schizophrenia; Language; Semantic memory; Disorder; Abnormalities

INTRODUCTION

A serious mental illness called schizophrenia affects 1% of adult humans worldwide. All of its symptoms are characterised by a malfunction of thought, language, and communication, but the most severe one is positive thought disorder, which is accompanied by chaotic and occasionally incomprehensible speech. The first of two studies examining higher order language and semantic impairment in schizophrenia is presented here. It attempts to provide an overview of the schizophrenia syndrome and the clinical, cognitive, and neuroanatomical approaches that have traditionally been used to study language impairments in schizophrenia [1]. I discuss positive thought disorder and clinical descriptions of language output in schizophrenia. I also take into account more principled descriptions of language output in schizophrenia and examine supporting data for the prevailing theories that have been used to describe these language anomalies. In the paper that goes along with it, I go into how psycholinguistic methods might help with the research of schizophrenia and how that, in turn, might help theories of language processing. Like the majority of other neuropsychiatric illnesses, schizophrenia is only identified through a clinical constellation of symptoms and signs, together with some level of functional impairment. Young adults typically exhibit these characteristics for the first time. Schizophrenia symptoms reveal deviations in many facets of human intellect, language, and

communication. These include issues with separating verbalised thought from outside speech (verbal auditory hallucinations), observing and understanding the world around us (delusions), difficulties with motivation and social interactions (negative symptoms), and difficulties with verbalising thoughts through language (thought disorder). These clinical characteristics are often categorised as "positive" or "negative" in nature. An excess or distortion of normal function is the defining feature of positive symptoms. They include positive thought disorder, delusions (fixed incorrect ideas held despite all evidence to the contrary), and hallucinations (most frequently spoken auditory hallucinations) (disorganized language output). Negative symptoms refer to the absence of traits that are typically present in healthy people. A flat or incorrect affect apathy, a lack of voluntary behaviour or motivation, and "negative thought disorder" are a few of them (poverty of speech and language). The *Diagnosis and Statistical Manual of mental disorders, fourth edition, or DSM-IV*, which outlines the criteria for psychiatric diagnosis, includes detailed descriptions of all of these symptoms (American Psychiatric Association 2000). All the characteristics listed above may not always be present in a patient with schizophrenia, either at one particular time or over the course of their life. Instead, a person must exhibit some impairment in social, occupational, and daily functioning in addition to exhibiting a certain number of these symptoms for at least six months in order to be diagnosed with schizophrenia. As a result, schizophrenia is a heterogeneous condition in which two people with the same diagnosis may exhibit various subsets of symptoms. Although schizophrenia is

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only clinically diagnosed, we now know that it is characterised by a number of brain abnormalities that may be seen at both the macroscopic and microscopic levels. None of these biological anomalies are distinct enough or specific enough to be employed as a diagnostic indicator [2]. Studies contrasting afflicted groups with demographically matched control groups, however, reveal minor but observable and pervasive brain abnormalities. Numerous of these anomalies can be observed in individuals who are still in the early stages of their sickness and have not yet taken any long-term medications. Patients exhibit volumetric anomalies in a variety of cortical and sub-cortical regions on a macroscopic level. Widespread cortical thinning is seen on structural MRI, especially in the frontal and temporal lobes. Studies using Diffusion Tensor Imaging (DTI) reveal extensive white matter anomalies, particularly in the frontal and temporal cortices. Functional neuroimaging studies also show extensive abnormalities, including atypical patterns of functional connectivity across areas and anomalous increases and decreases in hemodynamic activity (depending on the specific element of cognition being examined). Schizophrenia is characterised by synaptic dysfunction that affects the dopaminergic, glutamatergic, and GABAergic neurotransmitter systems on a microscopic level. Studies conducted after death show a rise in cell density and a corresponding fall in dendritic mass. It is obvious that schizophrenia has a complicated polygenetic base, with several genes interacting with multiple environmental circumstances, even though the exact pathogenetic pathways are unknown. There is also emerging understanding that schizophrenia has a neurodevelopmental base with anomalies present in early childhood and adolescence, despite the symptoms appearing for the first time in young adulthood. One of the many characteristics that can be used to diagnose schizophrenia is verbal communication impairment. However, not all schizophrenia patients exhibit these anomalies. In order to reflect the original perspective of psychopathologists, who believed that verbal communication impairments reflected underlying disorders of thinking rather than primary disturbances of language, patients who do exhibit verbal communication impairments are referred to as "thought disordered." Nevertheless, the term "thought disorder" is now only used to describe a wide range of conditions that hinder verbal communication. Without making any theoretical assumptions about its underlying origins, thought disorder is essentially examined by looking at patients' linguistic output. It is well established to be a factor in both social and professional dysfunction. There have been numerous attempts to describe and clinically describe the phenomena that make up mind disorder. They can be generically categorised as either "negative" or "positive." Negative thought disorder, which is characterised by a lack of verbal expression (alogia), seems to be more prevalent in individuals with additional negative non-linguistic symptoms. The term "positive thought disorder" refers to a number of various occurrences that cause speech to be disordered and challenging to follow; it tends to happen more frequently when other positive symptoms are present. Derailment is a pattern of spontaneous speech that tends to veer off course and in which the concepts stated are either tangentially linked or wholly unrelated, as in the example above. I have always enjoyed geography. August A was my last instructor for that topic. He was a black-eyed dude. Also, I enjoy black eyes. For example, "I really enjoyed some communities and tried it, but the next day when I'd be going out, you know, um I took control like uh, I put, um, bleach on my hair in, in California," or "There are also blue and grey eyes and other varieties, too." She was attending a junior college and was from Chicago. She wanted to apply peroxide on my hair because we resided in the YMCA, and she also wanted to. The patient may also respond to a question in an indirect or unrelated way, known as "tangentiality," as in the example below. Interviewer: "How have you been feeling today?" Patient: "Well, considering the prices in the shops are what they are and my flat is just around the block, I have been okay in myself. The majority of the time, I keep an eye out for the arbiters since they are right around the corner. Otherwise, there isn't really much to do. A "loosening of associations" frequently characterises derailment and

tangentiality. This term refers to the use of related terms that are unrelated to the main meaning of the sentence or context of the conversation. For instance, a patient in the famous quote below refers to his family as "mother, father, son, and Holy Ghost." In the excerpt that follows, although certain sentences are obviously related, the overall meaning of the text is unclear: "If you think it's a good idea to send me a bill for money I've already paid, I'm not going to do it until I hear the whys and wherefores from you to me."

LITERATURE REVIEW

However, where fours have been, fives will follow, along with other numbers, calculations, and accounts that will go unaccounted for. Positive thought disorder can occasionally include irregularities at the level of single words in addition to occurrences at the level of sentences and discourse. Some patients, for instance, create non-words or neologisms, such as "I became so upset I picked up a plate and tossed it at the geshinker" or "So I sort of bawked the whole thing up." Some people have a peculiar or distinctive way of using words, such as calling a watch a "time vessel" or a ballpoint pen a "paperskate." Positive thought disorder can present as 'word salad' or schizophasia in extremely severe cases, which is incoherent speech in which neither the individual words nor the sentences being strung together seem to match to any discernible overall meaning. What I think is that we might as well go there and trade in some pop caps and, uh, tyres and tractors to group, vehicle garages, so they can pull cars out of accidents [3].

When my parents mentioned it, I decided not to go there to buy any more pop. We can go over there to acquire cigarettes, but I only went there to get a pop can and an ice cream cone. In clinical rating scales, many of the events that make up thought disorder have been categorised and defined. These scales are mostly utilised in research to evaluate the severity of thinking disorders in specific people. The 20 items TLC: Scale for assessment of thought, language, and Communication is the most popular of them. This scale has made it possible to systematically examine the prevalence of these phenomena and the relationships between schizophrenia-related mental disorders and other symptoms in large patient populations. According to these research, sentence- and discourse-level abnormalities, such tangents and derailments, are more prevalent than single-word abnormalities, like neologisms.

Additionally, cluster and factor analyses have demonstrated that positive thinking disorder is more common in individuals who engage in disorderly, non-goal-directed behaviour than in those who have hallucinations and delusions. The former positive versus negative symptom dichotomy has been replaced with a three-way contrast within schizophrenia that includes "reality distortion," "disarray," and "psychomotor poverty." Any combination of these symptoms, however, may be present in a single patient at any one time. The attempts to combine the characteristics of positive and negative thought disorders outlined above are theoretical and solely based on clinical evaluation. They don't presuppose anything about normal language's structure or statistical characteristics. However, there have been numerous attempts to categorise schizophrenia's verbal output in a more logical way. These have centred on three major strategies: one that tries to characterise patient speech in terms of its statistical features, one that looks at language output in terms of lexical and grammatical structure, and one that concentrates on discourse structure [4].

DESCRIPTION

The first strategy focuses on the statistical characteristics of the speech made by schizophrenia patients. As previously mentioned, tangential and occasionally incomprehensible speech is a symptom of mental disorders. Words frequently seem out of place in relation to the

previous sentence and the speech context. Studies conducted in the 1960s and 1970s looked at transcripts of speech made by schizophrenia patients and evaluated the predictability and variability of a specific word within its sentence or discourse context in an objective way in an effort to describe and systematically quantify these types of incongruities. A Cloze analysis was used to gauge predictability, and the type: Token ratio, which compares the amount of different words (or "types") to the overall number of words used (or "tokens"), was used to gauge flexibility or variability. These experiments showed that when the context was quite lengthy, healthy individual assessors were less able to predict words removed from transcripts of patients with schizophrenia than those omitted from the transcripts of healthy controls (14 words surrounding the omitted word). Additionally, compared to healthy controls, the type: Token ratio was typically lower in the speech and writing samples of schizophrenia patients. Both of these measurements were quite particular to people who were clinically classified as having thought disorders. Computational models have been used in more recent efforts to describe the statistical characteristics of speech generated by schizophrenia patients. In one investigation, the number of associations within particular units of patients' recorded speech were counted using an association database [5,6].

CONCLUSION

In conclusion, there is solid evidence that schizophrenia causes language problems. There is evidence for problems in higher order comprehension, but production is where these anomalies are most clinically visible. Clinical language difficulties can be predicted by abnormalities in executive function, working memory, and semantic memory. This has given rise to the hypothesis that dual impairments in these systems can account for language dysfunction in schizophrenia. The study of language in schizophrenia will be covered in the companion article using online psycholinguistic techniques that may examine how neurocognitive processes and representations are formed in real time. The idea that positive thinking disorder in schizophrenia results from a quicker and wider automatic spread of activation through semantic memory is perhaps the theory with the most sway. This theory presupposes a model of semantic memory where words and concepts are connected inside a network based on how closely they are related or appear together.

The clinical phenomenon known as "loosening of association," which is discussed in section 2.1, is the propensity of some patients to produce strings of semantically associated words that do not always form a coherent whole. This theory has a lot of intuitive appeal because it suggests that a faster automatic spread of semantic associative activity could help explain this phenomenon. Studies employing the automatic semantic priming paradigm provide the strongest support for the semantic hyperactivity idea. The term "semantic priming effect" refers to the enhanced behavioural or neural response to a target word when it is preceded by a "prime" word that is semantically associated (or semantically related in some other way), such as "tiger"- "stripes," as opposed to one that is semantically unrelated, such as "truck"- "stripes." The associative semantic priming effect is believed to be driven, at least in part, by automatic mechanisms, such as the spread of activation from prime to target, under experimental conditions that reduce strategic processing, such as using a short Stimulus Onset Asynchrony (SOA - the interval between the onset of prime and target).

There are numerous reports suggesting schizophrenia patients, especially those who exhibit clinical signs of positive thought

disorder, exhibit higher direct priming and indirect priming under automated settings. Electrophysiological data show that thought-disordered patients exhibit an increased indirect priming electrophysiological effect between 300 and 400 ms after target onset, compared to non-thought-disordered patients and healthy controls. This finding was reported by Kreher et al. using a semantic monitoring task that did not require a behavioural response to trials of interest. However, not all behavioural and electrophysiological research have found that schizophrenia exhibits enhanced semantic priming effects during brief SOAs. This might be due to the fact that not all research have separated patients into those who have and do not have thought disorders. Another explanation could be that, even under 'automatic' experimental conditions, some of the semantic priming effect is mediated by strategic semantic processes, which are impaired in patients and include active attempts to connect the meaning of primes and targets or attempts to predict the target after encountering the prime. A follow-up study by Kreher et al. provides a particularly effective illustration of the impact of such techniques on semantic priming, even at short SOAs.

In schizophrenia, the semantic priming effect is abnormally diminished at long SOAs (which enable controlled methods like semantic matching, prediction, and selection). Both people with and without thought disorders experience it, and it has typically been linked to deficits in executive or working memory function, as explained in the paragraphs that follow. Declarative memory paradigms show that patients' strategic use of semantic knowledge is impaired. Patients fail to voluntarily employ such semantic categorization procedures, resulting in fragmented word lists at recall, in contrast to healthy controls, who exhibit greater recall of words that can be semantically categorised during encoding. When we take into account their neuroanatomical bases, the question of how automatic and regulated semantic processes interact in schizophrenia becomes very pertinent. A growing amount of neuroimaging research, including studies that used the semantic priming paradigm, suggests that the inferior temporal fusiform and left middle temporal cortices in healthy individuals store and reflexively activate lexicosemantic concepts.

The regulated, strategic retrieval and selection of semantic representations stored in the temporal cortex, on the other hand, is assumed to be mediated by the left Inferior Frontal Cortex (IFC). Though there have been few studies connecting this to semantic processing, numerous researchers have hypothesised that functional interactions between the temporal and prefrontal cortices are impaired in people with schizophrenia. We demonstrated that activity within the left inferior prefrontal and temporal cortices was increased to associated (*vs.* non-associated) targets in patients, *i.e.*, the neural priming effect was reversed, in an fMRI study examining the neuroanatomical correlates of controlled semantic priming in schizophrenia (with a long SOA). All schizophrenia patients exhibited this reversed hemodynamic priming effect, although those with positive thought disorder had it more pronounced in the temporal brain.

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