

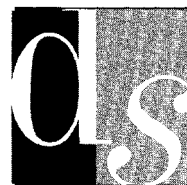
Disordered discourse in schizophrenia described by the Structure Building Framework

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Discourse Studies
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 SAGE Publications.
 (London,
 Thousand Oaks, CA
 and New Delhi)
 Vol 1(3): 355-372.
 [1461-4456
 (199908) 1:3:
 355-372; 008759]



ABSTRACT This article reviews the phenomena of disordered discourse often manifested in schizophrenia. It argues that the Structure Building Framework, a model of the general cognitive processes and mechanisms underlying discourse, can be used to account for these phenomena. According to the Structure Building Framework, the goal of comprehension is to build coherent mental representations or structures. Building a mental structure involves several component subprocesses: laying a foundation, mapping relevant information onto that foundation, and shifting to initiate a new substructure. Building a mental structure also involves at least two general cognitive mechanisms: enhancement of relevant activation and suppression of irrelevant or inappropriate activation. We suggest that schizophrenics who exhibit verbose disordered discourse have inefficient suppression mechanisms, are impaired in laying a foundation, and tend to shift too often. We also speculate that schizophrenics who exhibit impoverished disordered discourse have inefficient enhancement mechanisms and are impaired with the cognitive process of mapping.

KEYWORDS: *discourse comprehension, discourse production, general cognitive processes, mechanisms underlying language, schizophrenia, structure building framework*



A central feature of schizophrenia is an abnormality in producing discourse. This abnormality has been labeled 'thought disorder' by schizophrenia researchers (Kraepelin, 1911; Bleuler, 1950). In this article we shall refer directly to this phenomenon, labeling it 'disordered discourse'. Not all schizophrenics display disordered discourse, and when present its features are heterogeneous (Andreasen, 1979a; Barch and Berenbaum, 1996). However, several researchers have attempted to identify the characteristics of disordered discourse in schizophrenia and to classify those features into meaningful types. One very simple (but common) distinction is the categorization of 'positive' and 'negative' disordered discourse (Andreasen, 1979a). Positive disordered discourse is marked by

excesses in production, with a tendency for discourse to appear disorganized. Some of the features of positive disordered discourse are tangentiality (i.e. irrelevant or unrelated responses), derailment (i.e. a tendency for discourse to move off track), incoherence, and perseveration (Andreasen, 1986). The following examples illustrate the discourse of two schizophrenics who were classified as having positive disordered discourse; these utterances were responses to the interviewer's question of 'what city are you from?'

(1)

Well, that's a hard question to answer because my parents . . . I was born in Iowa, but I know that I'm white instead of black so apparently I came from the north somewhere and I don't know where, you know, I really don't know where my ancestors came from. So I don't know whether I'm Irish or French or Scandinavian or I don't, I don't believe I'm Polish but I think I'm, I think I might be German or Welsh. I'm not but that's all speculation and that, that's one thing that I would like to know and is my ancestors, you know, where did I originate. But I just never took the time to find out the answer to that question. (Andreasen, 1986: 476)

(2)

I'm from Marshalltown, Iowa. That's 60 miles northwest, northeast of Des Moines, Iowa. And I'm married at the present time. I'm 36 years old. My wife is 35. She lives in Garwin, Iowa. That's 15 miles southeast of Marshalltown, Iowa. I'm getting a divorce at the present time. And I am at presently in a mental institution in Iowa City, Iowa, which is a hundred miles southeast of Marshalltown, Iowa. (Andreasen, 1986: 479)

Similarly, example (3) illustrates the discourse of a schizophrenic classified as having positive disordered discourse; this utterance was in response to the interviewer's question of 'why do you think people believe in God?'

(3)

Uh, let's see, I don't know why, let's see, balloon travel. He holds it up for you, the balloon. He don't let you fall out, your little legs sticking out down through the clouds. He's down to the smoke stack, looking through the smoke trying to get the balloon gassed up you know. Way they're flying on top that way, legs sticking out, I don't know, looking down on the ground, heck, that'd make you so dizzy you just stay and sleep you know, hold down and sleep there. The balloon's His home you know up there. I used to sleep outdoors, you know, sleep outdoors instead of going home. (Chapman and Chapman, 1973: 3)

To avoid the evaluative connotation of the term 'positive disordered discourse' and capitalize on the quantitative connotation, in this article we refer to positive disordered discourse as verbose disordered discourse.

Conversely, we refer to negative disordered discourse as impoverished disordered discourse. Impoverished discourse is marked by a decrease in language production, evidenced in symptoms such as poverty of speech (i.e. a decrease in the amount of speech) and poverty of content (i.e. a lack of information; Andreasen, 1979b); for example, the impoverished content of example (4), produced in response to the interviewer's request to 'tell me what you are like, what kind of person you are'.

(4)

I happen to be quite pleased with who I am or how I am and many of the problems that I have and have been working on I have are difficult for me to handle or to work

on because I am not aware of them as problems which upset me personally. I have to get my feelers way out to see how it is and where that what I may be or seem to be is distressing, too painful or uncomfortable to people who make a difference to me emotionally and personally or possibly on an economic or professional level. And I am I think becoming more aware that perhaps on an analogy the matter of some who understand or enjoy the loud rages of anger, the same thing can be true for other people, and I have to kind of try to learn to see when that's true and what I can do about it. (Andreasen, 1979b: 1318)

Similarly, example (5) illustrates the impoverished content of a schizophrenic's discourse in response to the interviewer's question of 'why do you think that people believe in God?'

(5)

Well, first of all because, he uh, he uh ly, he are the person that, is their personal savior. He walks with me and talks with me. And, uh, the understanding that I have, um, a lot of peoples, they don't really, uh, know they own personal self. Because, uh, they ain't, they all, just don't know they own personal self. They don't know that he, uh, seemed like to me, a lot of 'em don't understand that he walks and talks with them. And, uh, show them their way to go. (Andreasen, 1986: 475)

Classifying verbose (positive) versus impoverished (negative) features of schizophrenics' disordered discourse may have improved identification of the symptoms but such a rudimentary classification has not significantly contributed to our understanding of the underlying discourse processing mechanisms. For example, counting the number of perseverations in speech during a clinical interview cannot possibly tell us what happened in the mind of the schizophrenic to produce this symptom of verbose disordered discourse (Maher, 1996). Explicating the cause of disordered discourse in schizophrenia is where one of the great controversies of the field exists. Some theorists posit a language-specific account (e.g. Chaika, 1974; Rochester and Martin, 1979; Andreasen, 1982). According to this view, disordered discourse in schizophrenia arises from impaired language-specific processes. By this account, disordered discourse in schizophrenia resembles aphasia (Chaika, 1974).

Another explanation for disordered discourse in schizophrenia does not implicate language per se. According to this view, disordered discourse in schizophrenia results from a breakdown or dysfunction in general cognitive processes and mechanisms. For example, Schwartz (1982) has argued that disordered discourse in schizophrenia is not a problem of language but rather an impairment in cognitive processing and selective attention. Lanin-Kettering and Harrow (1985) have also theorized that the discourse disturbances exhibited by schizophrenics are not the result of language-specific deficits but instead are a behavioral manifestation of a dysfunction in cognitive processing and conceptual thinking. The ability of individuals with schizophrenia to use linguistic conventions, such as the proper syntactic structure, has supported this view (Schwartz, 1982).

A cognitive model of disordered discourse in schizophrenia

To explain disordered discourse in schizophrenia as an impairment in general

cognitive processes and mechanisms, a model of the general cognitive processes and mechanisms underlying discourse should be incorporated. Such a model could provide a basis from which to explain the disordered discourse of those with schizophrenia and could generate testable hypotheses to guide future research. Previous research on disordered discourse in schizophrenia has lacked such a broad cognitive model.

One such model, Gernsbacher's Structure Building Framework, has been empirically tested and validated for over two decades (Gernsbacher, 1990, 1991, 1997). This framework has been used to explain typical language processing in normal individuals, and we argue here that it can be extended to describe disordered discourse in schizophrenia. A central tenet of the Structure Building Framework is that language comprehension reflects the operation of general cognitive processes and mechanisms. Although this framework was originally intended as a description of the general cognitive processes and mechanisms underlying discourse comprehension, it is proposed that the same general processes and mechanisms are also involved in discourse production. Based on this framework, many of the symptoms of disordered discourse in schizophrenia may be viewed as an impairment in the general components of structure building as opposed to a language-specific deficit. Using the Structure Building Framework as a guide, we discuss how impaired cognitive processes and mechanisms may lead to disordered discourse in schizophrenia.

STRUCTURE BUILDING FRAMEWORK

According to the Structure Building Framework, the goal of comprehension is to build coherent mental representations or structures. The building blocks of these mental structures are assumed to be memory nodes, which are activated by incoming stimuli. Building a mental structure involves several component sub-processes: laying a foundation, mapping relevant information onto that foundation, and shifting to initiate a new substructure. First, comprehenders lay foundations for their mental structures. Next, comprehenders develop their structures by mapping on information when that incoming information coheres or relates to previous information. When the incoming information is less coherent and therefore unrelated to previous information, comprehenders employ a different process: they shift to initiate a new substructure. According to the Structure Building Framework, most mental representations comprise several branching substructures of related information.

Furthermore, according to the Structure Building Framework, initial activation forms the foundation for mental structures. Once the foundation is laid, subsequent information is often mapped onto a developing structure. The more the incoming information coheres with previous information, the more likely it is to activate the same or connected memory nodes. In contrast, the less coherent the incoming information is, the less likely it is to activate the same or connected memory nodes. In this case, the incoming information might activate a different set of nodes and form the foundation for a new substructure.

Once activated, patterns of memory nodes transmit processing signals. These processing signals serve to enhance (boost) or suppress (dampen) the activation of other memory nodes. Presumably, memory nodes are enhanced because the information they represent is necessary for further structure building. The activation of memory nodes is suppressed when the information they represent is no longer necessary. If incoming information is relevant to the current discourse, memory nodes related to those previously activated are enhanced and relevant information is mapped onto the existing mental representation. If incoming information is irrelevant to the current discourse, previously activated memory nodes are suppressed and a new set of memory nodes become enhanced after the subprocess of shifting occurs to form a new substructure.

Gernsbacher and her colleagues have investigated the three subprocesses involved in structure building and discovered that they account for many language comprehension phenomena. For example, Carreiras et al. (1995), Gernsbacher and Hargreaves (1988, 1992), and Gernsbacher et al. (1989) demonstrated that the processes of laying a foundation and mapping information onto that foundation accounts for a phenomenon called The Advantage of First Mention. The advantage is this: participants mentioned first in a sentence are more memorable than participants mentioned later. This advantage is maintained even when the first-mentioned participants are not semantic agents or both the first- and second-mentioned participants are syntactic subjects (Gernsbacher and Hargreaves, 1988); the advantage is observed in English, Spanish (Carreiras et al., 1995), Korean (Lee, 1992), and American Sign Language (ASL; Emmorey, 1997). According to the Structure Building Framework, the advantage arises because comprehension requires laying a foundation and mapping subsequent information onto that foundation. First-mentioned participants are more accessible because they form the foundations for their sentence-level representations and it is through them that subsequent information is mapped onto the developing representations.

Gernsbacher and her colleagues have identified the cues in discourse that encourage comprehenders to employ the process of mapping. Four different types of coherence have been identified that are used in mapping, namely referential, temporal, locational, and causal continuity (Gernsbacher, 1996). For example, comprehenders use the definite article *the* and the explicitness of the referential device (from repeated noun phrases to definite noun phrases to pronouns) as cues for referential coherence (Foertsch and Gernsbacher, 1994; Gernsbacher and Robertson, in press). Deaton and Gernsbacher (in press) discovered that comprehenders use the conjunction *because* as a cue for causal coherence. In addition, Haenggi et al. (1993) found that comprehenders draw inferences about the implied location of protagonists in narratives and use those inferences as cues for locational coherence.

According to the Structure Building Framework, all comprehenders lose access to recently comprehended information when they shift from actively building one substructure to initiating another. Gernsbacher (1985) demonstrated

that the process of shifting can explain why comprehenders rapidly forget recently comprehended information (in particular, information that is typically considered 'superficial' or 'surface' information). These experiments also demonstrated that comprehenders rapidly forget recently comprehended information when they are comprehending nonverbal picture stories; therefore, the phenomenon is not unique to language (Gernsbacher, 1985). Furthermore, this rapid forgetting is most likely to occur when comprehenders encounter a structural boundary, for instance, when they encounter a new clause, a new sentence, or – as in the picture story experiments – a new episode. Because the structure of the information, rather than the amount, affects comprehenders' memory, the phenomenon is not likely to be due to limitations of a short-term memory. Gernsbacher (1985) empirically demonstrated that the phenomenon is not due to another popular explanation, namely, that comprehenders lose access to information – in particular, verbatim information – because it is recoded into 'gist'. Instead, Gernsbacher (1985) concluded that comprehenders rapidly forget recently comprehended information because comprehension involves the cognitive process of shifting; once comprehenders have shifted to initiate a new substructure, information represented in a previous substructure is more difficult to access (Gernsbacher, 1985). Surface information is least likely to remain accessible because it is least likely to be represented in multiple substructures (Gernsbacher, 1985).

Gernsbacher and her colleagues have also clarified the role that the two general cognitive mechanisms of suppression and enhancement play in comprehension. For example, Gernsbacher and Faust (1991b) discovered the role that the mechanism of suppression plays in the understanding of words with diverse meaning. When comprehenders encounter such homonyms (e.g. *spade*), multiple meanings are often immediately activated, even though one meaning is clearly implied by the context (e.g. *He dug in the garden with the spade*). However, within half a second, only the contextually appropriate meaning (e.g. the garden tool rather than the playing card meaning of *spade*) remains activated. Gernsbacher and Faust (1991b) found that the contextually inappropriate meanings do not become less activated through the mechanism of competitive inhibition (i.e. the contextually inappropriate meanings do not decrease in activation simply because the contextually appropriate meanings increase, as in a see-saw effect). The contextually inappropriate meanings also do not become less activated simply because they decay (Gernsbacher and Faust, 1991b). Instead, inappropriate meanings become less activated through an active dampening of activation (Faust and Gernsbacher, 1996); these meanings are suppressed by signals transmitted by memory nodes representing the semantic, pragmatic, and syntactic context (Gernsbacher and St John, in press).

Gernsbacher and her colleagues have also discovered the role that a general cognitive mechanism of suppression plays in other comprehension phenomena. These include, anaphoric reference (how comprehenders understand to whom or what anaphors refer; Foertsch and Gernsbacher, 1994; Gernsbacher, 1989;

Garnham et al., 1996); cataphoric reference (how words that are marked by devices, such as spoken stress, gain a privileged status in comprehenders' memories; Gernsbacher and Jescheniak, 1995; Gernsbacher and Shroyer, 1989); and metaphor interpretation (how we understand figurative expressions such as 'lawyers are sharks'; Gernsbacher et al., in press).

These three general cognitive processes (laying a foundation, mapping, and shifting) and the two general cognitive mechanisms (suppression and enhancement) appear critical to effective comprehension; when they are lacking, comprehension suffers. Individuals who are less skilled at comprehension exhibit impairments in structure building (Gernsbacher, 1990). For example, less-skilled comprehenders have less-efficient suppression mechanisms (Gernsbacher and Faust, 1991a; Gernsbacher, 1993; Gernsbacher and Robertson, 1995). More specifically, less-skilled comprehenders are less able to suppress inappropriate information such as the contextually inappropriate meanings of ambiguous words (e.g. the playing card meaning of *spade* in the sentence, *He dug in the garden with the spade*; Gernsbacher et al., 1990). Less-skilled comprehenders are also less able to suppress the incorrect forms of homophones (e.g. the word *rose* when they read *rows*) and are less able to suppress the typical-but-absent members of visual scenes (e.g. a picture of a *tractor* in a farm scene; Gernsbacher and Faust, 1991a). Less-skilled comprehenders are also less able to ignore words superimposed on pictures or pictures surrounding words in comparison to more skilled comprehenders (Gernsbacher and Faust, 1991a). However, less-skilled comprehenders are not less appreciative of context; in fact, they often activate contextually appropriate information more strongly than do more-skilled comprehenders. Therefore, the suppression mechanisms, but not the enhancement mechanisms, of less-skilled comprehenders have been demonstrated to be less efficient than those of more skilled comprehenders. Less-skilled comprehension may be additionally characterized by a greater tendency toward shifting (Gernsbacher et al., 1990), which could be related to an inefficient suppression mechanism. Because inappropriate information cannot be easily mapped onto an existing substructure, its activation could trigger the development of a new substructure, leading to an increased amount of shifting and poorer access to previously comprehended information.

Structure building impairments in schizophrenia

We shall argue here that the Structure Building Framework can be used to describe the disordered discourse exhibited by many individuals with schizophrenia. For example, just as non-schizophrenic less-skilled comprehenders appear less able to suppress irrelevant information (Gernsbacher, 1993), so too are some individuals with schizophrenia. The difference between groups may be only of degree, with the impairments in certain components of structure building in schizophrenia at the extreme end of a continuum, and the more efficacious structure building skills of more-skilled comprehenders at the opposite end. In the fol-

lowing sections, we describe how some of the previously observed features of disordered discourse in schizophrenia can be explained in terms of the Structure Building Framework.

SUPPRESSION AND ENHANCEMENT

Some aspects of disordered discourse in schizophrenia can be explained in terms of structure building deficits in the mechanisms of suppression or enhancement. For example, Chaika (1982) proposed that individuals with schizophrenia often commit errors in which they stray from 'normal path control' while speaking. According to Chaika (1982), normal path control consists of purposeful discourse moving toward an end goal; in the disordered discourse of schizophrenics the discourse often loses its purpose. Chaika (1982) claimed that the disordered discourse of schizophrenics often did not reach its end goal because of 'grammatical errors'. These errors include neologisms, the use of an incorrect word based on intended meaning, glossomania (i.e. words inappropriate to the discourse topic), errors of intrusion, perseveration, and word salad (Chaika, 1982). We argue that these errors – rather than reflecting grammatical or even language-specific impairments – may arise from an inefficient suppression mechanism. Perhaps schizophrenic speakers are unable to suppress a previously spoken word or topic or a competitor word or topic (a word or topic that 'comes to mind' during discourse production).

Support for our proposal comes from a study by Allen et al. (1993) in which schizophrenics with disordered discourse performed abnormally on a task of categorical verbal fluency: they responded with items that were inappropriate to the category and exhibited less clustering of items compared to controls and schizophrenics with impoverished features. The generation of inappropriate responses suggests a failure to suppress intrusive or irrelevant information. In contrast, however, the lack of semantic (categorical) clustering suggests against an over-active enhancement mechanism. In the latter case one would expect hyper-activation of semantically related information, and, therefore, tighter categorical clustering.

Inefficient suppression could also account for the differences in pausing found in schizophrenics' disordered discourse. Spitzer et al. (1994) studied the characteristics of pauses in the spontaneous discourse of (1) schizophrenics who exhibit disordered discourse; (2) schizophrenics who do not exhibit disordered discourse; and (3) non-schizophrenic controls when describing a picture. Controls and schizophrenics who do not exhibit disordered discourse produced longer pauses before nouns that were unrelated to the previous context and shorter pauses before nouns that were related to the previous context. In contrast, schizophrenics who produce disordered discourse exhibited the same pause durations before nouns regardless of whether they were related to the previous context or not. Although Spitzer et al. (1994) explained this finding in terms of spreading activation, an impairment in the structure building mechanism of suppression, as well as the process of shifting, could account for these results. When producing

discourse, individuals may need to pause longer before producing nouns unrelated to previous context because they need to suppress the previous context; it has now become irrelevant. They also need to shift to initiate a new substructure. However, thought-disordered schizophrenics may not be able to suppress the previous (now unrelated) information and would therefore pause the same amount regardless of whether a noun was related or unrelated to context.

Inefficient suppression could also explain the 'strong meaning response bias' frequently found in schizophrenia (Chapman et al., 1964, 1976; Strauss, 1975). Given a task in which a strong or weak meaning is put into a discourse context, and subjects are asked to identify the meaning, schizophrenic speakers are more likely to choose the strong meaning (the more dominant, more frequent meaning) even when the weak (less dominant, less frequent) meaning is more appropriate. For example, when given the sentence, *When the farmer bought a herd of cattle, he needed a new pen*, and asked to choose whether that sentence means that (a) the farmer needed a new writing implement (strong meaning); (b) the farmer needed a new fenced enclosure (weak meaning); or (c) the farmer needed a new pick-up truck (irrelevant meaning), schizophrenics with disordered discourse are more likely to choose the strong, but inappropriate, meaning (i.e. response (a) rather than the correct, but weak, meaning (i.e. response (b)). This dominant response bias in schizophrenia could be explained in terms of an inefficient suppression mechanism: schizophrenics are unable to suppress the experientially more frequent but contextually less relevant meaning of the word 'pen'. Perhaps also the strong meaning response bias exhibited by schizophrenics is due to an overactive enhancement mechanism. The strong meaning is selected because it is hyper-activated in schizophrenics' network of memory nodes. Without empirical research, we are unable to rule out this possibility, although our research with less-skilled comprehenders suggest that inefficient suppression rather than hyperactive enhancement contributes to their inability to quickly select a contextually appropriate meaning.

The perseverations produced in schizophrenics' disordered discourse may also be due to impaired suppression mechanisms. Consider the following task used by Cohen (1978). Subjects are asked to describe pairs of colored disks; one disk is the target, the other is the non-target. An example of a simple trial is when the target is red and the non-target is blue; a difficult trial would be a blue disk and a blue-green disk. The disk pairs became increasingly similar in color hue as the task progresses and, in order to communicate effectively, subjects must engage in more self-editing to make their message more referentially explicit. Cohen (1978) found that non-schizophrenic speakers edited their descriptions based on the similarity between the target and the non-target. In contrast, schizophrenics often engaged in 'perseverative chaining': they continued describing a subsequently presented disk as they had described a previously presented disk. Thus, as this task became more difficult, the responses of the schizophrenic subjects became less related to the description of the disks. Although the initial responses of schizophrenics were similar to those of non-schizophrenics, subsequent responses

were related more to words at the beginnings of their descriptions than to the target. We suggest that in order to perform this task correctly, one must suppress prior responses, and schizophrenic subjects have difficulty suppressing previous targets.

A review of some of the previous research on the disordered discourse of schizophrenics suggests that many of their discourse disturbances could be explained in terms of deficits in the structure-building mechanism of suppression. Irrelevant information may remain activated longer in this group's network of memory nodes, contributing to the production of disordered discourse features such as disorganized speech. We also raise the hypothesis that their enhancement mechanisms might be faulty, namely over-active, but we await further empirical research to support this hypothesis.

LAYING A FOUNDATION

According to the Structure Building Framework, the first step of comprehending a clause, sentence, or passage is to lay a foundation for the mental structure that represents that clause, sentence, or passage. A faulty foundation-laying process may account for additional features of disordered discourse in schizophrenia, often attributed to other impairments. For example, Rochester and Martin (1979) reported that schizophrenics with disordered discourse differ from non-schizophrenics in their use of referents. In their study of narrative production, schizophrenics with disordered discourse used Generic Reference groups (i.e. reference groups that refer to a set-whole membership, e.g. *athletics*) less frequently than both non-schizophrenics and schizophrenics who do not exhibit disordered discourse. In fact, rather than refer back to a Generic Reference group given as a topic for narration, schizophrenics occasionally introduced new Generic Reference groups in their discourse. For example, when instructed to speak on the topic of the effects of athletics on universities, schizophrenics with disordered discourse might have begun to speak of furniture – an unrelated, but generic topic – instead. In this study, schizophrenics with disordered discourse may not have used Generic Reference groups as frequently because the reference groups were part of an initial foundation that these individuals have difficulty forming. This proposed lack of a proper foundation may also be why these subjects introduced new referents instead of referring back to referents given as a topic.

Rochester and Martin (1979) found that schizophrenics who exhibit disordered discourse did not differ from schizophrenics who do not exhibit disordered discourse or controls in their use of Generalized Reference Groups that non-specifically referred to a participant in text, for example, 'one' in the sentence, *One can never predict what the future will bring*. We suggest that because this referent is nonspecific, the proper laying of a foundation is not necessary for its use in discourse. When describing narratives and cartoons, schizophrenics with disordered discourse also did not differ in their use of Noninitiating Reference Groups (i.e. referents that introduce specific participants but fail to provide referents for additional groups) but they *underused* Initiating Reference Groups (i.e. reference

groups that present an initial participant and subsequently provide referents for additional groups). For example, in the sentence, *The children planted tulips today, but tomorrow the children will plant roses*, the noun phrase, 'the children' is an initiating referent, and 'tulips' and 'roses' are noninitiating referents. Because Initiating Reference Groups provide a foundation for subsequent referent identification, schizophrenics who exhibit disordered discourse may have underused these referents because they experience difficulty forming an initial foundation. Since Noninitiating and Generalized Reference Groups are not linked to referents in this way, the referent introduced is not used as part of the initial foundation. Schizophrenics with disordered discourse should therefore, according to our explanation, perform normally on tasks that involve the use of these nonspecific reference groups.

The differential use of referents by schizophrenics with disordered discourse, which we attribute to impairments in laying a foundation, is affected by distraction. Hotchkiss and Harvey (1990) compared the discourse production of groups of schizophrenic, manic, and control subjects while manipulating their level of distraction. Subjects were presented with audiotaped white noise, random noise, or text while engaged in a conversation with the experimenter. In contrast to the manic and control groups, schizophrenic subjects produced significantly more unclear and ambiguous references in their discourse during a distraction condition compared to a condition in which no distraction occurred (Hotchkiss and Harvey, 1990). Although the authors interpreted this finding as a failure for schizophrenics to communicate properly during sensory overload (Hotchkiss and Harvey, 1990), these results could also be explained in terms of the Structure Building Framework. The presence of distraction could have affected the ability to lay an initial foundation, which would have increased the schizophrenics' likelihood of later using unclear or vague referents in discourse.

MAPPING AND SHIFTING

Certain features of disordered discourse in schizophrenia can also be explained in terms of the processes of mapping and shifting, which, once a foundation is laid, are the general cognitive processes that enable a coherent representational structure to be built. Morice and McNicol (1985) presented schizophrenic, non-schizophrenic, and manic subjects with a modified version of the Token Test. In the usual administration of the Token Test, subjects are given oral commands for arranging a set of small plastic tokens that vary in color, shape, and size; as the test progresses, the complexity of the commands increases. In Morice and McNicol's (1985) modified version, the tokens were arranged for the subjects, and the subjects' task was to describe the arrangement. Because the arrangements became more complex as the test progressed, the discourse describing the arrangements should have become progressively more complex. However, the sentences produced by the schizophrenic group were less coherent and less syntactically complex (i.e. lower depth of clausal embedding and less use of reduced relative clauses) than those of the manic and control groups. Perhaps the schizo-

phrenic subjects were shifting too often. As Gernsbacher (1985) demonstrated, once a processing shift has occurred, information represented in the previous substructure becomes less available. The presence of too much shifting could result in the production of discourse that does not cohere with previous information and lacks complex clausal structure.

In addition to shifting too frequently, schizophrenics who exhibit disordered discourse might take longer to complete the shifting process. In a study by Rochester and Martin (1979), schizophrenics and non-schizophrenic controls engaged in verbal communication tasks that involved describing and interpreting a cartoon, taking part in an interview, and discussing a narrative. Schizophrenics' and controls' pauses between clauses (at clause boundaries) differed, with schizophrenics producing longer pauses at clause boundaries compared to controls, but their pauses within clauses did not. If schizophrenics have more difficulty shifting between building one substructure to represent one clause and initiating another, they may pause longer at clause boundaries but not within clauses. The tendency for schizophrenics to pause longer at clause boundaries may also be tied to an inability to suppress previous information. If information from previous clauses is interfering, schizophrenics who exhibit disordered discourse may need more time to suppress this irrelevant information in order to continue with subsequent discourse.

Impoverished disordered discourse

Recall that schizophrenia researchers distinguish between what they call positive (and what we have termed 'verbose') and negative ('impoverished') disordered discourse. Impoverished disordered discourse may reflect different types of structure-building impairments than those manifested by verbose disordered discourse. Barch and Berenbaum (1997) found that decreased verbosity in schizophrenics' discourse was significantly correlated with greater pausing. It is interesting to note where these pauses occur. As we described earlier, schizophrenics who exhibit verbose disordered discourse pause more at clause boundaries; we interpreted that result to suggest difficulty with the cognitive process of shifting. Schizophrenics who exhibit impoverished disordered discourse – in particular, those who are characterized by alogia (i.e. decreased speech production and flat affect) – pause more within clauses. Indeed, Alpert et al. (1994) reported that the duration of within-clause pauses was the strongest predictor of alogia in schizophrenic subjects. A preliminary explanation (greatly in need of further empirical hypothesis testing) is that schizophrenics who exhibit verbose disordered discourse are impaired in their ability to shift from building one substructure to another (hence the greater pauses at clause boundaries), whereas schizophrenics who exhibit impoverished disordered discourse are impaired in their ability to map onto a developing substructure (hence the greater pauses within clauses).

Schizophrenics who exhibit impoverished disordered discourse may also be

impaired in their ability to enhance relevant information. Allen et al. (1993) found that schizophrenics with impoverished disordered discourse features retrieved fewer words on a categorical verbal fluency task compared to schizophrenics with verbose features. Recall that, as we have described, schizophrenics who exhibit verbose disordered discourse tend to generate many items on categorical verbal fluency tasks, many of which are inappropriate to the category. We suggested that the abundance of generation observed with schizophrenics with verbose disordered discourse features reflects inefficient suppression mechanisms; in contrast, we suggest that the paucity of generation observed with schizophrenics with impoverished disordered discourse features reflects inefficient enhancement mechanisms. Again, we should caution that these ideas are only speculative and must await further empirical hypothesis testing.

Comprehension difficulties in schizophrenia

Schizophrenics' discourse comprehension abilities are also impaired, in addition to their discourse production abilities, although the former have not been studied as extensively as the latter. The most precise study to date is by Condray et al. (1995), who examined medicated and unmedicated schizophrenic patients in comparison to controls on the Luria–Nebraska Relational Concepts Factor Scale, a measure of language comprehension. Both medicated and nonmedicated schizophrenics showed language comprehension deficits in comparison to controls. The co-presence of discourse comprehension difficulties with discourse production difficulties supports a model of general cognitive processes and mechanisms such as the Structure Building Framework as an explanation for these difficulties. Morice and McNicol (1985) also concluded that schizophrenics exhibit deficits in their ability to comprehend as well as produce complex discourse, with significant correlations between the two areas of discourse processing. These results corroborate Gernsbacher et al.'s (1990) studies with non-schizophrenic college-aged subjects. They found strikingly high correlations between their subjects' ability to comprehend spoken and written language and both skills were highly correlated with the subjects' ability to comprehend nonverbal picture stories.

Although questions exist concerning the extent to which schizophrenics exhibit generalized cognitive deficits (Chapman and Chapman, 1973), the evidence to date suggests that a variety of general cognitive processes and mechanisms may be dysfunctional in the disorder (e.g. Levin et al., 1989; Docherty et al., 1996). The application of the Structure Building Framework as a guide for investigating the cognitive processes and mechanisms that may be involved in schizophrenic disordered discourse could help clarify the nature of these deficits. A recent study by Landre and Taylor (1995) found that schizophrenics who exhibit disordered discourse also exhibit more impairments on a cognitive task of attention compared with schizophrenics who do not exhibit disordered discourse. The degree to which schizophrenics who exhibit disordered discourse are impaired by general cognitive deficits (and possibly more structure-building impairments)

compared with schizophrenics who do not exhibit disordered discourse needs further examination and clarification.

Conclusions

We have argued that the Structure Building Framework (Gernsbacher, 1990), a cognitive model of normative discourse comprehension and production, provides a guideline that can be used to explain the general cognitive processes and mechanisms that are atypical in schizophrenics with disordered discourse. Based on this model, we suggest that schizophrenics who exhibit disordered discourse, in particular those with what is known in the literature as positive features and what we referred to here as verbose features, have inefficient suppression mechanisms (they are less able to suppress the activation of inappropriate or unrelated information), are impaired in laying a foundation (they are less likely to use as a cornerstone the information received first in a discourse), and unparsimoniously tend to shift too often when producing discourse. We also speculated (with considerably less evidence) that schizophrenics who exhibit disordered discourse of the impoverished variety have inefficient enhancement mechanisms (they are less able to enhance the activation of appropriate or related information), and they have difficulty mapping information onto a developing representation to produce coherent discourse.

We should again emphasize that not all people diagnosed as schizophrenic produce disordered discourse, and those who do usually do so only periodically (Schwartz, 1982). The pattern of discourse disturbance seems to change as those with schizophrenia age, with poverty of speech becoming more frequent and disorganized discourse becoming less frequent (Harvey et al., 1997). In addition, persons diagnosed with the clinical syndrome of schizophrenia are not the only individuals to exhibit disordered discourse; other psychopathological groups often exhibit disordered discourse comparable to schizophrenics, particularly persons with symptoms of mania (Andreasen and Grove, 1986). Schizophrenics' disordered discourse is more likely to be marked by incoherence, whereas manics' disordered discourse is more likely to display confabulations (Solovay et al., 1987). More fundamentally, all discourse participants – at one time or another – are likely to say things that may be considered atypical. However, the discourse disturbances of persons with schizophrenia appear to be less reversible than any other group (Andreasen and Grove, 1979).

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