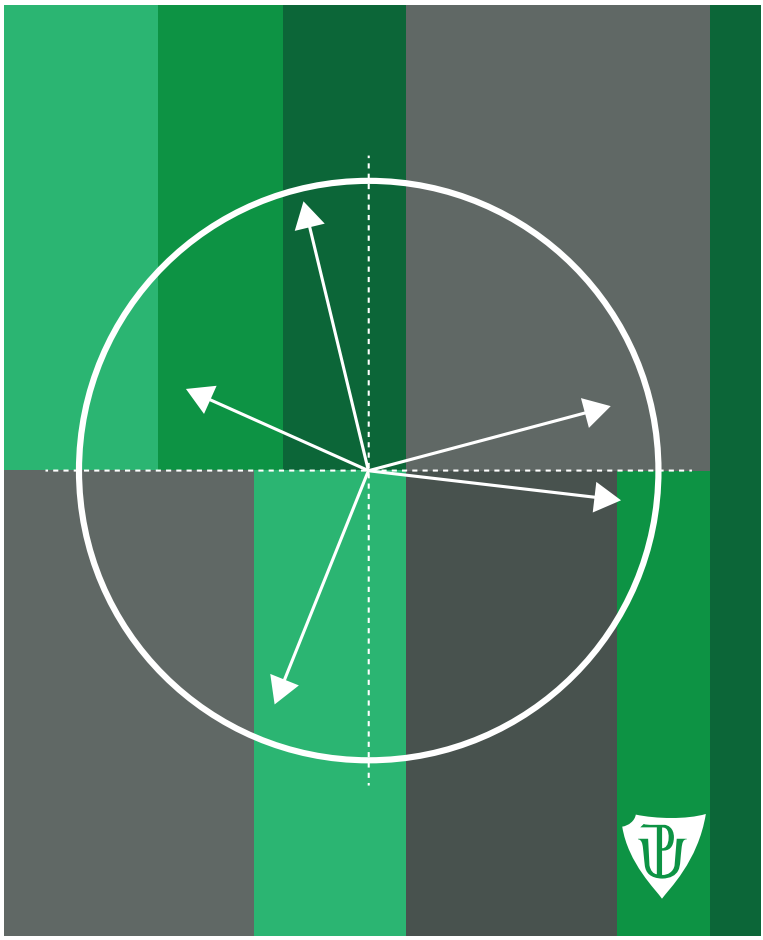
Edited by
Joseph Emonds, Markéta Janebová, and Ludmila Veselovská

Language Use and Linguistic Structure

Proceedings of the Olomouc Linguistics Colloquium 2018



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Language Use and Linguistic Structure

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Joseph Emonds, Markéta Janebová, and Ludmila Veselovská

Pragmatic and Syntactic Recursion of a Person Suffering from Schizoaffective Disorder in His Acute Phase: A Case Study

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Abstract: The paper aims to demonstrate that the occurrences of recursion in narrative and dialogue discourse of a person with schizoaffective disorder, both at the syntactic and pragmatic levels, support known deficits of linguistic functions in an acute phase. The case study describes the language usage of a right-handed male with schizoaffective disorder (bipolar type), in an acute relapse. The analysis can be divided into three major parts. In the first part general cognitive abilities were studied. The second part includes results of sentence-level tasks. And finally, the appearances of recursive structures were examined in spontaneous speech tasks and in an interview. Hypotheses were as follows: we sought to find out whether (1) spontaneous embedding in his speech production is present and, if it is, what pattern it may have. We assumed that (2) the topic will be about himself; his utterances will be characterized by syntactic recursion; while (3) pragmatic recursion will be less apparent.

Keywords: schizophrenia, schizoaffective disorder, language, recursion, embedding

1. Introduction

According to Crow's theory, language and psychosis have a common evolutionary origin (Crow 1997; 2000). Mitchell and Crow (2005) explain that language is linked to both hemispheres. The main linguistic symptoms of schizophrenia could be considered as a disorder of coordination between the two hemispheres. "Recursion" (understood as embedding) may be the one crucial domain-specific feature of linguistic ability (Levinson 2014, 6).

1.1 Schizophrenia

The first and comprehensive description of the disease was given by Emil Kraepelin (1856–1926). He set up a symptomatic criteria system which is also used for today's diagnostic systems (DSM[1] and ICD[2]) (see Bitter and Füredi 2000). According to the DSM-5 (2013), the following criteria of symptoms represent the disease: (1) delusions; (2) hallucinations; (3) incoherent speech; (4) strikingly disintegrated or catatonic behavior; and (5) negative symptoms, i.e. emotional emptiness, alogia, or lack of willingness. The disease is also characterized by social and occupational dysfunctions. An additional important criterion of the disease is the durational aspect: some signs of the disorder must last for a continuous period of at least 6 months. This six-month period must include at least one month of symptoms (or less if treated) that meet criterion A (active phase symptoms) and may include periods of residual symptoms. During residual periods, only negative symptoms may be present (DSM-5 2013).[3]

There are several different ideas for the development of schizophrenia from an etiological point of view: neurochemical, neuroanatomical, psychological and genetic factors may also be present in the background of the disease. Even though numerous studies approached schizophrenia in various ways, specific genetic, neurobiological or environmental factors have not been identified so far. Returning to the former spectrum theory holds promise to outline a possible endophenotype (see Tringer 2010, 305). The presumed endophenotype concept is closely related to Crow's theory, which explains schizophrenia on the evolutionary side: "schizophrenia is the price that homo sapiens pays for language" (Crow 2000, 118). He assumed that the underlying reason

1 DSM= **D**iagnostic and **S**tatistical **M**anual of Mental Disorders.

2 ICD: **I**nternational Statistical **C**lassification of **D**iseases and Related Health Problems.

3 DSM-5 is commonly used in clinical researches worldwide, however, ICD codes are also widely used for medical statistics and health record systems. Most of the tests used in clinical research, such as SCID-I and -II (Structured Clinical Interview for DSM-5) or PANSS (Positive and Negative Syndrome Scale), are all based on DSM-5 interview and diagnostic criteria system. The DSM-5 and ICD-10 classifications are in harmony with each other; those are complementary, rather than exclusive.

for the "preservation of schizophrenia", as a possible point of connection, may be the genetic changes that cause lateralization. Kéri and Janka (2003, 731) summarize Crow's approach as follows:

> It is accepted by many that a significant proportion of lexical, semantic, and pragmatic aspects of the language is linked to the left temporal areas. The right side of these left temporal areas are thicker in the majority of the population. This asymmetry in schizophrenia is often lacking, and the corpus callosum, which connects the two hemispheres, has also been reported to have differences compared to the brains of healthy people.[4]

In our case study, we analyzed the results of a person with – according to his last diagnosis – schizoaffective disorder. In accordance with basic findings (cf. Tringer 2010, 317–20), schizoaffective psychoses are psychotic states situated somewhere between the various types of schizophrenia and affective disorders, which, according to their classification, more closely resemble affective disorders. Pursuant to Tringer's summary, schizoaffective psychoses "absorb" the symptoms of schizophrenia, but the progression has characteristics similar to affective psychoses. Any mix of symptoms may occur. Diagnostic criteria rely on the existence of typical symptoms of schizophrenia in addition to severe depression and mania symptoms (Tringer 2010; Nussbaum 2013; Bitter and Füredi 2000). The behavior of affected people is seriously disorganized, symptoms often develop in a day or two. As it is a "mixed disease", we can talk about depressive and manic type of schizoaffective disorder (based on Tringer 2010, Nussbaum 2013).

1.2 Language and Thought Disorders

Thought disorders were divided by Cutting and Murphy into two categories: internal thinking disorders, and language and speech disorders. (Lieberman et al. 2006, 205) There are several types of thought disorders: *derailment* and *incoherence* (where the logical relations are violated or lost between words and sentences in the patient's speech); *tangentiality* (gradually moving away from the topic); *illogicality* (illogical answers); *circumstantiality* (unnecessarily details); in addition, a very characteristic symptom may be the so-called *clanging* (rhythm association) phenomenon.[5] Another significant symptom could be the using of *neologisms*. Abstract thinking may also become difficult, in addition *echolalia* or *thought block*, or even (in extreme cases) *mutism* can develop (Lieberman et al. 2006, 207–8).

4 Translated by Anita Bagi.

5 An example of clanging: "He went in entry in trying tying sighing dying ding-dong dangles dashing dancing ding-a-ling!" (Grinnel 2018).

Besides, the first and perhaps most striking symptom of schizophrenic language is *contextual disorder*. Contextual sensitivity can be described by word-recall and memory tasks. Schizophrenic patients provide better performance in semantic word study tasks compared to recall tasks of unrelated words. It can be assumed that it is not the disorders of lexical systems that cause the language deficit, but rather the disorders of imprinting strategies. (Lieberman et al. 2006, 206).

Covington et al. (2005) summarizes works about schizophrenia and language, which are sometimes quite contradictory. In prosody deviations from the healthy control groups can be detected: on supra-segmental levels intonational differences can be detected; additionally, lack of tone and intonation may appear as a negative symptom.

From the aspect of speech production on the one hand, spontaneous speech tasks examined the complexity of communicated thoughts. It was found that the message communicated by people with schizophrenia is less complex than that of the healthy controls, but in the case of patients with better performance, there were higher involvement with depression and anxiety disorders (Moe et al. 2015). On the other hand, the above-mentioned prosodic abnormalities and possible characteristics were investigated (Bedwell et al. 2014; Martínez-Sánchez et al. 2015; Elvevag et al. 2010), as well as fluency and disfluency of speech, i.e. quality and rate of the silent and filled pauses (Alpert et al. 1997; Rapcan et al. 2010).

From the perspective of speech perception, the social cognition of people with schizophrenia is an interesting direction of research: subjects were asked to make decisions about utterances with different emotional prosodies, and they performed worse than the healthy controls (Brazo et al. 2014).

The involvement of morphology is not characteristic, Covington et al. (2005, 90) cite examples from Chaika and Kleist. The syntax is intact, but semantics and the structure of discourse might be violated. Other authors, however, found differences in syntactic complexity: subjects with schizophrenia had worse results in comparison with the healthy control group (Meilijson et al. 2010). Perlini et al. (2012) also found a mild deviation between bipolar and schizophrenic patients in the aspects of speech tempo, local and global cohesion elements. Andor (2016) wrote about the status of the keyword (or the lack of it) in Hungarian. One of the most striking disorders occur at the level of pragmatics: “strange words in strange context” (cf. Nagels-Kircher 2016; Noonan 2014).

Garab (2007) summarized linguistic-based examinations of the executive functions, but these studies do not primarily approach the results from the field of linguistics. The importance of prefrontal cortex and thus the importance of executive functions, and the deficits of pragmatic abilities can also be observed in patients with right hemisphere injuries (cf. Tóth–Ivaskó 2012).

In present case study, the results of a person with schizoaffective disorder were analyzed. Due to the mixed symptoms of the diagnosis, we should also describe the

language symptoms that may appear alongside the possible language manifestations of schizophrenia. Schizoaffective disorder is between schizophrenia and affective disorders (see above Section 1.1), therefore, it can add the symptoms of bipolar disorder as well (Tringer 2010).

Bipolar disorders generally have two distinct states: depression and mania. Frequency is equally around 1% in both sexes; it manifests around the age of 30 (Tringer 2010, 265). It can be classified into three types: bipolar disorders I and II and cyclothymia. According to the duality of the disorder, depressive and manic main symptom groups could be distinguished (Tringer 2010, based on Nussbaum 2013).

The characteristics of the depressive symptom group are as follows. Mood disturbances can range from mild discomfort to deep vital depression. The patients' gestures become poorer or completely disappear; their speech is quiet, slowed down, perhaps it is just one word. Along with it, thinking also slows down, the patient is unable to discard a particular topic or incapable of making decision. An early symptom may be a distraction of attention and concentration: it is reported by those concerned that if they try to read, only "their eyes read". The person becomes tired and often becomes completely incapacitated. In severe depression, psychotic symptoms can also occur, such as hallucinations and delusions (based on Tringer 2010 and Nussbaum 2013).

The features of the manic symptom group are as follows. The abnormal elevation of the mood level can range from the cheerfulness to the ecstatic delight. The patient's attention is hyperprosex: it grabs every tiny detail, but does not bind it permanently. Thinking and associations are accelerating, sometimes there is racing thought, and this is reflected in the secondary incoherence of speech. The manic patient is characterized by logorrhea, the speech is often uninterrupted, in which the goal is difficult to recognize, and other times frequent and difficult to follow topic changes. There may also be sound associations in mania as well (Tringer 2010).

Articulatory movements of a depressed patient slow down – this is reflected by the speech rate, while in the case of a manic patient we see an acceleration. In addition, prolonged recall time has also been shown for words with repressed emotional content – presumably because of inhibition (Gősi-Greguss et al. 2004, cited by Gósy 2005, 339). Increasing the duration of vowels is frequent, while speech is quiet and weak, and the prosody is poor for an anxious person (Gósy 2005, 339). The linguistic characteristics of bipolar disorder are also twofold due to the two groups of symptoms: both in terms of quantity and quality of speech; from the speech rate to the differences in theory of mind result (Simon et al. 2011).

1.3 Recursion

"Beginning with Bar-Hill (1953), countless studies have argued that recursion is the tool that allows people to create a potentially infinite number of different sentences"

(cited by Bánréti and Mészáros, 2011, 9).[6] However, it can be seen that the various scientific fields provide different definitions of the concept of recursion. In our study, beside the definition of syntactically embedded recursion, the following recursion concepts will be used.

The present study used a method of Bánréti et al. (2011). Their concept of specific recursion is based on Chomsky's (1957) approach, according to which "computational operations of language recursively construct syntactic objects from the selected lexical units and the syntactic objects which had already been formed." (Bánréti and Mészáros 2011, 9.) Syntactic objects (language expressions) can be interpreted as combinations of smaller syntactic objects.

> Such a recursion in terms of hierarchical grouping allows the concept of specific recursion: repeatedly embedding a syntactic-structural component into the same type of structural component, for example a clause into a clause, a noun phrase into a noun phrase or detection of a word as a component in a compound word. … This recursion concept does not contain regulations to the amount of operations, using a previous output as an input once is just as much a recursive operation as if (in principle) it was repeated infinitely.[7]

Thus, structural (formal) recursivity can appear on the level of words, phrases and also on the levels of sentences. According to Hauser, Chomsky and Fitch (2002), the recursive nature of syntax is the only feature of language that is domain-specific, and this is responsible for the species-unique character of human language. Levinson, however, emphasizes the use of language instead of the linguistic structure (2014, 3). An important consequence of it is that he examines its role in understanding. The capacity for understanding central embedding, as a kind of recursion, is finite in sentences. Even degree 3 (embedding within an embedding within an embedding) is difficult to follow (e.g. Karlsson 2007). It can be assumed for longer spoken language utterances (narratives) that final embeddings are more frequent: the right-branching

6 Translated by Anita Bagi. In Hungarian: "Bar-Hilleltől (1953) kezdődően számtalan tanulmány érvelt amellett, hogy a rekurzió az az eszköz, amely lehetővé teszi, hogy az emberek potenciálisan végtelen számú, különböző mondatot hozzanak létre."

7 Translated by Anita Bagi. In Hungarian: "az ilyen hierarchikus csoportosítás értelmében vett rekurzió megengedi a specifikus rekurzió fogalmát: egy szintaktikai-szerkezeti összetevő ismételhető beágyazását azonos típusú szerkezeti összetevőbe, például tagmondat beágyazását egy tagmondatba, főnévi szerkezet beágyazását egy főnévi szerkezetbe vagy egy szó komponenseként való azonosítását egy összetett szóban. . . . E rekurziófogalom nem tartalmaz a műveletek mennyiségére előírást, a korábbi outputnak inputként történő felhasználása egy alkalommal éppen úgy rekurzív művelet, mintha (elvileg) végtelen sokszor ismétlődne."

structures characterize spontaneous speech, while central embeddings characterize pre-conceived, consciously edited speech, or written text.

The narrative is a "mental model" the defining property of which is its unique pattern of events over time (Bruner 1991, 6): it reveals the patterns that characterize the speakers themselves. Narrative and descriptive texts can also be considered as representation of narratives – assuming that the character of the text the speaker creates reflects the available presets, scripts and macrostructures.

In interactive discourse just as in narratives the basic units are utterances, not sentences. "There are embeddings in interactive discourse that have the same basic properties exhibited in sentential syntax, but that are distributed over two (or more speakers). But in this case there is no parallel limit on embedding – multiple embeddings seem in principle indefinite, certainly at least to degree 6" (Levinson 2013, 154). The ability to plan and execute common activities is the background for dialogues and speech acts (which are creating them), so it can be assumed that "mental time travel" supports the recursive nature of language (Corballis 2012; 2014, 27).

2. Materials and Methods

The study was approved by the Ethics Committee of the University of Szeged, and it was conducted in accordance with the Declaration of Helsinki.

2.1 Subject

The subject of the case study is BT. His latest diagnosis was schizoaffective disorder, bipolar type – at the end of an acute relapse. At the time of the examination (July 4–13, 2017), his age was 30 years, right handed, his education in years was 18. His previous diagnoses were the following: 2005: F2.380 other acute and temporary psychotic disorders; 2007: F20.00 paranoid schizophrenia; 2012: F20.90 unspecified schizophrenia + F31.00 bipolar affective disorder, hypomanic episode; earlier in 2017: F20.00 paranoid schizophrenia.[8]

His premorbid personality is in the upper zone of average intelligence; graduated as a social worker; open and friendly. First prodromal signs were at his age of 18: there was a short, just a few weeks long behavioral change during and after the stork camp.

His first psychotic episode (FEP) was at the age of 18. It had a fast progression with psychotic transition in a few days (provoked by a slight alcohol consumption). Leading symptoms were as follows: attention distractivity, conceptual disorganization, grandiosity, paranoid behavior, bizarre and destructive behavior, ambivalence, ambitendence, indifference and puerile behavior. His first psychiatric hospitalization was relatively short (2.5 weeks) with rapid therapeutic response (Risperidone 4 mg/day).

About psychotic relapses: FEP was followed by 3 other relapses (with 4 hospitalizations:

8 ICD-10-codes from *International classification of diseases*.

- Episode 2 (drug omission): at age 20 (2 weeks of hospitalization, Risperidone 6 mg/day)
- Episode 3 (with maintenance therapy): at age 25 (2.5 and 3.5 weeks of hospitalization, Risperidone Consta 37.5 mg/2 weeks + Risperidone 1 mg/day followed by Risperidone Consta 50 mg/2 weeks after second hospitalization) Risperidone 6 mg/day + Valproate 1000 mg/day)
- 5-year compensated period (Paliperidone worked well after Risperidone; the cause of change is unknown; Aripiprazole had not been switched on, soon after changing episode 4 happened – cause of change is unknown)
- Episode 4 (in connection with drug change): at age 30 (3 weeks of acute hospitalization followed by rehabilitation hospitalization; Paliperidone Depot 150 mg/4 weeks + Paliperidone 9 mg/day)

Developmental data: There was no perinatal injury (Chernobyl catastrophe preceded the conception by 3.5 months that the family had allowed). There was no cranial trauma with unconsciousness (in his childhood he hit his eye area on a smoking table, sometimes he knocked his head against the wall slightly). There was no psychosocial traumatization (at the age of 11 he lost his favorite horse).

Symptom pattern during acute psychotic and affective episodes: conscious functions leading to disintegration, once accelerated psychomotor system, no hallucination (perhaps once), attention slightly hypotenax, thinking content with megalomaniac ideas, overvaluation, sometimes with the deficit of reality testing, usually state-dependent anozognosis, usually euthymia-like mood level, but also parathym excited or calm, emotionally generally available. Mixed insomnia. His behavior is rejectional or uncritical and irritating, or trying to follow conventions.

Therapy:

- effective: Risperidone and Paliperidone
- ineffective: Aripiprazole
- current therapy: Xeplion (paliperidone) 150mg/4 weeks; Invega (paliperidone) 9mg/day; Nebivolol 5mg/day; Covercard (peridnopril/amlodipine) 5/10mg/day; Coverex AS Komb (peridnodpril/indapamide) 10/2.5mg/day

His social status is permanently compensated, has a good quality of life, worked in his own profession as a social worker, and lives with his parents.

Somatic history: laparoscopic knee surgery, tonsil surgery, hypertension.

Family psychiatric history: maternal grandmother maybe has dementia; aunt has depression; grandfather is a regular drinker and grandfather's brother hanged himself.

Stimulants: smoking for 10 years, alcohol occasionally, cannabis (twice in his life)

At the time of the examination: only moderate positive symptoms including conceptual disorganization and excitement; the negative symptoms also include a cognitive symptom, namely the lack of abstract thinking. Negative symptoms are mild. Mood is slightly hypomanic with a mix of minimal depressive symptoms (grandiosity is only indicated). His insight is now relatively well preserved. Functionally moderately damaged, weak. Cognitive performance and level of functioning are basically determined by leading conceptual disorganization.

2.2 Methods

The tests were taken at the Department of Psychiatry, University of Szeged, Szeged. The present study was achieved as part of an interdisciplinary research project.[9] There is a separate research room at the Department of Psychiatry, where all the paper and computer tasks were carried out. Results were archived on paper, computer outputs and sound recordings.

2.2.1 Testing Cognitive Functions and Working Memory Components

The following tests were carried out to measure different cognitive functions and working memory components.

Test	Tested function or working memory component
Mini Mental State Examination (= MMSE; Folstein et al. 1975) + Clock Drawing Task (= CDT; in Hungarian Kálmán et al. 1995)	General cognitive condition testing
Fluency tasks: letter, semantic, action naming (Tánczos 2012); Backward digit span (Racsmány et al. 2005), Listening span (Janacsek et al. 2009), Stroop test (based on Stroop 1935), SRT-test (Nissen & Bullemer 1987)	Executive functions, complex verbal working memory
Non-word repetition (Racsmány et al. 2005); Digit span (Racsmány et al. 2005)	Phonological short-term memory
ToM-tests (Herold et al. 2004), False belief (Youmains & Bourgeois 2010)	Theory of Mind abilities
Metaphor and irony comprehension (based on Herold et al. 2002a, 2002b); Pragmatic test (based on Varga 2015)	Pragmatic competence

9 This research was supported by the EU-funded Hungarian grant EFOP-3.6.1-16-2016-00008. The research was carried out within the Prevention of Mental Illnesses Interdisciplinary Research Group, University of Szeged, Szeged, Hungary

Test	Tested function or working memory component
Syntactic recursion (Bánréti et al. 2016)	Recursions
Spontaneous speech task	Semantic structure
Wisconsin Card Sorting Test (Grant & Berg 1948)	Behavioral and cognitive flexibility
Directed forgetting and remembering (Racsmány & Szendi 2001)	Inhibition and memory systems
Raven's Progressive Matrices (Raven 1938)	Fluid intelligence
Visual Pattern Test (Sala et al. 1997)	Visual short-term memory

Table 1. Recorded tests and tasks for cognitive functions or working memory components

2.2.1 Syntactic Recursion

The syntactic recursion test is a method for testing the syntactic-structural recursion (Bánréti and Mészáros 2011; Bánréti et al. 2016), in which photos of everyday life are shown to subjects and questions are asked about the pictures (154 images; based on Stark 1998). The test operates with four different types of questions, which are all required answers with defined syntactic structures. The question types are summarized in Table 2.

Types of questions	1: What is X doing?	2: What does X hate/like/want?	3: What can be the most entertaining/unpleasant/urgent thing for X to do?	4: What can X say / think / remind Y of / ask Y to do?
Structurally required answers	finite verb; inflected noun phrase or sentence	a subordinate clause in direct object role (with recursive operation); the verb of the question and its infinitival direct object; a definite noun phrase in the accusative	a subordinate clause in subject role (with recursive operation); a bare infinitive subject; a definite noun phrase in the nominative	a clause embedded (with recursive operation) signaled by a subordinating conjunction

Table 2. Types of question and structurally required answers

2.2.2 Pragmatic Recursion

Among the aspects of pragmatic recursion appearances of recursive structures were examined in spontaneous speech tasks and in an interview. The spontaneous speech task and the interview were analyzed as a record and as a prepared transcription as well.

3. Results and Discussion

In the next chapter results will be presented. They are divided into three main parts, i.e. the mapping of general cognitive abilities, measuring of syntactic recursion and the analysis of narratives and discourses.

3.1 General Cognitive Results

The subject showed the following symptoms during the examination: among moderate positive symptoms only conceptual disorganization and excitement were detected; among negative symptoms as another cognitive symptom, the lack of abstract thinking was appreciable – however, negative symptoms were mild. His mood was mildly hypomanic, with minimal depressive symptoms (grandiosity was only indicated). His acceptance of disease was relatively well preserved. His functionalization was moderately impaired and weak.

The results of the Wisconsin Card Sorting Test showed that his cognitive performance and the functional level were basically determined and limited by the leading conceptual disorganization. From the results of the directed forgetting and remembering tasks we can conclude that there was no directed forgetting effect either in case of free recall or with stimuli. Judging by Stroop Test, it appears that he was slower (according to RT [= Reaction Time]) in an incongruent set, compared to a neutral/congruent (Figure 1) one, but it could not be supported by a t-test since the data was noisy.

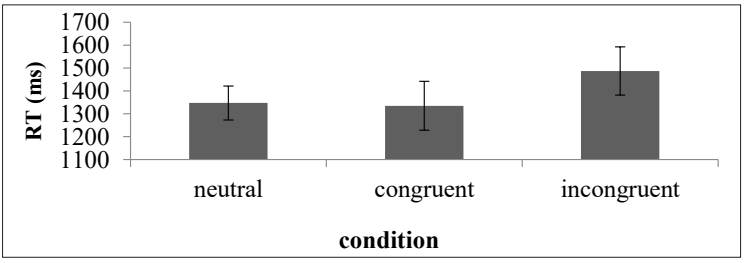

Figure 1. Results of the Stroop test

There was no sequence learning in the ASRT task, either on the t-test, accuracy or RT indicators (= reaction time) (Figure 2). From these results, it can be concluded that he responded equally to the pattern and random stimuli. Only a general acceleration can be observed in the reaction time.

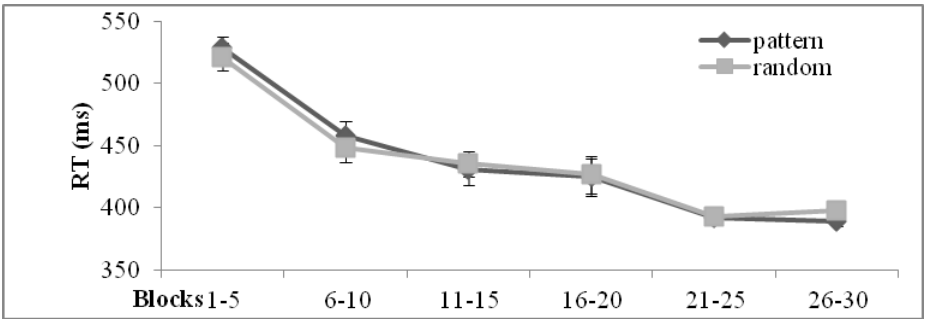

Figure 2. Results of the ASRT test

The results of further tests are shown in Table 3. His intelligence according to the Raven test is in the normal range. The VPT test measures short-term visual memory, on which he scored slightly low. The MMSE and CDT values are good. The results of measuring phonological short-term memory, digit span and non-word repetition tasks are within the normal range. The result of the listening span test (which measures complex working memory) is low.

Tests	Values
Raven	IQ: 102
VPT	7
MMSE (max. 30 p.)	30
CDT (max. 10 p.)	9
Non-word repetition (max. 9 p.)	7
Digit span (max. 9 p.)	5
Backward digit span (max. 9 p.)	4
Listening span (max. 8 p.)	2,6
ToM-1 (max. 4 p.)	4
ToM-2 (max. 8 p.)	8
ToM-2 (max. 8 p.)	M:4, I:1

Table 3. Results of further cognitive tests

The subject performed relatively well in the verbal fluency tasks (which are mapping the central executive functions); a higher semantic cluster number can be observed in some letter and category fluency tasks. The result of the backward digit span test is average. The results of the metaphor and irony comprehension tests showed a worse

score in irony comprehension (1 point). Considering all of these results, it seemed that his cognitive abilities were in normal range, but some cognitive functions had deficits.

3.2 Syntactic Recursion

Analyzing syntactic recursion we found that question Type 4 (which has a structurally required answer, i.e. a clause embedding, introduced by a recursive operation and signaled by a subordinating conjunction) is considerably different from the other types (Table 4).

	BT	
	R%	**NR%**
Type 1	18	72
Type 2	29	71
Type 3	44	56
Type 4	87	13

Table 4. The percentage distribution of recursive and non-recursive responses for the 4 types of questions (R: recursive, NR: non-recursive)

He gave structurally different answers for question Type 4 (Table 5). It can be said that the abilities of the syntactic-structural recursion and theory of mind reasoning are intact, but the answers to the content of the pictures are not always conventional. He used the content of theory of mind reasoning in situational sentences in his answers.

Category / **Subject**		**BT**
Simple sentences non-recursive	Simple descriptive sentences	8
	Simple sentence with subjunctive	-
Simple situational sentences		**5**
recursive	*That* + situative statement	25
	Introductory +"colon" + situative statement	10
	That + descriptive clause	23
	That + clause with subjunctive	29
Structural embedding of the clauses in TOTAL of the task's structured linked sentence		**87**
Total for situative statements		**38**

Table 5. The percentage distribution of grammatical categories of structurally linked grammatical responses to Type 4 question

The results show that the patient preferred syntactic recursion instead of direct positioning (situational sentence).

3.3 Pragmatic Recursion

When analyzing the narratives of the subject, our aim was to answer whether central embedding would appear in his speech production. Depending on the tasks we expected descriptive and narrative texts and in the case of the dialogue an interactive discourse. The degree of the syntactic and pragmatic embeddings was examined.

It was assumed that because of his status, he himself will be the main topic; his statements will be characterized by coordinate clauses and final embedding structures; anticipatory and deliberate editing mode (resulting in pragmatic recursion) will not be characteristic. If it is so, then it could be a reason for us to hypothesize a possible connection between mental status and discursive behaviour.

3.3.1 Description

In the first type of task (description), three separate 5-minute recorded speech productions were analyzed: *Talk about yourself! Talk about your mom! Talk about your dad!* In the self-describing text every utterance concerned the subject. Speaking about his mother, he held two clauses of "distance" at most, usually in every second clause turned his own viewpoint up. His father was "let go" by 5, 9, 6 units at the beginning of the presentation, but then the same close view (as a strategy) was selected as in the other two texts. The characteristics of the narratives are shown in Table 6.

	Himself	Mother	Father
Number of utterances	86	100	91
Degree 1 recursion	12	13	20
Degree 2 recursion	5	5	5
Degree 3 recursion	2	2	2
Initial embedding	2	1	2
Central embedding	3	2	2
Final embedding	14 (26)	17 (28)	23 (34)
Self-enclosed structure	1	1	1

Table 6. Features of narratives

The text about his father seems to have a larger number of utterances – in fact, however, a surface structural repetition sequence appeared. The subordinate structures were relative clauses. Whenever he stopped at an embedding, he did not revise his thoughts or the

structure, but started a new unit. The central embedding is always a certain change of plane: using deictic expressions, speaking out from the text, phrases; proverbs or quotations from well-known songs are interpolated. In fact, it is not a merger of syntactic structures, but rather elements of memories and knowledge are lifted into the descriptions.

(1) 6 How was it so,
7 as it was written in the story,
8 to believe that the ring is gold,
9 I do not know[10]

Self-contained units appear also as self-enclosed structures: a coherent description or story starts and ends, from which the speaker clearly stands off into the original frame.

(2) 41 but, but I hope,
42 that they will soon also understand it much better,
43 that I'm not like a marble taw ball,
44 what you lose and it's gone.
45 Maybe rather a lighter.
46 Not because,
47 because, because we can burn the house with it,
48 but
49 because the fire is an instrument, a tool.
50 Sometime there was a word,
51 "fire tool".
52 Today you can make it with a lighter
53 with a good lighter, with a good Zippo, with that smoothly.
54 Hm, my dad?

Overall, it can be said that real embedding as an organic incorporation does not appear in these texts, either in the individual sentences or in the text as a whole. There is no real embedding which could show a reflective order either in the temporal structures or the person-related beliefs. His own point of view is vindicated all the time.

3.3.2 Narrative

In the second type of task (narration: *Tell me about your previous day!*) a real narrative was expected. The text is divided into two parts: in the first half (1–60) there appeared temporality, referring to the specificity of the situation, connecting of events as well as some intentionality. Taking relevance and background knowledge into consideration,

10 All translations by Anita Bagi. For the Hungarian originals, see the Appendix.

contextual-sensitivity or normativity are not characteristic. No progression takes place in the story between units 60 and 201. Images flare up (dog and its keeper, horse racing, medicine experiment), and these are related to the patient but not related to each other. Time alignment is missing or at least not important. According to the syntactic characteristics this text consists of 201 utterances. Embedding levels are the following: degree1: 21; degree 2: 8; degree 3: 6.

(3) 94 Perhaps for some reason, there will still be
95 maybe,
96 my illness has brought it or something else,
97 that I feel,
98 I feel more, I'm worth more than,
99 to be put, to be put into a category like, well,
like the "*also-runs*"

While initial embedding appeared once only, central embedding appeared 6 times in his narrative. Two of these were two-tier (44-45, 95-96), one is linear (118; quotes from hypothetical subject).

(4) 114 I prefer a little more,
115 to lie back,
116 to clasp my hands
117 and for them to say,
118 all right, Tomi, I do not know what you did, I do not know if you did something or not, I do not know if you're worth something, but I see that you understood something,
119 which is not … no, "to understand" is not a good expression.

The apparent increase in embedding degree is due to the fact that the central embeddings in the descriptive texts are more phrase-like. In this text they are organically linked to the utterances: although the frame changes, it still reflects on himself. The four – in fact independent – scenes are introduced with conjunction words (*but*, *so*, *but*, *i.e.*), so it is almost impossible to isolate self-enclosed structures. The return is quite similar: there is no syntactical separation. However, recoiling is typical: the subject refutes himself four times and corrects his previous statement to the opposite. The opportunity of storytelling, exploitation of timeliness, intersection or forward and reverse deictic movement does not appear.

Overall, the text is organized around the subject, it is not a "real" narrative, rather a "bouquet of self-reflections". However, structurally more complex (than the syntactically typical max. degree 2 or the degree 3 in descriptions) constructions can be found

due to the embeddings being relevant to the topic, even though they change frames sometimes.

3.3.3 Discourse

Thirdly, the whole interview was examined as a discourse. Our aim was to find out whether pragmatics can outplay syntax (Levinson 2013, 157) in this case: if there are higher degree embeddings (4, 5, 6 and so on) in the dialogue.

We found two types of embedding structures in the discourse organization. In the first case, a frame change occurs, so we can call it structural. The interlocutors are reaching meta-level (degree 1), e. g.: interpreting the task, talking about the solution, but do not exceed the complexity of the typical syntactic recursion. It reaches no higher degree embedding because of the dialogic (interactive) discourse.

(5) (a) *closure* Good, thank you very much. That was the end of this session, the "mind" was still a point. Good. Okay. It went well.
(b) *changes frame* I did not know how to write, you said it so quickly, so it's such a luck to record it, because I know it re…
(c) *explain herself* I'm just trying to say it slowly!
(d) *revise herself* No! The point is to speak more and more. Do not worry about how I do it…
(e) *answer* okay, it's okay…
(f) *continue* Calmly, take your time! That's why we record it, to keep it…

The second type of embedding is thematic. Certain information from the dialogue or some kind of stimulus from the frame triggers the frame changing of conversational partners. The alternation of levels is not always continuous:

BA 0 – BT 1 – BA 2 – BT 3 - BA 4 – BT 3 – BA 5 – BT 0 – BA 4
– BT 2 – BA 3 – BT 4 – BA 5 – BT 6 – BT 2 – BA 3 – BT 0

This also means that the levels do not close onto each other. Within the levels the typical question-answer sequences of the dialogues can be found, these have maximum degree 3 structures. However, switches between levels, returns, and referrals are not consistent. The thematic structures of the subject are rather "merging" and cannot be considered as pragmatical recursive structures: one after the other, but not related – just a string of thoughts, memories and opinions after each other. To which the partner may connects, but the patient just follows his own line of thought indefinitely.

In the case of discourse, therefore, only in the thematic discursive (partner assisted) conversation organization could we find a pragmatic central embedding recursive structures that are different from the syntactical degree 2 embedding.

4. Conclusion

As a conclusion, in the case study of a person with a schizoaffective disorder we can state that in addition to certain well-maintained cognitive abilities, recursive theory of mind reasoning appears to be intact too, but at the same time, BT used significantly more recursive structures than the control group. With respect to independent textual products and discourse organization it seems that the present subject with schizoaffective disorder can create a central embedding structure, or a higher level of embedding than degree 2 only based on his memories. His pragmatic abilities and his insights regarding theory of mind are intact at the basic level. However, in the case of direct, dynamic, and context related actions, he stops at degree 3; he can only move on to another memory as if the way back would be "locked". The time management, even if present, is not an organizing force: the time for BT is just information, one of many memories, which is more like a "calling word" than an organizing force. The recall, the text or the discourse organization is more self-centered – "as if in a photo folder the random button would be pressed".

5. Limitations and Additional Questions

The analyses of recursion are worthwhile to be extended to the text-narrative-discourse level with other patients and healthy control subjects. It may turn out to be a schizophrenia language production feature that the higher degree of pragmatic recursion is only detectable in the thematic discourse organization.

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Appendix: Original Version in Hungarian

(1) 6 “Hogy úgy volt-e,
7 ahogy a mesébe írták,
8 hogy hitte a gyűrű aranyát,
9 azt nem tudom.”

(2) 41 de, de remélem,
42 hogy egyszer sokkal jobban fogják ők is érteni azt,
43 hogy hogy nem egy olyan golyó vagyok,
44 amit elveszítenek és akkor nincs többé.
45 Talán inkább egy öngyújtó.
46 Nem azért,
47 mert, mert felgyújtjuk vele a házat,
48 hanem
49 mert a tűz is egy szerszám, egy eszköz.
50 Valamikor volt egy olyan szó,
51 hogy tűzszerszám.
52 Ma már egy öngyújtóval lehet
53 egy jó öngyújtóval, egy jó zippoval, azzal simán.
54 Hm, édesapám?

(3) 94 Talán valamiért még lesz,
95 lehet,
96 hogy a betegségem hozta, vagy valami más,
97 hogy azt érzem,
98 hogy többet érzek, érek annál,
99 hogy be, betegyenek egy ilyen hát, futottak még kategóriába.

(4) 114 Én egy kicsit inkább arra vágyom,
115 hogy hátra dőljek,
116 összekulcsoljam a kezem
117 s azt mondják,
118 hogy ok Tomi, nem tudom, mit csináltál, nem tudom, hogy csináltál-e valamit, nem tudom, hogy érsz-e valamit, de látom, hogy te valamit megértettél,
119 ami nem, a megérteni az nem jó szó.