

Pragmatics in Wernicke's aphasia: A case report of a ventral pathway lesion

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ABSTRACT

T.S. suffered a left temporal Cerebrovascular Accident (CVA) and demonstrates difficulties in communicative pragmatics, more specifically, in Textual Pragmatics and Enunciative Pragmatics, whilst Interactional Pragmatics remains relatively intact. The CT scan and the Conversational Analysis mirror these symptoms. This is a first attempt to bridge pragmatics with dorsal and ventral streams of processing and we will demonstrate how such an analysis should be used for more accurate clinical assessment.

Keywords: Aphasia, pragmatics, Wernicke, ventral stream, communication, neurology

INTRODUCTION

Pragmatics refers to the social language, in other words, the use of language within a context (Kiefer, 2017). Scientific evidence suggests that pragmatic abilities can be spared in some stroke patients, whereas in some others, pragmatic deficits emerge (Champagne-Lavau & Joannette, 2009). Language and cognitive processes are no longer considered as focal functions, but as a result of the bi-directional neural partnerships of cortical and sub-cortical brain areas (Costa, Azambuja, Portuguez, & Costa, 2004). A dynamic communication exchange is used to examine the behaviors of pragmatics (Enunciative Pragmatics, Textual Pragmatics, and Interactional Pragmatics), and then compare this variability and structure to the cortical system. In the literature two different pathways are often discussed: a ventral and a dorsal one. The dorsal areas are responsible for the auditory-motor interface and the articulation of sounds, whilst the ventral stream operates as the connection between meaning and sound (Hickok & Poeppel, 2004). We estimate that there are language variables in communicative pragmatics that could be identified in T.S., a stroke patient and therefore, by examining these frameworks, distinct types of aphasia can be discerned (Hickok & Poeppel, 2004). Hence, given that there is scarce literature of patients in the Greek language, and heterogeneity of pragmatic deficits in patients with aphasia (Chatzopoulos, Loutrari, Diaz-Martinez, Kouki, & Proios, 2018), we report a detailed pragmatic evaluation of T.S. Furthermore, we attempt to partner the pragmatic deficits demonstrated in the conversational narrative of this patient with the framework of dorsal and ventral pathways. To our knowledge, such an endeavor has not been carried out in the past.

Methods Stimuli and Procedure

Three participants: a Key Conversational Partner (KCP), a familiar person of the patient (i.e., spouse) and the examiner, engaged in narrative that was video-recorded, transcribed, and analyzed with the approach of Conversational Analysis (CA). The conversation took place in the hospital settings of Papageorgiou G.H., twenty days after T.S.'s admission to the neurology unit. The ten-minute conversational exchange included asking the patient to describe a personal emotional narrative and describing a procedural task. Conversational data was transcribed using the Codes for the Human Analysis of Transcripts (CHAT) conventions.

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CHAT is a software capable of emphasizing verbal and non-verbal language domains (MacWhinney, 2000). Audiovisual data and the conversation transcription are uploaded to the international database, AphasiaBank (<https://aphasia.talkbank.org/access/Greek/NonProtocol/Thessaloniki.html>). As an examination instrument, the Pragmatic Evaluation Protocol – Revised (PREP-R) was used (Chatzopoulos, Loutrari, Diaz-Martinez, Kouki, & Proios, 2018). It is a tool that examines the pragmatic competence of the conversational structure and the content, including also, Enunciative, Textual and Interactional Pragmatics.

Firstly, Enunciative Pragmatics refers to a person's ability of achieving the communicative goals, irrespective of grammatical or lexical errors, such as speech acts, intentional acts, compensatory behaviors, and meta-pragmatic awareness (see table 1).

On the other hand, Textual Pragmatics measures the capability to narrate a story coherently and argue efficiently, as it includes the narrative and argumentative coherence, as well as the semantic, morphological and syntactic cohesion (see table 2).

Lastly, Interactional Pragmatics refers to non-verbal communication, and the flow of communicative exchanges and can be used to calculate the agility of turn taking and adequate conversational participation. Sub-components of Interactional Pragmatics are Preference and Predictability and relate to the initiatives a person takes in a conversation (see table 3). The documentation of pragmatic measures highlights common underlying language difficulties.

PREP-R items were individually assessed. The assessment of an item was positive, "Yes", when the participant used correctly the specific item during the conversation. On the contrary, when there was a misuse of an item, the assessment was negative, "No" and Not Observed, "N.O.", when the participant did not have the chance to use the specific item.

Case Report

T.S., a 61-year-old male patient, whose only language was Greek, after being admitted to the Neurology Clinic of the Papageorgiou General Hospital in Thessaloniki, Greece, as reported in the medical file he was in a "state of confusion, but without fever; T.S. was not able to perform verbal instructions due to difficulty comprehending verbal directions and used automatic speech with many phonemic paraphasias". Furthermore, the diagnosis of Wernicke's aphasia was reported from the department of neuropsychology. Computerized Tomography (CT) performed four days post symptom onset (Figure 1), and reported in his file "revealed the presence of a widespread acute ischemic lesion in the left temporal - parietal area, affecting the Wernicke's area; yet, midline structures had normal morphology". Work and family history included private company and living with his wife and his two children. T.S.'s medical history also included ethanol abuse; however, reportedly sobriety seven months before admission to the hospital. No reported Korsakoff Syndrome was noted in his medical records and neuropsychological testing. Medical records included a history of

Thrombotic Thrombocytopenic Purpura, an upper gastrointestinal hemorrhage, and the implantation of a permanent heart pacemaker. T.S. was informed about the study by the departmental chair of neurology and clinical researcher, who are both co-authors on this work. T.S. signed a consent form, so that his wellbeing and confidentiality were protected by the researchers. All testing took place in accordance to the ethical guidelines of the Declaration of Helsinki

Results

Inter-rater reliability was estimated using Cohen's kappa. For positive ("Yes") and negative ("No") ratings, Cohen's kappa indicated considerable agreement (0.621 and 0.632, respectively). Perfect agreement (1.00) was observed regarding the items that were rated as "Not Observed" (N.O) in the conversation. Agreement in all of the items achieved after thorough discussion. T.S. had no significant difficulties concerning the Speech Act Sublevel of the Enunciative Pragmatics. His utterances, most of the times, were intelligible, achieving the communicative purpose (Table 1; items 1.1, 1.2). Furthermore, T.S. was able to manage silence and pauses (Table 1; item 1.3), while his direct and indirect speech acts were not observable in the communication (Table 1; items 2.1, 2.2). The patient also used verbal strategies to gain time and to compensate the word retrieval deficits (Table 1; items 3.1, 3.2). This is present in the following example derived from the database AphasiaBank:

Excerpt 1

- 93 *INV: how many days are you here (.) approximately?
 94 *PAR: then I finished (.) last year +...
 95 *PAR: do I know xxx five six months
 96 *PAR: more or less xxx.
 97 *PAR: now how shall we remember.

T.S. demonstrated the ability to use gestures during the conversation, and when his utterances were not pertinent to the topic, he perceived that (Table 1; items 3.3, 4). In parallel, T.S. manifested considerable weaknesses at the level of Cooperative Principles of the Enunciative Pragmatics. More specifically, T.S. violated the maxims of quality, quantity, manner and relevance (Table 1; items 5.1, 5.2, 5.3, 5.4). His utterances, in many cases, were not trustworthy, while his responses were irrelevant to the topic. Also, the utterances were short and abrupt. The above is illustrated clearly in excerpts 2, 3 and 4.

Excerpt 2

- 31 *INV: How old are you?
 32 *KEY: xxx how old are you?
 33 *KEY: How old?

- 34 *KEY: sixty +...
 35 *KEY: two +..?
 36 *KEY: are you sixty-two years old?
 37 *PAR: xxx.
 38 *KEY: are you sixty?
 39 *KEY: or sixty-two?
 40 *KEY: do you remember how old are you?
 41 *PAR: how xxx how +...
 42 *KEY: sixty-two.
 43 *PAR: whatever

In Excerpt 3 it is obvious that T.S. cannot understand and follow the conversation. The investigator asks him how many days he is at the hospital, the correct answer of which is three weeks. Although, his response concerns a fact that took place the previous year, and later he adds that he has been at the hospital for five or six months. At this point it is well understood that T.S. has great difficulties in understanding language, while he violates the maxims of quality and relevance (see Table 1). The above is presented in the following segment of the conversation.

Excerpt 3

- 92 *INV: how many days are you here (.) approximately?
 93 *PAR: then I finished (.) last year +...
 94 *PAR: do I know xxx five six months.
 95 *PAR: more or less xxx.
 96 *PAR: now how shall we remember.

In the following example (Excerpt 4), T.S. is still unable to understand the content of the addressed question; his participation is minimal, violating the maxim of quantity and relevance, and his response is inadequate.

Excerpt 4

- 116 *KEY: how many children have you show me with your fingers?
 117 *KEY: how many children have you
 118 *KEY: eh?
 119 *PAR: when I don't remember.

TS did not have the opportunity to show whether he can use or understand the implicatures (Table 1; item 5.5) and idioms (Table 1; item 6). As we can see in Table 2, T.S. struggles at Textual Pragmatics achieving only two out of seven items. T.S. did not show the ability to narrate a well-structured story, as well as argue in favor for something (Table 2; items 7.1, 7.2). Also, he encountered severe difficulties recognizing and introducing a new topic (Table 2; items 8.1, 8.2). Finally, at the Cohesion Level, T.S. was not able to use words adequately, and presented recurring repetitions (Table 2; item 9). However, his morphological and syntactic abilities were relatively adequate (Table 2; items 10, 11).

Table 3 illustrates the results of T.S. at Interactional Prag-

matics. The patient was able to take his turn at the right moment of the conversation (Table 3; item 13), with a quick turn taking (Table 3; item 12). In contrast, T.S. participated minimally, without predicting conversational outcomes and addressing questions (Table 3; items 14, 15). T.S. did show the ability to interact properly and wait for his turn, in order to start talking (Table 3; item 16). Lastly, the patient with aphasia used gestures, eye contact and non-verbal skills during conversation (Table 3; items 17, 18).

Furthermore, the CT scan demonstrated a ventral lesion, for which we find useful information in the analysis of the narrative, as well as some Wernicke's aphasia symptomology. For example, T.S.'s deficits in Enunciative Pragmatics are presented through the violation of the maxim of quality (item 5.1. line 93-95; AphasiaBank). In the transcription of the conversation, and in particular in lines 105-109 (AphasiaBank), there are examples of his difficulty with Textual Pragmatics (e.g., item 8, lexical and syntactic cohesion and understanding when a new topic is introduced).

Apart from the above, phonemic paraphasia's were noted ("ὅτι κυκλοφορεί τις τα τεν" [Whatever circulates tis ta ten]), when the patient was asked about his children occupation. The verbal response of "τις, τα" [tis, ta] are articles presently used in the Greek language, whereas "τεν" [ten] does not exist in the Greek vocabulary. T.S. often responded with "I don't know" (e.g. "εγώ τι να ξέρω βρε" [What do I know] and many of his utterances were unintelligible, due to neologism and jargon nonwords. When the KCP asked repetitive questions to T.S., he was unable to understand the meaning, and respond efficiently; after many questions, T.S. replies "ε ὅτι είναι" [whatever] (line 54, AphasiaBank).

Finally, T.S.'s responses were inaccurate and untruthful (e.g. lines 92-94, AphasiaBank).

As it can be seen in Table 4, T.S.'s General Pragmatic Ability is impaired (48.27%). This is due to the reduction in both the Specific Pragmatic Ability (42.85%) and the Grammatically-Based Pragmatic Ability (62.5 %). According to Table 4, T.S. manifests great difficulties in the domain of Enunciative (46.66%) and Textual Pragmatics (28.57), with the latter being more impaired. Notwithstanding, his Interactional Pragmatics remains relatively intact (71.42%).

Discussion

We sought to show the intricate relationship between pragmatics and communication, and their relation to ventral and dorsal streams of processing. The results of our study are in line with the framework of Hickok and Poeppel (2004). The present patient sustained a CVA, which affected the Wernicke's area, a brain locus involved in the ventral processing of language (Mirman et al., 2015). Our patient demonstrated considerable difficulties with regard to language comprehension, mainly a ventral pathway procedure (Saur et al., 2008). Recent evidence suggests that word-form recognition lies within the auditory ventral stream (DeWitt & Rauschecker, 2013). Due to this inability, T.S. illustrated weaknesses in the pragmatic competence. His main deficits were the inability to acknowledge when a new topic was in-

roduced, leading to the violation of the cooperative principles (Grice, 1975), failure in predictability, and his weak participation in the discussion. Furthermore, T.S. exhibited some constraints in narration, focused mostly on the lexical aspects of language. All these are well-defined left hemisphere operations, usually apparent in patients with aphasia (Dick et al., 2001). Antithetically, dorsal and right hemisphere operations, such as gazes, gestures and taking part at the right momentum, remained intact. The results are consistent with previous research showing that only patients with lesions at the right hemisphere indicate those deficits (Champagne-Lavau, & Joannette, 2009).

Structural language and pragmatics are intertwined. Lexical, morphological, and syntactic cohesion are of paramount importance to the narration and argumentative discourse (Textual Pragmatics). Through narration, argumentation and discussion with the patient pragmatic difficulties might be revealed (Ulatowska & Olness, 2007). As Cummings (2009, p. 9) underlines "The dependence of pragmatics on other language subsystems is to be expected – after all, we can only produce and comprehend speech acts, generate and recover implicatures and frame coherent narratives if we have access to certain syntactic and semantic structures".

All neuropsychological testing was gathered from his medical file and since no other formal cognitive and language testing was completed by the examiner, this is a limitation to this work.

In synopsis, pragmatic evaluation and analysis can be used as a sensitive measure for diagnosis of language competence in patients with neurological disorder. The case report of T.S. provides insight into the pragmatic evaluation and analysis of a patient with Wernicke's aphasia.

Ethical Approval

Ethical approval was granted by Papageorgiou General Hospital and a written informed consent was obtained by the patient, giving permission for the publication of this data.

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Disclosure

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Appendix

INV = Investigator
 KEY = Key Conversational Partner
 PAR = Participant

Chat Conventions

CHAT conventions used in the cited excerpts:

1. (.) , (..) : small pauses; full stops indicate the number of seconds
2. xxx unintelligible speech
3. +... : trailing off
4. +..? : trailing off of a question

Tables & Figures

Figure 1. Brain computed tomography (CT) revealing a widespread lesion in the left temporal – parietal area (Ventral Stream).

Table 1. Analytical scores of T.S. in Enunciative Pragmatics

ENUNCIATIVE PRAGMATICS	T.S.
Speech Act Sublevel	
1. Speech acts	
1.1. Utterance acts	Yes
1.2. Propositional acts	Yes
1.3. Management of pauses and silence	Yes
2. Intentional speech acts	
2.1. Direct conventional speech acts	N.O.
2.2. Indirect speech acts	N.O.
Editing Tasks	
3.1. Utterance acts	Yes
3.2. Draft acts	Yes
3.3. Compensatory nonverbal acts	Yes
4. Metapragmatic awareness	Yes
5. Cooperative Principle: conversational maxims and particularized implicatures	
5.1. Maxim of Quality	No
5.2. Maxim of Quantity	No
5.3. Maxim of Manner	No
5.4. Maxim of Relevance	No
5.5 Implicatures	N.O.
6. Lexicalized tropic inferences	N.O.

N.O: Not Observed

Table 2. Analytical score of T.S. in Textual Pragmatics

TEXTUAL PRAGMATICS	T.S.
7. Coherence: Textual Superstructures	
7.1. Narrative superstructure	No
7.2. Argumentative Superstructure	No
8. Topic Management	
8.1. Recognition of the introduction of a new topic	No
8.2. Fluid introduction of new topics	No
Cohesion Level	
9. Lexical Cohesion	No
10. Morphological Cohesion	Yes
11. Syntactic Cohesion	Yes

Table 3. Analytical scores of T.S. in Interactional Pragmatics

INTERACTIONAL PRAGMATICS	T.S.
12. Agility of turn taking	Yes
13. Turn taking at the right moment	Yes
14. Adequate conversational participation	No
15. Predictability	No
16. Preference	Yes
17. Natural Use of Gestures	Yes
18. Gazes for communicating	Yes

Table 4. Pragmatic competence in different categories of pragmatic ability

Categories of Pragmatic Ability	Percentage
General Pragmatic Ability	48.27%
Specific Pragmatic Ability	42.85%
Grammatically-Based Pragmatic Ability	62.5%
Enunciative Pragmatics	46.66%
Textual Pragmatics	28.57%
Interactional Pragmatics	71.42%
