Stem-, Spraak- en Taalpathologie

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Stem- Spraak- en Taalpathologie

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The 16th International Science of Aphasia Conference is held in Aveiro, Portugal, September 17-22, 2015.

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What contributes to discourse coherence? Evidence from Russian speakers with and without aphasia

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Introduction

The quality of language which transforms several sentences into a discourse is called coherence. The way it is established is largely unclear. In this study two approaches were used to investigate coherence in discourse. Nine Russian native speakers with aphasia and nine control participant without language impairments were asked to retell the content of a short movie. First, the retellings were assessed with a method commonly used in aphasiology to evaluate connected speech, namely, human coherence ratings (e.g., Ulatowska et al., 1981, 1990, Glosser & Deser, 1990). Despite the usefulness of coherence ratings, for example, for diagnostic purposes, they are prone to rater-dependent fluctuations. However, the subjectivity can be partially eliminated through standardization.

In the second phase the retellings were annotated using Rhetorical Structure Theory (RST, Mann & Thompson, 1988), an approach formalizing the idea of an inner organization of discourse. This framework has been extensively tested on large collections of written, as well as spoken discourse. According to RST, coherence is established through the creation of discourse structure. Micro-linguistic data, including TTR, MLU, and error counts, were also collected for every sample.

In order to find out which micro- and macro-linguistic features contribute to the perception of coherence, a regression analysis was performed using Random Forests (RFs). By using this algorithm we attempted to imitate he choice between 'coherent' and 'incoherent' that listeners who rate the discourse samples have to make. One of the advantages of RF is its ability to select those parameters which are the most important for making a choice, in this case, between 'coherent' and 'incoherent'. This way the parameters from the quantitative analysis were then contrasted against the qualitative human ratings.

Methods

Participants

Nine people with aphasia (PWA) and nine non-brain-damaged native Russian speakers matched in age, gender, and education level participated in the study. Five of the PWAs diagnosed with fluent, others with non-fluent aphasia using Luria's Neuropsychological Investigation (Luria, 1966). None of

the control participants had any language or memory impairment history. The data represent a part of the Russian CliPS (Clinical Pear Stories) corpus.

Materials

The Pear Film (Chafe, 1980), a six-minute silent movie was used to elicit spoken discourse samples. The participants were instructed to tell what was going on in the movie to someone who had not seen it before. The discourse samples were transcribed using the Codes for the Human Analysis of Transcripts (CHAT) format (MacWhinney et al., 2000).

Procedure

Coherence ratings

Twenty naïve listeners, all native speakers of Russian, listened to 5 discourse samples each. The rating scale included four parameters, namely clarity, or understandability, on a scale from 1 to 9, connectedness, completeness, and the order of events as binary variables. The obtained ratings were transformed into standard scores and averaged out. This study focuses on the first two variables. An instruction and an example were provided to the raters.

Rhetorical Structure Theory

RST annotations were performed using Daniel Marcu's extension of the RSTTool (Marcu et al., 1999) by the first author. A second annotator analyzed the annotations, and problematic cases were resolved in thorough discussions. The extended set of relations suggested by Marcu and colleagues was used; all the annotations were performed following the guidelines developed by the group (Carlson & Marcu, 2001). The samples were segmented into elementary discourse units (EDUs), syntactically and semantically complete 'building blocks' of discourse. After that EDUs and spans consisting of several EDUs were connected to each other with a set of semantic, also called discourse or rhetorical, relations (e.g., 'Cause', 'Elaboration', 'Consequence', etc.). A number of parameters were calculated from the resulting discourse structures, including, for example, the number of different types of relations used to build the structure, its depth and length.

Random Forests

Regression analyses with different sets of parameters were performed in R ('caret' package, Kuhn et al., 2012) using Random Forests (RFs), a robust machine learning technique (Breiman, 2001).

Results

The accuracy of the group prediction (control vs. aphasic) reached 95%. Out of possible 15 variables the following were identified as critical for the distinction: number of errors (100%), ungrammatical EDUs (92%), number of discourse relations (88%), and percentage of EDUs with a missing syntactic constituent (80%). Accuracy of the understandability prediction based on the micro-linguistic predictors was at chance level, and slightly lower for the structural parameters, around 40%. All of the parameters taken into account, the accuracy improved to 60%. Selected features were the number of errors (100%), number of relations (72%), syntactically incomplete EDUs (64%), and TTR (64%). The connectedness prediction accuracy with all variables was up to 60%, however the feature

selection was unsuccessful.

Discussion

The results of this study demonstrate that neither the micro-linguistic features, nor the structural characteristics of a discourse can account for it being perceived and rated as coherent or incoherent. Based on a combination of both micro- and macro-structural parameters one can rather accurately identify whether a speaker who produced the discourse has aphasia or not, but not whether the discourse is coherent or not. Discourse of people with aphasia is less understandable, but not less connected than that of healthy speakers. The concept of coherence, a perceived feature of discourse co-created by a speaker and a listener, is thus only partially grasped by the correlates, such as clarity and connectedness, often chosen for its assessment. Moreover, these qualities are rather spectral than binary (see Fig. 1). Exploring the components of coherence perception, and investigating qualitative differences in organization of aphasic and unimpaired spoken language could advance our understanding of this complex phenomenon.

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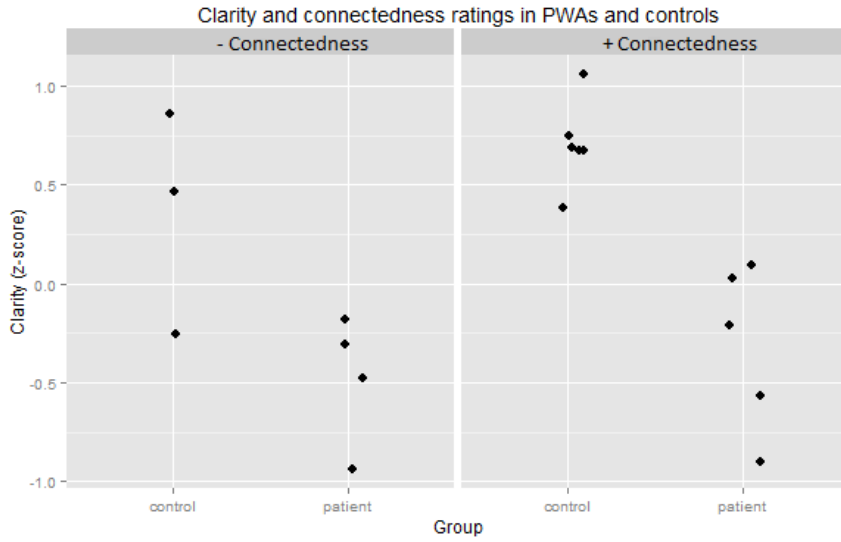
Figure 1. Clarity and connectedness ratings for the control and aphasic groups.