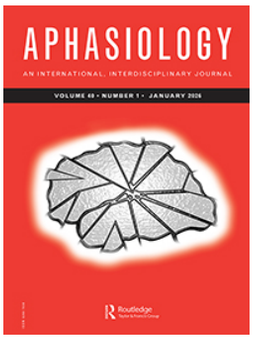

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Determinants of cohesion and coherence in various genres of discourse of Polish-speaking people with mixed aphasia

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ABSTRACT

Background: Aphasia is a disorder that seriously affects linguistic and communicative functioning. It might disturb speech comprehension, expression of grammatically correct and coherent speech, and discourse production.

Aims: This study aimed to investigate the hypothesis that the type of discourse influences the macro- and microstructure of the language of Polish speakers diagnosed with mixed aphasia and to demonstrate discourse-specific linguistic properties in two groups of patients compared to a neurotypical control group: patients with mixed aphasia with the motor component, and patients with mixed aphasia with the sensory component.

Methods & Procedures: Language samples were collected from people with mixed aphasia with a motor component (10 subjects), with a sensory component (10 subjects), and a control group (10 subjects), matched in terms of age and education. Discursive tasks (description of experiences related to the disease, description of an important life event, sequential image description, single image description, fairytale narrative, procedural discourse) were taken from the AphasiaBank protocol for discourse tasks. The discourse samples were analyzed in general terms of cohesion and coherence, the relations between these, and the influence of discourse genre on cohesion. Transcriptions of the patients' utterances were made, which were then analyzed for the presence of the determinants of cohesion indicated by M.A.K. Halliday and R. Hasan: references, substitutions, ellipses, conjunctions, repetitions, and collocations (see Halliday & Hasan, 1976). A Polish adaptation of Van Leer and Turkstra's English coherence scale (1999) was made, and the texts were then coded. For this purpose, the SALT (Systematic Analysis of Language Transcripts) software was used, which required specific codes to be introduced into the utterance transcripts in order to conduct the indicated analyses.

Outcomes & Results: It was noted that a significant determinant of cohesion is conjunctions, which for people with mixed aphasia are often an element that introduces the next utterance. The current research shows that people with mixed aphasia can achieve a higher degree of local coherence than global coherence. Our analysis shows that the statements of people with mixed aphasia is characterized by lower local and global coherence, which also

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reduces the occurrence of cohesion determinants in utterances, thus confirming reports from the subject literature.
Conclusions: There is a necessity to continue the research to show how cohesion and coherence patterns manifest in other types of aphasia in the Polish language. It is also worth conducting research that would examine the influence of the cohesion and coherence factors in other thematic discourses.

Introduction

A narrative is an account of experiences or events sequenced in time which shows some meaning (Engel, 1995). Narrative ability is closely related to linguistic competence, i.e., unconscious knowledge of constructing logical and grammatically correct sentences, and communicative competence, i.e., the ability to behave linguistically in relation to different variables, such as the situation of language use or the relation between interlocutors (Grabias, 2011, pp. 9–34). To achieve understanding between interlocutors, they must not only use the same linguistic code but also communicate it between themselves in a way that is coherent, since narrative consists of elements that make up the plot of a story and rules for connecting these elements in language production. An utterance is recognized as consistent by linking its individual elements so that they form a logical and organized whole. Consistency should be maintained within sentences, between sentences, as well as in relation to the overall theme of the utterance (Wolański, 2006). In the subject literature, the linking of meanings within sentences through semantic and grammatical markers is called cohesion (Halliday & Hasan, 1976), which is understood as the interdependence of content between parts of an utterance. The connectivity created by properly maintaining a certain aspect of a topic within discourse is called coherence. It is divided into local coherence when the content of verbalizations directly connects to preceding statements; it is called global coherence when statements relate to the overall topic of a conversation (Glosser & Deser, 1990). This article deals with the ability of people with poststroke aphasia to produce consistent speech. Aphasia is a disorder that results from damage to the central nervous system (historically so-called "language centers" located in the dominant hemisphere of the brain) and causes speech and language disorders (Krajewska, 2022). In line with current neuroscience, the term "language networks" is used instead of the outdated notion of "language centers" (Hsieh et al., 2024). The presented research consists of an analysis of errors made by patients with aphasia which disturb the connectivity of their speech and thus may affect their communication partners' understanding of the logic of their statements.

The term "mixed aphasia" refers to a type of aphasia where, in addition to non-fluent speech, impaired comprehension is observed. The distinction between mixed aphasia with a motor or a sensory components refers to the dominance of one of the crucial disturbed factors (Martínez-Ferreiro et al., 2017).

The study aimed to investigate the relation between elements of cohesion and elements of local and global coherence in the utterances of people with mixed aphasia and healthy controls.[1] This is an attempt to take part in the discussion in the international literature that examines the connections and mutual influences of micro- and macro-

linguistic aspects of aphasic discourse. The objectives of this research were threefold: to describe and measure the patterns of cohesion used in aphasia-impaired discourse; to investigate the relation between micro- and macro-linguistic aspects of discourse; and to examine the impact of mixed aphasia on discourse cohesion and coherence. The use of van Leer and Turkstra's (1999) and the theoretical assumptions of cohesion adopted by Halliday and Hasan (1976) enable research to be conducted on people suffering from poststroke aphasia.

While cohesion refers to specific relations of meaning between elements within discourse, coherence is sustained by overall thematic unity and is expressed linguistically through cohesive devices. Based on the literature in linguistics, neurolinguistics, and aphasiology as well as speech and language pathology and therapy (Armstrong, 2000; Glosser & Deser, 1990; Krajewska, 2022; Panasiuk, 2013), the following hypothesis can be formulated: occurrence of aphasia as a result of central nervous system damage has an impact on micro- and macro-linguistic aspects of discourse, namely cohesion and coherence. Hence, the disintegration of language features in aphasia also affects, for example, the ability to combine language structures into grammatically and logically consistent texts. Therefore, it is expected that the research will make it possible to determine the impact of mixed aphasia on the level of discourse coherence and the occurrence of cohesion determinants using specific statistical analyses.

The study addressed the following research questions:

(1) What are the patterns of cohesion observed in discourse produced by individuals with mixed aphasia?
(2) How are micro-linguistic features (such as cohesion markers) related to macro-linguistic aspects (such as coherence) in aphasic discourse?
(3) How does mixed aphasia affect the use of cohesion devices and the overall coherence of discourse?

Studies on discourse in people with mixed aphasia

A macrolinguistic approach was used to examine the linguistic features of aphasic discourse (Armstrong, 2000). Research undertaken from the macro-linguistic perspective, aligned with a functionalist perspective on language, has addressed the ways in which meaning is organized in discourse, and the overall meaning of texts representing different discourse types. Within this approach to discourse analysis, a range of issues related to discourse macrostructure have been investigated, including the use of specific interactive phenomena, such as conversational repair, adjacency pairs, or turn-taking (Lindsay & Wilkinson, 1999). Additionally, aphasic speakers' communication has been examined using Searle's (1969) notion of speech acts (e.g., Prutting & Kirschner, 1987) and Halliday's (1985) Systemic Functional Linguistics (e.g., Groenewold & Armstrong, 2018). Overall, studies conducted from the macro-linguistic perspective have demonstrated that mildly and moderately aphasic speakers maintain many conversational strengths and are still able to construct meanings and use language for a variety of functions (Ulatowska et al., 1983). Several macro-linguistic scales measuring local and global coherence have been developed and tested (Glosser & Deser, 1990; Wright & Capilouto, 2012). Such scales are helpful in assessing the functional correctness of aphasic speech from the listener's

perspective, therefore they can be clinically useful. However, insufficient research is devoted to the potential connections between the micro- and macro-linguistic approaches to discourse analysis (Anderson, 2000; Zhang et al., 2020). Also, among those researchers who have attempted to investigate such connections, there is still disagreement regarding the impact of lexical-grammatical impairment on the delivery of meaning, and several hypotheses related to the micro- vs. macro-linguistic dichotomy in aphasia have been put forward. Research results revealing dissociation between micro- and macro-linguistic skills in aphasic individuals have been explained by the hypothesized alignment of global coherence skills with the right hemisphere rather than the left hemisphere, which is responsible for micro-linguistic abilities (Glosser & Deser, 1990). The micro-/macrolinguistic skills dissociation hypothesis has been challenged by findings which trace a relation between, on one hand, disorders in the use of specific language subsystems that result from language disintegration and, on the other hand, the ability to plan utterances and discourse (Panasiuk, 2013, 2019; Zarębina, 1973). Anderson (2000) hypothesizes that the micro- versus macro-linguistic perspective might be a false dichotomy altogether and coherence should be regarded as a continuum that is closely linked to text microstructure, with a point at which the quantity and/or quality of lexical-grammatical breakdowns may lead to difficulties in the interpretation of meaning at the functional level (cf. Żydek-Bednarczuk, 2005). Cohesion analysis, as defined by Halliday and Hasan (1976), is proposed as a research methodology that might overcome the traps of this dichotomy and link research investigating the micro- and macro-aspects of discourse (Anderson, 2000; Zhang et al., 2020). An analysis by Wojenka-Karasek (2016) of the indicators of cohesion in Polish texts produced by learners of Polish as a foreign language should be noted here.

Linguistic research of discourse in aphasia is still in its developing stages, partially due to complications resulting from the existence of several different types of aphasia. To date, most studies of aphasic discourse have been conducted with the participation of individuals with fluent or non-fluent aphasia (e.g., Zhang et al., 2020), or individuals with prototypical aphasia types, mainly Broca's aphasia (e.g., Rossi & Bastiaanse, 2008), whose performance has often been compared with the performance of brain-healthy controls. Such research has shown that aphasic individuals' discourse is generally less cohesive than that of brain-healthy individuals (Lock & Armstrong, 1997). In addition, non-fluent aphasics present poor grammatical cohesion capacities (Marangolo et al., 2014), while fluent aphasics present significantly poorer lexical cohesion in comparison with brain-healthy individuals. Several researchers have recently suggested that cohesion/coherence research needs to include other types of aphasia (Zhang et al., 2020; Martínez-Ferreiro et al., 2017). Research of aphasic discourse is even further complicated by the various types of discourse, described as the "different ways of using language to achieve different culturally established tasks" (Eggins & Martin, 1997, 9).

Material and methods

Participants

The study participants included 10 patients diagnosed with mixed aphasia with predominance of the sensory component, 10 patients diagnosed with mixed aphasia with

predominance of the motor component, and 10 healthy control subjects who did not have any neurological disorders. All participants with aphasia were recruited at the Ludwik Rydygier Specialist Hospital in Kraków and at the Polish Functional Rehabilitation Center in Kraków. The relatively small sample used in the presented research results from limited access to patients with a diagnosis of mixed aphasia and also from lack of open-access clinical databases for Polish-speaking populations. The following inclusion criteria were adopted for participants with aphasia: 1) mixed aphasia resulting from a stroke, confirmed by neuroimaging or a clear medical diagnosis; 2) 3 months or longer since occurrence; 3) acceptable comorbid apraxia and/or dysarthria; 4) Polish self-reported as native language; 5) no dementia or comorbidities with serious cognitive consequences; and 6) vision and hearing (unaided or assisted) adequate for examination. Both groups of aphasia patients were matched to healthy brain subjects (1:1:1) in terms of age and years of formal education (see Figure 1 for age details and Table 1 for demographics such as sex, age, years of education and aphasia duration). Inclusion criteria for the control group were 1) no neurological diagnosis; 2) Polish self-reported as native language; 3) no dementia or comorbidities with serious cognitive consequences; and 4) vision and hearing (unaided or assisted) adequate for examination. The diagnosis of mixed aphasia with a motor and sensory components was based on medical records (epicrisis, neuroimaging, psychological examination, speech therapy diagnosis) from previous hospitalizations and additionally confirmed by interviews, clinical observations, and experimental assessments. These included the Brain Injury

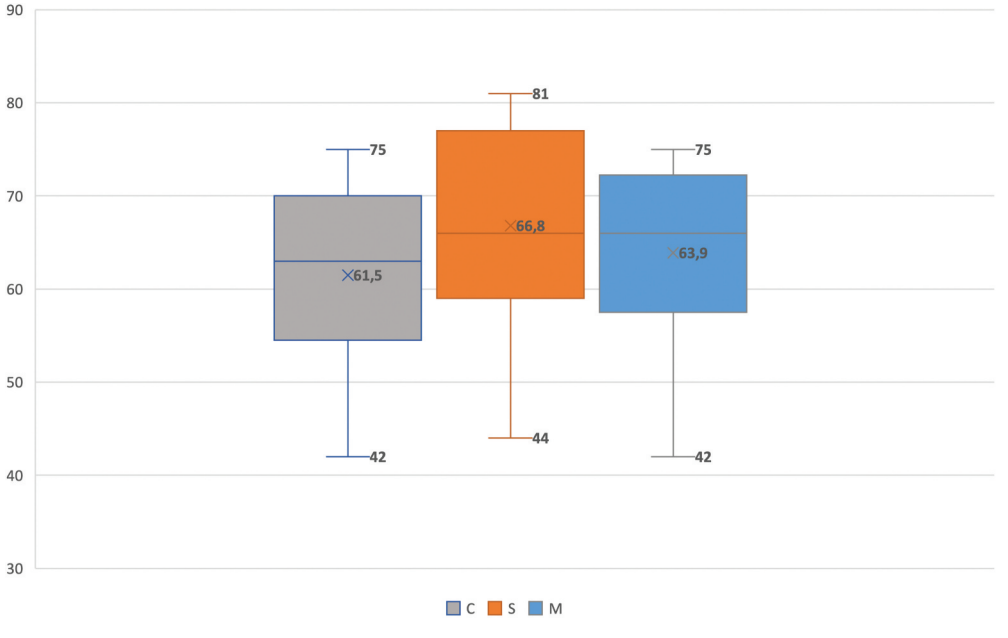


Figure 1. Demographics – age. Source: own materials; C = control group; S = group of patients diagnosed with mixed aphasia with a sensory component; *M* = group of patients diagnosed with mixed aphasia with a motor component.

Table 1. Demographics of testing groups.

Group	Sex	Age (years) M (SD) min – max	Education (years) M (SD) min – max	Months since the occurrence of aphasia syndromes M (SD) min – max
Control (C) n = 10	2 M 8 F	615 (10.00) 42–75	12.1 (1.7) 11–17	
Mixed aphasia with a sensory component (S) n = 10	6 M 4 F	66.8 (11.06) 44–80	12.1 (1.7) 11–17	8.7 (10.7) 1–36
Mixed aphasia with a motor component (M) n = 10	4 M 6 F	63.9 (9.6) 42–75	12.1 (1.7) 11–17	11.25 (11.75) 1–36

Source: own materials; *M* = male; F = female.

Cognitive Test Battery by Włodzimierz Łucki (Łucki, 1995), the Boston Naming Test (Pąchalska & MacQueen, 1998), and the Boston Diagnostic Aphasia Examination (Goodglass et al., 2001). In addition, the diagnosis itself was consulted with an interdisciplinary team (speech therapist, psychologist, doctor), referring to the test results and observations during therapeutic activities. None of the diagnoses were found to have accompanying disorders of the dysarthria type. The patients included in the study did not take medications (psychotropic drugs) that could affect their cognitive functioning. Based on the documentation provided, interview and medical examination, vision and hearing were assessed.

Prior to recruitment, patients were informed of the purpose of the research and asked to provide informed consent to participate by means of aphasia-friendly forms. The necessary permits were obtained from the health care facilities participating in the project. The project was approved by the Research Ethics Committee of the Institute of Polish Glottodidactics at Jagiellonian University in Kraków.[2]

Discourse elicitation and data gathering

This study used the AphasiaBank (AphasiaBank Consortium, n.d.) data collection protocol (https://aphasia.talkbank.org/) to maximize the use of existing resources and facilitate international comparison of the research findings. The "Instructions for discursive tasks" document was translated into Polish and culturally validated: a procedural discourse-elicitation task requiring participants to say how to make a peanut butter and jelly sandwich was changed to a task appropriate to Polish realities, so the question asked was "how to make a ham and tomato sandwich?". Each participant was individually interviewed by one of the mentioned authors (P.W-T) in the institutions participating in the study. The study concerned a few discourse genres: 1) spontaneous speech in which patients were asked to talk about the circumstances of their illness, the rehabilitation process, and a sad or happy event in their lives (Law et al., 2018); 2) description of three picture stories, one of which was a single picture (Kong et al., 2016), while the other two were sequential picture stories; 3) retelling the fairy tale about Cinderella (Cummings, 2019; Richardson et al., 2018, 2021); 4) a task involving procedural discourse (Stubbs et al., 2018) in which patients were asked to provide instructions for preparing a ham and

tomato sandwich. Following the literature, it was assumed that different discourse samples may require the use of different lexical resources and different degrees of cognitive skills (Fergadiotis & Wright, 2011). Discourse samples collected from each participant were recorded on a high-quality voice recorder and then transcribed by one of the authors (U. M.). Then, coding rules were established that specified the elements of coherence and the coding rules for local and global coherence. Four transcripts (approximately 20% of the data) were coded by all three investigators to refine the coding category definitions and ensure consistent coding across transcripts. In turn, the authors coded the transcripts independently and then compared their agreement until a high level of intracoder agreement was achieved (approximately 90%). This procedure was chosen because analysis of the same discourse sample can sometimes yield multiple outcome structures (Taboada & Mann, 2006).

Systematic analysis of language transcript (SALT, Miller & Iglesias, 2020)

Despite obvious difficulties with objectivity and efficiency, the use of language sample analysis (LSA) in language research is still a valuable tool for examining various processes occurring in language. Traditional methods of gathering and data analysis, particularly from a large group of patients, are very often tedious and may result in unreliable results. This phenomenon is caused by the need to have teams of researchers to conduct research and the inability to standardize methods which are used in both transcription and analysis.

To improve the process of collecting samples and conducting analysis, the SALT software was used in this research. This computer program allows users to enter properly prepared transcriptions of patients' discourse and analyze it in terms of coded content. The SALT software provides a number of instant specific reports containing numerous measurements and data interpretations, which is a great improvement in the analysis of language samples. The reports generated in SALT are the basis for the research presented in the article. In this study, the transcription of recorded narrations was carried out according to the SALT software guidelines: the utterances were divided properly, and the codes corresponding to the determinants of cohesion and the degree of coherence were included.

Cohesion coding

According to Halliday and Hasan (1976), cohesion is a concept that refers to semantic relations within a text. Cohesion occurs when the interpretation of some element in the discourse is dependent on another one. A quantitative analysis of cohesion was performed to determine 1) the amount of the cohesive component and 2) the variety of cohesive measures in the discourse samples collected in a previous project (cf. Zhang et al., 2020). "A 'coherent bond' was understood as 'unity', i.e., the occurrence of a pair of coherently related elements" (Halliday & Hasan, 1976).

The transcripts were divided into units, i.e., text sequences consisting of the main utterance, all subordinate utterances, and other attached or embedded structures (Gaies, 1980). The ratio of the total number of cohesive bonds to the total number of units was calculated and used as an indicator of the amount of cohesion in the discourse of participants with different types of aphasia and in the control group.

Cohesion coding was conducted according to methodology which includes rules for coding particular types of cohesion determinants: four types of grammatical cohesion (conjunctions [CN], references [R], substitutions [SUB], ellipsis [E]) and two types of lexical cohesion (repetitions [REP], collocations [COL]). These terms are explained below:

(1) A list of the most frequently used conjunction codes [CN] and coded words (in the original Polish version) is presented in Table 2, supplemented with an explanation of the conjunction types in order to make this part of the presented methodology clear and intelligible.
(2) "Reference" means that the semantic interpretation of an element is not based on its own properties but by reference to something else (Halliday & Hasan, 1976, pp. 31–32). The term "Reference" (coded as [R]) primarily means subject pronouns, object pronouns, possessive pronouns or reflexive pronouns, and adverbs relating to location, such as *there* or *here*. For example: *I can't control this*[R] *hand well*. [Nie mogę władać dobrze tą[R] ręką.]
(3) "Substitution" is a replacement of one item with another. According to Halliday and Hasan, substitution is a relation in the wording rather than in the meaning, as in the case of reference, as was discussed in the previous paragraph (Halliday & Hasan, 1976, pp. 88–90). Several types of substitutions can be distinguished (Halliday & Hasan, 1976), but in the process of adapting the methodology it was decided not to include these specific assumptions in this Polish-language research. Eventually, the statement that substitution occurs in discourse when one word is replaced with

Table 2. List of the most frequently used conjunction codes.

Code	Conjunction type	Conjunctions, participles, adverbs and other words matching to the context (original version in Polish)	Conjunctions, participles, adverbs and other words matching to the context (English translation)[3]
CNa	Addition	*(no, jak,) i, oraz* *a (to, teraz)* *(a,) także, też,* *albo, lub,- czy* *ani (. . . ani)* *nie tylko (to)* *(ale) także*	*and* *or, either . . . or* *too, also, as well* *whether, if neither . . . nor* *not only . . . but also*
CNc	Concession	*a* *ale (i), natomiast, lecz, tylko* *mimo wszystko (to)* *chociaż* *z drugiej strony* *z tym że*	*though, although, even though* *despite, in spite of* *but, yet, however, regardless* *nevertheless, nonetheless* *on the other hand* *except that*
CNsig	Signal cause/ effect	*ponieważ, bo* *dlatego* *dlatego że* *ze względu na* *o ile*	*because, since, for, cause,* *therefore, so, due to sth,* *by virtue of sth, on account of*
CNp	purpose	*aby, żeby* *tak, z obawy,* *w celu uniknięcia*	*to* *in order to* *with the purpose of . . .*
CNconti	continuation	*dalej, ciągle* *potem, następnie, później* *po chwili* *gdy, kiedy* *po czym*	*next, then* *still, all the time, constantly, afterwards*

Source: own materials.

another was accepted as a final definition of the term "Substitution", such as *He started yelling at my aunt, his wife*[SUB] [Zaczął krzyczeć na ciocię, swoją żonę[SUB].

(4) According to Halliday and Hasan (1976, p. 142), the term "ellipsis" is very similar to the term "substitution": ellipsis is simply 'substitution with nothing. This means that ellipsis is the intentional omission of information that is presupposed and derived from the context. For example, *It is going to rain. After all, it won't*[E] [Będzie padał deszcz. Przecież nie będzie [E].

(5) "Repetition" ("reiteration") is a form of lexical cohesion which involves a repetition of a lexical item (Halliday & Hasan, 1976, p. 278). For example, *I can't control this hand well. I can't*[REP] *raise it*. [Nie mogę władać dobrze tą ręką. Nie mogę[REP] podnieść do góry.]

(6) The term "collocation" is another type of lexical cohesion and is achieved through the association of regularly co-occurring lexical items (Halliday & Hasan, 1976, pp. 284–285). Any habitual juxtaposition of a particular pair or group of words is, according to this definition, cohesive. In the presented research, the term "collocation" also includes phrasal verbs, phrasemes and idiomatic expressions, such as *Well, she knew she wouldn't go, because, after all, she is of the lower sort*[COL]. [No to ona wiedziała, że nie pójdzie, bo przecież jest z gorszego gatunku[COL]].

Coherence coding

While cohesion is established by interdependence in content between parts of utterances, coherence is created by the relation of the entire utterance content to the topic (van Leer & Turkstra, 1999). The methodology used in research regarding global and local coherence is coded according to guidelines adapted by van Leer and Turkstra (1999), pp. 344–346). The term "global coherence" signifies the relation between the meaning or content of an utterance and the general topic of a conversation, which is determined by the examiner's last question (van Leer & Turkstra, 1999, pp. 344–345). The coding guidelines were scored on five-point scale:

- G5 – the utterance provides substantive information related to the general topic. Example from the research: Researcher's question: *How do you currently talk to other people?* Patient's response: *Because . . . however, I have trouble accurately understanding everything that someone says to me*. [Jak się panu obecnie rozmawia z innymi ludźmi? Dlatego że jednak mam problemy z tym, żeby zrozumieć wszystkiego co mi ktoś do mnie mówi dokładnie.]
- G4 – the utterance contains multiple clauses, wherein one clause relates directly to the topic and the other one relates indirectly. Example from the research: *Researcher's question: Do you remember that moment?* Patient's response: *On the second day, I (no no no no kn* no kn*) don't know how it happened*. [Czy pamięta pan ten moment? Na drugim dniu, to ja (nie nie nie nie wi* nie zn) nie wiem, jak to się stało.]
- G3 – the utterance provides information possibly related to a general topic or is an evaluative statement that does not provide substantive information, or the topic has

to be inferred from the statement. Example from the research: Researcher's question: *What are you doing to recover from the stroke?* Patient's response: *And nothing comes out of this rehabilitation*. [Co Pani robi, aby powrócić do zdrowia po udarze? I z tej rehabilitacji nic nie wynika.]

- G2 – the utterance contains multiple clauses, wherein one clause possibly relates to a general topic, and one does not. Example from the research: Researcher's question: *Do you remember the moment when the stroke occurred?* Patient's response: *Because it was stated by the doctor, (that) that you have to wait*. [Czy pamięta pan moment, w którym doszło do udaru? Bo to stwierdził lekarz, (że) że trzeba czekać.]
- G1 – the utterance is unrelated to the general topic or is a comment on the discourse. Example from the research: Researcher's question: *Do you remember the moment when the stroke occurred?* Patient's response: *(Well, and that's) later, (later) it went*. [Czy pamięta pan moment, w którym doszło do udaru? (No i to już) później, (później) to już poszło.]

The term "local coherence" means the relation between an utterance's meaning or content and that of the preceding utterance. This relation can be achieved through continuation, repetition, elaboration, or coordination of ideas from the preceding utterance (van Leer & Turkstra, 1999, pp. 345–346). In the same way as for global coherence, the coding guidelines were scored on a five-point scale:

- L5 – the topic of the preceding utterance is continued by elaboration, temporal sequencing, enumeration of examples, or maintaining the same actor, subject, action or argument as the focus. Context of the preceding statement: *The ambulance arrived around two or three o'clock*. Next rated statement: *And they took me to the ward at Rygdygier Hospital*. [Pogotowie przyjechało gdzieś czternasta, piętnasta. I mnie wzięli na oddział, co w szpitalu Rygdygiera.]
- L4 – the utterance contains multiple clauses, wherein one clause definitely relates to the content of the preceding utterance, but the others may not. Context of the preceding statement: *I really loved traveling*. Next rated statement: *And when I started swimming, it was my dream*. [Bardzo kochałem podróże. I jak zacząłem pływać, to było moje marzenie.]
- L3 – the utterance's topic generally relates to that of the preceding utterance, but with a shift in focus from the subject or activity of the preceding utterance, or the utterance is referentially vague or ambiguous, thus the relation to the preceding utterance has to be inferred. Context of the preceding statement: *And somehow it will unfold*. Next rated statement: *They gave medicines*. [I w jakiś sposób się to rozwinie. Podali leki.]
- L2 – the utterance contains multiple clauses, wherein one possibly relates to the content of the preceding utterance, but the others may not. Context of the preceding statement: *So . . . my first . . . such my thinking it is . . . .* Next rated statement: *For example, I can say that with my wife we arrived . . . .* [Tak mi pierwsze . . . takie moje myślenie to jest . . . Na przykład mogę powiedzieć, że z moją żoną doszliśmy . . .]
- L1 – the utterance has no relation to the content of the (immediately) preceding utterance. It may be a radical change of topic, a comment on the discourse, or an unintelligible utterance. Context of the preceding statement: *I was lying in . . .* Next

Table 3. Results of the 3 × 4 mixed-design ANOVA examining the effects of study group and task type on the levels of individual cohesion indices.

		SS	*df*	*F*	*p*	ηp^2
CNT	Group	0.01	2	2.60	0.093	0.16
	Task type*	0.00	1.892	1.135	0.327	0.04
	Task type × group*	0.01	3.784	0.851	0.496	0.06
R	Group	0.05	2	13.91	<.001	0.51
	Task type	0.02	3	5.29	0.002	0.16
	Task type × group	0.01	6	2.38	0.036	0.15
REP	Group	0.00	2	1.55	0.231	0.10
	Task type*	0.00	2.451	0.55	0.467	0.02
	Task type × group*	0.00	4.902	3.278	0.007	0.20
COL	Group	0.01	2	3.41	0.048	0.20
	Task type	0.00	3	10.74	<0.001	0.28
	Task type × group	0.00	6	1.11	0.366	0.08
SUB	Group	0.00	2	2.97	0.068	0.18
	Task type*	0.00	2.302	6.58	0.002	0.20
	Task type × group*	0.00	4.604	0.72	0.602	0.05

*Mauchly's test was significant; results are reported with the Greenhouse-Geisser correction.

rated statement: *No, I don't know how to say it*. [Byłem, leżałem w . . . Nie, nie wiem jak to się mówi.]

Data analysis

To address the research questions, statistical analyses were conducted using IBM SPSS Statistics 29. Descriptive statistics were calculated for all variables, including the Shapiro – Wilk test to assess the normality of distribution. These tests were performed to verify whether the assumptions for applying parametric analyses were met. In addition, mixed-design analyses of variance (ANOVAs), multiple regression analyses, and Spearman's rho correlations were conducted. The significance level for all analyses was set at $\alpha = .05$. Prior to running the ANOVAs, the assumptions of normality, homogeneity of variances, and sphericity were examined. Normality was assessed using the Shapiro-Wilk test. Homogeneity of variances was checked with Levene's test, and the sphericity assumption for within-subject factors was examined using Mauchly's test. Where the assumption of sphericity was violated, the Greenhouse – Geisser correction was applied. Effect sizes for ANOVA results are reported as partial eta squared (ηp^2). Mixed-design ANOVAs (3x4) were performed to examine the effects of group (between-subjects factor with three levels: mixed aphasia with a motor component, mixed aphasia with a sensory component, control group) and task type (within-subjects factor with four levels: spontaneous speech, story retelling, fairy tale retelling, procedural narrative) on the dependent variables, which were the cohesion indices (CNT, R, REP, COL, SUB) and separately the coherence indices (L1-L5 and G1-G5) (see Table 3). To examine the associations between cohesion markers and local and global coherence level, non-parametric Spearman's rho correlations were computed due to non-normal distribution of several variables. The dependent variables in this analysis were the coherence indexes (L1-L5 and G1-G5), and the independent variables were the cohesion markers (CNT, R, REP, COL, SUB). Furthermore, multiple regression analyses were conducted to determine whether cohesion determinants significantly predicted levels of local and global coherence. In these analyses, the dependent

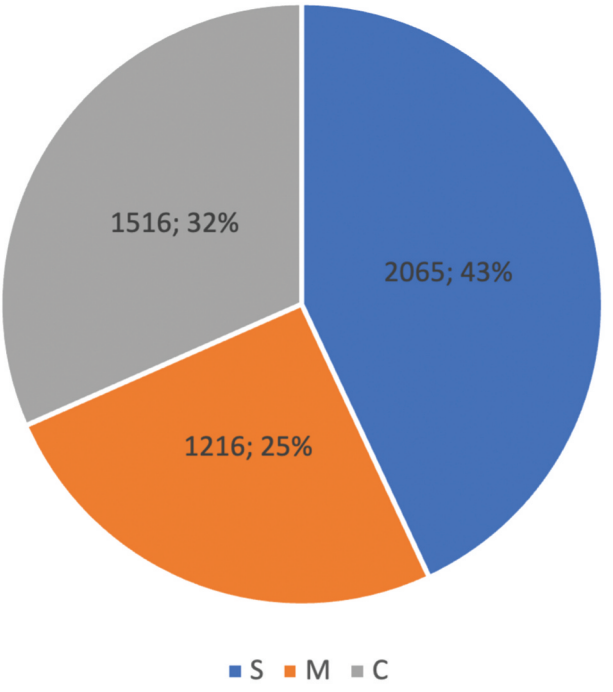


Figure 2. Percentage of utterances produced in the three groups: mixed aphasia with a motor component, mixed aphasia with a sensory component, and non-aphasic control group. Source: own materials. S – mixed aphasia with a sensory component; *M* – mixed aphasia with a motor component; C – control group.

variables were the coherence scores (L1-L5 and G1-G5), while the predictor variables were the cohesion determinants (CNT, R, REP, COL, SUB). Models are reported only for outcomes where the regression was statistically significant.

Results

Distinct differences between aphasic and non-aphasic discourse, as well as dissimilarities between motor and sensory types of aphasic language disorder, are clearly illustrated in Figure 2. Patients diagnosed with mixed aphasia with a sensory component were more likely to expand their statements, producing 2065 out of the total 4797 utterances (43%). In contrast, patients with mixed aphasia with a motor component produced 1216 utterances, accounting for 25% of the total. Noticeably limited language production is a distinctive feature of non-fluent aphasia (Blumstein, 1994), and production length is also one of the factors differentiating mixed aphasia in terms of its motor and sensory components.

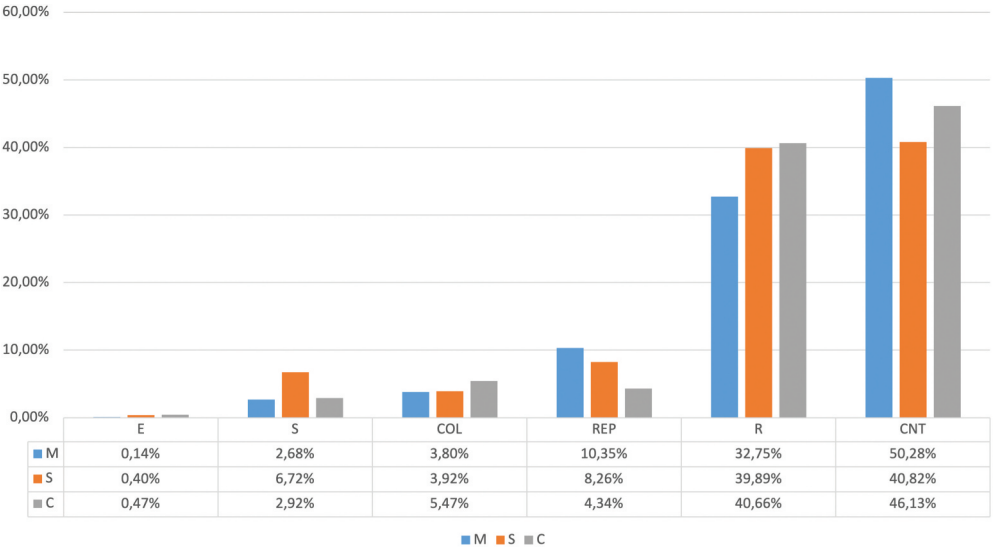


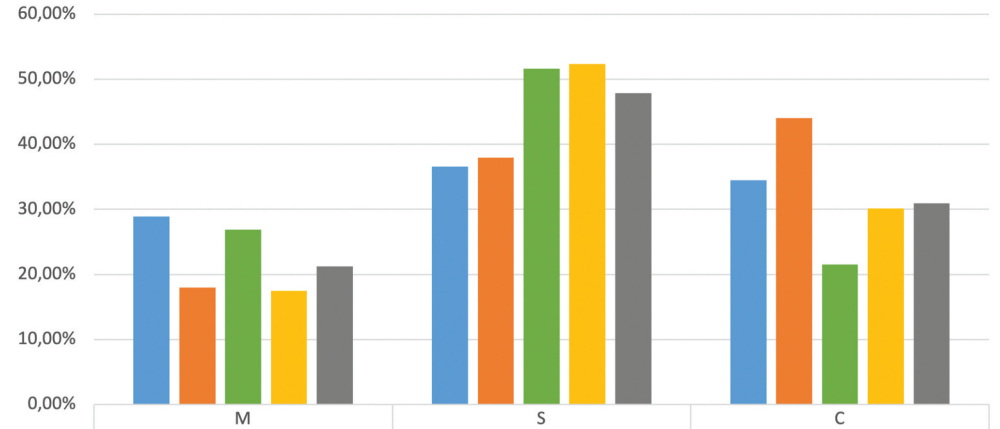
Figure 3. Percentage of cohesion determinants in the group of patients with mixed aphasia with a motor component, sensory component, and control group. Source: own materials. E – ellipsis; SUB – substitution; COL – collocation; REP – repetition; R – reference; CNT – conjunction in total.

Comparison of cohesion between control and aphasia groups

Firstly, the cohesion analysis was performed. Figure 3 presents the percentage of the usage of particular cohesion determinants (CN, R, REP, COL, SUB, E) compared to the total amount of cohesion determinants in the three groups: patients with mixed aphasia with a motor component, patients with mixed aphasia with a sensory component, and control group. In each group, the most frequently used cohesion determinants were conjunctions: in the mixed aphasia group with a motor component, conjunctions constituted 50.28% of all used cohesion determinants, which is the highest percentage result among all the groups. Moreover, in the group of patients diagnosed with mixed aphasia with a motor component, the difference between the most frequently used determinant and the second most used one was the largest among the groups: R factor constituted 32.75% of all used cohesion determinants. In the other two groups, the usage of the R factor was more frequent and closer to the CN score: in the group of patients with mixed aphasia with a sensory component, conjunctions constituted 40.82% and repetition constituted 39.89% of all used cohesion determinants; in the control group, conjunctions constituted 46.13% and repetition constituted 40.66%.

Figure 4 shows the most frequently used conjunctions in discourse by people from the three groups. Based on the results obtained, it was found that the most popular conjunctions included CNa (addition), CNc (concession), CNconti (continuation), CNp (purpose), CNsig (signal cause/effect).

The highest number of conjunctions occurred in the group of people with mixed aphasia with a sensory component, while the least was in patients with mixed aphasia with a motor component. A significant predominance of the use of conjunctive and



	M	S	C
CNa	28,94%	36,58%	34,48%
CNc	17,97%	37,97%	44,06%
CNconti	26,88%	51,61%	21,51%
CNp	17,46%	52,38%	30,16%
CNsig	21,22%	47,84%	30,94%

Figure 4. Comparison of the most frequently used conjunctions. Source: own materials. S – mixed aphasia with a sensory component; *M* – mixed aphasia with a motor component; C – control group. CNa - conjunction of addition; CNc - conjunction of concession; CNconti - conjunction of continuation; CNp - conjunction of purpose; CNsig - conjunction of signal cause/effect.

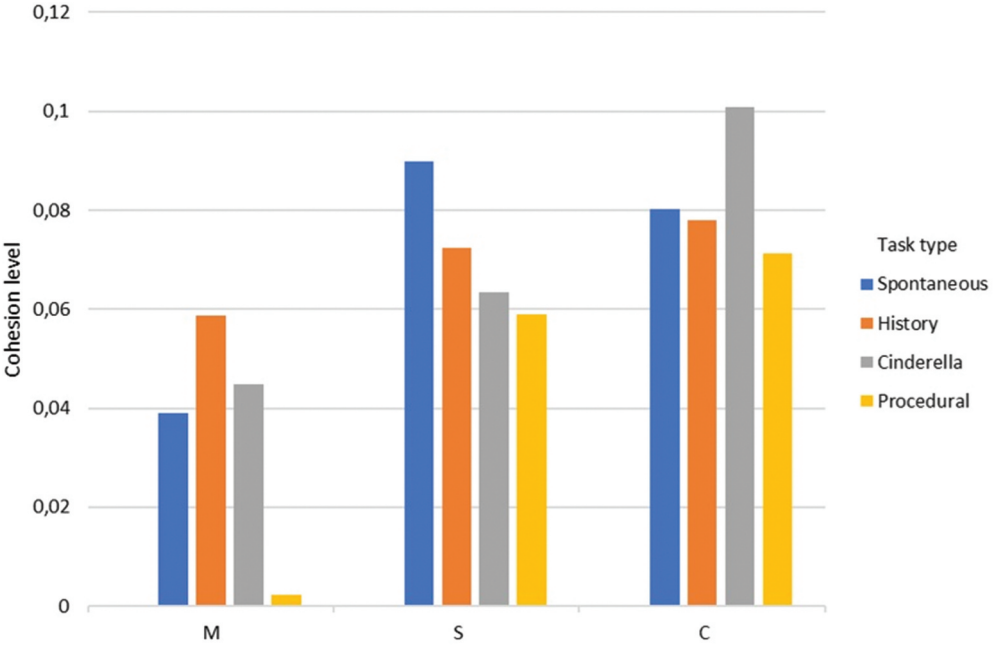


Figure 5. Influence of discourse genre and disorder on R index. Source: own materials. S – mixed aphasia with a sensory component; *M* – mixed aphasia with a motor component; C – control group.

disjunctive conjunctions was observed in each group. In the group of patients with mixed aphasia with a sensory component, there is a greater use of conjunctions indicating a goal (CNp), a continuation (CNconti) or a cause-and-effect relation (CNsig), which may mean attempts to create subordinate sentences and continue the statement.

Relationship between discourse genre and cohesion

A statistically significant interaction effect was noted for R ($F(6, 81) = 2.38$, $p = 0.036$, $\eta p^2 = 0.15$), accompanied by significant main effects of group ($F(2, 81) = 13.91$, $p < 0.001$, $\eta p^2 = 0.51$) and task type ($F(3, 81) = 5.29$, $p = 0.002$, $\eta p^2 = 0.16$). Post-hoc comparisons with Bonferroni correction showed that in the spontaneous speech task, the control group ($M = 0.08$, $SD = 0.034$) scored significantly higher than the group with mixed aphasia with a motor component ($M = 0.04$, $SD = 0.02$), $p < 0.015$.

A similar pattern was observed in the Cinderella task ($p = .004$). In this task, patients with mixed aphasia with a motor component ($M = 0.04$, $SD = 0.03$) scored significantly lower for R than control participants ($M = 0.10$, $SD = 0.03$).

In the procedural task, patients with motor-component aphasia obtained lower R scores ($M = 0.00$, $SD = 0.01$) than those with a sensory-component aphasia ($M = 0.06$, $SD = 0.04$, $p = 0.007$) and the control group ($M = 0.07$, $SD = 0.05$, $p < 0.001$).The average level of the R index for each task type and disorder type is presented in Figure 5.

A post-hoc test examining the REP index, following a statistically significant interaction between group and task type ($F(4.90, 81) = 3.28$, $p = 0.007$, $\eta p^2 = 0.20$), with no significant main effect of group ($F(2, 81) = 1.55$, $p = 0.231$, $\eta p^2 = 0.10$) or task type ($F(2.45, 81) = 0.55$, $p = 0.467$, $\eta p^2 = 0.02$), showed that subjects from the aphasia group with a sensory component ($M = 0.02$; $SD = 0.01$) obtained significantly higher REP scores in the history task than subjects from the control group ($M = 0.01$; $SD = 0.01$; $p = 0.037$). There was no difference between these groups in tasks other than in the history task.

In turn, in the procedural task there was a statistically significant difference between the control group ($M = 0.02$; $SD = 0.02$) and the group with aphasia with a motor component ($M = 0.00$; $SD = 0.00$; $p = 0.037$). Subjects in the control group had higher utterance coherence in REP than those in the aphasia group with a motor component. There were no differences between these groups in the remaining tasks. The average level of the REP index for each task type and disorder type is presented in Figure 6.

In the analysis performed for index COL, the main effect of task type ($F(3, 81) = 10.74$, $p < 0.001$, $\eta p^2 = 0.28$) and group ($F(2, 81) = 3.41$, $p = 0.048$, $\eta p^2 = 0.20$) was statistically significant, while the interaction between group and task type was not significant ($F(6, 81) = 1.11$, $p = 0.366$, $\eta p^2 = 0.08$) (see Figure 7). As shown by the post hoc test with Bonferroni correction, there were no statistically significant pairwise comparisons for the group; however, for the type of task the main effect was that the subjects in the procedural task ($M = 0.00$; $SD = 0.00$) achieved statistically significantly lower consistency in the COL index than when they performed the spontaneous speech task ($M = 0.01$; $SD = 0.01$, $p = 0.001$), history task ($M = 0.01$; $SD = 0.01$, $p = 0.003$) and Cinderella task ($M = 0.01$; $SD = 0.01$, $p = 0.003$).

The analysis in which the dependent variable was the level of coherence in SUB showed a statistically significant main effect of task type ($F(2.30, 81) = 6.58$, $p = 0.002$,

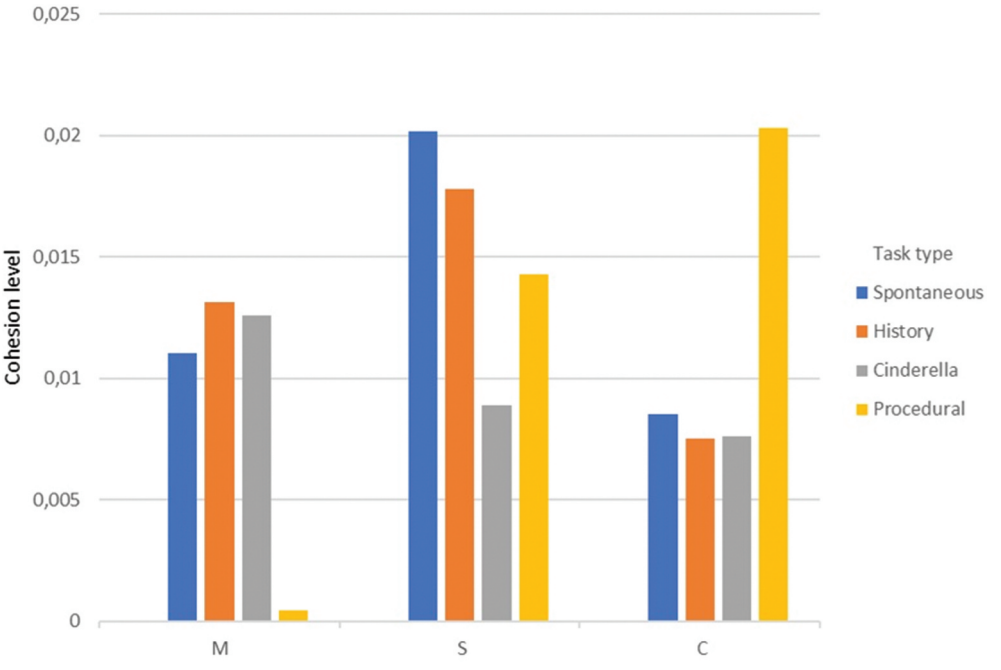


Figure 6. Influence of discourse genre and disorder on REP index. Source: own materials. S – mixed aphasia with a sensory component; *M* – mixed aphasia with a motor component; C – control group.

$\eta p^2 = 0.20$), with no significant main effect of group ($F(2, 81) = 2.97$, $p = 0.068$, $\eta p^2 = 0.18$) and no significant interaction between group and task type ($F(4.60, 81) = 0.72$, $p = 0.602$, $\eta p^2 = 0.05$). As shown by the post hoc test with Bonferroni correction, subjects in the procedural task ($M = 0.00$; $SD = 0.01$) obtained statistically significantly lower SUB level results than in the Cinderella task ($M = 0.01$; $SD = 0.01$, $p = 0.019$) and his ($M = 0.01$;
$SD = 0.01$, $p = 0.031$). There were no statistically significant differences between the spontaneous speech task ($M = 0.01$; $SD = 0.01$) and other measurements. The average level of the SUB index for each task type and disorder type is presented in Figure 8.

Comparison of coherence between control and aphasia groups

Figure 9 shows the average local coherence score in the three analyzed groups. Results are presented according to van Leer and Turkstra's five-point scale (1999). The highest result (3.91/5) was found in the control group, while the lowest was in the group of patients diagnosed with mixed aphasia with a sensory component (2.46/5). The result in the group of patients with mixed aphasia with a motor component was 3.05/5.

Figure 10 presents the average global coherence score in the three analyzed groups. Results are presented in accordance with van Leer and Turkstra's five-point scale (1999). As in the local coherence examination, the highest score (3.43/5) was found in the control group, while the lowest (2.03/5) was observed in the group of patients diagnosed with

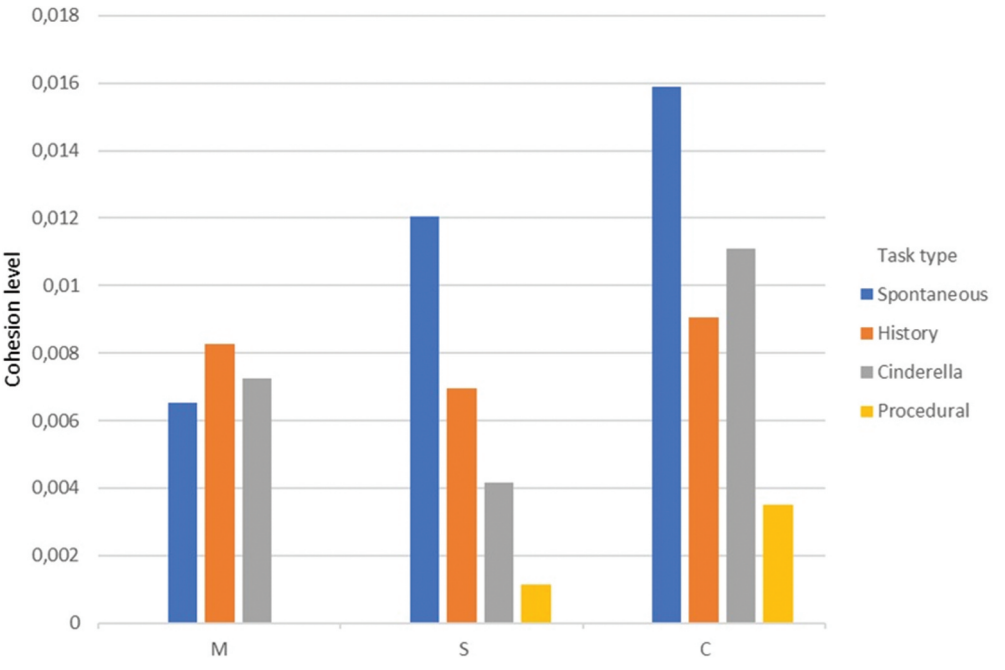


Figure 7. Influence of discourse genre and disorder on COL index. Source: own materials. S – mixed aphasia with a sensory component; *M* – mixed aphasia with a motor component; C – control group.

mixed aphasia with a sensory component. The result in the group of patients with mixed aphasia with a motor component was 2.66/5.

At the next stage of the analysis, regression analyses were performed to check whether the level of the coherence indexes (L1–L5 and G1–G5) is explained by the cohesion indexes (CN, R, REP, COL, SUB). Only the results for L2, L5 and G5 are reported because the remaining regression analyses turned out to be insignificant (see Table 4).

Discussion

As expected, the findings of the study show significant differences in discourse production between the control group and the two groups of patients diagnosed with mixed aphasia. Comparison of groups and discourse genres demonstrates that discourse varies depending on discourse genre and whether it is affected by aphasia or not. The results differ in each measurement: disparities can be seen in speech production, usage of cohesion determinants, and both local and global coherence. Similarly to international studies (Deng et al., 2024; Stark, 2019), presented study of discourse among Polish-speaking people with mixed aphasia and neurologically healthy individuals show that the control group produced more coherent output and more accurately used determinants of cohesion across discourse tasks. In aphasic discourse, the lower scores in local and global coherence result in poor cohesion and difficulties in linking the elements of an utterance (cf. Andreetta & Marini, 2015; Andreetta et al., 2012). The research confirms the

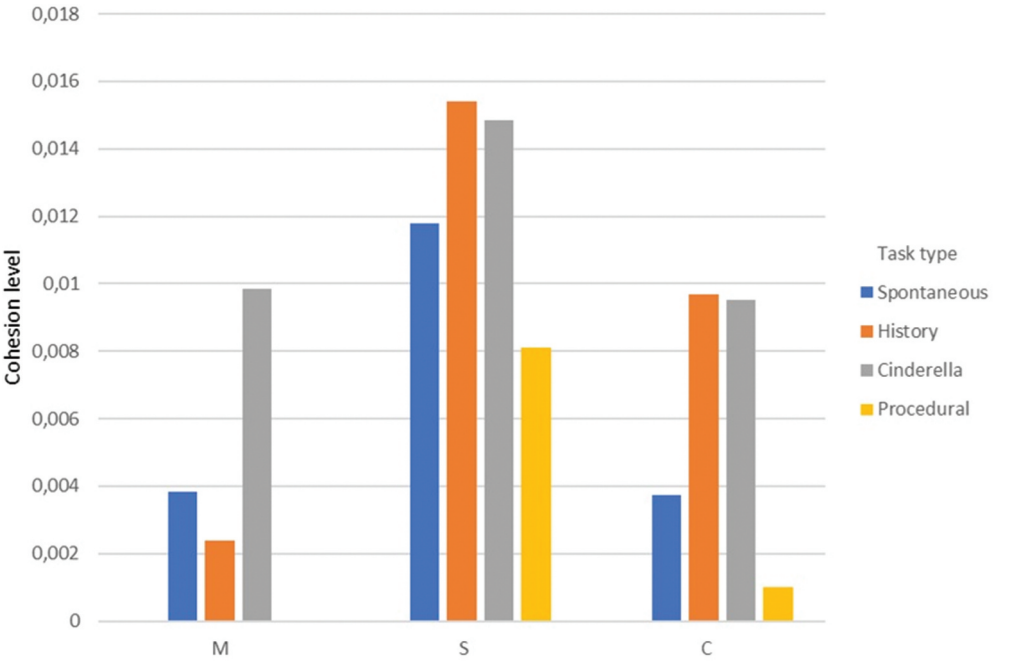


Figure 8. Influence of discourse genre and disorder on SUB index. Source: own materials. S – mixed aphasia with a sensory component; *M* – mixed aphasia with a motor component; C – control group.

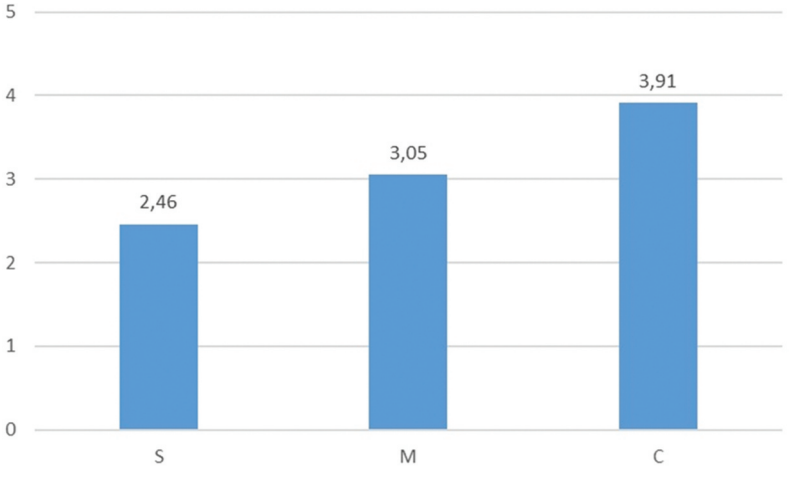


Figure 9. Average local coherence score in the three groups. Source: own materials. S – mixed aphasia with a sensory component; *M* – mixed aphasia with a motor component; C – control group.

fact that lower coherence within the macrolanguage may result from disruptions in the microlanguage.

The greater number of utterance productions in the mixed aphasia with a sensory component group may arise from difficulties in selecting the right vocabulary, and

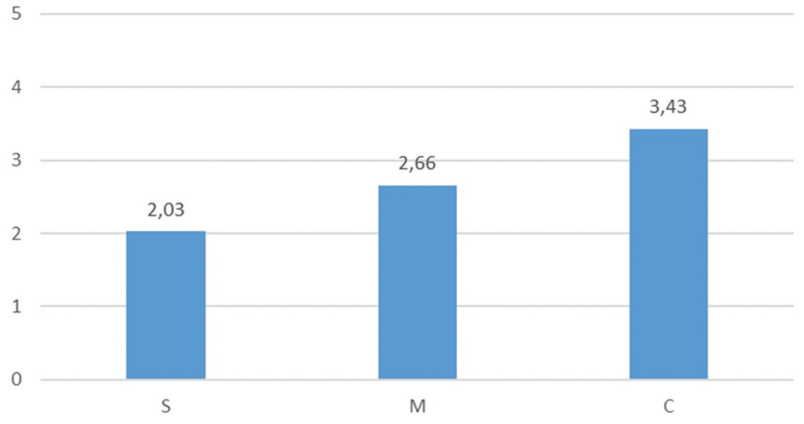


Figure 10. Average global coherence in the three groups. Source: own materials. S – mixed aphasia with a sensory component; *M* – mixed aphasia with a motor component; C – control group.

Table 4. Predicting L2, L5 and G5 level based on cohesion indices.

L2	*B*	*SE*	*Beta*	*t*	*p*
(constant)	0.01	0.01		1.40	0.173
CNT	−0.10	0.06	−0.29	−1.59	0.124
R	0.08	0.06	0.27	1.26	0.219
REP	−0.03	0.15	−0.04	−0.21	0.839
COL	−0.37	0.26	−0.24	−1.43	0.165
SUB	0.41	0.17	0.47	2.33	0.028
L5					
(constant)	0.34	0.15		2.27	0.033
CNT	−0.08	1.43	−0.01	−0.06	0.956
R	1.46	1.34	0.23	1.09	0.287
REP	−4.75	3.36	−0.26	−1.41	0.171
COL	10.20	5.83	0.30	1.75	0.093
SUB	−9.58	3.90	−0.49	−2.46	0.022
G5					
(constant)	0.34	0.13		2.72	0.012
CNT	−0.91	1.22	−0.14	−0.75	0.461
R	1.08	1.14	0.20	0.95	0.353
REP	−5.45	2.86	−0.35	−1.90	0.069
COL	9.09	4.96	0.30	1.83	0.079
SUB	−7.86	3.32	−0.46	−2.37	0.026

Source: authors' own materials; *B* - unstandardized regression coefficient; *SE* – standard error; *Beta* – standardized regression coefficient; *t* – test result.

sometimes overproduction; this means not greater coherence of elements but grammatical and semantic breakdown.

It was observed that conjunctions (CNT) were dominant determinants of cohesion in the discourses of all the groups. When the language system of people with aphasia disintegrates, conjunctions act as compensatory mechanisms. Another important determinant of cohesion in each group turned out to be references (R), which help to maintain the dynamics of statements, especially in narrative discourse. The study showed the lowest number of references (R) in each task in the group with mixed aphasia with a motor component, which may influence the use of telegraphic style in statements. The highest number of references (R) in spontaneous speech was found in the group of

people with mixed aphasia with a sensory component, which indicates greater difficulties in planning statements and a desire to emphasize connection and cohesion in the topic discussed. The highest number of repetitions (REP) occurred during procedural discourse in the control group. The task of planning or deduction requires good cognitive functioning, which results in disorders occurring in people with aphasia. The high repetition rate in the group of people with mixed aphasia with a sensory component when telling a story with reference to pictorial material may be an attempt to maintain consistency and progress the story from one picture to another. The smaller number of collocations (COL) in the group of people with mixed aphasia results from limitations in selection of vocabulary from lexical resources. Future, more specific studies may hypothesize that it may also be caused by limitations in a patient's cognition because using collocations in a discourse requires a high level of linguistic and cognitive functioning. Disturbances in lexical functioning may be caused by both perceptual and cognitive disorders, that refer to a range of neurological or psychological conditions that impair mental processes (Panasiuk, 2019, p. 211). The highest number of substitutions (SUB) was recorded in the group of people with mixed aphasia with a sensory component. This phenomenon may be caused by the occurrence of difficulties in naming, where the patient tries to select appropriate lexical and meaning units from the memory buffer. Substitution (SUB) was found to be the only significant cohesion index for each of the three analyzed variables. For the L2 variable, the more often SUB occurred, the higher the L2 index, which means that the level of local coherence decreased in utterances where substitutions occur. For the L5 and the G5 variables, the variance between SUB index and coherence level was the opposite: the less frequently SUB occurred, the higher the L5 or the G5 index, and the local or global coherence level increased. The use of substitution (SUB) in this case is compensatory behavior. In the case of people with mixed aphasia with a motor component, substitution is often used due to limitations in speech production. In the case of people with mixed aphasia with a sensory component, it is used due to disorders in selecting appropriate vocabulary from the meaning code. Perhaps a higher number of substitutions indicates compensatory actions that affect the level of local and global coherence. Patients make various combinations of both content and form, which are stored in cognitive structures and constitute a certain template or patterns for describing the phenomena of reality (Panasiuk, 2006).

It is known that words are stored in so-called semantic fields, which means that words with similar meaning can be found next to each other (Aitchison, 1991, cf. Panasiuk, 2006). A low percentage of ellipses (E) was recorded in all groups, but the most prominent disruption occurred in the discourse of those diagnosed with mixed aphasia with a motor component. This could mean that ellipsis is the least significant element of cohesion and does not have such a substantial impact on the structure of microlanguage. In response to the first research question, the study revealed distinct patterns in the use of cohesion determinants across the three groups. While conjunctions (CN) were the most frequently used cohesion devices in all groups, individuals with mixed aphasia – particularly with a motor component – used significantly fewer references (R), collocations (COL), and ellipses (E), suggesting limited access to cohesive linguistic resources.

In all three groups, average local coherence level results were higher than global coherence level. It can be concluded that maintaining discourse appropriate to the general topic of a conversation is more difficult and requires better linguistic functioning

than maintaining linear coordination between consecutive utterances. On the basis of the presented study, it can be concluded that the lowest local coherence was recorded in the group of patients with mixed aphasia with a sensory component. This result could be caused by the fact that people with a sensory aphasia often tend to select elements during the production of utterances that may disturb the semantic connection of the sentence. However, the lower local coherence of people with mixed aphasia with a motor component compared to the control group might be caused by difficulties with updating the structural elements that determine the shape of the utterance (Panasiuk, 2019, p. 305). Global coherence would certainly be influenced by the patient's cognitive functioning, especially thinking, planning and attention span. Concerning the second question, the findings demonstrate a clear relationship between cohesion and coherence. The higher frequency of substitution (SUB), especially in the sensory aphasia group, was significantly associated with lower levels of local and global coherence. This supports the view that micro-level cohesion deficits, such as overuse of substitution, contribute to macro-level coherence breakdowns.

According to coherence predictions based on the cohesion indices presented in this paper, it can be concluded that substitution is the cohesion determinant which has the most significant impact on coherence. The more often substitutions occurred in speech, the lower the level of local coherence; conversely, the less frequently the S index was, the more coherent the speech. In therapeutic procedures, increasing lexical-semantic competence and systematic organization of vocabulary in the lexical fields would reduce the occurrence of substitution, thus possibly improving patients' ability to produce coherent statements.

Difficulties in maintaining coherence at the micro- and macro-level of language in the groups of people diagnosed with mixed aphasia compared to the control group indicate the possibility of disturbances in everyday interactions. These may influence willingness to speak in an understandable and coherent manner, which also confirms the presence of elements of cohesion and coherence in the examined discourses.

Finally, regarding the third research question, the study confirmed that mixed aphasia significantly affects discourse cohesion and coherence. Both aphasia groups differed from the control group in the quantity and quality of cohesive markers used and, in their ability to maintain topic continuity. The sensory group exhibited lexical overproduction and semantic disorganization, which further disrupted both local and global coherence.

These findings confirm the initial hypothesis that the presence of mixed aphasia, resulting from central nervous system damage, negatively affects both micro- and macro-linguistic aspects of discourse. Specifically, the reduced use of cohesive devices and the lower levels of local and global coherence observed in the mixed aphasia groups compared to the control group support the claim that the occurrence of aphasia leads to disruptions in discourse structure and overall communicative effectiveness.

Future directions

There is a necessity for continuation of this research to demonstrate differences in other types of aphasia. Additionally, therapeutic activities should be undertaken for people with aphasia, through which their linguistic functioning and communication would improve.

Therapeutic activities aimed at improving the discourse coherence of people with aphasia should include exercises that indicate the correct use of coherence measures. Therefore, it is worth practicing creating complex sentences using conjunctions, learning how to make the right choice of lexical units, and understanding the validity of their use. The use of procedural discourse is important as it requires the involvement of processes and, above all, thinking, planning, and attention (Dipper et al., 2024).

The study of the linguistic subsystems of pragmatics and discourse in aphasia is particularly relevant to the contemporary sociocultural and psychosocial understanding of language, cognition, and learning (Austin, 1975; Vygotsky, 1978; Wittgenstein, 1953), where social factors are not only the context itself, but also the driving force of the process of language construction and reconstruction. This understanding of communication competence disorders is proposed by the ICF (WHO, 2001), an international conceptual framework for the definition, measurement and development of policy in the field of health and disability, also widely adopted in speech and language pathology (Dębski et al., 2021; Simmons-Mackie & Kagan, 2007). Therefore, it is important to continuously study speech and language in relation to its pragmatic use.

Limitations

Although a high degree of agreement between all three researchers was established during data coding, some inconsistencies may slightly affect the final results.

Another obvious limitation of the study is the relatively small sample of participants (10 in each testing group), which may result in reduced statistical analysis power. Establishing a clear link between cohesion, coherence and discourse genre requires more extensive research to strengthen statistical analyses. A larger number of samples in the statistical analysis may result in more correlations becoming apparent in predicting the level of coherence based on cohesion determinants. It would also make it possible to resolve whether and to what extent the differences between results presented in this and other studies are due to language typology. This study presents 3 correlations: the prediction of the L2, L5 and G5 variables.

Conclusion

The study confirmed that mixed aphasia significantly impacts both cohesion and discourse coherence. Individuals with aphasia with a motor and sensory components demonstrated distinct language patterns, and substitution emerged as a key predictor of coherence. Notable differences in the results of patients with mixed aphasia with either motor or sensory component and people from the control group clearly indicate the impact of aphasia on producing texts and on the level of both local and global coherence. These findings underscore the clinical importance of targeting coherence and cohesion related mechanisms in aphasia therapy.

Notes

1. Project OPUS21 from the National Science Center "Multilevel research on the discourse of Polish language users diagnosed with mixed aphasia", no. 2021/41/B/HS2/00898.
2. Decision number KEBN//004/100322, received on 22.03.2022.
3. In Polish some of the conjunctions presented in methodology perform a different function at the level of syntax and meaning than their English equivalents, for example: conjunction *kiedy* (while) in Polish signals either temporal relation or signals contrast between two clauses of the sentence. For this reason, there might be particular differences between methodology matched to Polish-speaking research group and its translation to English language. The purpose of presenting English translations of conjunctions is not to demonstrate similarity between Polish and English conjunctions but to make the methodology as intelligible as possible to non-Polish speaking recipients.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Data availability statement

Data available on request from the authors. The data that support the findings of this study are available from the corresponding author, upon reasonable request.

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