An analysis of discourse presented in transcripts of the Cinderella story retold from memory by aphasic and neurotypical speakers

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Abstract

Background: People with aphasia (PWA) experience a range of communication difficulties. Communicative deficits typically include problems with connected speech, or discourse. Improving communication success at the level of discourse is often a primary goal in aphasia rehabilitation. This investigation questions which skills should be targeted during aphasia rehabilitation in order to most efficiently result in discourse improvement. Most often, therapy has focused on sentence level skills (e.g., word-finding or syntax/grammar) because these are recognized as areas of impairment. However, Linnik et al. (2016) recently reported on a treatment that placed greater emphasis on suprasentence level skills (e.g., organization of ideas or coherence).

Aims: The study aims to determine the sentence and suprasentence level impairments exhibited by people with aphasia when they were asked to retell the Cinderella story from memory. Moreover, this study aims to compare their performance to that of neurotypical participants. Specifically, areas of interest addressed throughout this investigation include: (1) the number of main concepts that the participants included when they retold the story, (2) the order in which the participants arranged the 5 story events, and (3) potential correlations between these components and the Western Aphasia Battery (WAB) test scores.

Methods & Procedures: Transcripts were collected from 40 participants who were asked to retell the Cinderella story from memory. The 40 Cinderella story transcripts were composed of 20 controls and 20 PWA. These transcripts, as well as WAB test results, were collected from AphasiaBank (MacWhinney et al., 2011). The 40 transcripts were each individually coded and compared to a Main Concept (MC) list discourse task called “MCRules—Cinderella” (Richardson

& Dalton, 2015), which, is a document that AphasiaBank supplies. Data from the Cinderella transcriptions were then correlated to WAB test scores for participants with aphasia.

Outcomes & Results: At large, the control participants included a greater percentage of the 34 main concepts than the aphasia participants did when they retold the story. The average percent of control participants who included each of the 34 main concepts was 50.88%; while, the average percent of aphasic participants who included each of 34 main concepts was 22.5%. Nonetheless, the neurotypical participants and aphasic participants demonstrated similarities in the specific main concepts that they chose to include when they retold the Cinderella story. There was a significant correlation ($p=0.01$) between the number of main concepts included by participants with aphasia and their WAB Word Fluency test scores. Results also showed that the aphasic participants made few errors and the controls made no errors in the order that 5 story events were introduced.

Conclusions: This investigation concluded that in order to improve discourse skills, aphasia rehabilitation should focus on word fluency, as opposed to discourse organization. The reason for this conclusion was twofold: (1) the results do not show a significant difference between the control and the aphasic participants' performance on the order of events (discourse organization) portion of this investigation, and (2) the results do show a significant correlation between the WAB Word Fluency test scores and the number of main concepts that the aphasic participants included when they retold the Cinderella story, indicating potential similarities between the thought processes that are involved during a discourse task and a word fluency task.

Introduction

Aphasia is a communication disorder that results from brain damage, primarily to the specific language centers of the brain; commonly resulting from stroke or traumatic brain injury (TBI). The left hemisphere of the brain is dominant for language in most individuals (regardless of handedness). Therefore, with rare exceptions, PWA will have damage to the left side of their brain. Isolated impairments may occur, however, aphasia refers to those who have central language impairments. Central language impairments impact abilities to use language in all modalities including: speaking, listening, reading, and writing. Aphasia symptoms are categorized as fluent or nonfluent, and this categorization is based on the quality and quantity of an individual's spoken output. Once fluency is determined, differential diagnosis of the aphasia type is determined based on an individual's performance on auditory comprehension and repetition tasks (See Figure 1). Criteria for determining fluency includes: phrase length, grammatical variety, and the ratio of correct information conveyed to the total words spoken.

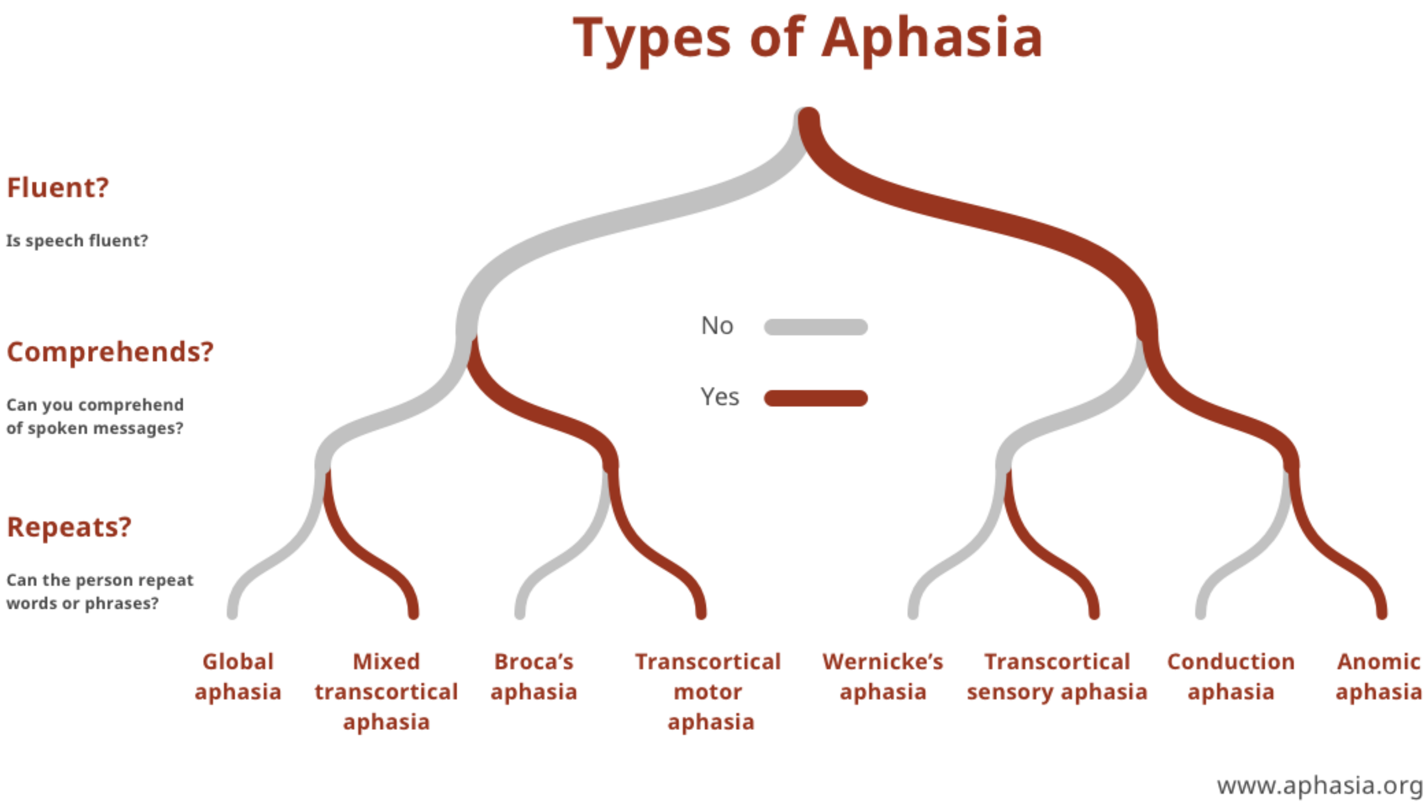

Figure 1. Aphasia Definitions (National Aphasia Association, 2017).

All PWA have word finding difficulties, or anomia, regardless of their specific type of aphasia. This can make communication quite frustrating. Individuals who have word finding difficulties may report certain words as being "caught on the tip of their tongue". They may have a clear idea about what they want to say and yet a particular word is unattainable at the moment. Words that are less frequently used may be more difficult to produce for PWA. PWA often combat word finding difficulties with circumlocution strategies. Circumlocution strategies help PWA avoid the word/s they are unable to retrieve, while still getting their point across. For example, if an individual wants to talk about their dog and the word *dog* is unattainable at the moment, then they may use circumlocution strategies and explain their dog as a "furry pet that barks" to make it clear that they are talking about their dog without having to say the word they are stuck on.

Paraphasia (a production error) often occurs when PWA are unable to find the correct word or phrase. There are several types of paraphasia. Table 1 provides types and examples of paraphasia errors.

Table 1. Types of Paraphasia.

Type of Paraphasia	Target	Production
Phonemic	spot	pot
Semantic Verbal	car	drive
Remote Verbal	car	dog
Neologistic	camera	camalee

Note. Referenced: Millea, 2013.

Empty speech is also a symptom of word finding difficulties. Some PWA produce fluent phrases or sentences but words that should carry specific content are replaced by nonspecific words. For example, “I went over there to do that thing with that person who came from there.”

PWA tend to have less difficulty recalling high frequency words, compared to low frequency words. For instance, a word like *hello* is likely more habitual to produce compared to a less commonly used word like *dragon.* That being said, a frequently used word may differ depending on the person, due to factors like occupation, culture, or family. There are many linguistic factors (i.e. word class) that make word finding either easier or more difficult and these impacts may vary depending on the individual. Tangibility of a word or concept can influence word finding. In other words, a concept that is concrete and has an easily imagined definition may be more accessible to produce, compared to a vague concept without a clear definition. Emotional connection to a concept and its meaning impacts the accessibility of the word as well. If an individual has an emotional memory associated with a word then it likely is more accessible than a word without that connection. Phonetic complexity is an example of a linguistic factor that impacts word finding.

Intuitively, more complex words with more linguistic components will be more difficult to retrieve in an instance of word finding difficulty.

Word finding is assessed based on a variety of tasks. This investigation analyzed word finding performance based on WAB assessments. WAB assessments analyze skills, such as: object naming, word fluency (the ability to rapidly produce words given a semantic category), sentence completion, and responsive speech (the ability to answer questions by producing nouns and verbs). This investigation looked at object naming scores; for this test, visual stimulus of various objects are presented to the patient and their response (whether it be correct, incorrect, or no response) is recorded. If they do not respond, or they respond incorrectly then the examiner must present a phonemic or semantic cue, meaning the first half of the word. This test is timed and participants are awarded with 1-3 points depending on their response (Kertesz, 1982, p.8). This investigation also included Boston Naming Test scores (BNT Short Form) and Verb Naming Test scores (VNT). The investigation incorporated word fluency test scores. A word fluency test could involve asking a patient to name as many animals as he or she can in one minute (Kertesz, 1982, p. 9). Another WAB test score that was looked at was sentence completion. In a sentence completion test, a participant could be asked to complete a sentence such as “The grass is _____” and the acceptable answer for credit would be *green* (Kertesz, 1982, p. 9). Responsive speech WAB tests could involve a participant being asked a question such as: “What do you write with?” and an acceptable answer for credit would be *pen* or *pencil* (Kertesz, 1982, p.9). Together, WAB test scores like these predict the Aphasia Quotient (AQ), which quantifies the severity of spoken language deficit.

Word finding skills are essential for discourse tasks—in order to carry out narrative discourse successfully, one needs access to a myriad of words. Aphasia rehabilitation places great emphasis on improving language at the discourse level. It is important to investigate discourse skills, because, these skills bear a resemblance to the ways language is used in functional situations on a daily basis. The purpose of aphasia rehabilitation is to contribute to functional improvements that impact PWA's everyday life conversations. This is why discourse analysis is exceedingly important in therapy.

A discourse analysis task that is commonly used by researchers, as well as therapists, is story retelling. This investigation utilized transcripts of participants retelling the Cinderella story from memory. Normative data for both PWA and neurotypical adults is available for this task (MacWhinney et al., 2011). The participants were first prompted by looking at a wordless Cinderella story picture book. The purpose of this is to briefly refresh their memory of the story prior to asking them to recite it. The story retelling can begin once the picture book has been removed. Retelling any story requires word finding skills to help recall the names and important words that make up the crucial events of the story. Retelling a story also requires discourse organization (i.e. telling the story from beginning to end and selecting what the important events/details vs. less important events/details are within the story).

PWA's discourse production has been investigated via other elicitation methods. For instance, in a study by Larfeuil & Le Dorze (1997), PWA were asked to tell a story when presented with a single complex picture depicting a bank robbery scene. Their study found that the duration of discourse produced, as well as the number of correct word-finding moments, were both correlated with the participants' severity of aphasia. The current study aims to grow from the base of knowledge that Larfeuil and colleagues presented (1997), by analyzing additional factors (other than solely severity) that impact discourse in PWA.

Storytelling appears to have a strong pragmatic component, thus, it may seem reasonable to contribute difficulties with discourse to pragmatic deficits. However, there is little support in the literature for this notion. Pragmatic aspects of language processing are not proven to be impacted by aphasia. Part of a study by Menn et al. (2010) addresses pragmatics and aphasia. Findings by Menn and colleagues supported both of their hypotheses pertaining to pragmatic abilities of PWA. One supported hypothesis was that PWA (who are within the testable severity range) respond to pragmatic factors of expectedness in similar ways to neurotypical speakers—this study added expectedness of information to the list of pragmatic factors that are preserved in people with aphasia (Menn et al., 2010, p. 505). Factors of expectedness refer to the inferrability of information. This information is relevant to the current study because; although, it may seem that pragmatic deficits would impact aphasic discourse, the study by Menn and colleagues suggests that there are preserved factors of pragmatics in PWA. Pragmatics would, then, not be the reason for aphasic discourse deficits.

The current investigation questioned whether the participants with aphasia exhibited discourse organization difficulties, and if they did, what might be the underlying causes. It was hypothesized in this investigation that if PWA did have difficulty with discourse organization, then it was due to word finding difficulties. If an individual was unable to produce a particular word that was crucial to a discourse element, then they may have skipped over that element and returned to it once/if the crucial word became attainable. PWA choose what they say based on the particular words that they are able to produce at that moment in time, thus, the order in which they organize events within a story may have been impacted by their word finding difficulties. Consequently, discourse organization may be correlated with WAB test scores—for example, WAB naming tests.

Witworth and colleagues (2015) approached the topic of discourse organization in a study that grew from work by Whitworth (2010). Additionally, Witworth expounded on coherence and cohesion—coherence (which involves story grammar) was the focus. They addressed this issue by considering therapeutic impact. Their study implemented two therapy conditions: (1) NARNIA intervention: combined word retrieval, sentence production, and discourse macrostructure across a range of everyday discourse genres and (2) UC intervention: use of any speech-language therapy routinely used in clinical practice, which is individualized to meet the needs of the participant (Whitworth et al., 2015). The results showed one significant between-group difference—the orientation aspects of macrostructure were much greater in the NARNIA group. Orientation aspects refer to the organization of a narrative into a beginning, middle, and end. The baseline prognostic factors between the two groups prior to intervention showed that there were single-word processing differences seen within-groups, but this was not seen between-groups. The UC group made isolated gains in sentence production and the NARNIA group made significant gains across all language levels. Retrieval of nouns in isolation increased across both groups, though, verb processing was only improved in the NARNIA group. Sentence production was not changed for either group. This study is significant because, as it is stated in the conclusion, "These findings are highly promising in demonstrating the use of macrostructure to scaffold production of words and sentences and improve discourse organization." (Whitworth et al. 2015, 1345).

A study by Carragher, Sage & Conroy (2015) emphasized discourse analysis through storytelling. Their study grew from another study by Ramsberger and colleagues (Ramsberger & Menn, 2003; Ramsberger & Rende, 2002) by extending interactive storytelling to a therapy task. Carragher and colleagues (2015) described a novel treatment, which, targeted discourse production in patients with non-fluent aphasia. This treatment focused on: 1) story grammar (i.e. the organizational level of discourse), and 2) word finding and sentence construction. The emphasis on story grammar in nonfluent patients was not previously addressed. In the study by Carragher and colleagues, four participants and their communication partners were recruited and a dual focus treatment was administered. The four participants had chronic nonfluent aphasia. The target of therapy was storytelling using “thinking for speaking” and story grammar. Three PWA demonstrated increased transfer of new information within untrained simple storytelling. The same was true for complex storytelling, for two of the PWA. There were changes to the order of events within the story. The simple story’s order of events became more similar to neurotypical participants. Their study presented a dual focused therapy technique where the communication partners were involved. This dual focus therapy method targeted skills used in information exchange and storytelling. The likelihood of generalization was also increased with this method of therapy. This investigation considers the relationship between macrolinguistic features (discourse organization) and microlinguistic features (word finding skills demonstrated by WAB scores) of discourse, by analyzing storytelling.

Helasvuo (2010) addressed the idea of collaborative completion during discourse between a person with aphasia and a communication partner without aphasia. They explained that collaborative completion aids conversation when the individual with aphasia struggles with word finding, because their conversation partner is able to help complete a unit in progress. This manner of communicating, as Helasvuo states, “invokes different discourse identities such as knowing/unknowing recipients and through them even larger social identities such as a husband and wife (C. Goodwin, 1987)”. When retelling the Cinderella story, an individual with aphasia does not have a communication partner there to complete their units—they do not have the opportunity for collaborative completion. Thus, word finding may impact storytelling discourse to a greater degree than typical back and forth conversation.

Researchers have already contributed studies that address aphasic discourse, however, there are missing components. Traditionally, the micro structure of language has been emphasized. More attention has recently been given to the macro level of language. Conclusions from a study by Linnik and colleagues (2016) grew out of Armstrong (2000), who points out the importance of investigating the connection between micro- and macrolinguistics. According to Linnik et al., in order to get a complete picture of the mechanisms of aphasic discourse production, both structural and functional perspectives must be considered. Furthermore, more effort should be put into investigating "discourse structure or discourse organization at the macrolinguistic level, and discourse coherence" (Linnik et al. 2016, 790). It is concluded that "bringing together studies on purely linguistic features and those focusing on the overall conversational success is essential for understanding the role language plays in establishing communication" (Linnik et al. 2016, 790).

Carragher and colleagues (2015) suggested that people with aphasia need to work on "thinking for speaking" aspects of language. In other words, they need to work on the macrolinguistic level of telling a story. As previously stated, microlinguistic levels of language (such as naming) have been the focal point in aphasia rehabilitation. That being said, this investigation questions whether micro- and macrolinguistic deficits lead to similar storytelling outcomes. If an individual with aphasia has difficulty with naming (this is a microlinguistic issue), then when that individual retells a story they may skip over a story event if they are unable to produce a crucial word for particular event. Skipping over an essential event could certainly impact the overall story structure. Moreover, this could impact the overall story structure in a way that is similar to an individual who has macrolinguistic deficits. If an individual has difficulty with discourse pragmatics (a macrolinguistic issue), then when they retell a story they may also skip over essential events. The result for both individuals is comparable, even though the source of their deficits differs. While, the study by Carragher and colleagues (2015) emphasized the importance of the macrolinguistic level of language, this current investigation aims to shine some light on the relationship between microlingusitic and macrolinguistic elements of discourse.

Carragher and colleagues (2015) also explained an issue of selectivity, which was raised by Marshall & Cairns (2005). Selectivity is required when retelling a story because one must pick out just enough information—not too much or too little—to get the ideas of the story across effectively. Selectivity applies to the current investigation because the participants who are retelling the Cinderella Story must also think selectively as they recall events. They must decide which events and details are key to the understanding of the story.

According to Carragher and colleagues, studying storytelling is important because, "Evidence suggests PWA engage significantly less in storytelling than their healthy counterparts (Davidson et al., 2003); thus, storytelling presents a psychosocially and clinically valid context for therapeutic focus." (Carragher et al., 2015, p.1398). Retelling the Cinderella story is, in all probability, not a frequent experience. Nonetheless, retelling the Cinderella story requires functional skills that are applicable to everyday life. For illustration purposes—if one were asked to talk about their day, or even to recapitulate their trip to the grocery store; then, their response is going to be similar to that of a story. Narrative discourse skills are required during daily conversations and when one retells the Cinderella story.

Aims of this investigation

The current investigation demonstrates an analysis of narrative discourse transcripts—focusing on the level of detail (i.e. main concepts included) and the discourse organization (i.e. order of story events) depicted in the transcripts. Specifically, this study aims to answer the following questions:

- Do the aphasic and control participants choose to include similar main concepts when they are asked to retell the Cinderella story from memory?
- Do the number of main concepts included in the participants' retellings correlate to any of the following test scores: WAB Aphasia Quotient (AQ), Name Score for AQ, Verb Naming Test (VNT) Total, Boston Naming Test (BNT) Short Form, WAB Object Naming, WAB Word Fluency, WAB Sentence Completion, and Responsive Speech?
- Do the aphasic and control participants arrange the Cinderella story events in the correct order?
- *If* the order in which the participants arrange the story events significantly deviates from the typical order, is there a correlation between the amount of deviation and any of the following test scores: WAB AQ, Name Score for AQ, VNT Total, BNT Short Form, WAB Object Naming, WAB Word Fluency, WAB Sentence Completion, and Responsive Speech?

Method

Aphasia is a low incidence communication disorder, which makes it extremely difficult for researchers to carry out investigations with adequate statistical power. Therefore, this investigation utilizes AphasiaBank (MacWhinney et al., 2011), which is a "big data set" available through Carnegie Mellon University. AphasiaBank provides access to the assessment results for 400+ patients and ~200 neurotypical controls. Results include transcripts of discourse and standardized test results, containing those for word finding performance. All data that was used in this investigation were accessed through AphasiaBank.

Participants

Twenty control participants and twenty aphasic participants were selected from the AphasiaBank Test Results Collection and Demographic Collection. First, I will discuss the method for selecting the aphasic participants. The following exclusion criteria were placed on the complete data set from AphasiaBank for the English speaking Aphasia participants (n=431): participants who have inadequate hearing or vision; who have concomitant diagnoses of apraxia of speech or dysarthria or other neurologic diagnoses; who have medical etiologies other than stroke; who are not monolingual; who have depression; and those who reported that they are not familiar with the Cinderella story. Male participants were also excluded because of the potential for gender based difference in familiarity with the details of the Cinderella story. Any participant who scored at or above the 93.8 cutoff on the Aphasia Quotient (AQ) subtests (Fromm et. al, 2017) were excluded because this is the cutoff for the diagnosis of aphasia. If a participant appeared more than once in the population set then their second transcript appearance was excluded, to insure that all of the participants were only represented once. Following application of these exclusion criteria, 35 potential participants remained. KUTOOLS (ExtendOffice.com, 2017) was then used to randomly select the final 20 aphasic participants.

The twenty control participants were similarly selected. Exclusion criteria included: non-English speaking participants; participants who are male; who have inadequate hearing or vision; who have any history of depression, memory impairment, stroke, head injury, neural condition, diagnosis of a communication disorder; who are not monolingual; and those who reported that they are not familiar with the Cinderella story (n=45). Any of the participants who appeared more than once, within the 45 participants who remained, were eliminated to insure that every participant was represented only once. KUTOOLS (ExtendOffice.com, 2017) was then used to randomly select the final 20 control participants. The video data for all 40 participants was then reviewed to assure that Cinderella data had been collected using the same methods (e.g., participants were allowed to look at the story book pictures, then the book was removed, and they were asked to tell the story from memory).

The exclusion criterion placed on the PWA and neurotypical participants shaped the demographics of both population sets. Nonetheless, in this investigation, the demographics and descriptive statistics were considered. The final group of 20 female control participants had an average age of 76.8 years (SD=7.701). The average years of education was 13.95 years (SD=2.500) for the control participants. The final group of 20 females with aphasia were primarily right handed—one participant was ambidextrous and one was left handed. These participants had an average of about 15.58 years of education (SD=3.24) and their occupations varied. The average aphasia duration was 4.16 years (SD=3.087). There were 6 participants presenting with Conductive aphasia, 2 with Wernicke's aphasia, 8 with Anomic aphasia, and 4 with Broca's aphasia. The average WAB test scores were as follows: AQ was 73.6 (SD=14.955); Object Naming was 42.85 (SD=12.513); Word Fluency was 7.5 (SD=4.148); Sentence Completion was 8.1 (SD=2.031); Responsive Speech was8.3 (SD=2.024); Naming Score for AQ was 6.675 (SD=1.858); VNT Total was 14.05 (SD=6.681); and BNT Short Form was 7 (SD=4.183) (See Table 2).

Table 2. Participant demographics and test scores with descriptive statistics.

Pt	Age (years)	Hand	Ed level (years)	Dur (years)	WAB Type	WAB AQ	WAB Obj Name	WAB WdFl	WAB SentComp	WAB RespSp	Name Score AQ	VNT Total	BNT Short Form
1	83.06	R	12.00	7.80	Conduction	79.50	58.00	12.00	10.00	10.00	9.00	21.00	6.00
2	68.15	R	25.00	1.50	Conduction	65.50	32.00	5.00	8.00	8.00	5.30	15.00	3.00
3	76.26	R	17.00	4.70	Wernicke	65.70	37.00	13.00	4.00	10.00	6.40	7.00	9.00
4	77.38	R	17.00	0.70	Wernicke	67.40	32.00	0.00	8.00	8.00	4.80	9.00	1.00
5	69.01	R	12.00	2.20	Anomic	89.00	58.00	6.00	10.00	10.00	8.40	17.00	11.00
6	45.54	R	15.00	2.60	Conduction	58.20	31.00	4.00	10.00	10.00	5.50	7.00	5.00
7	60.30	R	16.00	3.30	Broca	54.60	32.00	5.00	6.00	4.00	4.70	13.00	5.00
8	70.56	R	16.00	1.10	Anomic	83.00	58.00	5.00	10.00	10.00	8.30	9.00	11.00
9	74.90	R	16.00	2.24	Anomic	90.00	56.00	12.00	10.00	10.00	8.80	20.00	12.00
10	25.60	R	16.00	1.25	Broca	61.40	41.00	6.00	5.00	6.00	5.80	7.00	7.00
11	75.50	R	16.00	3.60	Conduction	60.50	35.00	5.00	5.00	5.00	5.00	5.00	4.00
12	61.68	L	16.00	5.90	Anomic	91.10	55.00	8.00	10.00	10.00	8.30	18.00	7.00
13	54.17	A	16.00	12.00	Anomic	91.80	46.00	10.00	10.00	10.00	7.60	22.00	10.00
14	57.40	R	U	8.70	Broca	71.10	58.00	9.00	10.00	10.00	8.70	18.00	7.00
15	70.42	R	12.00	4.60	Anomic	92.00	60.00	16.00	10.00	8.00	9.40	22.00	13.00
16	74.60	R	14.00	1.00	Conduction	60.70	22.00	7.00	6.00	7.00	4.20	5.00	2.00
17	70.50	R	14.00	5.80	Broca	54.30	34.00	2.00	6.00	4.00	4.60	8.00	3.00
18	88.16	R	20.00	9.00	Conduction	61.10	10.00	2.00	4.00	7.00	2.30	15.00	1.00
19	60.27	R	12.00	4.50	Anomic	85.60	52.00	12.00	10.00	10.00	8.40	22.00	8.00
20	63.23	R	14.00	0.75	Anomic	89.50	50.00	11.00	10.00	9.00	8.00	21.00	15.00
Min	**25.60**	**N/A**	**12.00**	**0.70**	**N/A**	**54.30**	**10.00**	**0.00**	**4.00**	**4.00**	**2.30**	**5.00**	**1.00**
Max	**88.20**	**N/A**	**25.00**	**12.00**	**N/A**	**92.00**	**60.00**	**16.00**	**10.00**	**10.00**	**9.40**	**22.00**	**15.00**
Mean	**66.34**	**N/A**	**15.58**	**4.16**	**N/A**	**73.60**	**42.85**	**7.50**	**8.10**	**8.30**	**6.68**	**14.05**	**7.00**
SD	**13.58**	**N/A**	**2.69**	**3.12**	**N/A**	**13.76**	**13.90**	**4.14**	**2.30**	**2.08**	**1.99**	**6.18**	**3.99**

Note. Pt = participant; Hand = Handedness; R = right handed; L = left handed; A = ambidextrous; Ed = education; Dur = Aphasia Duration; WAB = Western Aphasia Battery; AQ = Aphasia Quotient; Obj Name = Object Naming; WdFlu = Word Fluency; SentComp = Sentence Completion; RespSp = Responsive Speech; VNT = Verb Naming Test; BNT = Boston Naming Test; Min & Max = Range; N/A = nonapplicable; SD = Standard Deviation.

Data Collection

All of the participants' Cinderella transcripts were obtained from the AphasiaBank Browsable Database. In addition, WAB Type, WAB AQ, WAB Object Naming, WAB Word Fluency, WAB Sentence Completion, WAB Response Speed, Naming Scores for AQ, VNT Total, and BNT Short Form scores were taken from the AphasiaBank Test Results Collection for participants with aphasia. Demographic data was also gathered for all participants from the AphasiaBank Demographic Collection.

Coding of Cinderella Transcripts

Nicholas and Brookshire (1995) introduced the idea of main concept analysis for discourse tasks. A main concept is a narrative event that is essential to the overall story. If one of the main concepts is excluded from the story, then, it is missing an element. Richardson and Dalton (2015) identified main concepts for three discourse tasks—including the Cinderella story. In this investigation, the participant transcripts were compared to a Main Concept (MC) list discourse task called "MCRules—Cinderella" (Richardson & Dalton, 2015) which is a document that AphasiaBank supplies. The document lists 34 Cinderella story main concepts, identified by Richardson and Dalton (2015). The majority of the key words have alternative productions—similar to synonyms—listed. For instance, the main concept: "Cinderella's father remarried a woman" includes the key word *father*, which has the following alternative productions listed in the document: dad and daddy. The MCRules document suggests that the participant should only receive credit for the production of this key word if they produce *dad, daddy, or father.*

The first step to coding the 40 transcripts was to identify when/if each participant was attempting to retell one of the 34 main concepts (from the MCRules document). Key words, and their alternative productions, were used as indicators that participants were attempting to retell a concept. However, there were times when participants retold a main concept without using the specific key words listed (in the MCRules document) for that concept (See Table 3 for examples). This could result from word finding difficulties. Participants used circumlocution strategies, at times, to avoid a word they were stuck on. For example, one participant with aphasia (ACWT12a) explained main concept number 3, however, they did not use the vocabulary provided by the MCRules document. The participant stated: "The lady was uh cross all the time" and the MCRules document states: "Stepmother was mean". The MCRules document lists *lady* as a permitted alternative production for *stepmother*, however, the document does not list *cross* as an alternative production for *mean.* The meaning of main concept number 3 was maintained when the participant substituted the word *mean* for the word *cross*. During the transcript coding process, it was recorded each time a participant retold a main concept and whether they use the key words (or the key words' alternative productions) listed in the MC Rules document. Each time a participant used substitute vocabulary it was recorded as well. To ensure coding consistency, the first 10 transcripts (5 controls and 5 aphasic) were coded twice. These 10 transcripts were coded at different times—with one week between the first and second coding. Once it was ensured that coding methods were consistent, the rest of the 40 transcripts were then coded. The coding process also involved recording the number of main concepts recalled (out of 34) for each transcript. The number of mistakes made in the ordering of those 34 main concepts was also recorded.

Results

Most common main concepts included in story retelling—between group comparisons

In this investigation, how many participants retold each of the 34 main concepts was investigated. Retellings may have included vocabulary words and sentence structures that deviated from that listed in the MCRules document. Deviations from the MCRules document were permitted as long as the substitute vocabulary meaning was similar enough to that suggested in the document. In other words, for the current investigation, deviations from the MCRules document were permitted as long as the particular main concept's contribution to the story was maintained. Table 3 shows 10 examples (5 from aphasic participants and 5 from control participants) of substitute vocabulary that participants chose to use when they retold the Cinderella story.

Table 3. Examples of substitute vocabulary found in participant transcripts.

Group) PAR	MC #) Suggested Vocabulary	PAR Substitute Vocabulary
1) ACWT12a	3) mean	cross
1) adler05a	22) down the stairs	upstairs
1) kansas22a	29) try on	stick her foot in
1) kempler04a	20) he is enamored	he said oh my god
1) kurland07a	9) excited	delighted
2) capilouto01a	17) went	traveled
2) capilouto03a	3) treated her poorly	treated her like dirt
2) capilouto04a	16) gown	finery
2) capilouto18a	20) falls in love	smitten
2) capilouto32a	33) married	took her as his bride

Note. PAR = Participant; MC = Main Concept; Group1 = participant with aphasia; and Group 2 = control participant.

Some of the story concepts were more commonly produced by participants (had higher percentages) compared to other concepts. This part of the investigation questioned whether aphasic participants and control participants tended to produce the same main concepts (out of the 34). Table 4 shows the percentage of control participants and the percentage of aphasic participants who included each of the 34 main concepts when they retold the Cinderella story.

Table 4. Percentage of participants that produced each key concept.

Main Concept	Event Group	Control (%)	Aphasia (%)
1. (a)Dad (b)remarried (c)a woman with two daughters		65	20
2. (a)Cinderella (b)lives with (c)stepmother/stepsisters		45	25
3. (a)Stepmother/Stepsisters (b)were mean (c)to Cinderella		55	35
4. (a)Cinderella (b)was (c)a servant to the stepmother and stepsisters		25	5
5. (a) Cinderella (2) has to do (3) the housework	A	70	45
6. The king thinks (a) the prince (b) should get married		40	10
7. King announces (a) there is going to be (b) a ball in honor of son who needs to find a wife	B	85	30
8. (a) They (b) got (c) an invitation to the ball		25	10
9. (a) They (b) are excited about the ball		10	10
10. (a) Cinderella is told by the stepmother she (b) cannot go to the ball unless/because…		70	30
11. (a) The stepsisters (b) tore (c) Cinderella's dress		20	0
12. (a) Stepmother/stepsisters (b) went to the ball		40	35
13. (a) Cinderella (b) was (c) upset		40	10
14. (a) A fairy godmother (b) appeared to Cinderella		80	50
15. (a) The fairy godmother (b) makes (c) …turn into…		60	10
16. (a) The fairy godmother (b) makes (c) Cinderella (d) into a beautiful princess		75	25
17. (a) Cinderella (b) went (c) to the ball in the coach		65	25
18. She knew (a) she (b) had to be (c) home by midnight because everything will turn back at midnight	C	70	25
19. (a) The prince and Cinderella (b) danced around the room/all night/ with no one else		50	30
20. (a) Prince (b) falls in love (c) with Cinderella		50	20
21. Cinderella realized (a) it (b) is (c) midnight		55	30
22. (a) She (b) ran (c) down the stairs		50	25
23. As she was running down the stairs (a) she (b) lost one of the (c) glass slippers	D	85	40
24. (a) Prince (b) finds (c) Cinderella's shoe		45	15
25. (a) Everything (b) turns back (c) to its original form		15	5
26. (a) She (b) returned (c) home in time		25	25
27. (a) The prince (b) searched door to door (c) for Cinderella		75	35
28. (a) Prince (b) comes (c) to Cinderella's house		30	5
29. (a) The stepsisters (b) try on (c) the glass slipper		35	20
30. (a) The slipper (b) didn't fit (c) the stepsisters		55	15
31. (a) He (b) put (c) the slipper on Cinderella's foot		60	15
32. (a) The slipper (b) fits Cinderella perfectly		60	25
33. (a)Cinderella and the prince (b) were married		50	20
34. (a) Cinderella and the prince (b) lived happily ever after	E	50	40

Note. Percentage = #participants who retold the key concept / 20

In general, a greater percentage of control participants produced each of the 34 main concepts, compared to the aphasic participants. The average percent of control participants who included each of the 34 main concepts was 50.88%; while, the average percent of aphasic participants who included each of 34 main concepts was 22.5%. However, there were similarities in terms of the main concepts that had the highest percentages for each group. There were 10 main concepts (1, 5, 7, 10, 14, 16, 17, 18, 23, and 27) that were produced by the top 5 percentages (85%, 80%, 75%, 70%, and 65%) for the controls. There were 11 main concepts (3, 5, 7, 10, 12, 14, 19, 21, 23, 27, and 34) that were produced by the top 5 percentages (50%, 45%, 40%, 35%, and 30%) for the aphasic participants. Out of these most commonly produced main concepts, the two groups had 6 in common. The 6 main concepts that both groups produced most commonly were numbers 5, 7, 10, 14, 23, and 27. Thus, the two groups demonstrated similarities in their selection of the most important main concepts that they choose to include in their retellings of the Cinderella story. Their selections were not identical, however, there were similarities.

Correlation between WAB test scores & number of main concepts included—aphasia only

This investigation looked at the relationship between the WAB test scores and the number of main concepts that the participants included when they retold the Cinderella story. A correlation test was ran between these two components, using SPSS Statistics for Windows (24.0) (See Table 5).

Table 5. Pearson correlations between number of main concepts included and WAB scores.

WAB Score		Pearson Coefficient
WAB AQ	Correlation	0.334
	Sig. (2-tailed)	0.223
Name Score for AQ	Correlation	0.361
	Sig. (2-tailed)	0.186
VNT Total	Correlation	0.466
	Sig. (2-tailed)	0.08
BNT Short Form	Correlation	0.333
	Sig. (2-tailed)	0.226
WAB Obj Name	Correlation	0.222
	Sig. (2-tailed)	0.426
WAB WdFl	Correlation	.688**
	Sig. (2-tailed)	0.005
WAB SentComp	Correlation	0.327
	Sig. (2-tailed)	0.234
WAB RespSp	Correlation	0.204
	Sig. (2-tailed)	0.465
#Main Con Inc	Correlation	—
	Sig. (2-tailed)	

Note. WAB = Western Aphasia Battery; AQ = Aphasia Quotient; Obj Name = Object Naming; WdFl = Word Fluency; SentComp = Sentence Completion; RespSp = Responsive Speech; VNT = Verb Naming Test; BNT = Boston Naming Test; #Main Con Inc = number of main concepts included in story retelling; ** = Correlation is significant at the 0.01 level (2-tailed); * = Correlation is significant at the 0.05 level (2-tailed).

There was one significant correlation at the 0.01 level (2-tailed) and it was between the number of main concepts included and the WAB Word Fluency test scores. The correlation was significant because the P-value was less than 0.01, which is depicted with a ** symbol. If the correlation were significant due to a P-value less than 0.05, then it would be depicted with a * symbol. That being said, if neither of these symbols are present, then the correlation was not significant on either level. A larger correlation test was ran between all of the variables of interest (See Table 6).

Table 6. Pearson correlations for variables of interest.

Variables of interest	WAB AQ	Name Score for AQ	VNT Total	BNT Short Form	WAB Obj Name	WAB WdFl	WAB SentComp	WAB RespSp
	__	.911**	.868**	.784**	.872**	.713**	.791**	.714**
WAB AQ		0	0	0.001	0	0.003	0	0.003
Name Score for		__	.874**	.793**	.975**	.816**	.787**	.684**
AQ			0	0	0	0	0	0.005
			__	.719**	.818**	.768**	.782**	.604*
VNT Total				0.003	0	0.001	0.001	0.017
				__	.774**	.734**	.579*	0.411
BNT Short Form					0.001	0.002	0.024	0.128
					__	.733**	.686**	.578*
WAB Obj Name						0.002	0.005	0.024
						__	.522*	0.386
WAB WdFl							0.046	0.156
							__	.910**
WAB SentComp								0
WAB RespSp								__

Note. WAB = Western Aphasia Battery; AQ = Aphasia Quotient; Obj Name = Object Naming; WdFlu = Word Fluency; SentComp = Sentence Completion; RespSp = Responsive Speech; VNT = Verb Naming Test; BNT = Boston Naming Test; ** = Correlation is significant at the 0.01 level (2-tailed); * = Correlation is significant at the 0.05 level (2-tailed).

Order mistakes—between group comparisons

Each time a participant's order of main concepts deviated from the order specified by the MCRules document, it was recorded as an order mistake. That being said, it is not quite accurate to base one's deviation off of this number alone. There were two primary factors that impacted the severity of an order mistake throughout this investigation. The first factor that impacted the severity of an order mistake was how many total main concepts were included in the retelling. For instance, if an individual only retold three main concepts from the story (out of 34) and they made one mistake with ordering those three concepts, then that mistake was more severe than an individual who made one mistake when they ordered all 34 main concepts of the story. The second factor that impacted severity of an order mistake was the degree to which a main concept was out of place. For illustration purposes: if individual A retold main concept number five before number four, then this would be considered one order mistake. If individual B retold main concept number 32 at the start of the story between numbers one and two, then this would also be considered one order mistake. Both individuals made one order mistake, however, individual B's mistake was more severe or "more out of order" than individual A's order mistake. Hence, it is not inaccurate to solely take into consideration the number of order mistakes made without taking into account the factors that impact the severity of an order mistake.

For this investigation, the individuals who retold little to no main concepts, and as a result did not make an order mistake, were carefully considered. The individuals who retold less than 5 main concepts (out of the 34) and made zero order mistakes were excluded from further analysis of discourse order. For instance, there were individuals who did not retell a single concept on the list of 34, therefore, they did not make an order mistake. This information would skew the data if these individuals were included in the calculations. Twenty five percent of the aphasic participants made zero mistakes, but also stated less than five main concepts (out of the 34) total. Zero percent of the control participants fell into this category. As a result, no control participants were excluded; however, 5 participants with aphasia were excluded (elman14a, kurland07a, scale33a, whiteside12a, and williamson06a).

Throughout this investigation, both the control group and aphasia group demonstrated difficulties with arranging all 34 specific story concepts in the exact order suggested by the MC Rules document. Arranging all 34 main concepts in a precise order appeared to be restricting for the purpose of this investigation. Rearranging the 34 specific concepts (to a slight degree) does not always impact the discourse and story meaning overall. For example, when two consecutive main concepts are switched it may not impact the overall discourse of the story because the two concepts are in such close proximity. This investigation was primarily concerned with the impact on discourse, therefore it does not seem significant to analyze order mistakes that do not impact the discourse. In an effort to eliminate restrictions like this, the 34 main concepts were grouped into 5 story events. Rather than looking at how the participants ordered the 34 main concepts, the focus was on how each participant ordered the 5 story events. The 34 concepts from the MC Rules document was broken into 5 primary groups (See Table 4).

Each time a participant stated any of the main concepts within an event group (A-E) it was recorded. Some participants repeated event groups; meaning, they said at least one concept from an event group in two different chronological locations throughout their retelling. These repetitions of groups could have led to order mistakes or exclusion of certain events entirely. Mistakes like these can be problematic for discourse, which was applicable to this investigation. It is important to note that the five aphasic individuals who stated less than five main concepts, throughout the entirety of their retelling, were excluded from the data set for this analysis. Table 7 demonstrates the results of investigating how the participants ordered the five event groups. Note, that the 25% percent of the aphasic participants (elman14a, kurland07a, scale33a, whiteside12a, and williamson06a) whom make zero mistakes, but also state less than five main concepts (out of the 34) total were also excluded from the following table as well.

Table 7. Order of Events

Group #) PAR	# of events	# of missing events	#of repeated events	# of events in correct order	% of events in correct order
1) ACWT12a	5	0	0	5	100
1) adler05a	5	0	0	5	100
1) kansas14a	1	4	0	1	100
1) kansas18a	1	4	0	1	100
1) kansas22a	4	1	1	3	75
1) kempler04a	4	1	0	4	100
1) kurland26b	4	1	1	4	100
1) MSU07a	3	2	0	3	100
1) MSU08a	4	1	0	4	100
1) scale12c	3	2	0	3	100
1) scale17a	5	0	3	5	100
1) TCU05a	5	0	0	5	100
1) Whiteside02a	5	0	1	5	100
1) williamson18a	4	1	0	4	100
1) wright202a	5	0	3	4	80
2) capilouto01a	5	0	2	5	100
2) capilouto03a	5	0	0	5	100
2) capilouto04a	5	0	4	5	100
2) capilouto06a	5	0	2	5	100
2) capilouto12a	5	0	0	5	100
2) capilouto16a	4	1	1	4	100
2) capilouto18a	5	0	2	5	100
2) capilouto20a	5	0	0	5	100
2) capilouto31a	5	0	0	5	100
2) capilouto32a	5	0	0	5	100
2) capilouto42a	4	1	0	4	100
2) capilouto45a	5	0	0	5	100
2) capilouto47a	5	0	0	5	100
2) capilouto52a	3	2	0	3	100
2) capilouto56a	5	0	1	5	100
2) capilouto62a	5	0	0	5	100
2) capilouto63a	5	0	0	5	100
2) capilouto64a	5	0	0	5	100
2) capilouto77a	5	0	0	5	100
2) kempler01a	4	1	1	4	100

Note: PAR = Participant ID; Group 1 = aphasia participant; Group 2 = control participant.

All of the participants in group 2 (controls) had 100% of their story event groups in the correct order. Some of the control participants missed or repeated story events, however, the events they included were in the correct order. The same was true for most of the aphasia participants, still, there were two individuals who did not have 100% of their story event groups in order.

The coding for the order of events portion of the investigation was relatively straight forward, which, heightened reliability. The 34 main concepts were previously identified in the 40 transcripts during the initial coding process. Therefore, coding for the 5 event groups simply required categorization of the main concepts presented in each transcript. It was a direct process, because, every main concept was simply grouped based on the previously listed breakdown of event groups A-E. Once the event groups were listed, in the order presented in the transcript, the order of events could be analyzed. The number of events (See Table 7) refers to which of the five events the participants merely included—in any order—in their retelling. When one of the five events was not included, it was considered a missing event. When an event group (A-E) was listed more than once, it was considered a repeat. Each event that was presented in the correct order (i.e. A, B, C, D, or E) counted towards the number of events in correct order score (See Table 7). Coding for the order of events required little interpretation, which maximized reliability. That being said, coding for order of events relied on the reliability of the initial coding process—the identification of the 34 main concepts included in the transcripts.

Discussion

Task limitations

It is important to note that some of the control participants had comparatively short transcripts. In other words, some of the control participants did not include many of the 34 main concepts at all. Aphasia was not the reason for these individuals' lack of detail, therefore there must have been other contributions that led to their brief retellings. It is possible that they either did not remember the Cinderella story well or they did not realize that they were supposed to retell the story in great detail. If the control participants were not aware that they were instructed to retell the story with as much detail as they could remember, then this indicates a flaw in the manner in which they were instructed. This is significant information because the aphasic participants could have experienced similar obstacles. The factors that kept these particular control individuals from retelling the story in great detail could have impacted the aphasic participants as well. Hence, the aphasic participants' mistakes may not have been solely a result of their communication disorder. This is a component that may have been playing a role in their performance; thus, when considering the results of this investigation it is important to take this component into account.

Main concepts included—between group similarities

The control and aphasic participants tended to choose similar main concepts from the MCRules document when they retold the story. There were apparent similarities between the two groups' most commonly produced main concepts. The main concepts that had the highest percentages in table 4 were likely the concepts that the participants deemed to be the most important because they were most commonly produced by the participants. That being said, the participants with and without aphasia were generally in agreement about which main concepts were the most significant to the storyline of Cinderella. Due to word finding difficulties, participants with aphasia communicated words and concepts that were readily available in that moment. Perhaps the vocabulary needed to talk about the Cinderella story main concepts with the highest percentages (See Table 4) were more readily accessible for the participants with aphasia. The results show that the concepts that were more readily available to the participants with aphasia were similar to the concepts that the controls chose as being most important to mention.

Correlation between WAB test scores and number of main concepts included

As stated in the *Western Aphasia Battery Test Booklet,* a word fluency test could involve the following task:

> "Ask the patient to name as many animals as he or she can in 1 minute. The patient may be helped if hesitant: 'Think of a domestic animal, like the horse, or a wild animal like the tiger.' The patient may be prompted at 30 seconds. Score 1 point for each animal named (except for those in the example), event if distorted by literal paraphasia" (Kertesz, 1982, p.9).

In this investigation, the word fluency test score was highly correlated with the number of Cinderella story main concepts included in the participants' transcripts. Perhaps, this result suggests that a word fluency task involves a similar train of thought and continuation of productions as a storytelling discourse task.

Table 5 shows that there was a significant correlation between the participants' number of main concepts included in their retellings and their WAB Word Fluency test scores. This was the only WAB test score that appeared to be highly correlated. These results could suggest that a word fluency task (i.e. asking a patient to name as many animals as he or she can in one minute (Kertesz, 1982, p. 9)) involves a similar word finding process as a discourse task does. Word fluency tasks require the person to keep track of what they are saying and in which order they are saying it. In a word fluency task, participants do not receive credit for repeating items, which, is something that is also required when telling a story.

Other tasks, such as object naming, were not highly correlated to the number of main concepts that the participants included. Tasks such as visual confrontation naming, sentence completion, and responsive naming tasks provide contexts for word retrieval; however, they do not require an individual to think of various semantic contexts within a category. The ability to self-generate semantic context is required when retelling a story, as well as for word fluency tasks. Transitioning from one concept to the next is an important component for both word fluency tasks and discourse tasks. Discourse is differentiated from other tasks (such as object naming), because, discourse tasks require transitions from one concept to the next and connecting the concepts in a fluid way that makes coherent sense. Since word fluency tasks were highly correlated with this particular Cinderella story discourse task, perhaps transitions and connections between concepts is similarly crucial for word fluency tasks, like it is for discourse tasks. For example, an object naming task does not require fluid transitions or execution control in the same way as a discourse task; rather, object naming involves retrieving a single concept without connecting that concept to anything further.

Originally, it was estimated that strong word finding skills would impact discourse performance. However, tasks that specifically emphasize word finding skills (such as object naming) were not significantly correlated to the number of main concepts included by the participants (See Table 5). Word fluency, however, was significantly correlated. The fluidity of production and ability to express oneself well enough to retell the beginning, middle, and end of the Cinderella story required a clear train of thought with connections between concepts—this demands more than word retrieval.

Accuracy of MCRules document

Table 4 confirms that many of the 40 participants retold at least some of the 34 main concepts listed in the MCRules document. This document is helpful for clinical use because it provides a standard discourse rubric. The document was also helpful for this investigation because it allowed for an objective comparison between the participants' performance and normative data (presented in the MCRules document). The document allowed for 40 transcripts to be analyzed based on how many of the 34 main concepts they retold and in what order they retold them.

The MCRules document was useful for objective measurement, however, for this investigation it had limitations. The document lists common ways to retell each of the 34 main concepts, and includes alternative productions, but it does not include all possible correct alternative productions. The productions that the document includes are not all encompassing, this investigation showed that there were additional correct ways to retell each of the 34 main concepts (that are not included in the MCRules document). A number of the participants (aphasic or not) used vocabulary words and sentence structures, that are not included in MCRules, to explain events in the story (Refer to Table 3).

At times, the participants used substitute wording. Reasons for choosing alternative wording could include word finding difficulties, or even an advanced range of vocabulary. Participants were able to accurately explain main concepts with the use of substitute wording, though it was not permitted vocabulary—according to the MCRules document. Which, was why it was concluded that the document has limitations in the number of alternative productions it offers. For example, if an individual with aphasia experienced word finding difficulties as they attempted to produce one of the 34 main concepts from the story, then they likely used strategies to combat this. They might have used circumlocution strategies. At times, participants explained one concept using multiple sentences because they needed to utilize circumlocution strategies in order to get their point across effectively. These participants did not explain the concept in the same way it is listed in the MCRules document, however, they still got discourse information across. The investigation showed that the 34 main concepts of the Cinderella story can be conveyed while deviating from the rigid structure and vocabulary presented in MCRules document (See Table 3 for examples).

Order of event groups

This investigation aimed to find out if the participants with aphasia demonstrated difficulty with discourse organization, and if so, what potential reasons might there be for their difficulty. It was hypothesized that aphasia would impact discourse organization; which, grew from the suggestion that discourse topics were dictated by the vocabulary that the participants were able to access at a particular moment in time. For instance, hypothetically, if certain key words and concepts were not readily available at a particular moment (due to aphasia), then events could be skipped. Then, participants could come back to the skipped events once the vocabulary was accessible. In turn, discourse organization would be greatly impacted. The results of this investigation did not support this hypothesis.

The aphasic and control groups both showed difficulties with ordering the 34 main concepts. This could be a result of possible limitations within the MCRules document—at least for the purpose of discourse order—which, was why it was the reason for analyzing discourse order on a broader scale with 5 story events, opposed to 34 main concepts. Table 7 shows that, when the 34 main concepts were broken into 5 story event groups, all of the control participants had 100% of the 5 events in the correct order, while only 13.33% of the aphasia participants made order mistakes. Aphasic organizational errors were scarce and the aphasic participants generally performed similarly to the control participants. This investigation did not include further analysis on why PWA had difficulty with discourse organization because the participants with aphasia did not show apparent difficulties with ordering the story events. It was hypothesized that there would be a greater distinction between the control and aphasia participants, which, would suggest discourse order difficulties associated with aphasia. However, the distinction was quite small. Of course, this percentage was not large enough to draw significant conclusions and further investigation with a larger population is necessary. Still, based on the results presented, neither group seemed to struggle with ordering the story events.

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