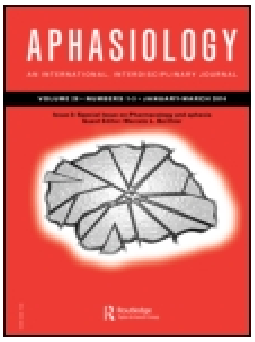

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The effects of direct and indirect speech on discourse comprehension in Dutch listeners with and without aphasia

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Background: Research on language comprehension in aphasia has primarily focused on comprehension of isolated words and sentences. Even though previous studies have provided insights into comprehension abilities of individuals with aphasia at the word and grammatical level, our understanding of the nature and extent of their language comprehension (dis)abilities is not yet complete. In contrast to the highly restricted semantic and syntactic interpretation of sentences, discourse comprehension requires additional pragmatic and non-linguistic skills.
Aims: The purpose of this study was to assess language comprehension in individuals with and without aphasia at the discourse level. In particular, it addressed the question of whether the use of direct speech, compared to indirect speech, affects comprehension of narrative discourse in Dutch aphasic and non-brain-damaged (NBD) listeners.
Methods & Procedures: The Direct Speech Comprehension (DISCO) test was developed to examine the effects of manipulating direct vs. indirect speech on discourse comprehension. Twenty-three individuals with aphasia and 20 NBD participants were presented with spoken narratives that contained either direct or indirect speech reports. The narratives were presented audio-visually on an iPad, and comprehension was assessed with yes/no questions.
Outcomes & Results: The performance of the participants with aphasia was significantly poorer than that of the NBD participants. Moreover, a main effect for condition type was found, indicating that narratives with direct speech reports were better understood than narratives with indirect speech reports by listeners with and without aphasia. There

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was no interaction between group and condition type indicating that this main effect held for both the aphasic and the NBD listeners. However, for the participants with aphasia, there was an interaction between condition and Token Test error score indicating that the positive effect of direct speech constructions diminishes for individuals with poorer comprehension.
Conclusions: Direct speech constructions facilitate language comprehension in listeners with and without aphasia. One explanation for this finding is the occurrence of additional "layers" of communication, such as intonation and facial expression, often accompanying direct speech constructions. An alternative account is the degree of grammatical complexity: In Dutch, the syntactic construction of indirect speech requires embedding, whereas in direct speech the introductory sentence and the quote are both main clauses. The finding that the beneficial effect of direct speech on language comprehension diminishes for individuals with severe aphasia may indicate that the DISCO is too difficult for them to reveal an effect of a subtle manipulation such as that of condition type.

Keywords: Aphasia; Discourse comprehension; Direct speech; Indirect speech.

The distinction between direct and indirect speech exists in many languages and has been a major focus in linguistic studies. Direct speech (e.g., *John said: "Gosh, I'm hungry"*) is assumed to constitute a *demonstration* of a reported utterance, whereas indirect speech (e.g., *John said that he was very hungry*) provides a *description* of what was said (Clark & Gerrig, 1990). Presenting ideas as dialogue is argued to be a strategy to frame information in a way that both communicates effectively and creates involvement (Tannen, 1989). Unsurprisingly, making discourse[1] more lively, direct speech has often been claimed to be an effective device for storytelling (Labov, 1972; Li, 1986; Mayes, 1990; Wierzbicka, 1974).

Previous studies have shown that the use of direct speech is usually preserved in aphasic speakers (Hengst, Frame, Neuman-Stritzel, & Gannaway, 2005; Ulatowska & Olness, 2003; Ulatowska, Reyes, Santos, & Worle, 2011; Wilkinson, Beeke, & Maxim, 2010). Additionally, in a study comparing the forms and frequencies of direct speech constructions in narratives produced by Dutch aphasic and non-brain-damaged (NBD) speakers, Groenewold, Bastiaanse, and Huiskes (2013) demonstrated that both NBD and aphasic speakers produce direct speech constructions, but that aphasic speakers use them more frequently than NBD individuals. Given the important role of direct speech constructions in discourse of individuals with aphasia, here we examine the role of direct speech in aphasic discourse in more detail and from a new perspective. We address the question of whether direct and indirect speech have different effects on the comprehension of spoken Dutch discourse in listeners with and without aphasia.

As will become clear from the literature overview later, the current study is concerned with a complex research topic of which only limited aspects have been addressed earlier. Nevertheless, based on the findings of the literature to date, later we formulate predictions for the outcomes of the current study. We first discuss how direct speech differs from reported speech. We then pay attention to some of general characteristics and shortcomings of the studies that have been

[1] "a unit of language larger than the sentence" (Chafe, 1992, p. 35).

carried out so far, before paying attention to the specific findings of these studies into the effects of direct and indirect speech processing, Next, we discuss studies of the effects of direct and indirect speech on healthy written language processing and healthy spoken language processing. Then, we focus on the results of a study into the effects of the occurrence of direct speech constructions in aphasic speech on healthy listeners. We move on to discuss the cognitive processes that accompany healthy discourse comprehension and impairments of spoken language comprehension in aphasia. Finally, we introduce the topic and research question and formulate predictions for the outcomes of the current study.

The authenticity of direct speech

Even though direct speech has often been claimed to portray what a current speaker or someone else said on a former occasion, it is certainly not restricted to accurate repetitions of prior speech. On the contrary, studies of reported speech in naturally occurring interactions have shown that this is rarely the case. First, it has been shown that speakers tend to remember the meaning rather than the form of utterances and are therefore not capable of giving an accurate repetition of former speech (Lehrer, 1989). Second, in many cases, the material represented as reported speech was never said at all (e.g., Clark & Gerrig, 1990; Holt, 2000; Tannen, 1989). In a corpus study, Mayes (1990) showed that at least half of all investigated "quotes" were inventions by the current speaker. Reporting speakers are not necessarily committed to reproduce an utterance verbatim, but instead they seem to aim to get the listener to recognise certain aspects of a situation (Clark & Gerrig, 1990).

Processing of direct vs. indirect speech

In spite of the claims of the effects of direct speech constructions on listeners (e.g., Labov, 1972; Li, 1986; Mayes, 1990; Wierzbicka, 1974), so far the comprehension of reported speech has received little attention. While there are some exceptions, (e.g., Eerland, Engelen, & Zwaan, 2013; Yao, Belin, & Scheepers, 2011, 2012; Yao & Scheepers, 2011; Groenewold, Bastiaanse, Nickels, & Huiskes, 2014), most of these studies have focused on written rather than spoken language. This is surprising, since the distinctive paralinguistic characteristics (e.g., pitch and voice quality, Romaine & Lange, 1991) of direct as compared to indirect speech usually become apparent in spoken language. In addition, the two studies that have used spoken rather than written narratives (Yao et al., 2012; Groenewold et al., 2014) relied on auditory rather than audio-visual stimuli. Therefore, the non-verbal aspects that often play an important role in production and interpretation of direct speech (Goodwin, 1990; Streeck & Knapp, 1992; Wilkinson et al., 2010) did not receive the attention they deserve. Finally, an important characteristic of the studies that have been carried out so far is that they have almost exclusively focused on processing of English direct and indirect speech constructions (but see, e.g., Groenewold et al., 2014). This restricted focus may have important consequences for the findings that have been obtained so far because of the limited grammatical differences between English direct and indirect speech constructions (both construction types have an subject-verb-object (SVO) word order, and both can occur without the complementiser *that*).

Direct and indirect speech in nbd written language processing

In a series of experiments, Eerland et al. (2013) addressed the question of how direct and indirect speech quotations in English written language affect how the contents are represented. Participants showed superior memory for the exact wording of an utterance when it had the form of direct speech as opposed to indirect speech. Contrary to the claims made by Lehrer (1989; see earlier), Eerland et al. (2013) argued that direct speech makes the exact wording of an utterance more salient, enhancing memory for the surface structure of the utterance, whereas indirect speech encourages listeners to focus more on constructing a mental model of a described situation during language processing. This means that information regarding the communicative situation would be more accessible in indirect speech than in direct speech (Eerland et al., 2013).

Direct and indirect speech in spoken nbd language processing

Yao et al. (2012) used fMRI to assess mental simulations of suprasegmental acoustic representations during auditory language comprehension of direct and indirect reported speech. They used audio recordings in which direct and indirect speech constructions were spoken monotonously. Monotonously spoken direct speech constructions elicited significantly higher brain activity in temporal voice areas of the right auditory cortex than listening to meaning-equivalent monotonously spoken indirect speech constructions. Yao and colleagues suggest that listeners spontaneously engage in mental simulations of vivid vocal depictions when listening to monotonously spoken direct speech, but not when listening to monotonously spoken indirect speech. These findings suggest that the brain keeps track of context-based expectations of vivid acoustic information for direct speech, but not for indirect speech utterances. This shows that listeners routinely expect vivid depictions for direct speech, but rarely for indirect speech (Yao et al., 2012).

The effects of direct speech in aphasic discourse on nbd listeners

Groenewold et al. (2014) examined the effects of the occurrence of direct speech on the perceived liveliness and comprehensibility of speech for a group of independent NBD listeners. They showed that direct speech has a positive effect on the perceived liveliness of speech. This effect was found for samples from both NBD and aphasic speakers. These findings support the qualitative claims of the positive effect of direct speech on liveliness (e.g., Macaulay, 1987; Wierzbicka, 1974). However, there was no effect of direct speech on perceived comprehensibility of speech. Even though this study provides quantitative data on the effects of the occurrence of direct speech on language processing, audio-only stimuli were used. This means that the listeners could only utilise a limited range of paralinguistic cues (such as prosody, pitch and volume) as markers of direct speech. The effects that were found may therefore be greater in real interaction, even in an audio-visual version of the same study (Groenewold et al., 2014).

Cognitive processes in discourse comprehension

Comprehending language is a complex skill, which depends on a variety of cognitive processes. Studies of "normal" language comprehension have shown that there are important differences between the processes required to comprehend single sentences and those for comprehending discourse. In contrast to the usually highly constrained syntactic and semantic interpretation of sentences, discourse requires an extensive application of pragmatic rules (Ulatowska, 1981). For example, while conversation involves rules about turn-taking, narratives usually involve a sequence of elements proceeding from the initial setting, through complicating events, and finally to the resolution (Kempler, 2004). Understanding discourse not only demands the decoding of a message using linguistic processes but also requires non-linguistic skills such as attention when longer discourse is to be understood. Verbal working memory is necessary to keep successive utterances in mind, and verbal learning is needed for transferring discourse content into a long-term memory representation. Executive function skills also come into play in, for example, the (re)structuring of information and the monitoring of comprehension success. Deficits in any of these cognitive processes can cause difficulty with understanding language in context (Ferstl, Walther, Guthke, & Von Cramon, 2005).

Impairments in aphasic language comprehension

Impairments in spoken language comprehension have been considered a central problem in aphasia for many years (Brookshire, 1978; Brookshire & Nicholas, 1984; Schuell, Jenkins, & Jimenez-Pabon, 1965). Virtually all individuals with aphasia have problems with comprehension, but there is considerable variation in the nature as well as in the severity of the comprehension deficits (e.g., Goodglass, Berko-Gleason, & Hyde, 1970). Most studies on aphasic language comprehension have focused on comprehension of isolated words (e.g., Jonkers & Bastiaanse, 2007; Mason-Baughman & Wallace, 2013) and sentences (e.g., Burchert, Hanne, & Vasishth, 2013; Yarbay Duman, Altınok, Özgirgin, & Bastiaanse, 2011). Hence, our understanding of language comprehension (dis)ability in aphasia is incomplete, and important aspects of discourse, such as macrostructure and linguistic context, have been overlooked (Nicholas & Brookshire, 1995).

Comprehension impairments in aphasia can be situated at the phonological, lexical or syntactic levels of language (Caplan, 1992). Individuals with aphasia have been shown to perform better on comprehension assessments when a facilitative context (such as a predictive or a non-predictive narrative) is presented (Germani & Pierce, 1992; Guthke, Hauptmann, & Ferstl, 2001). Two crucial components have been postulated for text comprehension (in contrast to word and sentence level comprehension). First, text comprehension requires inferencing. This refers to the combination of the text's explicitly stated information with additional information taken from general world knowledge (Graesser, Singer, & Trabasso, 1994; Singer, 1994). Second, comprehension requires extraction of the macrostructure of the text, which refers to the global meaning or topic of a text. In aphasic language production, both preserved (e.g., Glosser & Deser, 1991; Huber, 1990; Ulatowska & Chapman, 1994) and impaired macrostructures (e.g., Chapman & Ulatowska, 1992; Pierce & Grogan, 1992; Ulatowska & Sadowska, 1992) have been reported. Targeting assessment of text comprehension following brain damage, Brookshire and Nicholas (1993) developed the Discourse Comprehension Test (DCT), consisting of 10 stories of about 200 words. They used the DCT to assess the factors "explicitness" and "salience" in English individuals with left-brain-damage (LBD), right-brain-damage (RBD) and traumatic brain injury (TBI). While they had predicted that RBD and TBI patients would be affected by either or both of the factors, in fact all three groups showed sensitivity to both salience and explicitness (Brookshire & Nicholas, 1993).

Ferstl et al. (2005) developed the German Story Comprehension Task (SCT), which aimed to detect text comprehension deficits after brain damage. Even though it is very similar to the DCT with respect to the factors explicitness and salience and the use of yes/no questions, it consists of two stories, which are considerably longer than the DCT stories. Moreover, whereas in the DCT questions could be answered by referring to one content unit only, in the SCT many of the implicit detail questions could be answered by integrating several information sources. This was hypothesised to make the questions more sensitive to interference deficits. The performance of a group of control participants was compared to that of an unselected group of brain-damaged individuals, suffering from LBD, RBD or TBI. Across the entire group of brain-damaged participants, only the implicit, but not the explicitly stated information was found to be difficult. This is in line with previous studies on aphasic discourse comprehension, which found that explicitly mentioned information was better understood than implicit information (Brookshire & Nicholas, 1984; Nicholas & Brookshire, 1995; Wegner, Brookshire, & Nicholas, 1984). However, when analysed separately, the LBD group (which is prone to aphasic language deficits) responded better to implicit questions than to stated information. Ferstl et al. suggested that this group relied more on the use of contextual cues, general world knowledge and situation model representations rather than on the surface level of texts. Questions that required explicit detail information did not allow for these gist-based comprehension strategies and were therefore argued to be more difficult for LBD individuals (Ferstl et al., 2005).

The current study

In this study, we assess the effects of direct and indirect speech constructions on spoken discourse comprehension in Dutch listeners with and without aphasia. To do so, we developed the Direct Speech Comprehension (DISCO) test. The answer to this question is relevant for clinical practice, because if the occurrence of direct speech in narratives is beneficial for aphasic listeners, this will provide us with hints for conversational strategies to facilitate comprehension for individuals with aphasia. Moreover, the study will provide us with new insights into the discourse comprehension abilities of individuals with aphasia, and more specifically, the role of direct speech constructions in spoken discourse.

The question we aimed to answer was "*Is there a difference between the effects of direct and indirect speech constructions on comprehension of narrative discourse in Dutch listeners with and without aphasia?*"

Considering the findings of the studies discussed earlier, a number of predictions can be formulated. First, based on previous studies that showed that individuals with LBD have particular difficulty understanding detailed information in discourse, we expect NBD listeners to outperform aphasic listeners on the DISCO, which requires such knowledge. Second, based on the claim that the use of direct speech is an effective device for storytelling because of its dramatising, enlivening and demonstration-like character (Clark & Gerrig, 1990; Labov, 1972; Li, 1986; Mayes, 1990; Tannen, 1989; Wierzbicka, 1974), participants are expected to achieve higher scores for the direct than for the indirect speech condition. Such findings would be in line with the results of a previous study indicating that the presence of direct speech has a positive effect on the perceived liveliness of speech (Groenewold et al., 2014). Another factor that predicts better comprehension of direct than indirect speech is that, in Dutch, direct speech constructions are syntactically less complex than indirect speech constructions because they have no complementiser, and, in contrast to indirect speech, direct speech does not require an embedded construction (Groenewold et al., 2013).

However, not all previous findings point to direct speech having an advantage. As discussed earlier, Eerland et al. (2013) found no evidence that direct speech, relative to indirect speech, enhances the availability of information about referential and communicative information. They claim that "while direct speech makes the exact wording of an utterance more memorable, this does not necessarily hold for the information it conveys" (p. 8). The questions that were used in the current study generally do not require memorising of the exact wording of utterances. Therefore, participants are not expected to benefit from this characteristic of direct speech constructions. Consequently, if anything, Eerland et al.'s (2013) finding that indirect speech enhances listeners more to focus on constructing a mental representation of a described situation would predict better understanding of indirect rather than direct speech constructions.

METHOD

Ethics statement

The local medical ethical committee of the University Medical Center of Groningen, the Netherlands, approved the study and all participants provided a signed informed consent prior to participation.

Participants

Twenty-three individuals with aphasia and 20 NBD participants participated in the study. The NBD participants were matched to the individuals with aphasia for mean level of education and mean age at the group level. Descriptive information for the two groups is presented in Table 1, and demographic and clinical data for the participants with aphasia are shown in Table 2. The NBD subjects reported no history of neurological or language impairment and none showed evidence of cognitive or language impairment during the testing session. Individuals with aphasia were recruited from aphasia centres and rehabilitation centres and had to be at least 3 months post-onset. Diagnosis of aphasia was made by certified speech/language pathologists from results of standard aphasia tests. The individuals with aphasia had a broad range of traditional clinical diagnoses such as Broca's aphasia or anomic aphasia but they were not always classified or deemed classifiable by the speech/language pathologists.

TABLE 1
Descriptive information of participants without brain damage (NBD) and participants with aphasia (PWA)

		Age	*Education*	*MPO*
NBD	Mean	55.7	12.15	N/A
	SD	12.1	2.83	N/A
	Range	35–76	6–17	N/A
PWA	Mean	56.3	12.1	75.3
	SD	8.7	2.8	68.1
	Range	41–71	6–17	3–226

Education: Number of years of education completed; MPO: months post-onset; SD: standard deviation.

Materials

For the iPad-based DISCO test, we created seven pairs of narratives (one practice and six experimental narratives). The instructions, the passages and the questions for the DISCO were digitally video-recorded in a professional recording studio. Two different native speakers of Dutch were used, both being speech and language therapists. Each version (direct/indirect speech) of a narrative was read by the same speaker. To minimise distraction and to avoid a difference in non-verbal and paralinguistic information between the two condition types, the speakers were instructed to speak naturally and without gesturing (except for bodily speech-accompanying actions such as hand, face or small body movements). The speakers were not informed about the purpose of the study.

The DISCO contains one pair of practice narratives and six pairs of experimental narratives ranging in length from 12 to 16 sentences (191–258 words). The Flesch Reading Ease (FRE[2]; Flesch, 1948) scores varied from 67.2 to 88.9. Across condition types, FRE scores of the two versions of a narrative always fell within the same range. Moreover, any possible effect of difference in FRE was controlled for in the analysis. Descriptive information about the narratives is presented in Table 3.

The narratives describe reports of conversations between a husband and a wife that are on topics that would be familiar to most adults in the Netherlands. The two versions of the narratives were identical except for the structure of the reporting sentences, which differed in condition (direct vs. indirect reported speech) in the two versions. The narratives also contain declarative sentences, which were identical in the two conditions. Examples of the pairs are shown in Examples 1 and 2, and samples of the two versions of the entire narratives are presented in Appendix A.

[2] The FRE test is designed to calculate comprehension difficulty, based on the number of words, sentences and syllables of a narrative, using the following formula: 206.835 – 1.015 × (total words/total sentences) – 84.6 × (total syllables/total words). Higher scores indicate material that is easier to read. Texts with scores between 60 and 69 are considered standard, those between 70 and 79 are considered fairly easy and those between 80 and 89 are considered easy (Flesch, 1948).

TABLE 2
Demographic and clinical data for the 23 participants with aphasia

PWA	*Age*	*Gender*	*MPO*	*Cause*	*Diagnosis aphasia*	*Severity aphasia*	*TT*	*Education*
P2	44	Male	9	CVA left	Fluent	Mild	4	14
P3	62	Male	162	CVA left	Non-fluent	Moderate-severe	41	15
P4	55	Female	103	CVA left	Non-fluent	Severe	36	10
P7	67	Female	50	CVA left	Fluent	Mild	1	10
P8	68	Male	18	Brain tumour removal	Fluent	Mild	5	15
P10	45	Male	34	CVA left	Fluent	Mild-moderate	7	14
P11	41	Female	64	CVA left (carotid dissection)	Non-fluent	Moderate-severe	18	11
P12	50	Male	96	CVA left	Non-fluent	Moderate-severe	12	14
P14	68	Male	79	CVA left	Fluent	Mild	3	15
P15	43	Male	31	CVA left	Non-fluent	Mild	10	10
P16	53	Male	21	CVA left	Non-fluent	Mild	4	11
P17	52	Male	24	CVA left	Non-fluent	Moderate	24	10
P18	58	Male	34	CVA left	Non-fluent	Moderate-severe	13	17
P19	59	Male	211	CVA left	Non-fluent	Severe	40	17
P21	55	Male	210	CVA left	Fluent	Mild	9	11
P23	71	Female	43	CVA right	Fluent	Mild	3	6
P24	53	Male	3	Subarachnoid haemorrhage	Fluent	Moderate-severe	11	14
P26	60	Male	18	CVA left	Non-fluent	Moderate-severe	35	10
P27	53	Male	92	CVA left	Fluent	Mild	3	10
P28	61	Male	53	CVA left	Non-fluent	Severe	16	10
P29	49	Female	27	CVA left	Non-fluent	Moderate	2	14
P30	66	Male	122	CVA left	Fluent	Moderate	12	10
P33	62	Male	226	CVA left	Non-fluent	Mild	17	10

PWA: Participant with aphasia; MPO: months post-onset; CVA: cerebrovascular accident; TT: Token Test error score; Education: number of years of education completed.

TABLE 3
Descriptive information for materials

Story line	*Narrative*	*Number of words*		*Number of sentences*		*Words/sentence*		*FRE*	
		Direct	*Indirect*	*Direct*	*Indirect*	*Direct*	*Indirect*	*Direct*	*Indirect*
A1. Being on time	Airport	193	223	12	13	16.08	17.15	73.5	76.8
A2. Being on time	Theatre	198	217	12	12	16.50	18.08	86.7	87.1
B1. Home	Paint	201	214	12	12	16.75	17.83	86.3	87.5
B2. Home	Couch	218	217	13	12	16.77	18.08	88.9	87.5
C1. Making plans	Dinner	191	223	12	13	15.92	17.15	67.5	68.8
C2. Making plans	Jubilee	234	258	15	16	15.60	16.13	67.7	67.2

FRE: Flesch Reading Ease.

Examples 1 and 2. Dutch direct and indirect speech constructions. DS: direct speech; IS: indirect speech; LT: literal translation, TR: translation.

(1A) DS: De vrouw zegt: "we kunnen misschien wel een bootje huren".
LT: The wife says: "we can maybe [particle] a boat rent".
TR: "The wife says: 'we could rent a boat'".

(1B) IS: De vrouw zegt dat ze misschien wel een bootje kunnen huren.
LT: The wife says that they maybe [particle] a boat can rent.
TR: "The wife says they could rent a boat".

(2A) DS: De man antwoordt: "geen idee, zoek jij maar wat uit".
LT: The husband replies: no idea, pick you [particle] anything out.
TR: "The husband replies: 'no idea, you can pick anything'".

(2B) IS: De man antwoordt dat hij geen idee heeft en dat zij maar wat uitzoekt.
LT: The husband replies that he no idea has and that she [particle] anything picks.
TR: "The husband replies that he has no idea and that she can pick anything".

To ensure that the narratives were canonical, they all described a chronological sequence of events such that each sentence was either expository or a continuation from the prior sentences. Additionally, to reduce the demands on memory, no more than three characters were introduced per narrative, of which two were always the husband and the wife.

Each narrative was followed by eight questions. The same videos of the questions were used in the direct and indirect speech conditions. The first question served as a "warm-up" question and focused on the main idea of the text. The remaining seven questions required comprehension of more detailed information provided in the reporting utterances (either direct or indirect speech) of the narratives. The sequential order of the questions followed the order of mention in the narrative.

Comprehension of the stories was tested with yes/no questions, similar to, for example, those given in Brookshire and Nicholas (1993) and Ferstl et al. (2005). An important advantage of this assessment method is that it rules out possible interference effects from language *production* impairments. For four of the questions, the correct response was "yes, for the other four it was "no". In Appendix A, the questions belonging to the example narrative are provided.

To verify that the materials for this study were appropriate, a written version of the test was pretested online. Two lists were created, each containing 4 narratives and 32 questions. Two narratives were offered in condition A (direct speech) and two narratives in condition B (indirect speech). One of the lists contained Narrative 1 version A, Narrative 2 version B, etc., and the other one contained Narrative 1 version B, Narrative 2 version A, etc. In total, 70 NBD speakers read the short narratives and answered the questions. When a question was found to be difficult, the part of the narrative it referred to or the question itself was adapted. The final version of the (written) pretest was carried out by 26 participants who performed almost at ceiling (97.1% correct).

To ensure that correct answers to the questions could only be given when the narrative was understood (rather than relying on world knowledge or information that was presented in other questions), the questions were also presented to a separate group of NBDs (n = 33) who had not heard the stories. As expected, this group performed around chance level (proportion correct = 0.56, SD = 0.19).

Because of the potentially important role of non-verbal information we used audio-visual stimuli. When listeners both hear and see the speakers, they can obtain information from several "layers" of communication and potentially benefit from the speakers' paralinguistic (e.g., intonation) and non-verbal (e.g., facial expression) cues, just like in daily life.

Procedures

Each participant was tested individually in a single session of about an hour for the aphasic participants and 30 minutes for the NBD participants. The NBD participants were only tested on the DISCO, whereas the aphasic participants were also tested on the Token Test subtest of the Aachen Aphasia Test[3] (Graetz, De Bleser, Willmes, & Heeschen, 1992) to measure the severity of aphasia. The Token Test score reflects the number of incorrectly performed items (0–50).

The DISCO narratives were presented in a pseudo-random order using 12 fixed lists to control for any possible effect of presentation order. Before the test began, the participants were informed that they would be watching videos on an iPad, of which the first served as a practice item, and that after each video, they would be asked to answer eight yes/no questions about the content of the narrative. They were told that they could answer the questions by touching the screen, where a red button with a cross [no] and a green button with a tick [yes] would appear. All participants were instructed to use their left hand to answer the questions. The participants commenced the experiment by pressing a "start experiment" button. After pressing this button, the participants saw a short video with the following message (in Dutch), ensuring that the instructions were constant across participants:

> *You are going to watch 6 short videos. During these videos, my colleague and I will tell short stories. At the end of each of the stories you will hear 8 questions, which you can answer with 'yes', or 'no'. These questions concern the broad storylines. Therefore, you do not have to remember the details. We will start with a practice video.*

[3] During this test, the participant receives instructions to perform tasks that increase in difficulty with a set of tokens differing in shape, colour or size, such as "show me the red square and the yellow circle".

After these instructions spoken by one of the two speakers, the participants were presented with the practice item, which was recorded by the other speaker so that they were accustomed to both speakers and the procedure before commencing with the six experimental narratives and accompanying questions. Three seconds after the final sentence of each narrative, the first of the eight questions was automatically presented. The participants saw videos of a speaker asking the questions. Participants answered each question with a button press ("yes" or "no"). The response triggered the next question. Using this fixed paradigm, no variability in timing between the narratives and the first question existed across participants. Before moving on to the next narrative after the completion of the eight questions of the previous narrative, the participants saw a blank screen with a movie icon. This way, participants could either move on immediately or take a short break if desired. The software recorded the answer to each question as a binary variable (representing "yes" or "no").

Statistical analyses

SPSS 20.0.0.2 (SPSS IBM, New York, NY, USA) and R 3.0.2 (R Foundation for Statistical Computing, Vienna, Austria) were used to analyse the data. The mean and standard deviation were calculated for the Token Test scores. For the analysis of the DISCO results, the answers for all questions were converted into a binary variable (correct: 1; incorrect: 0) for logistic regression analysis. First, an item analysis was conducted to make sure all scores were suitable for further analysis, using a two-paired Wilcoxon Rank Sum Test.

For the overall analysis in which the results of both subject groups were analysed, we used generalised linear mixed-effects regression (GLMER) modelling. We included the following predictors of interest: group (NBD vs. aphasia) and condition type (direct vs. indirect speech). The GLMER approach allowed us to model that participants who were likely to answer one question correctly may also be more likely to answer other questions correctly (i.e., a random intercept for participant) and that some questions may be easier than others (i.e., a random intercept for question).

In addition, we took into account that there may be variability in the effect a certain predictor has. For example, some questions might show a great difference in performance between individuals with aphasia and NBD participants, whereas for other questions this effect might be smaller (i.e., a by-question random slope for group). Comparing the Akaike Information Criterion (AIC; Akaike, 1974) values of the model, we evaluated whether random intercepts and slopes for participant, story and question were needed. In Appendix B, a more detailed account of the procedures and interpretation of logistic regression and AIC differences is provided.

Furthermore, the possible effects of the following material-related covariates were examined: number of sentences, number of words, number of syllables, number of characters, mean length of utterance (MLU), mean length of words (in characters), FRE and question number. For the participants, the possible effects of the following factors and covariates were assessed: age, gender, number of years of education completed and educational level. Again, model comparison on the basis of AIC was used to assess whether each of these predictors or interactions between these predictors significantly improved the model.

To be able to take the severity of aphasia into account, we also conducted a similar analysis for the subgroup of individuals with aphasia. The only difference with the previous analysis was that instead of group, Token Test error scores were used as predictor in the model.

RESULTS

The item analysis showed that of the 48 (6 stories × 8 questions) items, 1 deviated significantly from ceiling performance for the NBD participants ($p < .05$, after applying a Bonferroni correction to account for multiple comparisons). Therefore, this item was removed before conducting any further analyses.

In Figure 1, the average scores per group and condition type are presented. Individual scores are given in Appendix C.

In Table 4, the proportions of "hits" (correct answer: yes, response: yes), "misses" (correct answer: yes, response: no), "correct rejections" (correct answer: no, response: no) and "false alarms" (correct answer: no, response: yes) for the two subgroups are presented.

Table 5 shows the best generalised mixed-effects regression model for the overall analyses, in which the scores for all participants were included. This model shows that there is a main effect of listener type: an NBD participant has a greater likelihood of answering a DISCO question correctly (i.e., has a better performance) than a participant with aphasia ($\beta = 1.57$, $z = 5.49$, $p < .01$). In addition, there is a main effect of condition type: participants perform significantly worse in the indirect

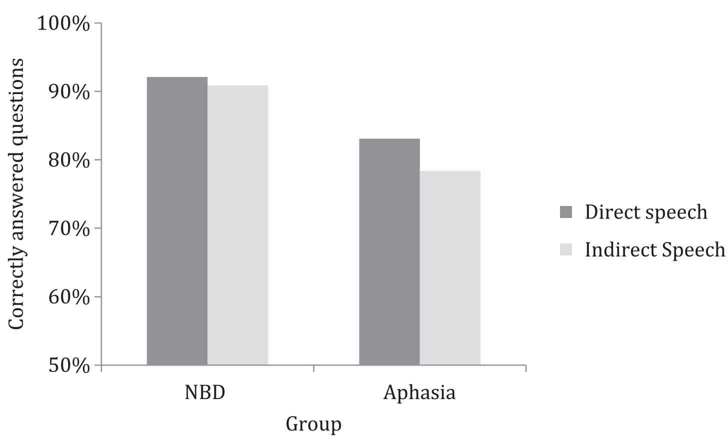

Figure 1. Average percentage of correctly answered DISCO questions, presented per group and condition type. NBD: Non-brain-damaged.

TABLE 4
Proportions of hits, misses, false alarms and correct rejections for the DISCO by participant group

	NBD		*Aphasia*	
	Response: Yes	*Response: No*	*Response: Yes*	*Response: No*
Stimuli: Yes	0.94 (hit)	0.06 (miss)	0.86 (hit)	0.14 (miss)
Stimuli: No	0.11 (false alarm)	0.89 (correct rejection)	0.26 (false alarm)	0.74 (correct rejection)

NBD: Non-brain-damaged.

TABLE 5
Generalised linear mixed-effects regression model predicting the probability (in terms of logits) of answering a Dutch DISCO question correctly

Fixed effects	*Estimate*	*Standard error*	*z-Value*	*p-Value*
(Intercept)	1.9203	0.2125	9.037	<.01
NBD as opposed to aphasic participant	1.5652	0.2853	5.487	<.01
Indirect as opposed to direct speech	−0.3025	0.1420	−2.130	<.05
Flesch Reading Ease (centred)	0.0415	0.0168	2.467	<.05

Only significant predictors were included. Negative estimates indicate a lower probability of answering a question correctly.

speech condition than in the direct speech condition ($\beta = -0.30$, $z = -2.13$, $p < .05$). Finally, if a story is easier (as measured by a higher FRE), participants are more likely to answer a question correctly ($\beta = 0.04$, $z = 2.47$, $p < .05$). No other predictors (or interactions between predictors) were found to be significant. Random intercepts were necessary for participant and question, but not for story. In addition, a by-question random slope was necessary for the group difference (NBD vs. aphasia) indicating that there is variability in how large the performance difference is between participants with and without aphasia for different questions.

Table 6 shows the results of the best GLMER model focusing on the group of participants with aphasia only. As becomes clear from this model, a high Token Test error score had a negative impact on the probability of answering a DISCO question correctly ($\beta = -0.06$, $z = -4.59$, $p < .01$). In addition, if a story was easier (as measured by the FRE), participants with aphasia were more likely to answer a DISCO question correctly ($\beta = 0.04$, $z = 2.39$, $p < .05$). As shown by the effect of question number, participants with aphasia were more likely to give an incorrect answer to questions that were presented later than those that were presented earlier in the sequence ($\beta = -0.12$, $z = -1.96$, $p < .05$). The effect of indirect vs. direct speech shows that the indirect speech condition was significantly more difficult for the participants with aphasia than the direct speech condition ($\beta = -0.89$, $z = -3.21$, $p < .01$). However, as there was a significant interaction between the Token Test error score and condition type ($\beta = 0.03$, $z = 2.46$, $p < .05$), the difference in performance (i.e., the probability of answering a question correctly) between direct

TABLE 6
Generalised linear mixed-effects regression model predicting the probability (in terms of logits) of a participant with aphasia answering a DISCO question correctly

Fixed effects	*Estimate*	*Standard error*	*z-Value*	*p-Value*
(Intercept)	2.7945	0.2871	9.734	<.01
Token Test error score of 1 point more	−0.0560	0.0122	−4.592	<.01
Indirect as opposed to direct speech	−0.8904	0.2777	−3.206	<.01
Flesch Reading Ease (centred)	0.0371	0.0155	2.390	<.05
Question 1 position later in a sequence	−0.1213	0.0619	−1.961	<.05
Indirect as opposed to direct speech & Token Test error score of 1 point more	0.0307	0.0125	2.462	<.05

Only significant predictors were included. Negative estimates indicate a lower probability of answering a question correctly.

and indirect speech diminishes for participants with higher Token Test error scores. More specifically, the difference is significant for participants with low and average Token Test error scores, but not for participants with high Token Test error scores.[4] No other predictors (or interactions between predictors) were significant. Random intercepts were necessary for participant and question, but not for story. Also no random slopes were required.

Summary of results

The performance of NBD individuals on the DISCO was better than that of the aphasic participants. Moreover, there was a main effect of condition with narratives that were presented with direct speech reports being more accurately understood than narratives in which indirect speech reports were used. The lack of interaction between condition type and group indicates that this held for both the individuals with aphasia and the neurologically healthy controls. In addition, an effect of FRE (Flesch, 1948) was found, indicating that participants obtained higher scores for narratives with lower complexity.

Focusing on the subgroup of individuals with aphasia, we found similar results: There was a main effect of condition type, with narratives in the direct speech condition being easier to understand than narratives in the indirect speech condition. Individuals with aphasia performed better on narratives that were less complex as measured by the FRE. Moreover, individuals with fewer Token Test errors performed better on the DISCO. An additional effect was found for question number: Participants with aphasia had more difficulty with questions that were presented later in a sequence than with those presented earlier, indicating that within each story the task became more difficult due to, for example, an increasing demand on memory or cognitive load. Finally, the interaction that was found between condition and Token Test scores indicates that aphasia severity played a role in the effect size of condition type. Individuals with mild to moderate aphasia clearly benefitted from direct as opposed to indirect speech constructions in narrative comprehension, whereas this effect diminished for individuals with severe aphasia. However, this finding should be interpreted with caution, since it is based on observations of a very small group of participants (n = 4). Moreover, a closer inspection of the data learns that three of these participants scored close to chance level (i.e., 64%, 64% and 55% correct), indicating that the task may have been too difficult for them to reveal an effect of a subtle manipulation such as that of condition type.

DISCUSSION

In the current study, we elaborated on previous research using spoken language and audio-visual materials. Moreover, we extended the focus from healthy comprehension only to both healthy and aphasic comprehension. Finally, we carried out the study in Dutch, in which more grammatical differences between direct and indirect

[4] Further analyses show that the direct speech condition is easier than the indirect speech condition for participants with Token Test error scores up to 29 and that the effect disappears for participants with Token Test error scores above 30. However, this threshold should be interpreted with caution, as it is based on different sample sizes (n = 19 and n = 4, respectively).

speech constructions exist than in English. The nature and the possible effects of these differences will be addressed later.

The beneficial effect of direct over indirect speech on narrative comprehension in listeners with and without aphasia that was found in the current study is in line with findings of several previous studies of "healthy" language processing. Based on qualitative descriptions, direct speech has often been claimed to be an effective device for storytelling, because of its dramatising and enlivening effects on narratives (Clark & Gerrig, 1990; Labov, 1972; Li, 1986; Mayes, 1990; Tannen, 1989; Wierzbicka, 1974). The results of the current study underline these findings. Yao et al. (2012) also argue for a beneficial effect of direct over indirect speech constructions. Conversely, Eerland et al. (2013) found no evidence that direct speech enhances the availability of information about the referential or communicative situation as compared to indirect speech. In fact, they found (some) evidence to the contrary.

Our findings also build on and complement previous studies of aphasic language comprehension. These studies revealed a number of factors that determine how well individuals with aphasia understand spoken discourse. Pashek (1977) showed that individuals with mild auditory comprehension deficits benefit from the use of contrastive stress in Token Test commands, suggesting that prosodic variations within spoken language facilitate auditory comprehension for at least some individuals with aphasia. The results of the current study, in which aphasic participants may benefit from prosodic variation as well, are in line with these findings. Pashek and Brookshire (1982) found that both speech rate and linguistic stress had an effect on discourse comprehension in aphasia: Scores of aphasic individuals were higher for paragraphs presented with a slow rate of speech than for those presented at a normal rate and for paragraphs presented with exaggerated stress than for paragraphs with normal stress. Their findings relating the effects of stress are compatible with our results, because it is known that speakers use intonational cues such as voice quality, tempo, pitch and loudness as a means of contextualising direct speech constructions (Couper-Kuhlen, 1998; Lind, 2002).

Therefore, one possible explanation for our finding of an advantage for direct speech relates to the additional "cues" that are often present in direct but not in indirect reported speech. While indirect speech is claimed to be description-like, direct speech is considered to be more demonstration-like (Clark & Gerrig, 1990). Direct speech constructions are often rich in terms of non-verbal and paralinguistic information such as intonation and facial expression (Couper-Kuhlen, 1998; Goodwin, 1990; Holt, 1996; Li, 1986; Streeck & Knapp, 1992; Wilkinson et al., 2010). Moreover, speakers often mimic other formal aspects of speech, such as the pitch or voice quality of the original speech (Romaine & Lange, 1991). This "prosodic richness" may lead to direct speech constructions being better understood than their "prosodically flat" counterparts. In a previous study (Groenewold et al., 2014), we showed that the occurrence of direct speech has a positive effect on the perceived liveliness of discourse produced by both aphasic and NBD speakers. Increased liveliness, in turn, has been argued to improve the comprehensibility of speech and to keep the listener focused (Hincks, 2005). Combining the findings of these studies, one would expect a positive effect of the occurrence of direct speech on discourse comprehension as was found here. While Groenewold et al. (2014) did not find any advantage for direct speech on perceived comprehensibility ratings, the current study, using objective measures of comprehensibility, indeed showed a beneficial effect of direct speech on language comprehension for both aphasic and NBD individuals.

However, the extra "layers" of communication that accompany direct but not indirect speech may not be necessary to obtain a differential effect between direct and indirect speech processing. As was argued by Yao et al. (2012), even monotonously spoken direct speech makes listeners spontaneously engage in mental simulations of vivid vocal depictions. Apparently, the surface form of direct as compared to indirect speech constructions can be enough to achieve a differential effect on spoken language processing.

An alternative explanation for the findings of the current study relates to the grammatical differences between direct and indirect reported speech. In a study assessing the effects of a number of linguistic variables on discourse comprehension in aphasia, Levy et al. (2012) found that passages with syntactically simple sentences were better understood than passages with syntactically complex sentences. This was the case for both individuals with aphasia and neurologically healthy controls. Since Dutch direct and indirect reported speech constructions also differ with respect to their grammatical complexity, this may be of influence in our study as well. To further address the difference in grammatical complexity of the two construction types we discuss Examples 3A and 3B.

Example and translation of direct reported speech in Dutch:

(3A) *Marie zei: "ik ben moe".*
Marie said: "I am tired".
"Marie said: I am tired".

Example and translation of indirect reported speech in Dutch:

(3B) *Marie zei dat ze moe was.*
Marie said that she tired was.
"Mary said that she was tired".

Even though the reported content and the quotation frame, *Marie said*, are the same, Examples 3A and 3B are grammatically different in several respects. First, Example 3A differs from Example 3B in the use of pronouns ("I" vs. "she") and verb tense ("ben" vs. "was"). Furthermore, Example 3B involves a change of the original (reported) word order in the reported clause, whereas in Example 3A the report remains in the same (main clause) word order.[5] Finally, in Example 3B, the reported speech is embedded in the main clause, as shown by the obligatory complementiser *that*. Direct speech constructions (e.g., Example 3A) do not require such an embedding and are, therefore, possibly easier to process for individuals with and without aphasia.

[5] Whilst it is clear that Example 3B has a changed word order (as compared to the *reported* word order, which is subject-verb-object (SVO)), it is not straightforward whether the SVO word order in Example 3A represents the base or the derived form. In Dutch, the position of the finite verb in main clauses differs from that in subordinate clauses. The unmarked order of main clauses is SVO, while subordinate clauses exhibit an SOV pattern. Therefore, which order is basic is a fundamental and highly debated problem in Dutch grammar. For many years, from the early 1970s, the general consensus was that Dutch (like German) is an SOV language (e.g., Bastiaanse, 2011; Bastiaanse, Hugen, Kos, & van Zonneveld, 2002; Bastiaanse & Zonneveld, 2006; Koster, 1975; Scaglione, 1981). However, new theories suggest that the SOV order is itself derived from a more basic SVO order (e.g., Den Dikken, 1996; Koster, 1994; Zwart, 1994, 1997). This linguistic debate regarding canonical word order in Dutch is beyond the scope of this article.

Since there are two candidate explanations for our findings, which cannot be disentangled with the data collected for the current study, further research is required. In order to determine the role of the obligatory complementiser and embedded construction in Dutch indirect speech, it is important to examine the effects of direct and indirect speech on discourse comprehension in a language that does not have these grammatical differences between condition types. In English, for example, the word order for indirect speech is the same as for direct speech (i.e., SVO). Second, unlike in Dutch, the complementiser *that* in English indirect speech constructions is not obligatory (e.g., *he said he will come later*). It is more, in the embedded clauses of verbs such as *say, know* or *think* in English conversation register the default construction is the one with an absent *that* (Biber, Johansson, Leech, Conrad, & Finegan, 1999; Llinàs-Grau & Martínez-Ferreiro, 2014). Conducting a similar study in English may reveal whether non-verbal and paralinguistic or grammatical factors are the critical feature.

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APPENDIX A

Written samples of the two versions of the DISCO materials (translated from Dutch). Reporting sentences in italics.

Direct speech

A husband and a wife go to a store. The wife is looking for a new couch. In the shop the couple are immediately welcomed. The shopkeeper asks: '*Can I help you somehow?*' The wife says: '*Thank you, we will just look around ourselves*.' The shopkeeper says: '*I'm available if you need any help.*' The husband and the wife walk around the store. The wife asks the husband: '*What would you like?*' The husband replies: '*No idea, you can pick anything*'. The wife says: '*I don't like that suggestion, I think we should both like the couch.*' The husband says: '*If you point to a couch, I will say whether I like it.*' The wife points to a couch. The husband says: '*Too small, I want to be able to lie on it.*' The wife points to a different couch. The husband says: '*That color is too dark, it does not fit in our house.*' The wife walks around and sits on another couch. The husband asks: '*Is it comfortable?*' The wife replies: '*Very!*' The husband says: '*Then we take that one.*' The wife walks towards the shopkeeper and says: '*We are taking the couch there in the corner of the store.*' After ten minutes the husband and the wife leave the store.

Indirect speech

A husband and a wife go to a store. The wife is looking for a new couch. In the shop the couple are immediately welcomed. The shopkeeper *asks whether he can help them somehow*. The wife *thanks him* and *says they would like to look around themselves*. The shopkeeper *replies that he is available if they need any help*. The husband and the wife walk around the store. The wife *asks* the husband *what he would like*. The husband *replies that he has no idea and that she can pick anything*. The wife *says she doesn't like that suggestion* and *that she thinks they should both like the couch*. The husband *says if she points to a couch he will say whether he likes it*. The wife points to a couch. The husband *says it is too small and he wants to be able to lie on it*. The wife points to a different couch. The husband *says that color is too dark, and that it does* *not fit in their house*. The wife walks around and sits on another couch. The husband *asks whether it is comfortable*. The wife *replies that it is very comfortable*. The husband *says they will take that one*. The wife walks towards the shopkeeper and *says they are taking the couch there in the corner of the store*. After ten minutes the husband and the wife leave the store.

Questions

(1) Is the wife looking for a new coffee table? [no]
(2) Would the wife like to get advice from the shopkeeper? [no]
(3) Did the wife find the opinion of the husband important? [yes]
(4) Did the shopkeeper make suggestions for a couch? [no]
(5) Did the husband want to be able to lie on the couch? [yes]
(6) Did the husband find the color of the couch important? [yes]
(7) Did the husband try the couch? [no]
(8) Did the husband and the wife buy a couch? [yes]

APPENDIX B

Supplements to the statistical procedures

By using logistic regression, we do not model the dependent variable directly, but rather model the probability (in terms of logits: the logarithm of the odds) of observing a correct answer. When interpreting the estimates, these need to be interpreted with respect to the logit scale (i.e., an estimate of 0 indicates that there is a 50% chance of answering the question correctly, whereas a positive estimate denotes a higher than 50% chance, and a lower estimate a lower chance).

The AIC difference can be used to determine the evidence ratio, which expresses the relative probability that the model with the lowest AIC is more likely to provide a more precise model of the data. An AIC difference of 2 is generally used as the minimum required reduction and indicates that the model with the lowest AIC is 2.7 times more likely to provide a precise model of the data (Akaike, 1974). Including random intercepts and slopes (if they provide a better fit) is important to prevent type-I errors in assessing the significance of the predictors of interest. More information about the merits of this approach can be found in Baayen, Davidson, and Bates (2008) and Baayen (2008, Ch. 7).

APPENDIX C

TABLE C1
Individual scores per group and condition type

Participant	*Group*	*Direct speech (%)*	*Indirect speech (%)*
P2	Aphasia	74.4	72.6
P3	Aphasia	77.4	70.2
P4	Aphasia	62.5	66.1
P7	Aphasia	91.7	91.1
P8	Aphasia	95.8	73.8
P10	Aphasia	87.5	73.8
P11	Aphasia	95.2	70.8
P12	Aphasia	91.7	91.7
P14	Aphasia	91.1	79.2
P15	Aphasia	70.8	74.4
P16	Aphasia	95.8	100.0
P17	Aphasia	79.2	95.8
P18	Aphasia	83.3	81.5
P19	Aphasia	61.3	66.67
P21	Aphasia	91.1	83.3
P23	Aphasia	91.1	58.3
P24	Aphasia	73.8	66.7
P26	Aphasia	44.0	66.7
P27	Aphasia	95.2	95.8
P28	Aphasia	86.9	66.7
P29	Aphasia	95.8	91.7
P30	Aphasia	91.7	83.3
P33	Aphasia	83.3	82.1
Average	Aphasia	83.1	78.4
C1	NBD	95.8	90.5
C2	NBD	87.5	82.7
C3	NBD	91.7	95.8
C4	NBD	91.7	100.0
C5	NBD	79.2	91.1
C6	NBD	83.3	87.5
C7	NBD	86.9	91.7
C8	NBD	100.0	95.8
C9	NBD	83.3	75.0
C10	NBD	100.0	87.5
C11	NBD	91.1	83.3
C12	NBD	91.1	83.3
C13	NBD	91.7	100.0
C14	NBD	91.7	100.0
C15	NBD	95.8	95.2
C16	NBD	95.8	91.1
C17	NBD	95.2	87.5
C18	NBD	100.0	95.8
C19	NBD	95.2	87.5
C20	NBD	95.2	95.8
Average	NBD	92.1	90.9

NBD: non-brain-damaged.