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

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## Abstract

*Background:* In a previous study, we demonstrated that narratives containing direct speech constructions were easier to comprehend than narratives with indirect speech constructions for Dutch listeners with and without aphasia. There were two possible explanations for this finding: either that direct speech has increased liveliness compared to indirect speech or that direct speech is less grammatically complex.

*Aims:* This study aimed to provide further insight into the mechanisms underlying the differences between direct and indirect speech constructions on discourse comprehension in Dutch. More specifically, it aimed to examine the role that the grammatical characteristics of direct and indirect speech play in discourse comprehension success by comparing English- and Dutch-speaking individuals with and without aphasia.

*Methods & Procedures:* An English version of the Dutch iPad-based Direct Speech Comprehension test (DISCO) was developed. Twenty individuals with aphasia and 19 neurologically healthy control participants were presented with spoken narratives that contained either direct or indirect speech constructions. Their performance was compared to that of the participants of the Dutch DISCO study. To assess the effect of language on performance, we conducted a single analysis in which we contrasted the English data with the Dutch data.

*Outcomes & Results:* Control participants performed better than participants with aphasia; English-speaking participants performed worse than Dutch participants and narratives containing direct speech were easier to comprehend than narratives with indirect speech constructions. However, a subsequent analysis including only

individuals with aphasia showed that the Dutch group differed from the English-speaking group: direct speech was only beneficial for the Dutch participants with aphasia.

*Conclusions:* This study expanded on the findings of a previous study, in which a facilitating effect of direct over indirect speech constructions for audiovisual discourse comprehension was found. The differential effects of direct speech on comprehension in Dutch and English showed that rather than one or other explanation being 'correct' both liveliness and grammatical characteristics play a role in discourse comprehension success. Grammatically less complex constructions (direct speech) are not necessarily always easier to comprehend than grammatically more complex constructions (indirect speech) for individuals with aphasia. In our study grammatically simple constructions introduced grammatical ambiguity, and therefore possible interpretation difficulties for the English-speaking participants with aphasia.

**Keywords**: aphasia, discourse comprehension, direct speech, indirect speech

## Introduction

The term direct speech is traditionally used to refer to expressions such as *John said: "I am hungry"*, whereas indirect speech is used for expressions like *John said (that) he was hungry*. The difference between direct and indirect speech has received a considerable amount of attention from researchers in a variety of disciplines. The fundamental difference between the two forms is claimed to lie in the point of view of the reporter: in direct speech the reporter lends his/her voice to the original speaker, whereas in indirect speech the reporter relates a speech event from his/her own point of view (Coulmas, 1986).

Several studies have shown that direct speech serves specific interactional goals in communication. Clark and Gerrig (1990) argue that an important function of direct speech is to provide a vivid *demonstration* of former speech, whereas indirect speech delivers a *description* of what was said. Various researchers have pointed out that direct speech is characterised by its dramatic, theatrical nature (e.g. Wierzbicka, 1974; Li, 1986; Tannen, 1989;). Compared to indirect speech, direct speech is usually more vivid and perceptually engaging than indirect speech (e.g. Yao, Belin & Scheepers, 2011). Therefore, it is often used at the climax of stories, and is proposed to be an effective way of conveying the point of a narrative (Mayes, 1990).

In the current study we focus on the effects of direct and indirect speech constructions on spoken discourse comprehension in English listeners with and without aphasia. This is a follow-up to a study in Dutch (Groenewold, Bastiaanse, Nickels, Wieling & Huiskes, 2014b) to examine whether the effects of direct and indirect speech constructions on discourse comprehension are the same or different for the two languages. Groenewold et

al. (2014b) showed that, for Dutch individuals with and without aphasia, narratives containing direct speech constructions were better comprehended than narratives with indirect speech constructions. Two possible explanations were put forward to account for these findings.

One of the candidate explanations was related to the increase in liveliness for direct speech compared to indirect speech (Groenewold et al., 2014b). Liveliness of speech is mainly associated with enthusiasm (Sinclair, 1995). The degree of perceived liveliness can be affected by modification of the three prosodic dimensions of speech: loudness, pitch, and tempo (Hincks, 2005). Based on several qualitative descriptions, direct speech has often been claimed to have a positive effect on liveliness of speech (e.g. Wierzbicka, 1974; Macaulay, 1987) and to be an effective device for storytelling (e.g. Labov, 1972; Li, 1986; Mayes, 1990). Similar effects have been reported for more quantitatively oriented research. Studies on processing of "unimpaired" language have shown that direct speech is perceived as more vivid and is thought to be more engaging than indirect speech (Yao & Scheepers, 2011; Yao et al., 2011; Yao, Belin & Scheepers, 2012). This has also been shown to hold for "impaired" language: auditory speech fragments of speakers with and without aphasia containing direct speech were perceived as more lively than those without (Groenewold, Bastiaanse, Nickels & Huiskes, 2014a). Other studies have shown that direct speech is considered a way to create involvement in a story (Chafe, 1982; Tannen, 1989), and that, in general, increased liveliness helps the listener to stay focused and understand the content of a message (Hincks, 2005). Given that direct speech is perceived as more vivid than indirect speech, it seems likely

that the occurrence of direct speech constructions not only contributes to the liveliness, but also to the comprehensibility of spoken language.

A second candidate explanation proposed for the differences found in Groenewold et al. (2014b) is related to the grammatical differences between direct and indirect speech constructions. Some of these differences exist only in Dutch, others exist in both Dutch and English. The grammatical characteristics of direct and indirect speech constructions that may be of relevance for our study are addressed below.

A first grammatical difference between direct and indirect speech concerns the degree of integration of reporting and reported parts of the sentence: Direct reported speech involves a word-by-word rendition of former speech. However, even though the propositional content is retained indirect speech typically modifies the grammar of the reported utterance to embed it in the reportative construction (Jäger, 2007). Individuals with (agrammatic) aphasia have been shown to have difficulty understanding embedded sentences (Abuom, Shah & Bastiaanse, 2013), and may therefore find it more difficult to process indirect speech compared to direct speech. Even though in both Dutch and English indirect speech has features that signal that the "quote" is more fused with the clause containing the (reporting) verb than in direct speech, this difference is greater for Dutch than for English. Dutch indirect speech constructions are more overtly marked for embedding than English constructions. First, unlike in English, in Dutch, indirect speech constructions are mandatorily introduced by the complementiser "dat" (*that*). Second, in Dutch clauses representing direct speech and clauses representing indirect speech have different word orders: While in direct speech the word order is subject-verb-object (SVO), in indirect speech it is subject-

object-verb (SOV) (Groenewold, Bastiaanse, & Huiskes, 2013). Which word order is basic is highly debated (Groenewold et al., 2014b): For many years the general consensus was that Dutch is an SOV language (e.g. Scaglione, 1981; Koster, 1975; Bastiaanse, Hugen, Kos, & Van Zonneveld, 2002; Bastiaanse & Van Zonneveld, 2006; Bastiaanse, 2011), however, more recent theories propose that the SOV order is actually derived from a more basic SVO order (see Zwart, 2011 for an overview of the discussion). In English, there is no difference in word order between direct and indirect speech constructions (both are SVO).

Direct and indirect speech differ in the use of pronouns and this is universal across languages (Li, 1986). Consider Example 1:

Example 1. Direct and corresponding indirect speech in English and Dutch.

| | **Direct speech** | | **Indirect speech** |
|---|---|---|---|
| (1a) | John told Paul: "I want to go".<br>Jan zei tegen Paul: "Ik wil gaan". | (1b) | John told Paul (that) he wanted to go.<br>Jan zei tegen Paul dat hij wilde gaan. |

In direct speech, pronouns (1a, *I, ik*) are consistent with the vantage point of the original speaker (first-person), whereas in indirect speech, pronouns (1b, *he, hij*) have the same person as in the surrounding narrative (third-person). It has been suggested that a first-person perspective is easier to identify with and to link to one's own perspective than a third-person perspective (e.g. Bohan, Sanford, Cochrane & Sanford, 2008). However, indirect speech (1b) may also be more difficult to process than direct speech (1a) because of construction ambiguity. In the direct speech in (1a), "I" unquestionably refers to the reporting speaker (in this case: John). If, instead, the pronoun "he" had been used, this could not be interpreted as referring to John, and the referent would remain clear (in this case: some other third party male person). Conversely, "he" in the indirect

speech of (1b) could refer to either the reported speaker (John) or to some other male person, and is therefore ambiguous. This is the case for both Dutch and English. Direct speech constructions do not suffer from referential ambiguity (Coulmas, 1986), and may therefore be easier to process in both languages.

It is not currently clear to what extent the findings of the Dutch DISCO study are also valid for other languages. It could be the case that the Dutch participants performed better on the direct speech condition because of an increase in liveliness compared to the indirect speech condition. If liveliness is the crucial factor, then we should find similar results for other languages, regardless of how direct and indirect speech constructions are grammatically realised. Alternatively, the difficulty for Dutch indirect speech constructions could be due to the grammatical factors discussed above. Replicating the previous study in English the current study serves to provide us with more insight into the effects of direct versus indirect speech constructions on discourse comprehension in aphasia, and the role that grammatical characteristics play in comprehension success.

Other previous studies have paid some attention to the contrasting effects of direct and indirect speech on language comprehension (e.g. Bohan et al., 2008; Yao et al., 2011; Yao & Scheepers, 2011; Eerland, Engelen & Zwaan, 2013). However, the scope and the methodologies of these studies have been diverse. As yet, no consensus has been reached with regard to either the direction or the size of the differential effects of direct versus indirect speech processing. In addition, there are some methodological factors that are limit interpretation of the results, making predictions for follow-up studies, and generalising the findings. For example, the majority of the experiments so far have used

*written* rather than *spoken* language to assess the difference between the two construction types (e.g. Bohan, et al., 2008; Yao et al., 2011; Yao & Scheepers, 2011; Eerland et al., 2013). Moreover, in the few cases in which spoken language was used, stimuli were *auditory* rather than *audiovisual* (e.g. Yao et al., 2012; Groenewold et al., 2014a). This is remarkable since many characteristics that play an important and distinguishing role in reported speech (e.g. the occurrence of gesture, facial expression, intonation, etc.) only become apparent in the audiovisual modality. Therefore, even though these studies have provided us with valuable insights into the effects of direct and indirect speech, the findings are not exhaustive nor necessarily representative of naturalistic speech data. Consequently, in the current study a different approach was used, relying on audiovisual recordings of spoken language.

The current study was conducted to gain further insight into audiovisual discourse comprehension in aphasia, to find out more about the differential effects of direct and indirect speech constructions on discourse comprehension, and to determine to what extent the findings of the Dutch DISCO study are also valid for English. It may help us to explain the findings of the Dutch DISCO study, to formulate predictions for other languages, and to develop recommendations for clinical practice.

The research question we aimed to answer in the current study was:

*"What are the differences between the effects of direct and indirect speech constructions on narrative comprehension in Dutch- and English-speaking individuals with and without aphasia?"*

## Methods

*Participants*

Twenty Australian-English native speakers with aphasia and nineteen Australian-English non-brain-damaged (NBD) native speakers participated in the English DISCO study[1]. The English-speaking participants with and without aphasia were matched to each other and to the twenty-three individuals with aphasia and twenty NBD participants of the Dutch DISCO study (Groenewold et al., 2014b) for mean level of education and mean age at the group level. The NBD participants reported no history of neurological or language impairment, and did not show evidence of cognitive or language impairment during the testing session. Individuals with aphasia were recruited through a database of research volunteers, and through local aphasia groups. Certified speech and language pathologists made diagnosis of aphasia from results of standard aphasia tests, and the participants with aphasia had to be at least three months post-onset. As part of the procedure, the Token Test (Aachen Aphasia Test, Graetz, de Bleser, Willmes & Heeschen, 1992) was conducted to establish the severity of aphasia. Table 1 presents descriptive information about the two groups, and in Table 2 shows demographic and clinical data for the participants with aphasia.

[1] Macquarie University Human Research Ethics Committee approved the study and all participants provided signed informed consent prior to participation.

Table 1: Descriptive information of participants without brain damage (NBD) and participants with aphasia (PWA). Education: number of years of education completed; MPO: months post onset; SD: standard deviation.

| | | | Age | Education | MPO |
|---|---|---|---|---|---|
| Dutch | 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 |
| English | NBD | Mean | 65.16 | 12.67 | N/A |
| | | SD | 8.78 | 2.66 | N/A |
| | | Range | 40-76 | 10-20 | N/A |
| | PWA | Mean | 64.90 | 13.47 | 89.65 |
| | | SD | 11.53 | 3.10 | 67.01 |
| | | Range | 35-78 | 8-19 | 10-249 |

*Materials*

For the English version of the DISCO experiment the narratives of the Dutch experiment were translated. Unless otherwise noted, the replication followed the procedures of the Dutch DISCO study (Groenewold et al., 2014b). The instructions, the narratives, and the questions for the English DISCO were digitally video recorded in a professional recording studio by two native speakers of Australian English. Each version of a narrative (direct/indirect speech) was read by the same speaker, and the speakers were instructed to speak naturally and only use limited gestures (such as hand, face, and small body movements). The speakers were not aware of the purpose of the study.

The English DISCO test consisted of 1 pair of practice narratives and 6 pairs of experimental narratives. The narratives ranged in length from 12 to 16 sentences (183-268 words). The Flesch Reading Ease scores (FRE[2]; Flesch, 1948) varied from 74.7 to 85.2. The FRE scores of the two versions (direct and indirect speech) of a narrative always fell within the same range. In addition, any effect of FRE was controlled for in

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

the analysis. Table 3 presents descriptive information about the Dutch and English narratives.

Table 2: Demographic and clinical data for the participants with aphasia. PWA: participant with aphasia; MPO: months post onset; CVA: cerebro-vascular accident; TT: Token Test error score (0-50); Education: number of years of education completed.

| Language | PWA | Age | Gender | MPO | Cause | Diagnosis aphasia | Severity aphasia | TT | Education |
|---|---|---|---|---|---|---|---|---|---|
| Dutch | D_P2 | 44 | Male | 9 | CVA left | Fluent | Mild | 4 | 14 |
| Dutch | D_P3 | 62 | Male | 162 | CVA left | Non-fluent | Moderate-severe | 41 | 15 |
| Dutch | D_P4 | 55 | Female | 103 | CVA left | Non-fluent | Severe | 36 | 10 |
| Dutch | D_P7 | 67 | Female | 50 | CVA left | Fluent | Mild | 1 | 10 |
| Dutch | D_P8 | 68 | Male | 18 | Brain tumor removal | Fluent | Mild | 5 | 15 |
| Dutch | D_P10 | 45 | Male | 34 | CVA left | Fluent | Mild-moderate | 7 | 14 |
| Dutch | D_P11 | 41 | Female | 64 | CVA left (carotid dissection) | Non-fluent | Moderate-severe | 18 | 11 |
| Dutch | D_P12 | 50 | Male | 96 | CVA left | Non-fluent | Moderate-severe | 12 | 14 |
| Dutch | D_P14 | 68 | Male | 79 | CVA left | Fluent | Mild | 3 | 15 |
| Dutch | D_P15 | 43 | Male | 31 | CVA left | Non-fluent | Mild | 10 | 10 |
| Dutch | D_P16 | 53 | Male | 21 | CVA left | Non-fluent | Mild | 4 | 11 |
| Dutch | D_P17 | 52 | Male | 24 | CVA left | Non-fluent | Moderate | 24 | 10 |
| Dutch | D_P18 | 58 | Male | 34 | CVA left | Non-fluent | Moderate-severe | 13 | 17 |
| Dutch | D_P19 | 59 | Male | 211 | CVA left | Non-fluent | Severe | 40 | 17 |
| Dutch | D_P21 | 55 | Male | 210 | CVA left | Fluent | Mild | 9 | 11 |
| Dutch | D_P23 | 71 | Female | 43 | CVA right | Fluent | Mild | 3 | 6 |
| Dutch | D_P24 | 53 | Male | 3 | Subarachnoid hemorrhage | Fluent | Moderate-severe | 11 | 14 |
| Dutch | D_P26 | 60 | Male | 18 | CVA left | Non-fluent | Moderate-severe | 35 | 10 |
| Dutch | D_P27 | 53 | Male | 92 | CVA left | Fluent | Mild | 3 | 10 |
| Dutch | D_P28 | 61 | Male | 53 | CVA left | Non-fluent | Severe | 16 | 10 |
| Dutch | D_P29 | 49 | Female | 27 | CVA left | Non-fluent | Moderate | 2 | 14 |
| Dutch | D_P30 | 66 | Male | 122 | CVA left | Fluent | Moderate | 12 | 10 |
| Dutch | D_P33 | 62 | Male | 226 | CVA left | Non-fluent | Mild | 17 | 10 |
| AVERAGE DUTCH | | 55.9 | | 67.8 | | | | 14.2 | 12.2 |
| English | E_P1 | 68 | Male | 105 | CVA left | Non-fluent | Mild | 15 | 12 |
| English | E_P2 | 74 | Male | 192 | CVA left | Non-fluent | Moderate-severe | 19 | 10 |
| English | E_P3 | 68 | Male | 60 | CVA left | Non-fluent | Severe | 19 | 19 |
| English | E_P4 | 68 | Male | 43 | CVA left | Fluent | Mild | 2 | 12 |
| English | E_P5 | 56 | Female | 47 | CVA left | Non-fluent | Severe | 30 | 11 |
| English | E_P6 | 58 | Female | 73 | CVA left | Fluent | Mild | 18 | 16 |
| English | E_P7 | 71 | Male | 106 | CVA left | Non-fluent | Moderate | 22 | 9 |
| English | E_P8 | 72 | Male | 81 | CVA left | Fluent | Mild | 10 | 13 |
| English | E_P9 | 73 | Male | 46 | CVA left | Fluent | Mild | 10 | 8 |
| English | E_P10 | 59 | Male | 89 | CVA left | Fluent | Mild | 1 | 12 |
| English | E_P11 | 64 | Male | 20 | CVA left | Non-fluent | Severe | 30 | 13 |
| English | E_P12 | 73 | Male | 11 | CVA left | Non-fluent | Moderate | 12 | 18 |
| English | E_P13 | 64 | Male | 45 | CVA left | Non-fluent | Mild-moderate | 20 | 14 |
| English | E_P14 | 70 | Male | 179 | CVA left | Fluent | Mild | 13 | 12 |
| English | E_P15 | 78 | Male | 162 | CVA left | Non-fluent | Moderate-severe | 23 | 19 |
| English | E_P16 | 72 | Male | 168 | CVA left | Non-fluent | Severe | 36 | 12 |
| English | E_P17 | 67 | Male | 10 | TBI | Fluent | Mild-moderate | 19 | 12 |
| English | E_P18 | 72 | Female | 38 | CVA left | Non-fluent | Severe | 24 | 12 |
| English | E_P19 | 35 | Female | 69 | CVA left | Fluent | Mild | 8 | 16 |
| English | E_P20 | 36 | Female | 249 | Brain hemorrhage | Fluent | Mild | 9 | 16 |
| AVERAGE ENGLISH | | 64.9 | | 89.7 | | | | 17.0 | 13.3 |

Table 3: Descriptive information for materials. FRE = Flesch Reading Ease: 90-100: Texts with scores between 60 and 69 are considered standard, those between 70 and 79 fairly easy, and those between 80 and 89 easy.

| | | | # words | | # sentences | | words/ sentence | | FRE | |
|---|---|---|---|---|---|---|---|---|---|---|
| Story line | Narrative | Language | Direct | Indirect | Direct | Indirect | Direct | Indirect | Direct | Indirect |
| A1. Being on time | Airport | Dutch | 193 | 223 | 12 | 13 | 16.1 | 17.2 | 73.5 | 76.8 |
| | | English | 183 | 205 | 12 | 13 | 15.3 | 15.8 | 80.4 | 83.1 |
| A2. Being on time | Theatre | Dutch | 198 | 217 | 12 | 12 | 16.5 | 18.1 | 86.7 | 87.1 |
| | | English | 212 | 223 | 12 | 12 | 17.7 | 18.6 | 85.2 | 84.0 |
| B1. Home | Paint | Dutch | 201 | 214 | 12 | 12 | 16.8 | 17.8 | 86.3 | 87.5 |
| | | English | 198 | 204 | 12 | 12 | 16.5 | 17.0 | 77.3 | 74.7 |
| B2. Home | Couch | Dutch | 218 | 217 | 13 | 12 | 16.8 | 18.1 | 88.9 | 87.5 |
| | | English | 213 | 236 | 13 | 12 | 16.4 | 19.7 | 83.4 | 81.1 |
| C1. Making plans | Dinner | Dutch | 191 | 223 | 12 | 13 | 15.9 | 17.2 | 67.5 | 68.8 |
| | | English | 201 | 227 | 12 | 13 | 16.8 | 17.5 | 78.3 | 79.2 |
| C2. Making plans | Jubilee | Dutch | 234 | 258 | 15 | 16 | 15.6 | 16.1 | 67.7 | 67.2 |
| | | English | 246 | 268 | 15 | 16 | 16.4 | 16.8 | 77.1 | 78.1 |

All narratives describe reports of conversations between a husband and a wife. The topics of the narratives would be familiar to most adults. The materials were designed in such a way that the narratives described a chronological sequence of events, and that each sentence was either expository or a continuation of the prior sentences. In addition, no more than three characters were introduced per narrative to reduce the demands on memory. Two of these characters were always the husband and the wife. In Appendix A samples of the two versions of the narratives can be found. Apart from the reporting sentences, which differed in condition (direct vs. indirect reported speech), the two versions of the narratives contained declarative sentences and were identical in the two versions. In order to make optimal use of the grammatical differences between Dutch and English indirect speech constructions, the English indirect reporting sequences did not contain the optional complementiser *that* (which is mandatory in Dutch). In colloquial English is much more common to omit *that* than include it, and is therefore considered the norm in conversational or informal styles (Biber, Johansson, Leech, Conrad & Finegan, 1999).

Eight yes/no questions per narrative were used to assess comprehension. This assessment method rules out possible interference effects from spoken language *production* impairments (Groenewold et al., 2014b), and is similar to that of, for example, Brookshire and Nicholas (1993), and Ferstl, Walther, Guthke and Von Cramon (2005). Just like the narratives, these English questions were translations of the Dutch DISCO questions. For four of the questions the correct response was YES, for the other four it was NO. The questions were video recorded, and the same videos were used for both conditions (direct and indirect speech). The first question always focused on the main idea of the text, and served as a "warm up" question. The remaining questions required comprehension of more detailed information provided in the reporting utterances (direct/indirect speech) of the narratives. The sequential order of the questions was in accordance with the order of mention in the narrative. The questions belonging to the example narrative are provided in Appendix A.

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 presented to a separate group of NBD participants (n=21) who had not heard the stories. As expected, this group performed at around chance level (proportion correct = 0.54, *SD* = 0.09).

*Procedures*

Testing took place individually in a single session of about an hour for the aphasic participants, and thirty minutes for the NBD participants. The NBD participants only

carried out the DISCO, while the aphasic participants also performed the Token Test subtest of the Aachen Aphasia Test[3] (Graetz et al., 1992) to provide a measure of aphasia severity. The Token Test scores reflect the number of incorrectly performed items (0-50).

To control for possible effects of presentation order, the English DISCO narratives were presented in a pseudo-random order using 12 fixed lists. In addition, order was controlled for in the analysis. The participants were informed that they would be watching 7 videos on an iPad, the first of which served as a practice item, and that after each video they would be asked to answer 8 yes/no-questions about the content of the narrative. The questions could be answered by touching the screen, where a red button with a cross [NO] and a green button with a tick [YES] appeared. The participants were instructed to use their left hand to answer the questions. The experiment commenced by the participant pressing the [START] button. The participants then saw a short video spoken by one of the two speakers with the following message (translated from the Dutch DISCO instructions), 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, color or size, such as: "show me the red square and the yellow circle".

Next, the participants were presented with a practice narrative, which was told by the other speaker. Hence, they were accustomed to both the speakers and the procedure of the test before commencing the 6 experimental narratives. Three seconds after the last sentence of each narrative, the first of the eight questions was automatically presented. The participants answered the question with a button press ("yes" or "no") which also triggered the next question. This fixed paradigm ensured there was no variability across participants in timing between the narratives and the first question. After completion of the 8 questions of the previous narrative the participants saw a blank screen with a movie icon before moving on to the next narrative. The participants could decide whether they wanted to take a short break or move on immediately.

*Analysis*

For the statistical analyses we used the protocol that was used for the Dutch DISCO study (Groenewold et al., 2014b), but added language (Dutch versus English) as an extra predictor. First, an item analysis using a 2-paired Wilcoxon Rank Sum Test was carried out to confirm that all items were suitable for further analysis. Items that deviated significantly from ceiling performance for the NBD participants were considered unsuitable and therefore removed.

Subsequently, generalized linear mixed-effects regression modeling (GLMER) was used to analyse the English and Dutch data together. The following predictors of interest were included: language (Dutch versus English), group (NBD versus aphasia) and condition type (direct versus indirect speech). We assessed whether random intercepts for participant, question and story were necessary to take into account that some

participants may perform better than others, and that some questions or stories may be easier than others. Furthermore, the necessity of (by-question, by-subject and by-story) random slopes was assessed to account for possible variability (per question, subject and story) in the effects of certain predictors. For example, some questions may show a greater performance difference between participants with and without aphasia, whereas this effect may be smaller for other questions (i.e. a by-question random slope for group). Taking these random slopes and intercepts into account prevents type-I errors in assessing the influence of the predictors of interest (Baayen, 2008). We evaluated whether random intercepts and slopes for language, participant, story and question were necessary by comparing the Akaike Information Criterion (AIC; Akaike, 1974) values of the model including the random slope or intercept to the one without. An AIC decrease of at least 2 indicates that the more complex model is warranted given the improvement in fit. 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 number of characters), FRE, and question number (within a story). The following participant-related covariates were examined: age, gender, number of years of education completed, and educational level. To assess whether each of these predictors or interactions between predictors significantly improved the model, we relied on AIC-based model comparison (with a reduction of at least 2 signifying that the more complex model provides a better fit to the data, given the added complexity). To assess the influence of aphasia severity using the Token Test error score, a separate analysis was also conducted including only the individuals with aphasia.

## Results

The mean Token Test error score for the Dutch participants with aphasia was 14.2 and 17.0 for the English-speaking participants with aphasia. Of the 48 English DISCO items (6 stories x 8 questions), five deviated significantly from the expected ceiling performance for the NBD participants ($p < 0.05$, after a Bonferroni correction for multiple comparisons), and were therefore removed for further analyses. The average scores per group and condition type after removal of these items are presented and compared to the Dutch DISCO scores in Figure 1. Individual scores for the participants are provided in Appendix B.

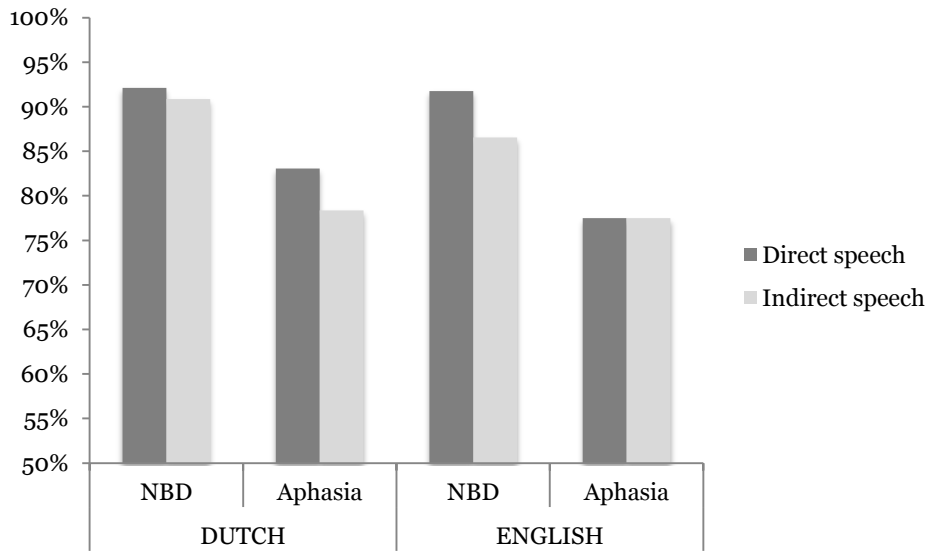


Figure 1: Average percentage of correctly answered DISCO questions, presented per language, group and condition type. NBD: non-brain-damaged.

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 Dutch and English DISCO participants are presented.

Table 4: Proportions of hits, misses, false alarms and correct rejections for the English and Dutch DISCO by participant group. NBD: non-brain-damaged.

| | | **NBD** | | **Aphasia** | |
|---|---|---|---|---|---|
| | | Response: YES | Response: NO | Response: YES | Response: NO |
| Dutch | Stimuli: YES | 0.94 (*SD* = 0.05) | 0.06 (*SD* = 0.05) | 0.86 (*SD* = 0.10) | 0.14 (*SD* = 0.10) |
| | Stimuli: NO | 0.11 (*SD* =0.09) | 0.89 (*SD* = 0.09) | 0.26 (*SD* = 0.16) | 0.74 (*SD* = 0.17) |
| English | Stimuli: YES | 0.92 (*SD* = 0.07) | 0.08 (*SD* = 0.07) | 0.82 (*SD* = 0.12) | 0.18 (*SD* = 0.13) |
| | Stimuli: NO | 0.15 (*SD* = 0.08) | 0.85 (*SD* = 0.08) | 0.28 (*SD* = 0.19) | 0.72 (*SD* = 0.20) |

Table 5 presents the final generalized mixed-effects regression (GLMER) model for the overall analysis in which the scores for groups, condition types, and countries were included. The model shows that there is a main effect of listener type: an NBD participant has a greater likelihood of answering a question correctly than a participant with aphasia ($\beta$= 1.33, $z$ = 6.34, $p$ < .01). Furthermore, there is a main effect of condition: participants perform significantly better in the direct speech condition than in the indirect speech condition ($\beta$ = 0.26, z = 2.59, $p$ < .01). Finally, a main effect of language was found: the Dutch participants were more likely to answer a question correctly than the English-speaking participants ($\beta$ = 0.47, z = 2.50, $p$ < .05). No other predictors or interactions between predictors were significant. Random intercepts were necessary for participant and question, but not for story. Finally, a by-question random-slope for group was necessary, indicating that there was variability in the performance difference between participants with and without aphasia for different questions.

Table 5: Generalized linear mixed-effects regression model predicting the probability (in terms of logits) of answering a Dutch or English DISCO question correctly. Only significant predictors were included.

| Fixed effects | Estimate | Standard error | *z-value* | *p-value* |
|---|---|---|---|---|
| (Intercept) | 1.1958 | 0.2085 | 5.736 | <.01 |
| NBD as opposed to aphasic participants | 1.3261 | 0.2092 | 6.338 | <.01 |
| Direct as opposed to indirect speech | 0.2595 | 0.1003 | 2.586 | <.01 |
| Dutch as opposed to English participants | 0.4740 | 0.1893 | 2.503 | <.05 |

Table 6 presents the results of the best GLMER model focusing on the group of participants with aphasia only. As is clear from this model, a higher Token Test error score had a negative impact on the probability of answering a DISCO question correctly ($\beta$ = -0.04, $z$ = -4.43, $p$ < 0.01). In addition, if a story was easier (as measured by the FRE), participants with aphasia were more likely to answer a DISCO question correctly ($\beta$ = 0.03, $z$ = 2.24, $p$ < 0.05). Furthermore, participants with aphasia were more likely give an incorrect answer to questions that were presented later than those that were presented earlier in the sequence within each narrative ($\beta$ = -0.14, $z$ = -2.42, $p$ < 0.05). Finally, there was an interaction between condition and language ($\beta$ = 0.47, $z$ = 2.15, $p$ < 0.05): the English-speaking individuals with aphasia showed no significant effect of condition ($\beta$ = -0.07, $z$ = 0.16, $p$ = 0.67), whereas for the Dutch participants with aphasia the direct speech condition was significantly easier than the indirect speech condition ($\beta$ = 0.40, $z$ = 2.46, $p$ < 0.05).[4] No other predictors (or interactions between predictors) were significant. Random intercepts were necessary for participant and question, but not for story. No random slopes were required.

Table 6: Generalized linear mixed-effects regression model predicting the probability (in terms of logits) for participants with aphasia of answering a Dutch or English DISCO question correctly. Only significant predictors were included. Negative estimates indicate a lower probability of answering a question correctly. DU = Dutch, EN = English.

| Fixed effects | Estimate | Standard error | *z-value* | *p-value* |
|---|---|---|---|---|
| (Intercept) | 1.8484 | 0.1874 | 9.865 | <.01 |
| Token Test error score of 1 point more | -0.0439 | 0.0099 | -4.428 | <.01 |
| Flesch Reading Ease (centered) | 0.0292 | 0.0131 | 2.240 | <.05 |
| Question 1 position later in a sequence | -0.1393 | 0.0576 | -2.418 | <.05 |
| Condition=direct * Language=Dutch | 0.4684 | 0.2179 | 2.149 | <.05 |

[4] There was not enough support to distinguish the English-speaking participants with aphasia from the other groups in the analysis including the NBD participants. The AIC reduction of the more complex model including the contrast (over the model reported in Table 6) was 1.4, and the interaction term was only marginally significant ($p$ = 0.06).

## Summary of results

Examining both languages and both subject groups, the NBD participants performed better than the participants with aphasia. In addition, there was an effect of language on comprehension accuracy, indicating that Dutch participants obtained higher scores than English-speaking participants. Finally, there was a main effect of condition, indicating that narratives that were presented with direct speech reports were understood more accurately than narratives with indirect speech reports. There was no interaction, indicating that this held for both the NBD participants and the individuals with aphasia.

Focusing on the individuals with aphasia, we found an effect of Token Test score on comprehension accuracy, indicating that, as expected, individuals with fewer Token Test errors performed better on the DISCO. In addition, there was an effect of Flesch Reading Ease (Flesch, 1948), indicating that aphasic participants obtained higher scores for narratives with lower complexity. Question number also affected performance: questions that were presented earlier after each story had a higher probability of being answered correctly than questions presented later, indicating that as the time after a story had finished increased, the task became more difficult. This could be due to, for example, an increasing demand on memory or cognitive load. Finally, there was an interaction effect between condition type and language: Whereas for the Dutch participants with aphasia narratives containing direct speech were significantly easier to comprehend than narratives containing indirect speech, no such effect was found for the English-speaking aphasic participants.

## Discussion

This study replicated, in English, our earlier Dutch study on the effects of direct speech on discourse comprehension (Groenewold et al, 2014b). It particularly aimed to provide us with greater insight into the effects of direct versus indirect speech on discourse comprehension in English-speaking individuals with aphasia.

First, as expected, we found that, in both languages, the aphasic participants performed significantly worse than matched individuals without brain damage. Nevertheless, importantly, the participants with aphasia did perform above chance level, indicating that the DISCO test is suitable for assessing audiovisual discourse comprehension in aphasia in both English and Dutch. Second, Dutch participants performed better than English-speaking participants. This finding reflects the outcomes of the Token Test where the English participants with aphasia were more severely impaired in comprehension generally compared to the Dutch participants with aphasia. Finally, as in Dutch (Groenewold et al., 2014b), in English, narratives containing direct speech were easier to comprehend than narratives containing indirect speech. The DISCO materials therefore are sensitive enough to detect differential effects of subtle manipulations such as the occurrence of direct versus indirect speech constructions.

Two possible explanations were proposed to account for the fact that direct speech was better comprehended than indirect speech in the Dutch DISCO study: (1) direct speech is more lively than indirect speech; (2) indirect speech is more complex grammatically than direct speech (Groenewold et al., 2014b).

Had liveliness been the crucial factor, then the beneficial effect of direct over indirect speech would exist in both languages and for all participant groups because the

difference in liveliness between condition types is similar across languages. Indeed, overall, the same pattern was found in both languages, suggesting that liveliness does play a role. Critically, however, English-speaking people with aphasia did not show the benefit for direct speech that was seen in the other groups. Consequently, we suggest that the grammatical differences between Dutch and English direct and indirect speech constructions also play a role. As mentioned in the Introduction, there are several grammatical differences between the conditions in the two languages. The differences that may be relevant for the explanation of the results will be addressed below.

First, unlike in English, in Dutch there is a difference in word order across condition types. In direct speech, the word order is subject-verb-object (SVO), whereas in indirect speech, it is subject-object-verb (SOV) (Groenewold et al., 2013). The topic of basic word order in Dutch is still highly debated, and beyond the scope of this paper. However, it seems plausible that the canonical SVO word order of direct speech benefits comprehension for the Dutch participants (and perhaps particularly the participants with aphasia). In English, there is no such difference and hence no benefit. Second, unlike in English, in Dutch, indirect speech constructions are explicitly embedded in the main clause, using the obligatory complementiser “dat” (that). Embedding has been shown to negatively impact sentence comprehension in individuals with agrammatic aphasia (Abuom et al., 2013), and could therefore explain the differences in comprehension of direct speech constructions (which do not contain embedding) and indirect speech constructions (which do contain embedding) in Dutch individuals with aphasia.

While the use of a complementiser is obligatory in Dutch indirect speech constructions, in English it is optional. In fact, the default construction in English conversation register is the one with the absent *that* (Biber et al., 1999). For this reason, in the English DISCO materials we omitted the complementiser in the indirect speech condition of the narratives. Nevertheless, indirect speech constructions still represent embedding in English.

Consider the two following examples:

(2a) The man says the woman is waiting

(2b) the man says: "the woman is waiting"

In (2a) 'the woman is waiting' is an embedded sentence, in which 'that' has been omitted, whereas in (2b) this same clause is not an embedding. When is a sentence is perceived, it must be parsed. This happens fully automatically and incrementally, that is, word by word (see e.g. Levelt, 1989) in a matter of milliseconds. Notice that the surface syntactic structure of sentences (2a) and (2b) is identical, that is, it is unclear from the surface structure whether the object is an embedded sentence or not. In order to resolve this surface syntactic ambiguity, the listener must draw on other interpretive resources, such as contextual and/or paralinguistic information. It is only when information at several levels (discourse, prosody, syntax, etc.) is integrated, that the sentence can be fully parsed and understood. Disambiguating such structures requires extra processing costs (Frazier, 1987). In NBD English individuals, these extra processing costs are not problematic. However, it has repeatedly been reported that individuals with aphasia are slower to fully integrate grammatical, lexical-semantic,

discourse and prosodic information (see e.g. DeDe, 2012). The extra processing costs required by the integration process may disrupt the parsing process of English sentences with direct and indirect speech in individuals with aphasia. We suggest that, for English individuals with aphasia, these extra processing costs overrule the advantages that direct speech has in NBD English individuals and in Dutch NBD and aphasic individuals. In Dutch, there are no extra processing costs since the syntactic structure is transparent because of differences in word order and the obligatory use of a complementiser.

We expected to find similar patterns for English-speaking NBD and aphasic participants, however, we found differential patterns for the two English-speaking subgroups. This suggests that neither of the candidate explanations put forward in Groenewold et al (2014b) can stand alone. While an advantage from paralinguistic and non-verbal factors, producing increased liveliness, can account for the benefit for direct speech that was found for the English-speaking NBD subgroup, grammatical factors can explain the lack of an effect for the English-speaking participants with aphasia. For this subgroup, the extra parsing effort required to resolve the ambiguity caused by the absence of grammatical markers of embedding may nullify the positive effect of increased liveliness and reduced syntactic complexity in direct speech.

In sum, the findings of the current study have provided us with new insights into the role of direct speech constructions in aphasic discourse comprehension. Conducting similar studies in further languages may provide us with more insight into these and other effects of direct and indirect speech on discourse comprehension, and help us determine to what extent the findings can be generalised cross-linguistically. In order to

assess the role of ambiguity introduced by the omission of the complementiser in the English version of the DISCO, a follow-up study introducing a third condition type (i.e. indirect speech containing the complementiser *that*) could be carried out.

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# Appendix A

Written samples from the two versions of the English DISCO materials. Reporting sentences are in italics.

**Direct speech**

It is a Sunday morning in summer. At the airport, a couple are queuing to board their flight to Paris. They are going on their honeymoon and only have twenty minutes before the plane departs. The wife looks in her bag. She says to the husband: "*I am almost certain that my passport was in my purse, but I cannot find it*." The husband exclaims: "*We will miss our flight, we have only twenty minutes left!*" The wife says: "*Calm down, we will find it. Oh, I know, I left it on the table in the café*." The husband looks at her and says: "*You can be so absent-minded! Stay here, I will go there immediately!*" The wife thinks to herself: "*What a troublemaker!*". Not even a minute later the husband comes back running. He says: "*We are really lucky!*" The wife asks: "*Lucky, why?*" The husband says: "*The waiter was waving at me with your passport in his hand and asked whether we could leave the table neatly the next time*." The wife says: "*I was right, there's nothing to worry about*".

**Indirect speech**

It is a Sunday morning in summer. At the airport, a couple are queuing to board for their flight to Paris. They are going on their honeymoon and only have twenty minutes before the plane departs. The wife looks in her bag. She *says to the husband she was almost certain that her passport was in her purse but she cannot find it*. The husband *exclaims they will miss their flight and have only twenty minutes left*. The wife *says he should stay calm and that they will find it*. She *says she already knows where it is, and that she left it on the table in the café*. The husband looks at her and *says she can be so absent-minded*. He *tells her to stay there and says he will go there immediately*. The wife *thinks to herself he is a troublemaker*. Not even a minute later the husband comes back running. He *says they are really lucky*. The wife *asks why*. The husband *says the waiter was waving at him with her passport in his hand and*

*had asked whether they could leave the table neatly the next time*. The wife *says she was right and that there is nothing to worry about*.

**Questions**

1. Were the husband and the wife at the station? [no]
2. Was the wife in a panic? [no]
3. Was the husband afraid that they would miss the plane? [yes]
4. Did the wife remember where her passport was? [yes]
5. Did the wife think the husband overreacted? [yes]
6. Had the waiter accidentally thrown the passport away? [no]
7. Did the husband think they had been lucky? [yes]
8. Did the wife admit the husband was right? [no]

# Appendix B

Individual scores by language, group and condition type. NBD: non-brain-damaged.

| Participant | Language | Group | Direct speech | Indirect speech |
|---|---|---|---|---|
| D_P2 | Dutch | Aphasia | 74.4% | 72.6% |
| D_P3 | Dutch | Aphasia | 77.4% | 70.2% |
| D_P4 | Dutch | Aphasia | 62.5% | 66.1% |
| D_P7 | Dutch | Aphasia | 91.7% | 91.1% |
| D_P8 | Dutch | Aphasia | 95.8% | 73.8% |
| D_P10 | Dutch | Aphasia | 87.5% | 73.8% |
| D_P11 | Dutch | Aphasia | 95.2% | 70.8% |
| D_P12 | Dutch | Aphasia | 91.7% | 91.7% |
| D_P14 | Dutch | Aphasia | 91.1% | 79.2% |
| D_P15 | Dutch | Aphasia | 70.8% | 74.4% |
| D_P16 | Dutch | Aphasia | 95.8% | 100.0% |
| D_P17 | Dutch | Aphasia | 79.2% | 95.8% |
| D_P18 | Dutch | Aphasia | 83.3% | 81.5% |
| D_P19 | Dutch | Aphasia | 61.3% | 66.67% |
| D_P21 | Dutch | Aphasia | 91.1% | 83.3% |
| D_P23 | Dutch | Aphasia | 91.1% | 58.3% |
| D_P24 | Dutch | Aphasia | 73.8% | 66.7% |
| D_P26 | Dutch | Aphasia | 44.0% | 66.7% |
| D_P27 | Dutch | Aphasia | 95.2% | 95.8% |
| D_P28 | Dutch | Aphasia | 86.9% | 66.7% |
| D_P29 | Dutch | Aphasia | 95.8% | 91.7% |
| D_P30 | Dutch | Aphasia | 91.7% | 83.3% |
| D_P33 | Dutch | Aphasia | 83.3% | 82.1% |
| AVERAGE | Dutch | Aphasia | 83.1% | 78.4% |
| E_P1 | English | Aphasia | 76.7% | 91.7% |
| E_P2 | English | Aphasia | 91.7% | 86.1% |
| E_P3 | English | Aphasia | 91.7% | 100.0% |
| E_P4 | English | Aphasia | 86.9% | 80.6% |
| E_P5 | English | Aphasia | 73.0% | 79.2% |
| E_P6 | English | Aphasia | 87.5% | 89.2% |
| E_P7 | English | Aphasia | 55.6% | 83.3% |
| E_P8 | English | Aphasia | 61.1% | 80.8% |
| E_P9 | English | Aphasia | 87.5% | 95.8% |
| E_P10 | English | Aphasia | 87.5% | 76.4% |
| E_P11 | English | Aphasia | 87.5% | 55.6% |
| E_P12 | English | Aphasia | 80.8% | 79.2% |
| E_P13 | English | Aphasia | 58.0% | 68.1% |
| E_P14 | English | Aphasia | 63.9% | 53.3% |
| E_P15 | English | Aphasia | 77.8% | 87.5% |
| E_P16 | English | Aphasia | 51.4% | 47.4% |

| | | | | |
|---|---|---|---|---|
| E_P17 | English | Aphasia | 61.7% | 44.2% |
| E_P18 | English | Aphasia | 73.8% | 75.0% |
| E_P19 | English | Aphasia | 95.8% | 91.7% |
| E_P20 | English | Aphasia | 100.0% | 91.7% |
| AVERAGE | English | Aphasia | 77.5% | 77.8% |

| Participant | Language | Group | Direct speech | Indirect speech |
|---|---|---|---|---|
| D_C1 | Dutch | NBD | 95.8% | 90.5% |
| D_C2 | Dutch | NBD | 87.5% | 82.7% |
| D_C3 | Dutch | NBD | 91.7% | 95.8% |
| D_C4 | Dutch | NBD | 91.7% | 100.0% |
| D_C5 | Dutch | NBD | 79.2% | 91.1% |
| D_C6 | Dutch | NBD | 83.3% | 87.5% |
| D_C7 | Dutch | NBD | 86.9% | 91.7% |
| D_C8 | Dutch | NBD | 100.0% | 95.8% |
| D_C9 | Dutch | NBD | 83.3% | 75.0% |
| D_C10 | Dutch | NBD | 100.0% | 87.5% |
| D_C11 | Dutch | NBD | 91.1% | 83.3% |
| D_C12 | Dutch | NBD | 91.1% | 83.3% |
| D_C13 | Dutch | NBD | 91.7% | 100.0% |
| D_C14 | Dutch | NBD | 91.7% | 100.0% |
| D_C15 | Dutch | NBD | 95.8% | 95.2% |
| D_C16 | Dutch | NBD | 95.8% | 91.1% |
| D_C17 | Dutch | NBD | 95.2% | 87.5% |
| D_C18 | Dutch | NBD | 100.0% | 95.8% |
| D_C19 | Dutch | NBD | 95.2% | 87.5% |
| D_C20 | Dutch | NBD | 95.2% | 95.8% |
| AVERAGE | Dutch | NBD | 92.1% | 90.9% |
| E_C1 | English | NBD | 85.0% | 84.7% |
| E_C2 | English | NBD | 93.3% | 62.5% |
| E_C3 | English | NBD | 85.0% | 76.6% |
| E_C4 | English | NBD | 100.0% | 91.7% |
| E_C5 | English | NBD | 100.0% | 100.0% |
| E_C6 | English | NBD | 85.0% | 77.8% |
| E_C7 | English | NBD | 86.1% | 72.5% |
| E_C8 | English | NBD | 87.5% | 89.2% |
| E_C9 | English | NBD | 95.8% | 87.5% |
| E_C10 | English | NBD | 95.8% | 89.2% |
| E_C11 | English | NBD | 94.4% | 78.3% |
| E_C12 | English | NBD | 95.8% | 89.2% |
| E_C13 | English | NBD | 89.2% | 95.8% |
| E_C14 | English | NBD | 91.7% | 100.0% |
| E_C15 | English | NBD | 89.2% | 95.8% |
| E_C16 | English | NBD | 100.0% | 95.8% |

| | | | | |
|---|---|---|---|---|
| E_C17 | English | NBD | 95.8% | 79.2% |
| E_C18 | English | NBD | 87.5% | 87.5% |
| E_C19 | English | NBD | 86.3% | 91.7% |
| AVERAGE | English | NBD | 91.8% | 86.6% |