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The mini-mental state examination (MMSE) from a language perspective: an analysis of test interaction

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\textbf{ABSTRACT}
Assessment of language and cognitive abilities are associated with clinical challenges. The aim of the present study was to learn more about the MMSE test process from a language perspective by looking in detail at the interaction between patient and tester. In addition, we aimed to further explore the relationship between linguistic and cognitive difficulties.

The study was based on an analysis of 20 MMSE test dyads, 10 persons with aphasia and 10 persons with dementia, in interaction with speech and language pathologists. All conversations were audio and video recorded and transcribed verbatim according to Conversation Analytical principles. The thorough analysis of the interactions highlighted some main findings that affected the communicative project of the test interactions. Finally, the test results were summarized and analyzed.

Through the analysis, some particularly challenging aspects emerged; the understanding of the verbal instructions, the handling of the instructions and the evaluation of the answers. The test results demonstrated that there were no significant differences between the two groups of participants’ MMSE results. The results in the ‘language’ category did not seem to capture the language disorders among many of the participants more than the remaining test items. By qualitative analyses of the interactional aspects of test situations, information about both cognitive and linguistic abilities that otherwise would have been overlooked may be revealed.

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The mini mental state examination (MMSE); language assessment; cognition; interaction

\textbf{Introduction}

Dementia is a disorder primarily affecting cognitive abilities whereas aphasia more specifically affects language functions (Bryan & Maxim, 2006). In clinical practice, the underlying causes of a patient’s language disorder are not always distinct (Fonseca, Ferreira, & Martin, 2017). Many patients with presumed cognitive deficits or suspected dementia have undergone the Mini-Mental State Examination (MMSE), the world’s most frequently used cognitive screening test (Ismail, Rajji, & Schulman, 2009). The MMSE briefly evaluates language among other cognitive abilities (Folstein, Folstein, & McHugh, 1975). Since the MMSE assessment is verbally oriented, there might be uncertainties about whether an incorrect answer is caused by language impairments rather than cognitive deficits (Le Rhun, Richard, & Pasquier, 2005). Based upon this, there is a need to further
explore how language ability may influence the MMSE test process and what clinical implications this might have.

**Dementia**

Dementia is a major health condition affecting 5% to 8% of the population over the age of 60 years (WHO, 2017). There is a growing body of evidence that the linguistic and communicative abilities of persons with dementia are affected by the neurodegenerative process (Schrauf & Müller, 2014). Among other cognitive symptoms, persons with dementia may demonstrate problems with word-finding, lack of cohesion in communication and sentence comprehension deficits (Kempler & Goral, 2008). Dijkstra, Bourgeois, Allen, and Burgio (2008) demonstrated that disturbing topic shifts and empty phrases were found rather frequently in a conversation involving persons with dementia (PWD).

When examining turn-taking in conversation, persons with Alzheimer’s disease (AD) produce fewer utterances (Beckett, 2004). Caspari and Parkinson (2000) argue that individuals with AD tend to frequently ask their conversational partners to repeat utterances and to clarify information, something that may be interpreted as a compensatory strategy for the limitations of the working-memory capacity.

Due to a lack of definitive tests or biomarkers, the diagnosis of dementia to a large extent relies on careful examination and application of clinical criteria. In dementia assessments, cognitive tests play a critical role, and they are often essential in establishing the diagnosis and also for observation of changes over time (Drachman, 1994). The benefits of more specifically examining language in dementia assessments are well documented (McKhann et al., 2011). However, there is limited research on how the linguistic evaluation can be achieved, and language assessments are seldom systematically carried out (Bryan & Maxim, 2006).

**Aphasia**

Approximately one third of individuals with ischemic stroke are affected by aphasia (Engelter et al., 2006). In these cases, a thorough language examination is a standard procedure. Linguistic tests play a central role when it comes to diagnosing aphasia and providing a detailed description of the type and severity of the condition (Murray & Coppens, 2013). Even if several informal language assessment methods are available, there is limited information on when to use them or what the agreed procedure for each given method comprises in terms of administration, documentation and analysis (Thomson et al., 2018). A recent systematic review addresses the importance of capturing co-present communication, instead of individualizing language and communication (Barnes & Bloch, 2019). However, the authors describe the absence of an overarching model of communication. In the article, the need of guiding frameworks, concepts and methods is emphasized, in order to improve language assessments and intervention strategies.

Several hypotheses considering the relationship between linguistic deficits and cognitive abilities have been proposed. One way of defining cognition is as an information processing skill, and because language uses information processing, it might be embedded in cognition (Davis, 2012). Other hypotheses consider the negative impact on the language
ability of attentional resources (Murray, Holland, & Beeson, 1997), short-term memory (Christensen & Wright, 2010), and executive functions (Kalbe, Reinhold, Brand, Markowitsch, & Kessler, 2005). According to attentional hypotheses, the syntactic processing deficits in aphasia can be explained by a deficit in the ability to allocate attentional resources (Murray et al., 1997). Other authors argue that language and cognition are not strictly related and that several aspects of cognition engage distinct brain regions independent of language (Fedorenko & Varley, 2016). Recently, it has been argued that in aphasia assessments, the focus should rather be on the processes than on the linguistic elements per se (Code, 2018).

In a study by Kalbe et al. (2005), 94% of 154 patients with moderate and severe aphasia examined with a non-verbal test presented deficits in at least one of the cognitive functions investigated. Furthermore, they showed a relationship between linguistic performance and memory, attention and reasoning. The severity of participants’ linguistic deficit seems to be related to the severity of the cognitive impairment (Kauhanen et al., 2000; Marinelli, Spaccavento, Craca, Marangolo, & Angelelli, 2017). It has also been discussed how naming, comprehension, reading and spelling may be the linguistic domains that primarily predicted participants’ cognitive profiles (Marinelli et al., 2017). Discordant results were presented in another study in which no correlation was seen (Helm-Estabrooks, 2002). However, Helm-Estabrooks stated that persons with aphasia constitute an extremely heterogeneous group when it comes to the type and severity of cognitive dysfunctions.

It is not known whether aphasia enhances the risk of dementia, beyond the risk resulting from any focal brain lesion. This uncertainty is due to challenges associated with cognitive evaluations in persons with aphasia (Fonseca et al., 2017). To differentiate language problems from cognitive deficits such as impairments in working-memory or episodic memory is a problematic issue. There are several tools available to evaluate cognitive function in stroke patients (Rodrigues et al., 2018). However, many neuropsychological tests have a linguistic mediation and several materials are too complex for persons with severe aphasia, thus leading to floor-effects (Marinelli et al., 2017). Stroke guidelines emphasize the importance of early cognitive screening in order to offer tailored intervention (Blackburn, Bafadhel, Randall, & Harkness, 2013). The recent review by Fonseca et al. (2017) demonstrates that persons with aphasia tend to present lower scores on non-verbal cognitive assessments than stroke patients without aphasia. The authors state that a consensus tool ought to be developed to screen or evaluate cognitive function in individuals with language impairments.

The mini-mental state examination (MMSE)

The MMSE is a widely used psychometric screening assessment, used to map out levels of cognitive function (Ismail et al., 2009). It is designed for clinical use in the diagnostic process in dementia evaluations and it is claimed to facilitate the assessment of progression and severity. The MMSE assesses various cognitive functions, including memory, attention and language. In the assessment of dementia, MMSE is only one part of the examination which also includes other tests, a physical examination and the patient’s history and symptoms (Folstein et al., 1975).

There have been numerous studies demonstrating that MMSE is a relatively sensitive marker of overt dementia with good inter-rater reliability. Among other advantages of
MMSE is the fact that it is quick and rather easy to administer, there is a standard scoring system, it is translated into many languages, and no major variations exist worldwide (Ismail et al., 2009).

In a study where cognitive assessments with the MMSE were performed on 127 stroke-patients 10 years after the onset of the disease, cognitive impairments were demonstrated in 46% of the cases. The odds of having severe cognitive impairments (here defined as MMSE <23) were 2.5 times higher among the stroke patients compared to the healthy controls (Burgess et al., 2006).

Several shortcomings of the MMSE have been discussed. The main issue is that the MMSE is not very useful in detecting mild cognitive impairment (Delavaran et al., 2017). It is also problematic to use MMSE for capturing changes in severe dementia (Lancu & Olmer, 2006). Furthermore, there is a risk for ceiling effects in patients with high premorbid intelligence or education, thus leading to false negatives (Palsetia, Rao, Tiwari, Lodha, & De Sousa, 2018). The MMSE does not explicitly assess common post-stroke domain-specific impairments such as executive function, neglect, apraxia, and aphasia, which is problematic when it is used to assess stroke sequelae. Co-occurring difficulties in these domains may confound the results, which might lead to under- and overestimation of specific cognitive impairments in stroke patients (Mancuso et al., 2018).

As far as we are aware, no previous study investigates the MMSE testing process. Looking closely at the interaction between participant and tester, using the framework of communicative projects during the testing procedure, could thus give insights into the MMSE test process, how persons with language deficits handle the MMSE test conversation, and how it might affect their results.

**Aim**

The aim of the present study is to learn more about the MMSE test process from a language perspective by looking in detail at the interaction between patient and tester. In addition, we aim to further explore the relationship between linguistic and cognitive difficulties.

**Methods**

**Participants**

Ten individuals diagnosed with aphasia (Table 1), and 10 individuals diagnosed with dementia (Table 2) were recruited in two different Swedish regions. The diagnosis was the only inclusion criteria; however, the participants were supposed to live in ordinary housing and attend day-care activities. Additionally, the participants needed to be able to comprehend “aphasia friendly” information about the study in order to indicate their consent. The only exclusionary criterion for persons with dementia was known aphasia. None of the participants with dementia had any previous contact with an SLP. For participating persons with aphasia, the exclusionary criterion was known as neurodegenerative disease heavily associated with language difficulties or memory problems. Among the participants with aphasia, all had previous or ongoing SLP services. The participants with aphasia were aged 51–98 years with a mean age of 67 years (median 64.5 years). The
Table 1. Characteristics of participants with aphasia.

<table>
<thead>
<tr>
<th>Participant (SLP)</th>
<th>Age</th>
<th>Sex</th>
<th>Primary aphasia symptom</th>
<th>MMSE score</th>
<th>Previous occupation</th>
<th>Education</th>
<th>Severity of aphasia</th>
<th>Clinical description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1 (SLP1)</td>
<td>56</td>
<td>F</td>
<td>expressive</td>
<td>29/30</td>
<td>Technical operator</td>
<td>Upper secondary school</td>
<td>mild</td>
<td>Work part-time with adjusted tasks</td>
</tr>
<tr>
<td>A2 (SLP2)</td>
<td>73</td>
<td>M</td>
<td>expressive</td>
<td>27/30</td>
<td>Saw mill worker</td>
<td>Secondary school</td>
<td>moderate</td>
<td>Apraxia of speech</td>
</tr>
<tr>
<td>A3 (SLP3)</td>
<td>69</td>
<td>M</td>
<td>receptive</td>
<td>18/30</td>
<td>Medical doctor</td>
<td>University</td>
<td>moderate</td>
<td>Very fast speech rate</td>
</tr>
<tr>
<td>A4 (SLP3)</td>
<td>56</td>
<td>F</td>
<td>expressive</td>
<td>6/30</td>
<td>Industry operator</td>
<td>Upper secondary school</td>
<td>severe</td>
<td>Uses a filofax as a communication aid</td>
</tr>
<tr>
<td>A5 (SLP1)</td>
<td>66</td>
<td>M</td>
<td>receptive</td>
<td>6/30</td>
<td>Officer</td>
<td>University</td>
<td>moderate-severe</td>
<td>Dependent on aphasia-ID and similar aids</td>
</tr>
<tr>
<td>A6 (SLP3)</td>
<td>51</td>
<td>F</td>
<td>expressive</td>
<td>15/30</td>
<td>Nurse's assistant</td>
<td>Secondary school</td>
<td>moderate</td>
<td>Spanish as first language</td>
</tr>
<tr>
<td>A7 (SLP1)</td>
<td>78</td>
<td>M</td>
<td>expressive</td>
<td>23/30</td>
<td>Travel agency manager</td>
<td>Upper secondary school</td>
<td>moderate-severe</td>
<td>Very slow speech rate</td>
</tr>
<tr>
<td>A8 (SLP1)</td>
<td>60</td>
<td>M</td>
<td>receptive</td>
<td>17/30</td>
<td>Machinist</td>
<td>Secondary school</td>
<td>moderate</td>
<td>Work part-time with adjusted tasks</td>
</tr>
<tr>
<td>A9 (SLP3)</td>
<td>63</td>
<td>F</td>
<td>expressive</td>
<td>10/30</td>
<td>Machinist</td>
<td>Secondary school</td>
<td>severe</td>
<td>Apraxia of speech</td>
</tr>
<tr>
<td>A10 (SLP1)</td>
<td>98</td>
<td>F</td>
<td>expressive</td>
<td>24/30</td>
<td>Shop assistant</td>
<td>Secondary school</td>
<td>mild-moderate</td>
<td>Lives in own housing without any support</td>
</tr>
</tbody>
</table>

Information about primary aphasia symptom and severity of aphasia assembled from the participants’ medical journals.

Table 2. Characteristics of participants with dementia.

<table>
<thead>
<tr>
<th>Participant (SLP)</th>
<th>Age</th>
<th>Sex</th>
<th>Dementia diagnosis</th>
<th>MMSE score</th>
<th>Level of cognitive impairment</th>
<th>Previous occupation</th>
<th>Education</th>
<th>Clinical description</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1 (SLP1)</td>
<td>73</td>
<td>F</td>
<td>Alzheimers</td>
<td>26/30</td>
<td>mild</td>
<td>Receptionist</td>
<td>Secondary school</td>
<td>Little disease insight</td>
</tr>
<tr>
<td>D2 (SLP1)</td>
<td>75</td>
<td>F</td>
<td>Alzheimers</td>
<td>18/30</td>
<td>severe</td>
<td>Industry worker</td>
<td>Secondary school</td>
<td>Slow speech rate</td>
</tr>
<tr>
<td>D3 (SLP4)</td>
<td>79</td>
<td>M</td>
<td>Alzheimers</td>
<td>8/30</td>
<td>severe</td>
<td>Teacher</td>
<td>University</td>
<td>Talkative and makes a lot of jokes in conversation</td>
</tr>
<tr>
<td>D4 (SLP4)</td>
<td>74</td>
<td>M</td>
<td>Mixed dementia</td>
<td>9/30</td>
<td>severe</td>
<td>Welder</td>
<td>Secondary school</td>
<td>Hungarian as first language</td>
</tr>
<tr>
<td>D5 (SLP4)</td>
<td>72</td>
<td>M</td>
<td>Alzheimers</td>
<td>18/30</td>
<td>severe</td>
<td>Repairer (janitor)</td>
<td>Upper secondary school</td>
<td>Very active, visits gym several times a week</td>
</tr>
<tr>
<td>D6 (SLP1)</td>
<td>72</td>
<td>M</td>
<td>Alzheimers</td>
<td>18/30</td>
<td>severe</td>
<td>Marketer/teacher</td>
<td>University</td>
<td>Very slow speech rate</td>
</tr>
<tr>
<td>D7 (SLP1)</td>
<td>75</td>
<td>M</td>
<td>Alzheimers</td>
<td>13/30</td>
<td>severe</td>
<td>Forester Farmer</td>
<td>University</td>
<td>Uses hearing aid Tested in his own home, dependent on his wife</td>
</tr>
<tr>
<td>D8 (SLP1)</td>
<td>83</td>
<td>M</td>
<td>Alzheimers</td>
<td>22/30</td>
<td>severe</td>
<td>Farmer</td>
<td>University</td>
<td>Has close to tears several times in conversation</td>
</tr>
<tr>
<td>D9 (SLP5)</td>
<td>79</td>
<td>M</td>
<td>Vascular dementia</td>
<td>13/30</td>
<td>severe</td>
<td>Electrician (own firm)</td>
<td>Upper secondary school</td>
<td>Expresses a lot of doubt regarding his answers</td>
</tr>
<tr>
<td>D10 (SLP5)</td>
<td>84</td>
<td>M</td>
<td>Alzheimers</td>
<td>17/30</td>
<td>severe</td>
<td>Truck technician</td>
<td>Secondary school</td>
<td></td>
</tr>
</tbody>
</table>

Level of cognitive impairment is based on the participants’ MMSE results.
participants with dementia were aged 72–84 years with a mean age of 76.6 years (median 75 years). Information about the participants and their conditions was assembled from their medical journals or from the municipalities’ dementia contact nurses.

 Furthermore, five SLPs were involved in assessing the participants. They all had at least 5 years’ experience in working with communication disorders in adults, mainly aphasia. All of the SLPs had some experience of working with persons with dementia, but primarily in combination with a stroke diagnosis or Parkinson’s disease.

**Ethics**

Ethics approvals for the study were obtained from the Regional Board of Ethics in Linköping, Sweden (dnr 2012/443-31). Informed consent was obtained from the study participants.

**Materials and procedure**

Depending on the preferences of the participants, the meetings took place either at an activity center for persons with aphasia, at an activity center for persons with dementia, or in two cases, in the participant’s home. The SLPs were instructed to carry out the Swedish revision of the MMSE assessment according to the manual (Palmqvist, Terzer, Strobel, & Wallin, 2013). The testing was foregone by small-talk and testing with other test protocols, as part of a larger research project. Each meeting was both video and audio recorded.

**Theoretical framework**

The methodological basis of this study is qualitative and builds on research approaches established within the tradition of talk-in-interaction (Schegloff, 2007). Interaction analysis is an interdisciplinary method for the empirical investigation of the interaction between human beings and their environment. It is grounded in ethnography and Conversation Analysis and is based on the assumption that knowledge and actions are sprung from a social origin (Jordan & Henderson, 1995). The analysis requires the use of recorded data. The use of video recordings in the clinical setting has proven to be a very useful method when it comes to analysing clinician–patient interaction (Asan & Montague, 2014). The starting point of the analysis was to watch all video recordings without pre-conceptions. This is a way of observing and noticing phenomena, starting from the data, grounding all analytical claims in the recordings (Sacks, 1984). Conversation Analysis provides a useful analytical method for examining the impact of communication disorders on everyday interactions (Laakso & Klippi, 1999; Mikesell, 2009). The transcriptions are essential, since they enable the researchers’ close examination of how participants’ talk are organized (Heritage, 1984).

Communicative projects represent a kind of discourse-analytical concept, directly or indirectly related to actors’ own apperceptions of their own doings. Communicative projects aim at solving a “communicative problem” of some kind and are characterized by dynamic progression as they involve co-action (often asymmetrical) between two or more parties. All communicative projects are organized in a somewhat hierarchical manner; projects are nested (direct or indirectly) within other projects which in turn can belong to larger “global” projects (Linell, 1998). Communicative projects vary in size, from very small three-part sequences (local communicative projects) to whole
communicative encounters (or series of encounters), such as police interrogations or job interviews (Linell, 2014).

**Data analysis**

Based on the video-recordings, the MMSE protocols were re-corrected by the first author. The MMSE includes six categories; orientation (10 points); registration (3 points); attention and calculation (5 points); recall (3 points); language (8 points); and copying (1 point) (Folstein et al., 1975). The scores for MMSE range from 0 to 30. When interpreting the MMSE scores, the following commonly used cutoffs for defining cognitive impairment were applied (Delavaran et al., 2017): none = 27–30 (indicating normal cognitive function), mild = 23–26 (indicative of mild cognitive impairment) and severe = 0–22 (indicative of dementia). The differences between the two groups (for the total MMSE score and for each category) were analysed using a nonparametric test (Mann–Whitney U).

All test conversations were transcribed verbatim according to Conversation Analytical principles (Goodwin & Heritage, 1990). Thereafter, the material was analysed sequentially using the framework of communicative projects. Three aspects that particularly seemed to have an impact on the collaborative activity of the communicative projects were identified by the researchers’ examination of the structures of interaction in the analysis of the transcriptions. The phenomena of special interest that emerged through the analysis were:

1. the understanding of the verbal instructions;
2. the handling of the instructions;
3. the evaluation of the answers.

To illustrate how these factors come across in the interaction and how the test process is affected, examples are presented in the Results section. The analysed examples are selected as representative cases of the aggregate patterns observed in the data. Hence, these examples hold for several instances, rather than just the individual example. They were also chosen to provide some diversity among the participants. The final selection of examples was translated from Swedish to English.

**Results**

**Overall scores**

The mean result on the MMSE was 17.5 for the participants with aphasia and 16.2 for the participants with dementia, whereas median scores were 17.5 for both groups. Solely looking at the scores and the recommended cutoffs, 9 out of 10 participants with aphasia and 10 out of 10 participants with dementia were classified as having a cognitive impairment (MMSE<27). Among these, six participants with aphasia and nine participants with dementia had scores indicating severe impairment (MMSE <23) and three participants with aphasia and two participants with dementia had scores indicating mild impairment (MMSE <27). One participant with aphasia had a score indicating normal cognitive function according to the MMSE manual (27–30). For assembled results, see Table 3 (with the maximum score in brackets).
The most problematic category for all participants was “Attention and calculation”. This category consists of one test item, in which the participant is instructed to subtract 7 from 70 and continue to a total of five subtractions. One point is given for each correct answer up to a maximum of 5 points. Likewise, the one test item in the “recall” category was difficult, especially for the participants with dementia. Here, the participant is asked to recall three words that he/she was told and instructed to repeat and remember earlier (the test item in the “registration” category).

The statistical analysis confirmed that there were no significant differences between the two groups regarding the overall MMSE scores ($P > .05$). Looking at the MMSE categories separately, the only category in which there were significant differences between the results from participants with dementia and participants with aphasia was the “copying” category ($P = .028$, using a Mann–Whitney U test, 2-tailed). There were very small differences between the participants with aphasia and the participants with dementia regarding the results in the remaining categories.

In the “language” category, the test item that seemed the most problematic for all participants was the repetition of a sentence, the Swedish translation of “no ifs, ands, or buts”. In the data of the present study, the sentence was repeated correctly only by 2 of the 10 participants with dementia (D5 and D8) and by one of the 10 participants with dementia (A1). In the “naming” test item, in which the participant is asked to name the objects of a wristwatch and a pen, 8 out 10 of the participants with aphasia (A5 failing both objects; A9 failing one) managed to name both objects whereas 9 out of 10 participants with dementia (with D3 failing one object) passed the test item.

Altogether, there were small differences between participants with aphasia and the participants with dementia regarding MMSE scores. The analysis of the test interactions, however, demonstrated some issues that were not reflected by the test results.
**Test interaction**

In light of the framework of communicative projects, the MMSE test conversation may be viewed as a global communicative project with the dominant goal of carrying out the screening test (Linell, 2014). The different MMSE categories may be seen as local communicative projects that in turn can be organized in even smaller local communicative projects, namely each specific test item (Linell, 1998). The local communicative projects stand out as the most important units as parts of interlocutors’ immediate understandings of what they consider are going on (Linell, 2010).

**The understanding of the verbal instructions**

The verbal instructions in the MMSE form a potential problem for participants with language comprehension problems. How this might be manifested is demonstrated in the test interactions.

For a majority of the cases, it is the first time that the participants meet the SLP. However, they have been engaged in conversation and several other tasks prior to the MMSE assessment. In this example, the test items in the “orientation” category are carried out.

**Example 1**

1. SLP1: och vilken månad är det
   **and what month is it**

2. A5: (2.0) deutschland (.) ja tyskland (.) jaa >asså vettu va< england och tyskland >det är nu< (.) >det är det här< ((writes Fre))
   (2.0) deutschland (.) yes germany (.) yees >you know that< england and germany >it is now< (.)
   >that is what we got< ((writes Fre))

3. SLP1: jaa (.) du börja skriva fre och jag tror nästan: du tänker februari (.) [eller hur >var det det du skull]<
   yes: (.) you started to write fre and I believe: you think february (.) [don’t you? >or what did you]<

4. A5: [jae nae:] jag menar inte så inte serru utan (.) ett första året utan ett de va sista året ettan (.) asså har vi tvåan det är nu ju=
   [yes: neh:] I don’t mean that either but (.) one first year without one it was last year one (.)
   and then we have two it is now then=

5. SLP1: =det är nu
   =it is now

When being asked about what month it is, A5’s responses in example 1 are easily dismissed as nonsense talk. Concurrently, he writes “Fre”, which is interpreted by SLP1 as the beginning of “February” (it is February at the time). When A5 mentions “two” in line 4, it might emphasize this interpretation. Even if the answer is reported as incorrect in the test protocol, the interaction analysis indicates that it might be language problems that are causing A5’s incorrect answers. Nevertheless, it opens up for the possibility that A5 actually understands the question from SLP1. The analysis indicates that a memory problem is not the only reason for A5’s low score (2/10) in the “orientation” category. A5 has documented problems with language comprehension; however, similar examples are demonstrated among participants with more expressive aphasia. Slightly impaired language comprehension is also present in many individuals.
reported to have solely expressive aphasia (Hillis, 2007). The local communicative project of the test item is, as a majority of the asymmetric global communicative projects, initiated by SLP1. If A5’s communication problems were not known (which is probably the case in most dementia evaluations), his answers in line 2 and 4 could easily have been interpreted as sudden initiations of new local communicative projects. As Linell (2010) discusses, those small sequences may also have important functions in larger wholes.

In example 2, D8 and SLP1 are sitting at the kitchen table in D8:s home. They have met once prior to this meeting.

Example 2

1. SLP1: nu undrar jag (.) <vilka tre ord var det: som jag bad dig komma ihåg förut>  
   now I wonder (.) <which three words it was: that I asked you to remember earlier>
2. D8: ja dom d "har jag" (.) ja det har jag ingen aning om yes those h “I got” (.) yes I have no idea about that
3. SLP1: (2.0) det var tre ord [de va] hotell (1.0) det var banan (.) och mynt (2.0) it was three words [it was] hotel (1.0) it was banana (.) and coin
4. D8: [hh]hotell banan och mynt ah dode har jag inget minne av [hh] hotel banana and coin ah I have no memory of that
5. SLP1: nå  
6. D8: >hotell banan å mynt hotel and banana< och (. ) mynt hur länge ska jag komma ihåg det då? >hotel banana and coin hotel and banana< and (. ) coin for how long should I remember those then?
7. SLP1: nå nu behöver du inte komma ihåg dem mer no now you don’t need to remember them anymore
8. D8: nehe

D8 cannot recall any of the words and when he gets them from SLP1 in line 3, he starts repeating them in the following lines. This behavior, alongside with his question in line 6 about how long he should remember the words, indicates that he has problems with remembering the words, but also that he has a problem with remembering/understanding the instruction from SLP1, something that is not revealed by the MMSE results. Here, potential problems with understanding the test instructions result in the separation of the interlocutors’ goals of the test item’s local communicative project. This might indicate that the boundaries and purposes of the test situation are not clear to some of the participants. This is something that is demonstrated in several of the analysed test conversations of the participants with dementia, but also in some conversations of the participants with aphasia.

In example 3, A9 and SLP3 are engaging in interaction over the “orientation” test items.

Example 3

1. SLP3: ehm: (.) vilket landskap är vi i ehm: (.) what province are we in?
2. A9: (8.0) ((wanders with the pen over the paper)) hm: (5.0) nåe† (8.0) ((wanders with the pen over the paper)) hm: (5.0) no†
3. SLP3: ska jag skriva några
should I write some

4. A9: ja
   yes
5. SLP3: mm (2.0) *ehm:° ((grabs the note pad and writes
different options)) (8.0)="
6. A9: =((points at the option “Hälsingland” before SLP3
is done writing))
7. SLP3: ((puts the note pad in front of A9))
8. A9: ((points at “Hälsingland” again))
9. SLP3: så tar vi dom här
   and then we take these

A9 has a very limited oral ability but has some ability to give written answers. In
eexample 3, she seems unable to answer the question. SLP3 abandons the test instructions
and offers written alternatives. It should be noted here that A9 and SLP3 have met on
several occasions prior to this particular meeting. This might be a reason for SLP3 being
so perceptive about A9’s need for communication aids. A9 has documented problems with
language comprehension and it might be that she misunderstands the question to be about
her home province (which is Hälsingland) when she points at that option in line 6.
Altogether in the “orientation” category, A9 has a total score of 2 out of 10. In example
3, as in the prior two examples, it is difficult to tell what is causing the participants’
incorrect answers. It is not only for the participants with aphasia that a plausible reason is
difficulties understanding the test instructions.

Overall, when analysing the test interaction and the participants’ answers, it is first
of all obvious that the test instructions consist of rather complex verbal
constructions. Second, it is not obvious how to untangle linguistic and cognitive
abilities, neither among the participants with dementia nor participants with aphasia.
In the following examples, one way to pursue the analysis further is to look closer at
different aspects of how the participants handle the instructions.

The handling of the instructions
It might also be an issue, especially for persons with aphasia, but also for persons with
dementia, that expressive language problems and word finding difficulties may be regis-
tered as memory deficits. This is demonstrated in the following examples.
A8 and SLP1 had not met prior to the MMSE testing which is taking place at the
activity center for persons with aphasia. A8 has primarily receptive language deficits, but
he also has word-finding problems.

Example 4
1. SLP1: kan du komma ihåg vilka tre ord det var
   do you remember which the three words were
2. A8: jaa ((grabs the pencil)) (6.0) neej=ja får inte
   °ut°= yes ((grabs the pencil)) (6.0) noo °I can’t get
   °ut°= out°=
3. SLP1: =kommer du ihåg nåt av orden
   °do you remember any of the words
4. A8: (5.0) ((sighs)) jag får inte ut det
   °(5.0) ((sighs)) I can’t get it out
5. SLP1: neej: (2.0) det var hotell
   °no: (2.0) it was hotel
6. A8: ata ja där ja
   ota yes there yes
7. SLP1: banan= banana=
In example 4, when SLP1 is carrying out the “recall” test item, there are uncertainties whether A8 is unable to remember the words or if it is a word-finding issue when he says that he “can’t get it out” in line 4. SLP1s initiation of a new very local communicative project in line 11 can be said to be nested to the superior communicative project of the “recall” test item.

There are similar situations in the data from the participants with dementia. In example 5, D4 and SLP4 are working with the MMSE “orientation” test items. This meeting at the activity center is the first time they meet.

Example 5

1. SLP4: eh: vad skulle du säga att det är för årstid ute  
   eh: what season would you say that it is outside
2. D4: jaa de (2.0) jaa jag *tänker inte [så mycket på*  
   yes its (2.0) yes I *don’t think [much about*  
   ((laughs)))]
3. SLP4: [jaa precis] men är det=  
   [yes exactly] but is it=
4. D4: =äde därför tog jag eh fram den där eh (1.0) att jag  
   kan träna alltså hemma=  
   =th why I eh brought that eh (1.0) so I can work  
   out at home=
5. SLP4: =ja men precis† då kan du [träna inne]  
   =oh yes exactly† then you can [work out indoors]
6. D4:  
   [yes thethe] that’s right
7. SLP4: ja men eh skulle du säga att det är vår sommar  
   vinter eller höst  
   yes but would you say that it’s spring summer  
   winter or fall
8. D4: ja det är vinter [är det jul]  
   yes it’s winter [is it]
9. SLP4:  
   [yes yes]  

In line 4, D4 starts a sub-activity within the communicative project by talking about a training device in his home. This is picked up by SLP4, but she returns to the original communicative project in line 7. When SLP4 gives D4 alternatives, he promptly tells the right answer. D4 has great difficulties with all the MMSE categories (total score of 9 out of 30), including the “language” category (2 out of 8). In fact, he is more successful in the “orientation” category where he gets a score of 6 out of 10. These two examples illustrate the complexity of evaluating both language and cognitive ability in persons that have plausible deficits in both of these areas.
The evaluation of the answer

Another aspect that is demonstrated in the test interactions is that there are uncertainties about whether some answers should be reported as correct. In some cases, this is due to limited information in the test manual. This is problematic because an incorrect answer may, in fact, respond well to the test question, whereas a correct answer according to the manual may provide important clinical information.

In example 6, SLP3 is answering to a test item in the “orientation” category.

**Example 6**

1. SLP3: eh: (1.0) vad har vi för årstid nu (.) vilken årstid är det
   
   temperature what is it

2. A9: (1.0) subber
   
   yes

3. SLP3: jaat (1.0) det ska i alla fall vara det [*mhmhmhm*]
   
   yes at least it’s supposed to be
   
   Example 6 yields information about A9, in fact, being oriented to the season. In example 6, SLP3 handles A9s response “subber” in line 2 as if she is referring to summer and the answer is reported as correct. A9 has a score of two out of 10 in the “orientation” category. Even though she manages to get the word “subber” out, most of her responses are impossible to interpret. When SLP3 in line 3 confirms with a “yes”, she completes the local communicative project of solving the test item and when she adds “at least it’s supposed to be”, it is actually her who takes the initiative to a new local project.

Examples 7 and 8 are from the local communicative project of the MMSE “orientation” category. A8 and SLP1 are meeting for the second time at the activity center for persons with aphasia when the MMSE assessment takes place.

**Example 7**

1. SLP1: eh: vilken månad är det nu
   
   what month is it now

2. A8: (2.0) eh (3.0) ((holds pen over paper)) tre tredje
   
   third

3. SLP1: [den tredje? mm]
   
   third

4. A8: mm

**Example 8**

1. SLP1: eh och vad är det här ((shows with arm)) för ställe
   
   what is this place called

2. A8: eh hehe *afasi*
   
   aphasia

3. SLP1: afasi [*jaa*]
   
   aphasia [*yes*]

4. A8: [*hehe*]

Among the participants with aphasia, there are several examples like examples 7 and 8 that demonstrate that the participants seem to know the answers, even though they are evaluated as incorrect. The analysis of the interaction in examples 7 and 8 indicates that
A8 understands the questions and is able to give adequate information (albeit not the correct answers according to the manual). In example 7, A8 answers that it is the third month and no score is given. Neither does he get any score for his answer “aphasia” in example 8. Since it is March and the testing, in this case, takes place on a day-care center for persons with aphasia, there is substance to both A8’s answers. A8 manages to get most other answers in the “orientation” category out and he gets a score of 7 out of 10. In both these examples, when analysed in the context of the communicative projects, the answers from A8 clearly relate to the aim of the communicative project. There are no examples of these kinds of responses among the participants with dementia.

In the following example, D9 and SLP5 are meeting for the first time at an activity center for persons with dementia.

Example 9
1. SLP5: nu ska du få (.) skriva en fullständig mening här
   now I want you (.) to write a full sentence here
2. D9: “ha” (4.0) ja vad som helst menar du
   “ha” (4.0) yes you mean anything
3. SLP5: jaa
4. D9: ((writes “Vem har hitat på det här?”)) (25.0) jag har
   inte “eh” skakat (.) förr men eh: jag skakar eh när
   jag prat när jag (.) skriver ibland
   ((writes “Who mad this ip?”)) (25.0) I haven’t
   “eh” shaken (.) before but eh: I shake eh when
   I tal when I (.) writes sometimes
5. SLP5: just det: aa (1.0) det är inga problem att läsa det
   där åndå
   that’s right: aa (1.0) I have no problems reading that anyway

In the MMSE “writing” category, scores are given if the written sentence is intelligible; there is no need for correct spelling or grammar. This analysis is important in language assessments due to poor spelling and syntax being listed among core symptoms in both aphasia and primary-progressive aphasia (Rogalski & Mesulam, 2007). Spelling errors have also been reported in persons with AD and mild cognitive impairment (Afonso, Álvarez, Martínez, & Cuetos, 2019). When D9 writes the sentence, his arm starts to tremble, which he is referring to in line 4, thus initiating a new local communicative project. Even though scores are given for D9’s answer in example 10, it is important to analyse the written sentence. An incorrect spelling and/or poor syntax seen in MMSE ought to be an indication for further testing of language abilities. Apart from this, the analysis of the interaction in example 9 gives additional insight into D9’s feelings towards writing and that the test item itself is problematic.

Discussion

The results of the present study give information about the MMSE test process involving persons with aphasia and persons with dementia. The analysis of the test interaction and the test results demonstrates different aspects that ought to be handled carefully when using the MMSE. Based upon this, there are a few issues that are important to discuss.

Even though it is well known that the MMSE is a verbally oriented test, the small differences of the overall MMSE results between the persons with aphasia and the persons with dementia were not an obvious outcome. Overall, there seemed to be a connection
between the severity of the participants’ language problems and their overall problems with the MMSE. It is reasonable to believe that an MMSE result indicating normal cognitive function, like participant A1’s, additionally might be a reflection of mild language impairment. Most studies on cognitive and linguistic abilities point toward a connection between the severity of aphasia and the level of cognitive impairment (e.g. Marinelli et al., 2017). As for the data of the present study, it is hard to tell whether the connection lies in troubles with the linguistic area, with cognitive ability, or in fact both.

The small differences in the mean scores in the “language” category were not an obvious outcome due to the participants’ with aphasia language deficits. One reason for this might be that the participants with dementia in the present study presented more language deficits than expected. Another, perhaps more plausible, the explanation might be that the test items in the MMSE language category are not sensitive enough, causing a ceiling effect on particularly the “naming” test item (which was the specific MMSE test item that where the participants in both groups had the highest scores). The opposite can be discussed the “repetition” test item in the “language” category which most participants in both groups failed. This indicates that the “language” category is in fact not a direct measurement of language function and may instead represent more heterogeneous cognitive functions (Jefferson et al., 2002). It might be the case that the test items in the “language” category do not test language abilities more than the remaining test items of the MMSE. This is supported by the analysis of the data of the present study.

There are documented challenges associated with the cognitive evaluations of persons with aphasia (Fonseca et al., 2017). Nevertheless, it is important to find ways to make those evaluations for various reasons. The qualitative analysis of the test interaction demonstrates that it might be problematic for especially persons with aphasia but also for some persons with dementia to understand the MMSE spoken instructions due to language impairment. An additional risk that is shown in several examples in the data of the present study, especially for persons with aphasia, but also for persons with dementia, is that expressive language problems and word-finding difficulties cause troubles with test items, not only in the “language” category, and the answers might falsely be registered as memory deficits. The risk also seems to be the opposite, that memory problems are interpreted as language impairments, when assessing persons with aphasia and other persons with documented language problems. These challenges associated with cognitive evaluations of persons with aphasia might indicate that there is an underdiagnosing of memory problems/dementia in the population, at least in the earlier stages of the disease. What the framework of communicative projects adds to the analysis in this paper is the information on how participants handle the local communicative projects of the test situation. Even if the participant’s answers are reported as incorrect according to the test manual, the tester can benefit from being perceptive on how an answer aligns with the local communicative project. This could yield information about cognitive as well as communicative abilities. The observation of participants’ initiations of new local topical communicative projects in the middle of the test items might indicate that the boundaries and purposes of the test situation are not clear to some of the participants. It might be the case that persons with aphasia or dementia, with troubles with initiating, maintaining and contributing with new information to topics might have an impact on the collaborative activity of communicative projects.
However, it should be emphasized that MMSE is a screening test. It is also stated in the manual that the test is verbally oriented, thus leading to ambiguities when assessing persons with known language problems. The tester needs to be perceptive on how the test participant seems to understand the verbal instructions and how the test instructions are handled. Nevertheless, language problems are not always known in advance. Furthermore, the options for cognitive screening tools are limited and it is commonly used on stroke survivors, of which even individuals without aphasia may present language deficits (Rodrigues et al., 2018). Making qualitative notes alongside the MMSE-scores might be a beneficial procedure, giving an opportunity to make an informal evaluation of the test participant’s answers. Additionally, it may give information about language abilities like spelling errors, paraphasias or language comprehension problems; factors that are important to consider, for example, detecting and differentiating between different dementia types. When the clinician wants to examine language more thoroughly, there is a need for a conceptual assessment of real-time co-present communication by collecting casually diverse phenomena under the same conceptual frame, with a particular focus on turn-taking, sequences and repairs, as suggested by Barnes and Bloch (2019) in combination with standardized language tests.

The sample of participants in this study is too small to draw strong conclusions. Therefore, our findings must be interpreted with caution and further investigations are needed in order to obtain conclusive results. Neither was that the participant’s previous experiences of the MMSE not controlled for. Moreover, the authors did not control for other variables that might affect the participants’ performances, such as hearing ability, premorbid IQ and other factors that might have affected their MMSE results. Another limitation might be the inclusion of SLPs as test leaders. It might be the case that SLPs are more perceptive in conversation with persons with aphasia, and they may also provide more communication support than the average person normally conducting the MMSE.

**Conclusions**

The conclusions of the present study mainly regard the issue that it is unclear whether the MMSE measures cognitive or language abilities, an important issue in evaluating persons with aphasia, but perhaps even more important to bear in mind in evaluating persons without known language disorders, like persons with dementia, when less obvious to suspect language impairments. The analysis highlights that there is a need for the tester to be perceptive on certain aspects and to also adopt a qualitative approach to the MMSE test process, in order to be able to differentiate and identify language problems. Furthermore, there is a need to combine the MMSE with more non-verbal cognitive tests. There is a need for more research on the effect of aphasia in different cognitive domains. Nevertheless, it is important to discuss the ecological validity of the MMSE and other cognitive tests.

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**Appendix 1. Transcription conventions**

The following conventions have been used in the present article. They are adapted with some modifications from Sacks, Schegloff & Jefferson, 1974

- **yes** stress
- **CAPITALS** strong emphasis
- **really↑** sharp rise in intonation
- **?** rising intonation
- **ye:** sound elongation
- **-** cut off word
- **=** speech immediately latched on to the previous utterance
- **"mhmm"** word or utterance pronounced quietly or soft
- **.hh** inbreath
- **(.)** micro-pause (less than 0.2 sec.)
- **(0.4)** pause
- **[yea]** overlapping speech
- **>words<** accelerated speech
- **<words>** slowing of speech