Early Detection of Cognitive-Communicative Change Associated with Mild Cognitive Impairment

This study investigated whether performance on a complex discourse production task differentiates individuals with mild cognitive impairment (MCI) from those with normal cognition and to extend the findings of a previous study (Reference Blinded). The study also attempted to identify the role of executive function (EF) in discourse production. MCI is an evolving, intermediate diagnostic category between normal cognitive aging and dementia (Holsinger, Deveau, Boustani, & Williams, 2007; Petersen et al., 2001; Taler & Phillips, 2008). Over time, some individuals with MCI remain stable or return to normal functioning. Conversely, 50% or more of persons with MCI progress to dementia within five years, making MCI a primary risk factor for dementia (Gauthier et al., 2006; Kantarci et al., 2009).Currently, no standardized test of cognitive-communicative function designed specifically for persons with MCI exists. However, it is plausible that similar to dementia, subtle changes in communicative abilities may be the initial symptom of declining neurological status. Presuming that subtle decline may initially appear within the context of relatively complex linguistic behaviors, the ideal task for the detection of slight changes would be one in which the complexity is sufficient enough to tax seemingly intact cognitive-linguistic abilities. A complex discourse production task seems appropriate because the task requires higher-order abilities such as planning, problem solving, cognitive flexibility (References Blinded) which have been found to be impaired in individuals with MCI (Zhang, Han, Verhaeghen, & Nilsson, 2007).

The research questions for the study were: 1) What are the quantitative and qualitative characteristics of spoken discourse in cognitively normal individuals and individuals with MCI? 2) What is the relation between the spoken discourse production and the higher-order cognitive skills in cognitively normal individuals and individuals with MCI?

Method

Participants

Preliminary data analysis has been completed on ten (10) adults in two groups, six adults with a diagnosis of MCI (*M* age = 73.17; *SD* = 5.00) and four age and education matched cognitively normal adults (*M* age = 72.50; *SD* = 6.61). All data has been collected, and the final analyzed data set will contain data from 10 adults with a diagnosis of MCI and 10 age-matched neurologically intact adults. Inclusion criteria for the individuals with MCI were: physician diagnosed MCI; no premorbid or concomitant neurological injury or psychiatric illness other than MCI; at least 12 years of formal education; vision and hearing acuity corrected to normal or near normal limits; and English-speaking. Inclusion criteria for age and education matched cognitively normal adults were: English-speaking, negative for neurological injury, dementia, or psychiatric illness, at least 12 years of formal education, and no more than one standard deviation below the mean (>40 T score) *Mini Mental State Exam* (MMSE: Folstein, Folstein, & McHugh, 1975), and vision and hearing acuity within normal or near normal limits.

Screening and Ability Tests

The MMSE (Folstein et al., 1975) a brief quantitative measure of cognitive status in adults, was administered to screen for alterations in cognitive status. Abilities tests included: The Logical Memory subtest of the *Wechsler Memory Scale*-III (Wechsler, 1997) which assessed

memory for connected speech and the *Boston Naming Test* (Short Form) (Kaplan, Goodglass, & Weintraub, 1983) which measured single-word confrontation naming.

Experimental Tasks

Each participant was assessed in terms of (1) spoken discourse production, (2) the cognitive flexibility and (3) planning components of EF. The *spoken discourse* task had a relatively high cognitive load and will be referred to as a simulated complex discourse elicitation task (CDET) (Reference Blinded). The task required participants to pretend that they are planning a trip to New York City and to describe in detail activities associated with preparing for this trip. This generative discourse production task had the potential to contain elements of both narrative and procedural discourse, thus contributing to its relatively greater complexity. The *cognitive flexibility* component of EF was assessed using the Design Fluency and the verbal fluency subtests of the *Delis-Kaplan Executive Functions Scale* (Delis, Kaplan, & Kramer, 2001). The *planning* component of EF was assessed using the Tower and Trails subtests of the *Delis-Kaplan Executive Functions* Scale.

Procedures

All participants were tested individually, and general identifying information, such as chronological age, educational status, occupation, and information about current or past speech-language or hearing concerns was gathered using an intake questionnaire. The entire test procedure took approximately 90 minutes. Discourse samples were audio-tape-recorded for later verbatim transcription and analysis. Transcripts were analyzed using *Systematic Analysis of Language Transcripts* (SALT: Miller & Iglesias 2006). Data were analyzed for quantitative and qualitative differences. Quantitative analyses included standard discourse measures such as total number of words, T-units, error words, and mazes. Qualitative analysis will be based on the thematic coding of information, i.e., core elements, provided during discourse production, the number of indefinite terms used in proportion to the total number of words, and maze production.

Results

A multidimensional scoring system was employed to analyze the complex discourse task on multiple domains. At preliminary data analysis, the groups did not appear to differ in terms of age, $z = 0.65$, $p = .610$; years of education, $z = 0.75$, $p = .476$; or the MMSE, $z = -1.30$, $p = .257$. The groups were significantly different in terms of the LMS Total Score, $z = -2.35$, $p = .019$, as expected.

The groups were significantly different in terms of CDET percent of utterances with mazes, $z = 2.14$, $p = .032$. The groups thus far appear to have performed similarly on other discourse variables including: total number of words, $z = 0.85$, $p = .476$; total number of t-units, $z = 0.21$, $p = .831$; length of t-units, $z = 1.28$, $p = .201$, amount of embedding, $z = 0.00$, $p = 1.000$; and percent dependent clauses are of total clauses, $z = 0.43$, $p = .670$. The discourse task will be further analyzed analyzed in terms of 13 thematic core concepts which will be rated 0 if the concept was absent, 1 if mentioned briefly, and 2 if mentioned in detail (Total points = 26). In addition, participants will be scored on a similar scale for irrelevance and verbosity: 0 if absent, -1 if minimally present, and -2 substantially present. At the current time, this portion of qualitative analysis is ongoing.

In terms of EF, The two groups did not differ in terms of planning ability as measured by the Tower Test and the Trail Making Test. The two groups differed in terms of cognitive flexibility as measured by Verbal fluency (category), $z = -2.15$, $p = .031$ and Design Fluency (nonverbal), $z = -2.39$, $p = .017$.

Discussion

Preliminary analysis indicates cognitively normal adults and adults with MCI not only differ in memory and general cognitive abilities, but also in language ability. The complex discourse task detected subtle changes in communicative ability in terms of the percent of utterances with mazes. Syntactic complexity in persons with MCI appears relatively spared, which supports previous findings (Reference Blinded). Further, there appears to be a relationship between cognitive flexibility and discourse production as measured in this study. Overall, results seem to support the use of a discourse task, such as "Trip to New York," to differentiate cognitively normally aging adults from those with MCI.

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