

Introduction

Everyday functioning can become significantly more challenging in the face of cognitive declines associated with aging. Changes in declarative memory are common among older adults with up to half of older adults complaining about decreased everyday memory function (Jonker et al., 2000). Even healthy adults show memory loss with age, especially after the sixth decade (Schaie, 1996). This decline in memory ability across the lifespan can be parsimoniously attributed to downward changes in cellular, morphologic, and volumetric aspects of the hippocampus and related medial temporal lobe (MTL) structures as a function of aging (e.g., Jernigan et al., 2001).

The current study, examining the social and collaborative learning of healthy older adults, is part of a programmatic line of research aimed at characterizing the nature of preserved and impaired memory and learning abilities in aging and in individuals with profound declarative memory impairments (e.g., hippocampal amnesia, Alzheimer's disease (AD)) and at developing and validating rehabilitation techniques for individuals with disorders of learning and memory. This work builds on evidence that (1) individuals are capable of performing at higher intellectual levels when asked to work in collaborative and social contexts than when asked to work individually (e.g., Luria 1947/1970; Vygotsky, 1978), (2) cognitive function in older adults is enhanced by involvement in social activities and by intellectual engagement in collaborative problem-solving (e.g., Bassuk et al., 1999; Stine-Morrow et al., in press), and (3) collaborative social learning is preserved in patients with profound declarative memory impairments secondary to hippocampal damage (Duff et al., 2006) and AD (Gallegos et al., 2007).

Building on our previous work in hippocampal amnesia and AD using a collaborative referencing task, we studied a developmental sample of community-dwelling, healthy adults, aged 25-90, with a learning paradigm that was situated within a social and collaborative context. We hypothesized that the typical effects of aging upon memory function seen reliably when comparing younger adults to older adults on clinical tests of memory (on the order of a 1 to 1.5 standard deviation decline in declarative memory performance with age) would be attenuated, or perhaps even abolished, when the learning environment entailed social and collaborative processes. Specifically, we predicted that older adults would demonstrate robust collaborative learning across trials, arriving at increasingly efficient labels with which to communicate, with a reduction in the amount of communicative resources (i.e., turns, words) and a decrease in time required to complete each trial. Such findings would have obvious implications for our understanding of age-related changes in hippocampal function in normal aging and its impact on everyday memory and communicative processes.

Methods

Participants

68 healthy adults took part in this study: 17 older adults, 17 younger adults, and 34 familiar communication partners. The 17 older participants were 71.6 (range = 55-90) years old and had 15.4 years of education, on average. The 17 younger participants were 32.8 (range = 25-50) years old and had 16.9 years of education, on average. Each older and younger participant selected a familiar partner (e.g., spouse) with whom they completed all task trials forming 34 participants pairs (e.g., older participants and familiar partner). All participants had normal

corrected vision and hearing, a negative history of neurological disease and premorbid learning disabilities, and were monolingual American English speakers. All participants completed a neuropsychological battery to rule out cognitive dysfunction and dementia.

Procedures

Participants completed the collaborative referencing task as described in Duff et al., (2006). Briefly, participant-pairs sat facing each other with a low barrier between them, identical boards in front of them, and identical sets of twelve cards displaying unfamiliar, abstract tangram figurers. A partial barrier obscured the view of the others' stimulus cards but allowed participants to see each others' facial expressions and gestures. The directors' (older and younger participants communicated to the matcher (familiar partner) how to fill the numbered spaces with the cards so that at the end of the trial the two boards look alike. Pairs were encouraged to communicate freely and to treat the task as a game. The task was completed on a total of 24 trials, with 6 trials conducted in each of 4 sessions, 2 sessions per day with 30 min between sessions. Sessions were videotaped for detailed discourse analysis.

Data Analysis

All sessions were transcribed using a consensus transcription procedure. Each trial was timed and card placements were scored for accuracy. Transcripts were coded for the number of words and turns used by the pairs. Primary dependent measures included time to complete each trial, number of words, and number of turns. Additional analyses aimed at characterizing the verbal descriptions and labels used to reference the target cards, changes in these labels across sessions, and identifying differences in communicative practices between older and younger pairs (e.g., use of another's perspective for referencing, verbal play) that have proven robust in our previous work (e.g., Duff et al., 2008; in press) are ongoing and will be completed by March 2009.

Results

Older and younger pairs successfully completed all trials, with high card placement accuracy, 98.7% and 99.4%, respectively. Across trials, all pairs displayed dramatic reductions in time to complete each trial. Interestingly, while the typical disparity between older and younger participant performance was observed on the first trial (mean time to complete placements of the 12 cards was 12:41 (min:sec) and 7:04, for older and younger pairs, respectively) by the final trial this difference was ameliorated (mean time to complete placements of the 12 cards was just 0:45 (min:sec) and 00:31, for older and younger pairs, respectively) (see Figure 1). The same pattern was observed for the number of turns produced across trials: mean number of turns dropped from 183.8 and 114.2 on trial 1, for older and younger pairs, respectively, to just 24.2 and 20.8 on the final trial, respectively. Pairs also demonstrated dramatic reductions in the mean number of words produced to reference the twelve cards: 1883.1 and 1165.5 on trial 1, for older and younger pairs, respectively, to just 106.6 and 41.6 on the final trial, respectively. Preliminary analysis of the labels used in the final trials suggests that while the labels generated by the older participants became increasingly concise and streamlined, these labels did not become quite as succinct as the labels generated by the younger pairs. The additional analyses proposed should illuminate these differences.

Discussion

Our findings suggest that social and collaborative discourse reduces the adverse effects of age on memory and learning. These findings differ from previous work (Filer & Scukanec, 1995; Hupet et al., 1993), where less robust learning in older adults using a similar task was reported. The current work more closely approximates real-world communication (i.e., interaction with familiar partners across multiple days, use of facial expressions, gestures) encouraging participants to engage in goal-directed activity and to problem-solve collaboratively allowing heterogeneity and flexibility to be incorporated into the interactions. This is in contrast to the gold standards in the neuropsychological assessment and experimental study of declarative memory which are by design inflexible – consider the ubiquitous word list learning tasks which almost always call for rote learning and later verbatim reproduction. These social and collaborative sessions are potent learning environments and may have significant promise in mitigating age-related cognitive decline and in the rehabilitation of memory and learning disorders.

References

- Bassuk, S. S., Glass, T. A., & Berkman, L. F. (1999). Social disengagement and incident cognitive decline in community-dwelling elderly persons. *Annals of Internal Medicine*, 131, 165-173.
- Duff, M.C., Hengst, J., Tranel, D., & Cohen, N.J. (in press). Hippocampal amnesia disrupts verbal play and the creative use of language in social interaction. *Aphasiology*.
- Duff, M.C., Hengst, J., Tranel, D., & Cohen, N.J. (2008). Collaborative discourse facilitates efficient communication and new semantic learning in amnesia. *Brain and Language*, 106 (1), 41-54.
- Duff, M.C., Hengst, J., Tranel, D., & Cohen, N.J. (2006). Development of shared information in communication despite hippocampal amnesia. *Nature Neuroscience*, 9 (1), 140-146.
- Filer, L., & Scukanec, G. (1995). Collaborative referencing in elderly women. *Perceptual and Motor Skills*, 81, 995-1000.
- Gallegos, D., Duff, M.C., Denburg, N.L., Houston, W.S., & Tranel, D. (2007, November). Learning in Alzheimer's disease is facilitated by social interaction and common ground. Paper presentation at the Society for Neuroscience Conference, San Diego, CA.
- Hupet, M., Chantraine, Y., & Nef, F. (1993). References in conversation between young and old normal adults. *Psychology and Aging*, 8 (3), 339-346.
- Luria, A.R. (1947/1970). *Traumatic aphasia*. Mouton: The Hague.
- Vygotsky, L. (1978). *Mind in society: The development of higher psychological processes*. Cambridge: Harvard University Press.

Figure 1. Time to Completion for Older and Younger Pairs

