

Background

The behavioral domains of attention, memory, and language processing have been studied extensively in individuals with and without neuropathology, but models for understanding the role or precise effects of sensory competition and distraction are few. Events in daily life occur in context and are perceived in context, but the effects of attended and unattended auditory and visual events on language are irresolute. Little research has attempted to clarify the relative degradation capacity or potential of ambient backgrounds or of linguistic and nonlinguistic consequences.

Models of cognitive resource allocation have drawn attention to the effects of dual task paradigms and cognitive distribution and sharing during linguistic processing in aphasia (Tseng, McNeil, & Milenkovic et al, 1993; LaPointe & Erickson, 1991; Murray, Holland, & Beeson, 1997), but few studies of the effects of semantic distraction on linguistic processing in aphasia or in persons without aphasia have been reported. A recent study (LaPointe, Stierwalt, Hancock, Goff, & Heald, 2005) reported the results of related and unrelated semantic distraction in a group of young adults. Both modality and semantic relatedness effects were found with visual distraction of semantically related items hindering performance in both speed and accuracy when compared to semantically unrelated items. Many variables remain to be identified and controlled before a clear understanding of the effect of semantic related distraction is achieved. One of these variables is the effect of age.

Wingfield and colleagues (Tun & Wingfield, 1998; Tun, O'Kane, & Wingfield, 2002) have studied age effects on speech processing and distraction and have contributed much of what we know about age effects in language processing. Tun & Wingfield (1998) reported that age differences in recall of spoken sentences were associated with the type of background noise as well as its intensity. In subsequent research, Tun, O'Kane, & Wingfield (2002) reported that older adults were impaired more by meaningful than nonmeaningful distracters.

The Problem and Purpose

The degree to which ambient backgrounds of semantic visual or auditory distraction would facilitate or interfere with ongoing linguistic processing is uncertain. An array of variables exist that need to be systematically identified, controlled, and studied before we have a comprehensible picture of how ambient distraction affects non-neurologically compromised younger and older adults and subsequently what we might predict about the performance of persons with aphasia under similar contextual conditions.

The purpose of this study was to measure the effect of ambient semantically related and unrelated background of both visual and auditory distractions during a picture identification task in younger and older adults.

Methods

Thirty three adults with no reported history of neurological damage or disease served as participants. Sixteen older adults [mean age of 75.0 years] with no history of neurological impairment passed a hearing screening measure and their performance across conditions of

modality and semantic relatedness were compared with 17 younger adults [mean age of 20.1 years]. Participants sat directly in front of a 17-inch computer monitor and a four-button keypad. While staring at a central fixation cross, participants heard a simple direction, for example, “point to *corn*.” Immediately following the direction, four pictures, including the target, appeared on the screen in a quadrant array. Forty targets in each of two semantic categories (sports, vegetables) were presented. Auditory distractions were presented at 60 dB HL during the picture displays. The primary task (i.e., “point to _____”) remained constant but the semantic relatedness of the visual foils and auditory distractions were manipulated. In half of the trials (20 targets from each semantic category), the three foil pictures were semantically related to the target (*e.g.*, target picture of corn shown with pictures of lettuce, tomato, and eggplant). The other half of the trials incorporated semantically unrelated foil pictures (*e.g.*, pictures of table, bucket, shoes with the target picture of corn). Participants repeated the task (order of targets was randomized) in four conditions of auditory distraction: (1) words semantically related to the target, (2) words semantically unrelated to the target, (3) bursts of white noise, and (4) the control condition of no auditory distraction and only visual presentation of targets and foils.

Results

Significant differences were found in the reaction times between younger and older groups for distraction when visual and auditory modalities and semantically related and unrelated responses were pooled. The older group generated a mean of 1287 ms (164) compared to the younger groups performance of 1048 (151) ms. ($t = 10.194$; $p < .000$).

Modality (Visual vs. Auditory)

When semantically related and unrelated responses were pooled, no significant differences existed between visual or auditory distractions for either the younger or the older groups (Younger Mean of 837 ms for Visual, 883 ms for Auditory; Older Mean of 1186 ms Visual, 1252 Auditory).

Semantic Relatedness

The degree of semantic relatedness of the ambient visual distraction does appear to affect participant’s speed of identifying pictures but this effect varies across modality for the groups.

For the younger group the visual factor had a main effect of significance beyond the 1% level: $F(1,16)=237.1$; $p < .000$. A post-hoc Tukey analysis revealed that RT is always longer when visual distraction is semantically related to the target. For example, identifying a picture of corn takes longer when foils are vegetables, compared to when foils are semantically unrelated. This finding was indicative of the performance of young adults as well as older adults.

Effects of Semantic Relatedness in Auditory Distraction

For the younger group, semantic relatedness did not appear to affect reaction time (Mean of 880ms vs. 886ms for related and unrelated). For the older group, however, semantic relatedness of distraction significantly slowed reaction time of picture identification (1332 vs. 1172ms for

related and unrelated conditions). The auditory condition of distraction, whether semantically related or unrelated was significantly different from the white noise condition for both younger and older groups.

Effects of category (sports, vegetables)

Reaction times for the semantic category of **vegetables** were shorter for both groups than for **sports** (Younger = 778 [SD 342]ms Vegetables vs 897 [SD 372]ms Sports; Older= 1057[SD 478]ms Vegetables vs. 1316 [SD 284]. These differences across semantic categories were not statistically significant for the younger group but reached statistical significance ($p < .05$) for the older group.

Age Differences

The performance of older adults differed from that of younger adults across several parameters of our study. Older adults performed significantly slower across all conditions of modality and semantic relatedness. Both older and younger adults performed significantly faster during the condition of bursts of white noise. Older participants were slower identifying targets in the sports category than they were for vegetables.

Discussion

The effect of semantic relatedness of distraction on picture identification varied according to the modality of distraction across younger and older adults. Older adults appeared to have equal difficulty with either visual or auditory ambient distraction lending support to related findings on age effects on linguistic processing by Wingfield and colleagues (Wingfield, Lingfield, & Goodglass, 1999; Tun & Wingfield, 1998; Tun, O'Kane, & Wingfield, 2002).

Performance in the presence of distraction is determined by many factors, including the linguistic context or semantic relatedness of the distraction and the modality of the distraction. Further investigation is necessary to identify more conditions that facilitate or hinder processing speed during ambient distraction. This study provides a foundation for the further investigation of the effects of interference, competition, and distraction on persons with aphasia.