TIME OF DAY EFFECTS ON PROCEDURAL DISCOURSE

Amada Stead, Ph.D., CCC-SLP & Rachel Moore, B.A., SLP-A
School of Communication Sciences and Disorders | Pacific University | 2043 College Way
| Forest Grove | 97116 | Oregon

ABSTRACT
This study's purpose was to investigate whether language discourse follows a diurnal pattern in normally healthy, young adults and individuals with mild to moderate Alzheimer's disease. Twenty healthy adults and ten older adults clinically tabulated with probable Alzheimer's disease were recruited for this study. Measurements included narrative language, and cognition, the Benton Judgment of Line Orientation (BJLO), were collected across one day at 9:00am, 12:00pm, 3:00pm, and 6:00pm. Language samples were evaluated for linguistic variables, to estimate the quantity and quality of the discourse samples. Results indicated that the two groups differed in performance across the day, but that time of day was not a significant factor in procedural performance.

BACKGROUND
Older adults complain of word-finding difficulty and mental fatigue at the end of the day. Circadian rhythms (CRs) research has provided evidence that certain cognitive processes are susceptible to changes in arousal (May, Heath, & Stoff, 1993; May, Heffer, & Fong, 2005), but that research has not studied whether arousal patterns impact language discourse. Given that discourse relies heavily on both memory and attention (Bayses & Tenore, 2006), it seems plausible that language processes may be affected by diurnal rhythms as well. Moreover, while researchers have demonstrated a significant shift toward improved proficiency and task performance in the morning as a function of aging, (Ishihara, Miyaoka, & Miyagi, 1991; Hashier, Chung, & May, 2002), no studies in the cognitive language literature have reported controlling for the time-of-day effect.

PROCEDURAL DISCOURSE
A procedural discourse is a set of sentences used to explain how an activity is carried out. In this study, examiners requested that patients explain daily living activities (e.g. unlocking a door) in a procedural manner. Family members were asked to this exercise to assess the effects of the brain for successful discourse, including memory of the action, organization of events, and the ability to narrate and recount the steps. Procedural discourse requires that an individual possesses skills in the areas of memory, organization, and sequencing (Ripsch, Carpenter, & Zol, 1997).

Procedural discourse requires an explanation of how a procedure is carried out. According to Schacter (1998), procedural discourse relies heavily on procedural memory. The speaker must provide instructions in a particular order to achieve an outcome by stating the essential, sequential, and optional steps. Therefore, procedural discourse steps were correlated heavily with measures of cognition in healthy aging. In a later study, Ulmerski et al. (1999) found that when comparing 10 subjects with AD and 10 normal aging adults in a sentence and cognitive language protocol that included procedural discourse, the normal and AD participants performed similarly on linguistic measures (e.g., T-units, root sentences, words per clause). Conversely, the AD subjects had more shortened utterances, fewer a priori propositions, and more irrelevant statements. A commonly used procedure is the construction of a peanut butter and jelly sandwich. Ripsch, Carpenter, and Zol (1997) used a procedural discourse task to investigate language changes in 60 people with AD and 50 normal aging elderly peers. Subjects were asked to describe four common tasks: unlocking a door, getting dressed, making a bed, and cooking toast and jelly. The AD group produced fewer words, and omit both essential and optional steps from procedural descriptions, asked more questions seeking clarification, and produced fewer intelligible utterances. The number of people diagnosed with AD is expected to reach 7.7 million by 2030 (Alzheimer’s Association, 2015). Therefore, it is imperative to identify factors that contribute to cognitive and language change, such as time-of-day effects on ability. We aim to answer the following questions:

- Does a statistically significant difference exist between WAIS and healthy aging participants on the accuracy of procedural discourse sampled at four times of day?
- Does a relationship exist between procedural discourse and cognitive and language processing across four times in a day?
- Are certain aspects of procedural discourse more vulnerable to changes in arousal than other aspects (e.g., emotional steps, auxiliary steps, and inappropriate and inappropiate off-topic remarks)

METHODS
Participants:
Twenety-five participants, ages 65-89 will be recruited into the study and divided into two groups: 10 healthy older adults; and 10 older adults clinically tabulated with probable Alzheimer’s disease (diagnosed by physician), who also score 11-25 on the Mini-Mental Status Examination (MMSE; Folstein, Folstein, & McHugh, 1975). Inclusion criteria include, 80% or better on the Arizona Battery for Communication Disorders of Dementia (ABC; Bayses & Tenore, 1993) speech discrimination measures, hearing and vision screening, and absence of additional neurological impairment.

RESULTS
AD Subject Response
- "Well, ya need to, what you got (uh) wrote in there. And then put your stamp on it and put it in the mailbox or (the) at the post office, whichever one you got".
- "Gotta find the right key, for one thing, the main thing, and put it there and unlock it. If you don't have the right key you can't do, you gotta be sure you have the right key"

NHA Subject Response
- "Well, you first have to have a key that you know that fits (laughs) if you use a key or a (um) you might have a deadbolt, might do that first, and then you use a key, and open the door.
- "Well, if you gonna do it in the oven you turn the oven on. And you butter the toast. And (bor) it, and then put your jelly on it. And it's a toaster you put it in the toaster, and push the little lever down, and bring it out and butter it and put your jelly on it.

LITERATURE CITED

CONCLUSIONS
In summary, the results of the measures across the day indicate that procedural production is not susceptible to changes in circadian rhythms, though procedural discourse may vary. In the current study, individuals with AD produced fewer utterances, and their language samples had shorter patterns, more abbreviated, and less fluent. However, it appears as though people with mild to moderate deficits still have enough preserved ability to complete a procedural task. The mounting evidence that cognitive functions are affected by circadian rhythms (Bennett et al., 2007) motivates further study. Since language processing entails a multitude of cognitive processes to function adequately, it is likely that certain circadian rhythms would also affect the language samples of these patients. The patients attempted to examine language processing or production for diurnal patterns. Reinberg and colleagues (1999) studied diurnal patterns in brain-stem activity throws and voicing have been also examined similarly (Folckard, 1975 Morton & Dikutb, 1993, 1995). These studies showed mixed results, indicating that some aspects of language are vulnerable to circadian rhythms, and others are relatively stable. This is consistent with the results found in the current study. Yandlez and colleagues (1995, 1996) examined word fluency in dementia subjects. Their results indicated that word fluency may not always show a diurnal pattern problem, but only for those subjects not severely cognitively deficient. The results of the current study corroborate these results by suggesting that a floor effect may exist in some language measures and that more sensitive measures may be needed to eliminate a floor effect.

LIMITATIONS AND FUTURE DIRECTIONS
Limitations to this study include the small number of participants and the possible influence of external variables on the measures. Since the current study did not control for these extraneous variables, it is possible that events, such as mealtime could have played a significant role in task performance. Furthermore, the sample size recruitment larger in homogenous groups. This includes controlling for possible meal effects, work patterns, and sleep patterns. This study also investigated the correlation of physiological measures to linguistic ones. Measures of blood pressure, temperature, and heart rate have been used to indicate subtle changes in circadian rhythm; this could provide a clearer picture on individualization in rhythm. Finally, the investigation into how these cognitive measures, such as conversation, could provide informational value to the real-life performance of NHA and individuals with AD across the day. Much remains to be investigated in this area.

CLINICAL IMPLICATIONS
Though procedural discourse did not demonstrate a change, a time-of-day effect exists in some areas of language and cognition in healthy elderly dementia, failure to recognize circadian differences may lead investigators and clinicians to erroneous conclusions because other cognitive functions have shown declines across a day. Assessment and therapy should always be provided during a patients optimal time of day or maximal impact.