Statement of Research Interests

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My major area of interest is cognitive aging. The primary focus of my research is the study how attention processes change as we age. The goals of my research are three-fold: first, to characterize the patterns of attentional changes that accompany normal aging; second, to explore possible cognitive processes that can offset attentional declines associated with age; third, to examine translational components of my research to apply those methods to real-world situations.

In my research, I have examined attentional changes that are associated with normal aging. My early research focused on spatial attention and the inhibitory processes that are associated with spatial attention. The main inhibitory process that I studied was inhibition of return (IOR). This attentional effect, in which targets are detected more slowly at previously attended locations, is thought to be an adaptation of visual search to bias attention toward new locations. I have examined how younger and older adults were able to inhibit the return of attention to multiple locations (Langley, Gayzur, Saville, Morlock, & Bagne, 2011). We found that both groups showed intact IOR, and that older adults were able to distribute attention similarly to younger adults. I have also examined the time course of how quickly older adults inhibit attentional return to a previously attended location (Gayzur, Simon-Dack, Saville, & Langley, in preparation). In that examination, I examined behavioral differences and brain wave differences in the time course of IOR. Not only did the behavioral results demonstrate that older adults were slower to develop IOR, but the brain wave data confirmed the behavioral results and showed that IOR related brain patterns did not develop until later for older adults compared to younger adults.

My first investigation into how cognitive processes, such as context, aided age-related declines in attention on how older adults use semantic contexts to guide attentional processing (Langley, Saville, Gayzur, & Fuentes, 2008). Using a semantic priming task, my colleagues and I found that older adults were able to use semantic context (relationship between words) predictively across changing probability contexts (e.g. 20% related prime-target pairs). While older adults were able to use context to guide attention in this task, older adults were slower to use context compared to younger adults. We concluded that older adults are able to flexibly guide attentional mechanisms based on prime-target predictability, but the attentional mechanisms of older adults take slightly longer to engage and utilize contextual information. However, in Langley et al. (2008), three forms of context provided information to respond predictively: (a) probability information supplied by the pattern detected across trials, (b) instructions that described this pattern, and (c) the semantic relatedness of prime-target pairs. Thus, it was unclear what contextual information younger and older adults used to respond predictively. Therefore, my master's thesis further examined if the instructions that highlighted the probability context were important for responding predictively. Using only the 20% related condition (to control for semantic relatedness), younger and older adults were given instructions that either highlighted the probability manipulation or were not. Participants (young and old) who were given instructions demonstrated that they could guide attention based on the probability context. *Both* younger and older adults who were not given instructions responded in a non-predictive manner. Thus, for this task, younger *and* older adults needed the instruction context to respond predictively (Gayzur, 2008).

My recent research has examined how older adults learn and use visual context to guide attention in scenes. In general, older adults have demonstrated age-related declines in the ability to find targets in visual search tasks. However, these tasks do not have the same context as real-world scenes. In real-world situations, there is not only spatial predictability in the location of objects (e.g., the coffee table is in front of the couch) but also meaningfulness in the scenes. In two studies, I examined if older

adults are able to learn and use context and if age differences exist in the how quickly older adults learn and use context. I found that when older adults are given context on visual search tasks, they are able to learn and use context similarly to younger adults.

To date, my program of research has shown interesting patterns of intact and diminished attentional performance associated with normal aging. Furthermore, the findings provide insights into possible cognitive processes, such as context, that can aid potential age-related declines in attentional processing. These studies have a translational component insofar as the research examines ways to aid potential age-related declines. Extending this line of research, I have examined how cognitive training can improve older adults' attentional abilities. In this study, we assessed attentional ability and driving behavior of older adults before and after video game training (action games or first person shooter games). We found some evidence that training improved older adults' attentional abilities.

In a recent study, I examined if low cost changes in road signs increased driving safety for older adults in rural driving environments using an immersive driving simulator (Gayzur, Langley, Saville, Vachal, Alvarez Vazquez, & Gordon, in preparation). We manipulated the presence and distance of road signs. We found that when an intersection warning sign was present and when the destination road sign was moved farther back from an intersection (400 ft or 600 ft from the intersection) from the NDDOT standard distance (200 ft), both middle-aged and older adults increased preparatory turn behaviors and increased driving safety. Because of these findings, the NDDOT is in the initial stages of field testing moving destination road signs farther away from intersections in rural areas to examine actual driving behaviors.

My program of research has examined possible ways to aid age-related cognitive declines. I plan to continue this line of research. I think this area of research is necessary in this field. First, I will continue research on how context can aid visual search. Currently, my dissertation is the first to test how meaningful contextual information can impact older adults' search performance. While there is promise with the initial findings, I would like to further investigate how context can help older adults' visual search performance. I would like to further examine how primary aging changes, such as visual acuity and contrast sensitivity declines, impact older adults' performance. Also, I want to examine how meaningful associations in scenes can facilitate object recognition. Secondly, my research has focused on high-functioning older adults, who are independent community dwelling and in excellent health. I would like to examine if these benefits generalize to other samples of older adults, such as older adults in assisted living facilities or nursing homes. This would incorporate some of the cognitive training research that I have conducted. In my research, I not only want to examine potential age differences in cognition but to examine ways to alleviate those age-related cognitive declines. The best way to research this is with a sample of older adults that would benefit more from training than independent older adults.

As in the past, my future collaborations will include students as well as colleagues. I will encourage students to play an active role in my program of research. Conducting research is an important learning experience outside the classroom for students; working with students is a rewarding teaching experience for me. In this collaborative manner, we will continue to gain insights into the cognitive and attentional changes that characterize aging and potential ways to aid age-related cognitive declines.