The Problem

- Aging is associated with specific deficits in cognitive abilities.
- Aged human and non-human animals show declines in cognitive function.
- Unfortunately, the comparative psychology of aging suffers from a dearth of transparent explanations in human and non-human animals.
- In order to effectively explore (or other) therapeutic interventions for deficits in the elderly, it is incumbent upon us to strengthen the relationship between the basic behavioral findings in human and non-human subjects.

The Solution

- We recently discovered a particularly subtle cognitive deficit in aged mice, in the course of investigating the extinction and re-emergence of fear responses. This deficit essentially stems from an inability of aged animals to utilize contextual cues to discern the meaning of a target stimulus.
- The use of one cue to disambiguate the meaning of an accompanying cue is otherwise known as occasion setting; occasion setting has a rich history of investigation in nonhuman subjects.
- In the past decade, significant progress has been made in exploring occasion setting in humans, but no investigation has been made to date regarding potential age-related deficits.
- However, the human aging literature is replete with instances in which aging is accompanied by a deficit in the understanding of the contextual information that might serve an occasion setting function for individual targets.
- Thus, we aim to establish whether aged humans show deficits in occasion setting that parallel those that we have seen in mice. If they show such deficits, then we will have significant justification for a series of investigations of the basic mechanisms of aging deficits in mice and humans. We also will have sufficient confidence that behavioral manipulations aimed at rectifying these deficits in mice will prove beneficial one day for the treatment of aging deficits in the elderly.

The Tools

- In order for a “Feature” stimulus (F) to be considered an occasion setter, it must only have an informative relationship with the conditional stimulus (CS), as opposed to the unconditional stimulus (US). For example, the F must only cause participants to expect that the CS will lead to the presentation of the US, and not simply that the US will be presented. Money (F) causes the expectation that a button press (CS) will be followed by a snack (US), but money does not directly cause the appearance of the snack. Second, the transfer potential of a stimulus must be limited to other CSs that have been trained previously with other Features. (Baeyens et al., 2001). Money is expected to make a variety of button presses effective.

- Since research has consistently found a negative relationship between age and associative learning (Navon-Aharon et al., 2004; Spencer & Raz, 1995), the learned associations underlying the two criteria for occasion setters may be hampered in older adults.
- Baeyens and colleagues (2001) successfully demonstrated occasion setting using a computerized “Martians” game in experiments with undergraduate participants. Features facilitated responding only when presented shortly before the target CS (i.e., sequential acquisition). We borrow this methodology in our proposed investigation.

- A common finding is that the sequential (F ➔ CS) versus simultaneous (F/CS) presentation leads F to more often meet these criteria in both humans (e.g., Youn et al., 2000) and animals (e.g., Holland, 1991). The dynamics of stimulus competition may depend upon associative processes that are compromised with aging; thus, we might expect age to interact with the sequential/simultaneous factor.

- Lastly, the relationships among the F, CS, and US can be manipulated to form different conditional relationships. “Feature Positive” discriminations are established when the F signals that the US will follow the CS. “Feature Negative” discriminations are established when F signals that the US will not follow the CS (e.g. a “SOLD OUT” message indicates that a button press will not be successful in producing a snack). Feature Negative discriminations (in animals) rely on brain areas known to be compromised in older adults; thus, we might expect particularly significant aging deficits with this type of discrimination.

References