Efficiency of spoken word recognition declines across the lifespan

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Cognitive Processes for Language

- Language lies at the intersection of cognition and hearing
 - Need to perceive the signal to process language
 - NH older adults often report struggling with speech comprehension, especially in noise (Pichora-Fuller, 2003)
- Many cognitive processes specific to language
 - Cue weighting
 - Word recognition
- Lexical Access
- Sentence processing
- Discourse processing

Dealing with temporary ambiguity









Mechanisms of Lexical Access

Word recognition starts early and proceeds incrementally (Allopenna et al., 1998; Marslen-Wilson, 1987)

Models of spoken word recognition take into account interaction between competitors

 Several factors might impact word recognition outside the system

Does word recognition decline with age?



(Hannagan, Magnuson, & Grainger, 2013)

Aging & Language

- Aging is associated with a variety of changes in cognitive abilities that might support language processing
 - Declines in working memory, processing speed, inhibition (Johns, Myers, & Skoe, 2018)



Adapted from Park & Reuter-Lorenz, 2009

Aging & Language

Vocabulary remains a strength with increasing age

• But that's crystallized knowledge

Older adults

- Have different perceptual cue weights (Toscano & Lansing, 2019)
- Show more interference from competitors (Dey, Sommers, & Campbell, 2018)
- Have more difficulty in noise (Ben-David et al., 2011)

What about online processing?

The Visual World Paradigm



Word recognition presents a competition problem that must be resolved by the listener

Age-related changes to processing

- Spoken word recognition continues to develop late into adolescence (McMurray et al., 2018)
- Older adults are slower to process spoken words (Van Engen et al., 2020)
- However, age is often treated as discrete (old vs. young), many related factors aren't controlled for (e.g., visual cognition)



Van Engen et al., 2020

Present study

- How do the dynamics of lexical access change across the lifespan?
 - Are the processes supporting word recognition declining?
- Do hearing ability and domain-general cognition explain changes to lexical access?
 - Are broader cognitive resources needed to support changes to word recognition?

Design

111 participants from 11-79 years old

Age-typical hearing

- Some older adults had mild hearing loss at higher frequencies
- PTA < 25 dB HL in at least one ear

No reported cognitive/neurological deficits

Age Group	Age Range	Ν
Adolescent	< 25	21
Younger adult	25-44	22
Middle-aged adult	45-64	36
Older adult	65 +	32

Experimental Tasks

Visual World Paradigm

- 60 item sets (Target, Cohort, Rhyme, Unrelated)
 - 30 monosyllabic, 30 bisyllabic
- 300 trials
- Hear a target word, click on the picture



What might we see?



Timecourse of Word Recognition



Characteristics of Word Recognition



Effect of Age



Age²: B = -1.33; p = .002

Age: B = -0.12; p = .02 Age²: B = -0.15; p = .05

But what about other factors?

- Several factors could be contributing to age effect
 - Hearing ability
 - Visual cognition
 - Domain-general inhibitory control
- To account for this, subjects also completed:
 - Standard audiogram
 - Visual-analogue Visual World Paradigm
 - Spatial Stroop

+

Unique contribution of age

- Age still explains variance when controlling factors are included
 - Model containing age & age² increases R² by 0.08

Peak cohort activation

Summary & Conclusion

- How do the dynamics of lexical access change across the lifespan?
 - Rate of target activation slows down and competitor resolution weakens
 - Efficiency of lexical access changes across the adult lifespan
- Does hearing ability and domain-general cognition explain changes to lexical access?
 - Only visual cognition predicted performance in spoken VWP
 - Even when accounting for these factors, age still plays a unique role
- Unique age effect on spoken word recognition
 - Valuable place to investigate as mediator between cognition and hearing loss

Thank you!

Thanks to: Kristin Rooff Francis X. Smith Marissa Huffman Charlotte Jeppsen John Muegge

Supported by: NIDCD P50 DC 000242 to B. Gantz & B. McMurray

