Speech Comprehension Difficulties in Older Adults:
A Longitudinal Study

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Introduction

Understanding speech requires both hearing and cognitive abilities. In a recent cross-sectional study of participants from every decade of adult life, our lab found that, despite declines in hearing and cognition that begin as early as age 20, **listening comprehension** remains unchanged until approximately age 65. After that, listening comprehension declines progressively each year. While **hearing loss** contributes to this decline, there are unexplained changes in listening comprehension after removing hearing's contribution. The authors suggest these unexplained changes may be due to **cognitive declines**.

The goal of the present study was to examine the extent to which older adults experience longitudinal declines in hearing and working memory (a cognitive ability), and if they predict declines in listening (i.e., speech) comprehension.

Method

Listening Comprehension

When there is damage to a structure called the fusiform gyrus in the temporal lobes on both sides of the brain, what you get is a patient who can no longer recognize people's faces. Now that syndrome is very well known, but there is another syndrome that is quite rare, and that's what we call the Capgras syndrome…[his patient] had one profound delusion: he would look at his mother and say, "Doctor, this woman looks exactly like my mother, but she isn't; she's an imposter." (duration of full passage: 3-5 minutes; 6 comprehension questions per passage)

1. Why do researchers believe that Capgras syndrome is associated with an intact fusiform gyrus?

A. Individuals with this syndrome are able to recognize their family members' faces.
B. The only damage that can be identified is in the retina.
C. All of the other visual areas of the brain appear to be intact.
D. Both the amygdala and the limbic system are correctly 'wired' to the fusiform gyrus.

Participants & Procedure

- Thirty-five older adult participants
- 65+ years old at the time of the original study
- Completed a listening comprehension test (6 passages), 3 hearing tests, and 8 memory tests
- Tested in two 90-minute lab sessions

Time since original study: mean=4.30 years (*SD*=.33, range=3.90-5.10 years)

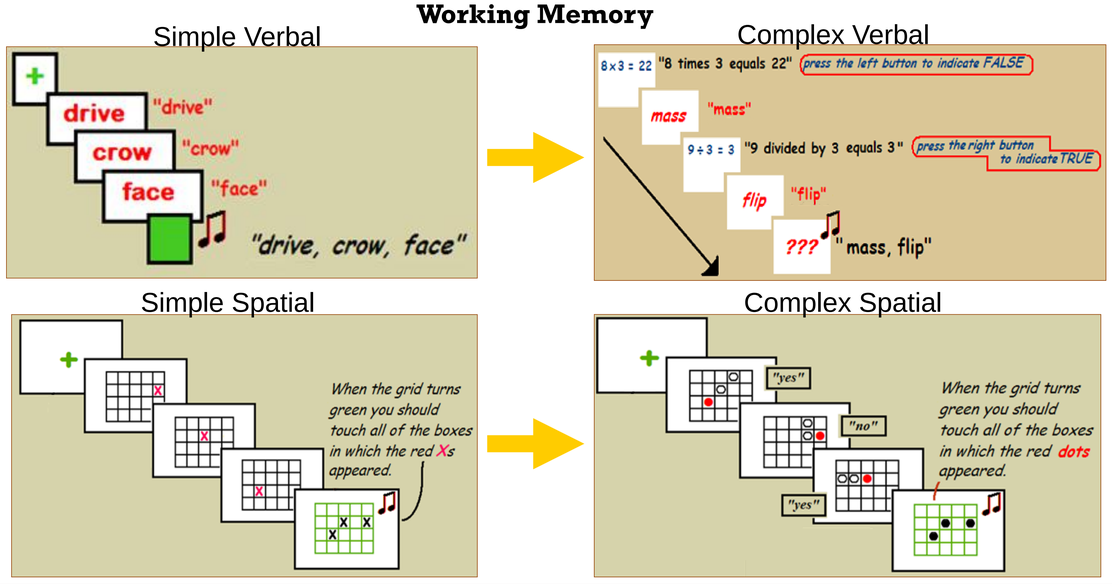
Hearing

Pure-Tone Thresholds
Low frequency: 250 Hz, 500 Hz, 1000 Hz
High frequency: 2000 Hz, 4000 Hz, 8000 Hz

Babble threshold
Crowd of talkers

Speech in Noise
Ruth couldn't know about the shrimp.

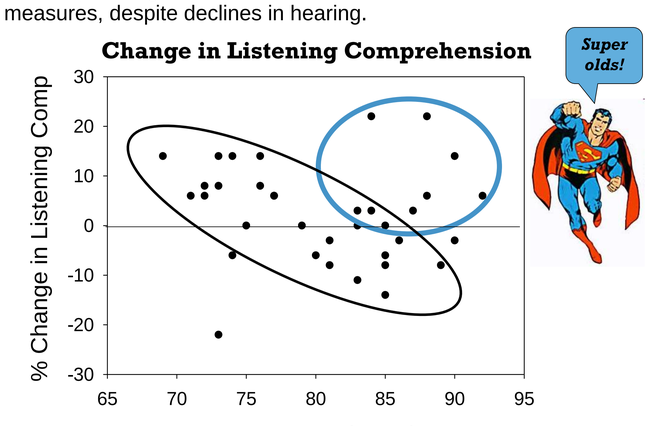
Working Memory



Results

After approximately 4 years from the time of original testing, old-old adults (>80 years) tended to experience declines on listening comprehension, while young-old adults (<80 years) did not. However, all older adults on average experienced declines on working memory (WM) and hearing. For working memory, older adults declined 5-8% on most tasks, except for the simple verbal tasks. For hearing, older adults showed poorer hearing for tones and for speech in noise (SPIN). There was an exceptional groups of "super" old-olds that did *not* show declines on listening comprehension or some working memory measures, despite declines in hearing.

Change in Listening Comprehension



Change in Working Memory and Hearing

Spatial WM	
Simple	
SSpan	-5.48%
GSpan	-6.20%
Complex	
2Span	-5.47%
ASpan	-7.58%
Verbal WM	
Simple	
LSpan	-1.07%
WSpan	-0.37%
Complex	
CSpan	-7.68%
Ospan	-6.44%

Hearing	
Low Tones	-3.48
High Tones	-3.96
Babble	4.12
SPIN	-4.59%

Change Correlations*

Spatial WM x LISN	
Simple	
SSpan	.37
GSpan	.09
Complex	
2Span	.39
ASpan	-.06
Verbal WM x LISN	
Simple	
LSpan	.46
WSpan	.43
Complex	
CSpan	.28
OSpan	.44

Hearing x LISN	
Low Tones	.50
High Tones	.45
SPIN	.26

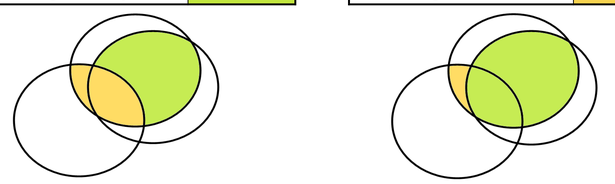
Correlations: Declines in most spatial and verbal working memory (WM) tasks were moderately correlated with declines in listening comprehension (LISN). Declines in hearing for tones and speech in noise (SPIN) were also moderately correlated with declines in listening comprehension.

Regressions: In reference to predicting declines, after removing hearing's contribution to listening comprehension (LISN), working memory (WM) still largely contributed. However, the reverse was not true, as working memory overwhelmed hearing's contribution.

Change Regressions*

LISN = Hearing + WM	
1. Hearing	34%
2. Working Memory	66%

LISN = WM + Hearing	
1. Working Memory	86%
2. Hearing	14%



N=12; only those who declined on LISN, two outliers removed

Conclusions

Given the age-related declines in nearly all the working memory measures assessed, and the correlations between changes in working memory and changes in listening comprehension, there is support for the contribution of **cognition** to declines in the ability to understand speech. Previous studies have minimized the importance of cognition, or failed to measure it at all, emphasizing the primary role of **hearing** in listening comprehension. The current study finds a shared contribution of cognition and hearing to listening comprehension, even finding a greater contribution from cognition.

These findings have **clinical implications** for treating older adults with speech comprehension complaints and suggest targets for cognitive training. In short, to help improve older adults' social lives, *hearing aids are not sufficient!*