Adult cognition and hearing aids

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Working memory & selective attention

(Klingberg, et al., 2002) (Wright, 2010)
Cognitive aging & executive processes

Bilateral prefrontal activity linked with working memory for older adults

...this activity is usually lateralised in younger adults

(Goh, 2011)
Lin et al., 2011 (Baltimore, US; Longitudinal Study N = 639; mean follow-up 11.5 years) – “Hearing loss independently associated with incident, [all-cause] dementia. Whether hearing loss is a marker for early stage dementia or a modifiable risk factor, deserves further study.”

Lin et al., 2013 (Pittsburgh and Memphis, US; N = 1,984 older adults - mean age 77.4 years) – “Hearing loss is independently associated with accelerated cognitive decline and incident cognitive impairment in community-dwelling older adults.”
Outline of the present study

Will aiding measurable hearing loss decrease or arrest cognitive decline?

Would selective attention & working memory improve following a standard hearing aid trial?
**Participants – experimental group**

1. New users of hearing aids
2. Decided to purchase/trial hearing aids.
3. Be over 45 years old
4. Able to return for follow-up appts. & proceed through aid fitting procedure
5. Comfortable with computer use

**Assessments prior-to & following the finalization of a standard aid fitting:**

1. Questionnaires surveying perceived hearing handicap & hearing aid benefit
2. Selective attention & working memory abilities

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**Allen et al., 2010 (n = 960)**

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<td><strong>Total</strong></td>
<td>104/105</td>
<td>37/84</td>
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Participants – control group

1. Also over age 45 years
2. Participants age & gender-matched
3. Never worn hearing aids
4. Comfortable with computer use
1 Experimental Group:

- Diagnostic Appointment
- Fitting Day
- At least 3 weeks
- Finalisation Appointment

1. New hearing aid client expresses interest in project
2. Client meets criteria and is assigned to experimental group
3. Assessment Session 1: HHIA APHAB Digit Span Listening Task
4. Client uses new hearing aids as normal.
5. Assessment Session 2: HHIA APHAB Digit Span Listening Task

2 Control Group:

- Client with hearing loss expresses interest in project (may have been contacted as participated in another study)
- Client meets criteria and is assigned to control group
- Assessment Session: Digit Span Listening Task
- At least 3 weeks
- Assessment Session: Digit Span Listening Task

3 Normal Hearing:

- Assessment Session: Digit Span Listening Task
- 10 days
- Assessment Session: Digit Span Listening Task
Methods: selective attention (Humes et al., 2006)

To study people's ability to focus their attention while hearing conflicting information we will present you with TWO phrases that contain conflicting information. The phrases will be played at the SAME TIME.

Each of those phrases are similar to:

“Ready CHARLIE go to BLUE EIGHT now”

- Call signal
- Color
- Digit

Each sentence contains a CALL SIGNAL (e.g. "Charlie") and information about a COLOR (e.g. "Blue") and a digit (e.g. "8"). Each sentence has its own call signal, its own color and its own digit. They are never the same.
Methods – data acquisition

Familiarisation phase

Charlie

Listen to: the TARGET  Don’t listen to: Distractor
“Ready Charlie go to Blue 8 now”  “Ready Hopper go to Red 1 now”

This is the Response Screen:

Choose a color AND a digit

BLUE
RED
WHITE
GREEN

Select the COLOR and the DIGIT of the Target Sentence with the Mouse Cursor and click the left Mouse Button.

Familiarisation phase
The following practice is to familiarize you with the FORWARD assessment.

(1) You will first see a red circle on the screen.
(2) Once the circle is erased, you will HEAR a sequence of digits from 1-9.
(3) Another red circle signals the end of the digit sequence.
(4) a textbox is presented in the middle of the screen.

Please type in the digit sequence you heard in THE ORDER it was presented, i.e. if you heard (three, six, two) type 362 into the textbox.

NO data will be recorded during the practice.

Please, continue when you are ready.
Progress summary:

All data has not been collected for all groups seeking N = 24 for all groups:

- 6 participants from the experimental group have been processed fully (Mean age 70.83 years; 3 female, 3 male)
- 11 participants from the control group have been processed fully (Mean age 71.64 years; 6 female, 5 male)
- 5 from the normal-hearing group have been partially processed
Results – how do things look so far?

- The aided group appears to have definitely improved in terms of reaction time for the selective attention task...
- However, we need to analyze their results against our control group and normal group, to factor out any potential procedural learning effects, to determine significance.
- The control group does not appear to have improved as much as the aided group, but this could change with the full complement of data.
- At this stage, the working memory task does not appear to be as sensitive an index for potential cognitive improvements with aging but this may change once all data is collected and analysed.
Thank you to the University of Auckland for the opportunity

Thank you to:

- Our participants,
- University of Canterbury’s Department of Communication Disorders,
- and the Audiology team
References & websites:


- **Slide 2**: [http://www.highiqpro.com/working-memory-training](http://www.highiqpro.com/working-memory-training)


- **Slide 3**: [http://newvaluestreams.com/wordpress/?cat=20&paged=2](http://newvaluestreams.com/wordpress/?cat=20&paged=2)

- **Slide 3**: [http://jobsandnewstoday.blogspot.co.nz/2013/03/various-software-testing-approaches.html](http://jobsandnewstoday.blogspot.co.nz/2013/03/various-software-testing-approaches.html)

References & websites:

- **Slide 4:** Yang, S., Su, W., Bao, S. (2012). Long-term, but not transient, threshold shifts alter the morphology and increase the excitability of cortical pyramidal neurons. *Journal of Neurophysiology*, 108(6), 1567-1574.
- **Slide 9:** [http://www.millisecond.com/download/library/](http://www.millisecond.com/download/library/)