One conversation, two streams? Exploring attentive listening through the just-follow conversation task

William M. Whitmer[1,2] **David McShefferty**[1] & **Karolina Smeds**[1,3]

[1] Hearing Sciences – Scottish Section, University of Nottingham, Glasgow [2]School of Health and Wellbeing, University of Glasgow [3]ORCA Europe, WS Audiology, Stockholm, Sweden

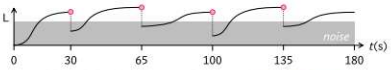
Motivation

The challenges of the passive listener in a conversation can involve multiple types of attention. One must **focus** their attention on the current signal of interest but may also need to **distribute** their attention across multiple signals of interest.

In the assessment of listening, the subjective impression is paramount to understanding activity limitations and hearing-aid uptake. [1,2] Here, we use the **Just Follow Conversation** task to probe how our perception of conversational listening ability is affected by different attentional demands. [3]

Just-Follow Conversation

In the original method-of-adjustment task, "conversation" = continuous monologue [4,5]



Monologue level adjusted to **just follow** by participant ↑↓ 4× over 3 min passage

Definition (task instruction) of **just follow** (in translation)

Focus on the talker and adjust the level of the speech until you can just follow what the talker is saying when you really concentrate on listening. That means that you will miss a word now and then, but you must comprehend the meaning of what is being said.

Summary

What does the JFC tell us about attentional demands of conversational listening?

- *A dialogue is composed of two sources, but it can be one stream*
  - When aided in a dynamic, realistic (café) background, the speech level necessary to follow a dialogue was equivalent to the level necessary to follow a monologue.
  - When unaided, regardless of background, the speech level required to follow a dialogue was equivalent to the level required to follow simultaneous monologues.
    - *Aiding can reduce distributed-attention cost of conversational listening.*
    - *Background changed how dialogues were heard relative to monologues.*

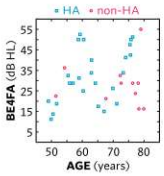
Is the JFC a viable measure of self-perceived listening ability? *Maybe...*

- Test-retest reliability on par with many speech intelligibility tests (e.g., HINT) *but...*
- Effects were small ⇒ potential difficulties for further explorations of effects of changes in technology effects
- Further work needed to optimise method & instruction
  - Use more natural conversations? Different adjustment than overall signal level?

Methods

Participants

- **36** adults (19 ♀) aged 48-79 years (median 66 years)
  - Better-ear 4-frequency pure-tone threshold average (BE4FA) 11-55 dB HL (median 31)
  - 25 bilateral HA wearers were tested aided & unaided
  - 11 non-HA users were tested twice unaided

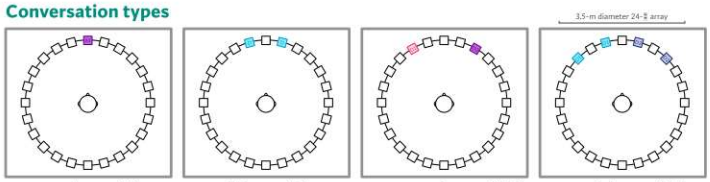


Stimuli

- Monologues & dialogues from IELTS practice tests

- Different ♀/♂ talkers & accents; no overlaps or backchanneling in dialogue
- 2 types of background noise presented from 24 at fixed overall level of 67.3 dB A
  1. Café (ARTE database [6]) – spectrotemporally dynamic Ambisonics background
  2. Same-spectrum noise (SSN) – 'steady-state' uncorrelated background
- Signal onset 5 s after background noise

Conversation types



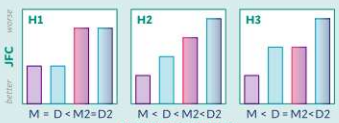
monologue (**M**) *1 continuous source* | dialogue (**D**) *2 alternating sources* | two monologues (**M2**) *2 simultaneous sources* | two dialogues (**D2**) *4 alternating sources*

Hypotheses : What are the attentional demands of conversational listening?

H1. Focused attention : one source/stream at any given time (ignoring overlap)

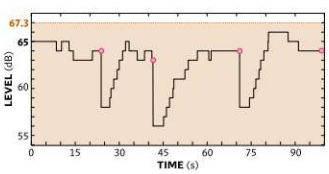
H2. Focused-distributed attention : greater demands due to switching sources

H3. Distributed attention : conversations comprised of separate sources/streams

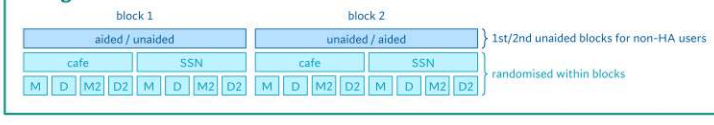


Procedure

- Participants adjusted signal level from starting level of 65 dB A to **just follow** using same instructions as Hygge et al.
- User-controlled end of each run ◦ (4×/trial)
  - Median run & trial times = 25 s & 103 s
- **JFC** = mean(just follow levels) – noise level (e.g., 63.75 – 67.3 = -3.55 dB SNR)



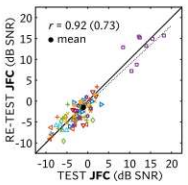
Design



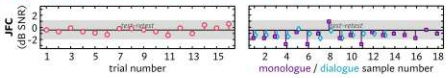
Results

Psychometrics : non-HA group test/retest results

- Test-retest difference |Δ| = **1.5 dB** ± 0.5 (σ)
  - No test-retest differences (μ or σ) between café & SSN

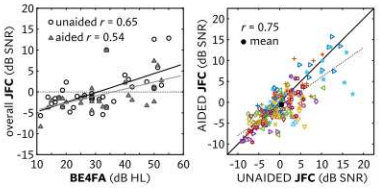


Psychometrics : procedural & stimulus effects

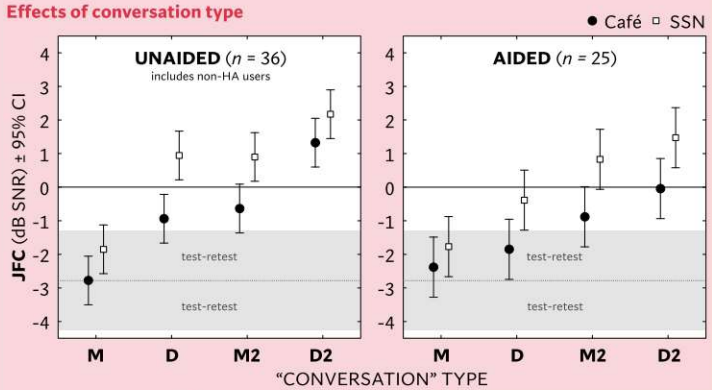


Main effects : HA group (RMANOVA)

- **Aiding** [η^2 = 0.26; p = 0.008]
  - Aided < unaided JFCs (1.1 dB)
  - Both were correlated w. BE4FA
- **Background** [η^2 = 0.55; $p \ll 0.001$]
  - Café < SSN JFCs (1.2 dB)
- **Conversation** [η^2 = 0.47; $p \ll 0.001$]
  - M < D = M2 < D2 JFCs (0.8-3.6 dB)



Effects of conversation type



Aided listening in café

H1 (focused attention)
1 dialogue ~ 1 monologue

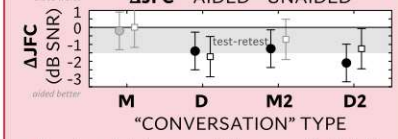
Aided listening in SSN

H2 (focused+ attention)
1 dialogue > 1 monologue

Unaided listening

H3 (distributed attention)
1 dialogue ~ 2 monologues

ΔJFC = AIDED - UNAIDED



- Hearing aids improved (decreased) JFCs for dialogues (D) but not monologues (M)

[1] Laplante-Lévesque A, Hickson L, Worrall L (2012) What makes adults with hearing impairment take up hearing aids or communication programs and achieve successful outcomes? *Ear Hear* 33(1): 79-93.
[2] Saunders GH, Forsline A, Fausti SA (2004) The performance-perceptual test and its relationship to unaided reported handicap. *Ear Hear* 25(2): 117-126.
[3] Makov S, Pinto D, Har-ShaiYahav P, Miller LM, Zion Golumbic E (2023) "Unattended, distracting or irrelevant": Theoretical implications of terminological choices in auditory selective attention research. *Cogn* 231: 105313.
[4] Hygge S, Rönnberg J, Larsby B, Arlinger S (1992) Normal-hearing and hearing-impaired subjects' ability to just follow conversation in competing speech, reversed speech and noise backgrounds. *J Sp Hear Res* 35: 208-215.
[5] Larsby B, Arlinger S (1994) Speech recognition and just-follow-conversation tasks for normal-hearing and hearing-impaired listeners with different maskers. *Audiol* 33: 165-176.
[6] Weisser A, Buchholz JM, Oreinos C, Badajoz-Davila J, Galloway J, Beechey T, Keidser G (2019) The Ambisonic recordings typical environments (ARTE) database. *Acustica* 105: 695-713.

Work is supported by the UK Medical Research Council [grant number MR/X003620/1] & WS Audiology.