Listening effort over time depends on attention mobilization in anticipation of difficult listening

Michael A. Johns1, Regina C. Calloway1, Lien P. Decruy1, I. M. Dushyanthi Karunathilake2, Samira Anderson1, Jonathan Z. Simon1,2,3, & Stefanie E. Kuchinsky4

1Institute for Systems Research
Dept. of Electrical and Computer Engineering
Depart of Hearing and Speech Sciences
2Dept. of Biology
Correspondence: maj@umd.edu

Background
Understanding speech is difficult, especially in noisy contexts or environments.

Alain et al., 2018; Killion et al., 2004; Zekveld et al., 2010

Sustained listening compounds this difficulty.
McGarrigle et al., 2017

Listeners have limited cognitive resources to handle difficult listening situations.

How does anticipated difficulty affect listening effort during a sustained listening task?

Attention Mobilization

• How an individual prepares their attention in anticipation of an upcoming task or stimulus.

Effort Allocation

• How an individual deploys cognitive resources during the task or stimulus.

In anticipation of more optimal listening conditions, listeners may not mobilize (or prepare) their attention as greatly. As such, the amount of attention they allocate (or deploy) will likely not be as great.

But, if listeners anticipate more difficult listening situations, they may need to both mobilize and allocate extra attention—or if overwhelmed—may ultimately under-allocate their attention.

Methodology

19 young adults (M_age = 21.1 y, with normal hearing) listened to 60-sec long audiobook passages (The Legend of Sleepy Hollow)

0 dB SNR: two competing talkers presented at the same loudness

-6 dB SNR: target talker presented 6 dB softer than competing talker

Each passage was presented three times in a row

Magnetoecephalography (MEG) and eye-tracking data were recorded

Results

No effect of SNR or presentation order on accuracy to comprehension questions following each passage.

Self-reported intelligibility was significantly reduced in the -6 dB SNR condition (r = -4.40, p < .001)

Baseline pupil size increased from the 1st to the 2nd presentation and remained high at the 3rd presentation.

At low baseline pupil sizes, listeners must allocate extra effort in the harder condition (-6 dB SNR) due to anticipatory attention being under-mobilized.

At intermediate baseline pupil sizes, there are little-to-no differences in the amount of effort listeners allocate between the two conditions, suggesting optimal attention mobilization.

At high baseline pupil sizes, listeners initially do not differ in how much effort is allocated in the two conditions.

By the second presentation, listeners appear to “give up” or under-allocate effort to the harder condition.

By the third presentation, listeners under-allocate effort at first, but eventually recover, benefitted by the additional repetition.

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References


