The Stimuli used: We analyzed the expressions of various behavioral and physiological measures have been used in research settings to assess listening difficulty (e.g. the dual-task paradigm, subjective rating scales, pupillometry). However, all these measures have some drawbacks (as listed alongside).

Our long-term goal is to determine the feasibility of using real-time facial expression recognition algorithms to quantify listening difficulty in-situ. We selected facial expressions because: 1) it may be recorded more naturally and is an easier task, 2) it may be recorded in real-world listening situations by the camera in mobile devices, while a person is filling out in-situ surveys (i.e. Ecological Momentary Assessment6). 3) With advancements in technology and if they could be analyzed in real-time, facial expressions may be useful for tele-audiology.

The goal of the present study was to explore how listeners’ facial expressions changed as a function of speech listening difficulty.

We hypothesized that with increasing difficulty in speech listening, listeners would be more likely to generate facial expressions that reflect negative emotions such as confusion and frustration.

METHODS

- Participants: 20 adults, aged 22 to 37 (Mean = 27.45, SD = 4.92) with normal hearing.
- Stimuli used: Speech perception testing using iMotions.
- The facial expressions of individuals were recorded using a camera (Logitech HD Pro Webcam C930) and the Emotient FACET software (v6.3.6973.6; iMotions) at various signal-to-noise ratios (SNRs: -3.5, -7.5, -11 dB; presented randomly), and in quiet. Participants were also asked to subjectively report their listening effort for each condition.
- The iMotions software assesses the movement, texture, and shape of the face and defines facial expressions as a combination of action units. Different action units work synergistically to produce specific facial expressions such as confused and frustrated.
- The iMotions software allows for the assessment of individual action units and allows for the generation of facial expressions that reflect negative emotions such as confusion and frustration.
- With advancements in technology, facial expressions may be detectable in real-time, which is an important aspect of tele-audiology.

RESULTS

- For analysis, the evidence levels obtained were first baseline corrected. Following this, the graph above was obtained for each condition. The peaks of this graph denote a higher probability of presence of the emotion. The positive area under the graph (integrated value) was obtained for each individual for different SNRs. This was then averaged across individuals and conditions to obtain the graphs represented below.

CONCLUSIONS AND IMPLICATIONS

- Although there is no graded change in facial expression for each condition, the main effect of SNR suggests that the evidence level for confusion, frustration and negative emotions increased monotonically as SNR decreased. These findings support the feasibility of using facial expression to assess listening difficulty, at least in controlled environments.
- Our next step is to determine the relationship between facial expressions and pupillometry, an established method of measuring listening effort, during a more normal time window centered around the offset of the stimulus.

ACKNOWLEDGEMENTS

National Institute on Disability, Independent Living and Rehabilitation Research (NIDILRR) 90RE52002(010).

CONTACT

Contact soumya-venkitakrishnan@uiowa.edu for further information.

REFERENCES