Conversational skill development strategies for cochlear implant users

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Introduction

• Cochlear implant (CI) users typically need optimum conditions to hold a satisfactory conversational experience: quiet environment, one-to-one setting, communication awareness to avoid both parties talking at once.
• Recent improvements in CI devices mean it is now realistic for users to attempt to engage in natural conversations in which overlapping talk is a common occurrence.
• There are no established training materials that hearing professionals can use to help CI users deal with the problem of simultaneous talk.
• Acoustic analysis of typical turn-taking behaviour has suggested various strategies that normal-hearing listeners employ to manage their conversational exchanges.
• Some relevant cues are transmitted through the CI; other aspects crucial to a normal-hearing listener’s perception and action remain inaccessible.
• Training materials may promote key conversational competencies in (i) listening skills and (ii) speaking skills.

Challenges for CI users

• CI devices have low spectral resolution: hard to distinguish one talker from another, and even harder to segregate two concurrent talkers.
• Voice fundamental frequency (F0) is not well represented in CI devices: difficult to identify social actions such as turn completion that are realised by prosodic cues.
• 26 adult CI users surveyed (HISQUID) [5].
• Overlapping talk is challenging.
• “When no background noise is present, can you effortlessly participate in conversations with friends or family members? (e.g., after dinner)?” Mean response 5.7 (5=frequently, 6=almost always).
• “When multiple people are talking simultaneously, can you effortlessly follow conversations of friends and family members?” Mean response 2.8 (2=rarely, 3=occasionally).

Conversational dataset

• 4 friends (native English-UK) chatting informally; 3 hours of data [3].
• Annotation: segmented by turn construction unit (TCU); orthographically transcribed; overlap competitiveness scored; xml data created using ELAN annotation format [1].

Turn-taking

• Conversation analysis [6] shows that while overlap occurs frequently, speakers generally seek to minimise its duration.
• Turn content, form and length reflect social action performed by speaker.
• Turns may be segmented in Turn Construction Units (TCUs): speaker projects what kind of a unit it is and when it is likely to end.
• Transition-relevant places (TRPs) occur at TCU boundaries and make it possible for transition between speakers.

Software development

1. Listening skills

• Objective: understand multi-party conversation.
• User tasks are designed for repeated listening practice and incremental learning.
• 3 key skills:
  - identify main talker
  - recognise speech
  - understand social action

2. Speaking skills

• Objective: join in a multi-party conversation.
• Initial stage: control voice pitch and loudness; provide normative user data.
• Identify TRPs as suitable times to join conversation, i.e. begin talking.
• Use overlaps appropriately – competitiveness and overlap onset position measured with acoustic factors.

Software evaluation

• 5 expert CI-users recruited through Sheffield Cochlear Implant Service.
• They discuss conversational experiences and awareness of overlap, and iteratively evaluate listening and speaking software.
• Speech materials graded – first two-speaker clear transitions vs. one-speaker increments; – later including overlaps and increasing number of speakers.
• User tasks graded – four speakers’ options in multiple choice selection; including contextual clues; – gradually increasing number of options; reducing/removing contextual clues.
• Open source software release in March 2015.
• We expect that learning interaction strategies for handling OT will complement technological advances and will increase CI-users social participation and integration.

References


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Homepage: http://overlap.rcwtec.dcs.shef.ac.uk