
Vocal comfort in simulated acoustic environments

A Data Management Plan created using DMPonline

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Template: Swedish Research Council for Health, Working life and Welfare

Grant number: 2019-01329_Forte

Project abstract:

The acoustic environment is of certain interest in work environments in which oral communication is a primary working tool. As retirement ages are increasing, the same is true for the demands for effective communication at older ages. Factors important to communication, such as voice, hearing and cognitive functions, change with normal aging. However, the knowledge of how room acoustics affect the communicative abilities in the older working force is sparse. The aim of this project is to investigate how healthy adults (ages 20–72) adapt their communication to room acoustic conditions. Special emphasis lie on how acoustic parameters related to the talker, such as room gain and voice support, affect factors such as voice use, speech rate, pausing and language complexity. Participants are divided into separate age- and gender groups, enabling for analyses of age- and gender-related differences. The results of this project will increase the understanding of communication changes due to normal aging, and how acoustic environments affect communication strategies. This will bring us closer to understanding how work environments can be adapted for the older employee, enabling for a longer, healthy, work life.

Last modified: 22-11-2022

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Data Collection

Overview:

All data are original data collected at DTU during the time period October 2021 - May 2022. Data will be collected from research participants during one or two sessions with researcher GÖW. In the first session, data from cognitive testing and self-reports on demographics and relevant health issues are collected. Cognitive tests are performed at DTU Lyngby campus using a DTU laptop and the software Psychopy. Demographics and health data are collected using a digital questionnaire (Excel survey, provided by DTU Onedrive)

In the second session, the participant is invited to the audio-visual immersion lab (AVIL) at DTU Lyngby Campus, building 354. The participant is equipped with a head-mounted microphone, a virtual reality headset and a virtual reality hand-held device. This enables for recording of speech data as well as reaction times on visual stimuli. The participant also answers self-assessment questions orally, and the answers are recorded as audio files.

All raw data files are named with date and a project-specific participant ID number. All raw data are pseudonymized, hence they contain no names, CPR-numbers or contact information of participants.

Hearing screening with pure-tone audiometry is also performed. If the participant signs a specific agreement, data of hearing level thresholds on right and left ear are stored in a participant database upheld by Hearing Systems (DTU Sundhetsteknologi). Otherwise, hearing level thresholds will not be stored, and only information regarding the test having been performed is noted in the project specific database. This indicates that the participant passed the test, because if not, the participant would be excluded from taking part in the study.

Types of raw data:

- Audio files with participants' speech (.wav)
- Test results from cognitive tests N-back and SART (.xls)
- Demographic and health-related data of participants (.xls)
- Self-assessment questionnaires (VFI, PSS, PSQI)(.xls)
- Reaction time data (.xls)

Specifics of raw data and data processing:

Test results from cognitive tests:

Two tests are performed: N-back and Sustained Attention to Response Task (SART). The tests are performed on a DTU laptop using the software Psychopy. Raw data are automatically stored as xls-files in the project folder on the DTU-server (M:drive). Test results (% correct answers and reaction times) are noted as variables in a project specific database.

Demographics, relevant medical history and self-assessment questionnaires:

An online survey (built on Excel survey provided by Office 365 and the DTU Onedrive) is used to collect data on demographics and relevant medical history, as well as self-assessment instruments on vocal fatigue (Vocal Fatigue Index), stress (Perceived Stress Scale - 10) and sleep quality (Pittsburgh Sleep Quality Index). Survey responses are automatically stored in researcher GÖWs Onedrive folder, and data is moved weekly from Onedrive to the project folder on the DTU server (M:drive).

Audio files:

The audio files are recorded and initially saved on a local folder on the desktop computer connected to the Audio Visual Immersion Lab at DTU Lyngby Campus. After each session, all recorded data are moved to a project specific folder on the DTU server. The sound files are processed using MATLAB for acoustic analysis of the voice. The following variables will be extracted to the project specific database:

- Voice levels (Leq, max, min [dB])
- Fundamental frequency (F0 mean, max, min, [Hz])

Reaction time data

Reaction time data are initially stored in a local folder on the desktop computer connecting the virtual reality system to the audio visual immersion lab. After each session, all recorded data are moved to the project specific folder at the DTU server. Means and standard deviations for reaction times will be calculated for each experimental task, and are then extracted as variables to the project-specific database.

Self-assessments

During the experiments, the test leader will ask the participant eight questions per task. The replies are recorded as audio files. After each session, the responses are transferred as variables to the project-specific database.

Project-specific database:

A project-specific database will be created in order to enable for statistical analyses on differences between groups (age and gender). The database will be located on GÖWs M-drive on the DTU server during data collection. A

Data amount:

Estimated number of participants is 80. Pilot tests have shown that each participant will generate ca 3,6 GB data, resulting in a total of ca 290 GB.

The project involves use of personal data, such as age, gender, profession, medical history as well as results from screening tests on hearing status and mental health. The project also involves audio files with the participants voice.

Data management follow the requirements set by Danish authorities and internal policies at DTU such as DTU Danish Conduct for Research Integrity, DTU Policy for the Retention of Primary Material and Data as well as DTU Information Security Policy. The project is carried out under the ethical permission H-16036391 from the Danish Science-Ethics Committee/Capital Region Committee.

Data Storage

During data collection, all raw and processed data will be stored in researcher GÖWs M-drive on the DTU server. This ensures constant back-up of data. After the data collection finishes, copies of raw and processed data will be shared with project manager Jonas Brunskog at DTU Elektro using an encrypted USB.

All raw and processed data are pseudonymized, so that every test participant has a personal identification code. An identification key is kept in physical paper form in researcher GÖWs locked office in a locked cupboard at DTU Lyngby Campus. After completion of the data collection, the identification key is destroyed.

Documentation

A folder with metadata will be stored in the data folder as well as on the ACT department O:drive. This folder contains information of researchers involved in the data collection, documentation on how to run the experimental set-up in the audio-visual immersion lab, room simulation specifications as well as copies of all test materials (cognitive tests, questionnaire forms and experimental protocol).

See above. In addition, a file containing explanations for all variables in the project database, including variable coding, will be stored together with the database.

Data Sharing

Data will, due to confidentiality, only be shared with researchers involved in the project. Metadata will be made freely accessible, to enable for possible collaborators to request data from the principal investigator. All requests for data will be considered, and data will be shared if this is not in conflict with ethical or confidentiality agreements.

See above.

Long-term Preservation

Raw data files, processed data and the project database will be stored on project manager and DTU employee Jonas Brunskogs M:drive at DTU.