

LISTENING EFFORT IN EATERIES

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1 Introduction

Eateries such as restaurants, cafeterias, and food courts can be noisy. For instance, they tend to have large crowds of people talking, and often they also have music playing. Most eateries also lack sound-absorbing treatments, such as curtains or carpet, further contributing to the high level of background noise. These factors force people in eateries to raise their voices and increase the effort that they exert during listening, known as listening effort. Despite the relevance of this issue, studies of people's experience of listening in eateries have been limited to the use of subjective measures [1]. In addition, studies of the acoustical environment of eateries have been limited to sound level measurements [2]. Thus, the current study has three broad aims. The first aim is to objectively measure the effort that people exert while listening in eateries, and the second aim is to determine how this effort changes with the quantity and quality of background noise. Finally the study will acoustically characterize the associated noise profiles.

2 Method

2.1 Noise measurements

A stereophonic headset and a digital recorder will be used to collect 10-minute samples of ambient noise in four restaurants, two "quiet" and two "noisy". Collecting samples from "quiet" and "noisy" restaurants will allow the study to determine whether noise in these environments, in addition to their quantitative differences (i.e., the sound level), also differ qualitatively (e.g., the frequency content). The specific noise qualities that will be considered include LAeq, L10, L90, LPeak, as well as 1/8 and 1/3 band spectra

2.2 Speech perception task

Fifteen younger adults will participate in the study. They will complete a task that requires them to listen to sentences, which will be presented among the background noise recorded from restaurants, and repeat back the final word. These sentences will always be presented at the same level, but two variables will be manipulated. The first manipulation will be the type of restaurant from which the background noise was recorded: "quiet" or "noisy". The second will be the level of background noise: no background noise, signal-

to-noise ratio (SNR) = +4, SNR = +1, and SNR = -2. To avoid interference noise, participants will complete the task in a double-walled sound-attenuated chamber, with the stimuli presented via insert headphones.

2.3 Functional near-infrared spectroscopy

As participants complete the task, the listening effort that they exert will be measured objectively using functional near-infrared spectroscopy, a non-invasive optical brain imaging method. This method requires the use of a sensor pad affixed to participants' foreheads, which contains four light sources and 10 light detectors. The light sources emit near-infrared light into the scalp above the prefrontal cortex (PFC), and the light detectors measure the amount of light that returns to the sensor pad. Based on the amount of light that results, the concentration of oxygen in the PFC will be calculated. This will serve as an objective measure of the listening effort.

3 Expected results

It is predicted that as SNR decreases (i.e., as the level of background noise increases), the listening effort that participants exert, as indexed by PFC oxygenation, will increase [3]. It is also predicted that oxygenation of the left lateral region of the PFC, including the inferior frontal gyrus, will be most sensitive to changes in SNR. There is no prediction as to whether listening effort will differ across "quiet" and "noisy" restaurants, nor is there a prediction as to whether and how noise will differ qualitatively across these environments.

4 References

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