Temporal profile of contextual adaptation in horizontal sound localization

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1. Introduction

Background
Localization of a sound can be affected by:
- acoustics of the environment (reverberation)
- temporal arrangement of targets (precedence effect)
- sensitivity to localization cues, etc.

In Kopčo et al. (2007), trials with target preceded by distractor were interleaved with no-distractor trials with target alone. Localization shifts were observed not just in trials with distractor, but also in no-distractor trials.

Current study
Examine the influence of context on localization performance.
Design similar to Kopčo et al. (2007).

2. Methods

Setup
Array of 8 loudspeakers (Figure 1):
- 7 used to present target sound
- 1 (frontal) to present distractor

Experimental procedure
Nine normal-hearing subjects
Stimuli
- target: 2-3 ms of noise burst presented randomly from one of the 7 target loudspeakers
- distractor: identical noise burst as target, presented from (known) frontal location
- distractor-target onset asynchrony was fixed: SOA of 25, 100 or 400 ms.

Data analysis
Consider only no-distractor trials from all blocks. Analyze difference in bias between distractor and baseline blocks.
Plot across-subject mean and within-subject standard error.

3. Results

Figure 3 Mean responses on no-distractor trials for different "inducing" distractor trial types and probe-trial-only baseline.

Responses on no-distractor trials for different distractor trial types and probe-trial-only baseline.

Contextual adaptation will build-up quickly (within 5 minutes).

Figure 4 Bias in responses induced by context (bias re. probe-trial-only baseline).

Figure 5 A) Bias in responses re. actual target location, averaged across target locations. B) Bias in responses re. probe-trial-only baseline, averaged across inducing trial types.

Figure 6 Build-up and decay of contextual bias as a function of the repeat number within a block, averaged across target locations and inducing trial type.

Figure 7 Response profiles for different distractor trial types (pre-adaptation baseline block).

Hypotheses
Contextual plasticity builds up and decays quickly (within 2-3 minutes)

3. Summary and Discussion

Summary
Responses on probe trials shifted away from the location of the (now missing) distractor.

The effect size
- depends slightly on "inducing" task difficulty (SOA), grows slightly with frequency of "inducing" trials,
- depends on distance of probe target from the distractor,
- fast build-up and decay

Parameters of context for future studies: 25% of probe trials, 25 or 50% 25% 10%.

Discussion
Contextual plasticity
- unlikely to be related to acoustic factors like reverberation (because shifts had equal strength also for SOA 400 ms),
- could be either bottom-up or top-down effect
- is likely to affect performance in many common and laboratory situations
- relatively strong contextual bias possibly also due to absence of visual input during experiment (subjects had their eyes closed while plasticity was induced and tested)

Motivation for future studies - examine effect of:
- distractor location
- visual input
- top down vs. bottom-up, etc.

References:

[Supported by NIH #1R03TW007640 and VEGA #1/3134/06]