1. Background

Attention facilitates selection of objects, events, or spatial regions in complex scenes. Very few studies focused on the effect of attention on auditory localization. Even fewer studies looked at whether the effect is modality-dependent.

2. Experiment

**Motivation:**
Few previous studies asked whether directing automatic or strategic attention by an auditory cue can improve sound localization (Spence & Driver, 1994; Sach et al., 2005; Kopco et al., 2001). Results:
- Improvements in reaction times (Spence & Driver, 1994), but
- small (Sach et al., 2000) or no (Kopco et al., 2001) improvements in performance
Possible reasons:
- Tested SOAs too short to orient attention
- Auditory cue not efficient because auditory not primarily a spatial modality

**Current study:**
Perform behavioral experiment to determine:
- Whether attentional effects occur at longer SOAs
- Whether auditory control is modality-dependent (visual vs. auditory cue)
- Whether eye movements affect results

**Hypotheses:**
- H1: Attention will affect performance at long SOAs by decreasing bias and variability of responses
- H2: Effect of attention will be modality- and eye-position dependent

**Procedure:**
- 10 one-half hour sessions
- Each session consisted of 7 blocks, one per measurement type
- 2 modalities (auditory, visual)
- 3 informativeness (no cue, low, high)
- One each of 10 locations x 3 (SOAs) trials
- SOA: 50, 100, 200 ms

**Stimulus:**
- Sound source at SOA 1600 ms
- Acoustic stimuli were filtered to equalize amplitude responses

**Setup:**
- Subjects seated in front of a computer (Fig 1A), surrounded by a semicircle with pictures of speakers
- Stimuli were presented using a numeric keypad on computer

**Results:**
- Across-subject mean and standard error in the difference between responses with and without a cue
- Auditory Cue:
  - Causes a combination of:
    - A medial bias (2°)
    - Bias towards attended side
      - Rightward shift, 2°
    - Independent of SOA
  - Visual Cue:
    - At short SOA medial bias similar to auditory cue
    - At larger SOA, bias always towards the cued side (right)

**Discussion:**
The effect of cuing is modality and eye-position dependent.

3. Methods

**Experiment 1**
12 normal hearing subjects

**Stimulus:**
- Target: broadband 2-ms click, presented at 80°
- No fixation

**Procedure:**
- 10 one-half hour sessions
- Each session consisted of 7 blocks, one per measurement type
- 2 modalities (auditory, visual)
- 3 informativeness (no cue, low, high)
- One each of 10 locations x 3 (SOAs) trials
- SOA: 50, 100, 200 ms

**Setup:**
- Subjects seated in front of a computer (Fig 1A), surrounded by a semicircle with pictures of speakers
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**Results:**
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  - Visual Cue:
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4. Results: Mean Responses

**Experiment 1**
FIGURE 2 Bias in responses induced by the cue. Across-subject mean and standard error in the difference between responses with and without a cue.

**Experiment 2**
FIGURE 3 Effect of fixation on the bias in responses induced by a visual cue at SOA 1600 ms. Across-subject mean and standard error in the difference between responses with and without a cue.

5. Results: Standard Deviations

Only 50%-informativeness data shown because 85%-informativeness data had only 2 measurements per repeat on unattended side - not enough to estimate standard deviation. However, collapsed data are very similar (see Fig 5).

**Experiment 1**
FIGURE 4 Standard deviation in responses induced by the 50%-informatively cue. Across-subject mean and standard error in the standard deviations observed with vs. without the cue.

**Experiment 2**
Effect of eye fixation on performance with visual cue at SOA = 1600 ms (Fig 5)

**Discussion:**
- Very small effect of visual or auditory cuing

6. Summary

**H1:** Attentional cuing can influence auditory localization
- by inducing biases (not clear whether these biases are improvements)
- by increasing variability in responses on unattended side at cue-to-target stimulus onset asynchronies of up to 1600 ms

**H2:** The effect of cuing is modality and eye-position dependent
- Auditory cuing:
  - Causes bias and has no consistent effect on variability
- Visual cuing:
  - Has effect that has covert and overt components (distinguished by fixation)

7. References and Acknowledgement


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