Exploring How Sight and Sound Interact

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Introduction:

It is known that what you see affects how you hear things. Examples of this are:

- The **McGurk effect** – in which observers watch a video of a woman mouthing a certain syllable. The video has been dubbed with a different syllable, with the result being that the observer hears an entirely different syllable. (McGurk & MacDonald, 1976)
- The **ventriloquist effect,** where the ventriloquist appears to 'throw' his voice to make the dummy talk by synchronizing the dummy's mouth movements with his speech. (Bertelson, 1999)

Aims:

During this project, I aimed to:

- Establish whether non-facial visual stimuli affect how we hear non-speech tones.
- Discover whether this interaction occurs to the same extent as speech and facial interactions.

Method:

- Experiments were conducted on a computer in a sound-proof room.
- Each experiment consisted of an **Audio-Only (AO) block**, in which participants only heard pairs of sounds, and an **Audio-Visual (AV) block**, in which an image appeared on the screen, at the same time as one of the sounds in each pair.

The Sounds: Varying amplitude modulated tones. A sound whose amplitude/loudness varies/fluctuates with time. The most modulated tone was played in either the first or second intervals randomly.

Modulation waveform of shape

20% Modulation

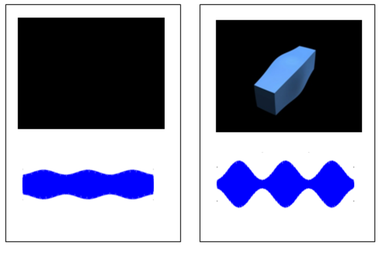
52% Modulation

The Shape: A contracting and expanding cuboid. This was the same shape for each trial.

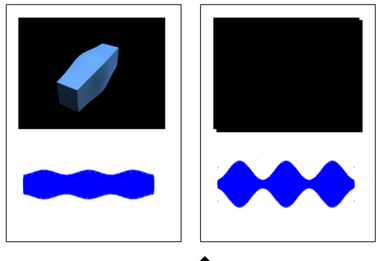
The cuboid expanded and contracted with the same waveform as the sound!

There were 3 key conditions:

1. AV> in which the visual was paired with the most modulated sound.
2. AV< in which the visual was paired with the least modulated sound.
3. AO the Audio-Only condition



AV> Condition: The visual stimulus is paired with the most modulated sound.



AV< Condition: The visual stimulus is paired with the least modulated sound.

In my project, I conducted 3 experiments, each varied in an attempt to test the hypothesis that what you see affects what you hear.

Human subjects (aged 18- 40) performed one experiment each. They were required to listen to the tones over headphones whilst watching the screen, and make a decision by pressing a key on the keyboard after both sounds had been heard.

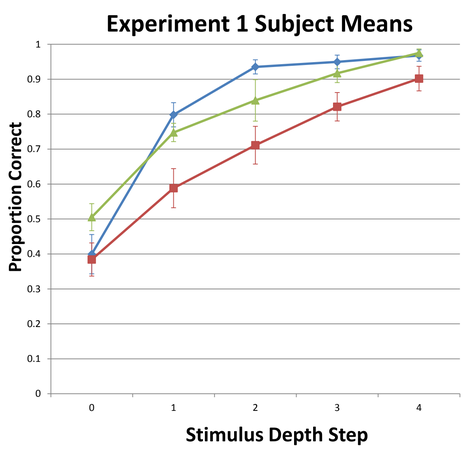
Tasks:

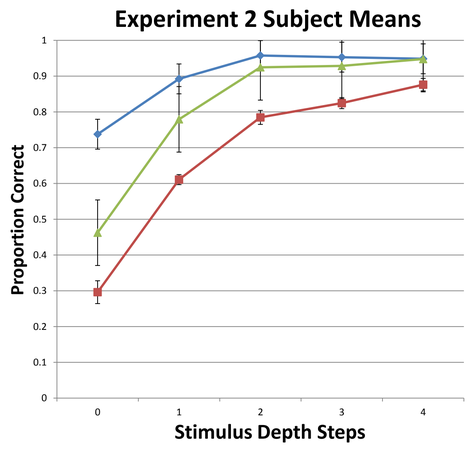
Experiment 1: Subjects were asked to listen to pairs of sounds, and judge which sound had the larger amplitude modulation. The task was the same in both the Audio-Only and the AV block. In the AV block, the visual stimulus was always paired with the second sound.

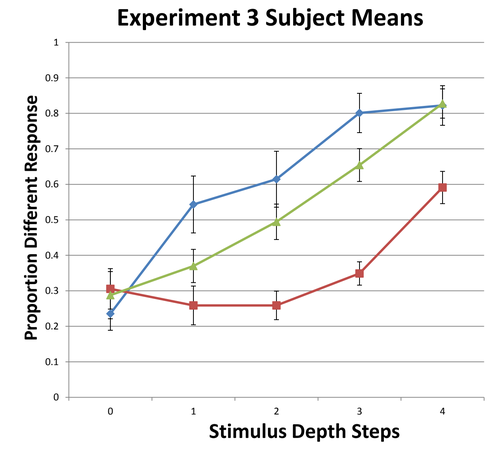
Experiment 2: The task in Experiment 2 was the same, as 1, but to address the possibility of response bias, the visual stimulus could now appear with either the first or second sound in the AV block

Experiment 3: here participants had to listen to pairs of sounds, and say whether they were the same or different. Like experiments 1 and 2 sounds in the AO and AV conditions.

Results:







The results are plotted as the proportion of trials a subject answered correctly as a function of Stimulus Depth Steps. The stimulus depth step is the difference in modulation depth between the two sounds: 0 being no difference and 4 being the largest difference.

SPSS was used to analyse the data collected using ANOVA.

What Do These Graphs Mean?

1. Subjects were significantly less accurate in the AV< condition than the other two conditions, AV> and AO, sound in all 3 experiments.
2. This doesn't change whether the visual object appears in the first or second interval - subjects aren't just biased to choose one particular interval.
3. The same pattern of results can be seen on Experiment 3 as well, showing that the results are not caused by a bias to select the interval with the visual stimulus.

Subjects ARE influenced by the visual stimulus!

References:

Bertelson, P. (1999). In: Cognitive contributions to the perception of spatial and temporal events. 347–363*; McGurk, H., & MacDonald, J. (1976). Nature, 264, 746–748.*i

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