Sansning og perception

Weighting: 2/17

Shams, L., Kamitani, Y., & Shimojo, S. (2002). Visual illusion induced by sound. *Cognitive Brain Research*, *14*(1), 147–152.

## Agenda

* What is perception?
* Visual illusion induced by sound
* Motivation and hypothesis
* Method
* Results
* Authors’ conclusion
* Criticism
* Greater perspective

## What is perception?

* Our conscious experience of the world
* Combining information from several modalities (such as auditive and visual information)
* Combines bottom-up (Data driven: The system registers individual elements of stimulus and combines them into a common object) with top-down processes (Knowledge-driven: Sensory information interpreted in light of prior knowledge, concepts, expectation, ideas, context, cultural influences) to take in and understand sensory information
  + Only top-down means hallucinations
* Illusions

## The article: visual illusion induced by sound

Explores cross-model interactions in which other modalities affect vision (and not vice versa, e.g. McGurk and ventriloquism (mistakenly localising sound to visual stimuli)). They refer to the examined phenomenon as sound-induced illusory flashing. Authors argue that this cross-modal interaction reflects a phenomenological change in the visual stimuli, participants actually *perceiving* more flashes than were shown.

### Experiment 1

Examines whether the sound-induced illusory flashing effect is a perceptual illusion or due to artefacts.

#### Method

Figure 1: Computer-based experiment

Figure 2: Stimulus Onset Asynchrony (23 ms)

#### Results

Figure 3 displays the sound-induced illusory flashing effect. If more than one beep is shown participants perceived more than the one flash which was shown. The effect is not linear.

4a: testing the difficulty of the task, control data. Linear increase confirms that participants are able to perceive the flashes within the given time intervals.

4b: ensuring that participants didn’t mistakenly report number of heard beeps rather than number of perceived flashes.

**Figure 5: When 1 flash is shown along 0-1 beep, participants perceive 1 flash. When 2 flashes are shown along 0-1 beep participants perceive 2 flashes. However, when 1 flash is shown along 2 beeps participants also perceive 2 flashes.**

### Experiment 2

Behaviourally measuring temporal window within which sound can alter vision.

#### Method

Figure 6: Altering SOA

#### Results

Figure 7: If the beeps occur long enough before or after the flashes, we do not see the sound-induced illusory flashing effect.

About 100 ms temporal window, “This ~100 ms temporal window of interaction is interesting as it is consistent with integration window of polysensory neurons in the mammalian brain” (p. 150).

### Authors’ conclusions

Experiment 1: Yes, sound-induced illusory flashing effect can be achieved.

Experiment 2: The temporal window is roughly ± 100ms

Figure 8: The question is not whether vision interferes with auditory stimuli or vice versa but that discontinuous stimuli (here, the beeps), interfere with continuous stimuli (the flashes).

This goes against the modality appropriateness hypothesis (perception gives preference to the sensory **modality** best suited to the task at hand)

They claim that the illusory flash effect is different from auditory driving (changing perceived frequency of flashes by changing frequency of initially synchronous auditory stimulus – 10 flashes/sec can be perceived as 7 or 22) because auditory driving is ‘more’ temporal and thus favours hearing

## Criticism

* Small samples (N = 8)
* Few test trials (25%)
* Are the two samples even comparable? Skewed age and gender distributions.
* Based on figure 4, authors conclude that the sound-induced illusory flashing effect reflects a *phenomenological* altering of the visual stimuli. However, data from figure 4 includes 0 and 1 beep trials only; one might argue that the task is of a different nature when the task includes more beeps, reflecting conflict between top-down and bottom-up processes, priming, etc. (see discussion for authors’ remarks on these issues)
* Error bars are quite large; conclusions are based on means…
* **Might not go against the modality appropriateness hypothesis:**
  + Spatial tasks are usually determined mainly by vision, as no other modality is as accurate
  + Hearing provides greater temporal accuracy so may be prioritised over vision

## Greater perspective

* Kanizsa’s triangle (we see a triangle, even though there isn’t one).
  + The visual pathway -> ganglia (paro=small, magno=big) -> receptive fields
  + **magnocellular system**: The component of the primary visual processing pathway that is specialized in part for the perception of motion and other aspects of stimulus change; so named because of the relatively large neurons involved.
  + **parvocellular system:** The component of the primary visual processing pathway that is specialized in part for the detection of detail and color; so named because of the relatively small size of the neurons involved.
* Multisensory integration
  + Phantom limb illusion
* Explaining the illusion
  + If you were to build a system that could judge number of flashes even though the system has a ‘fault’ of e.g. an after image (visual persistence); you’d have to integrate information from other sources, e.g. auditive stimuli. In real life we usually judge a situation based on integration of all relevant inputs.
  + Another ‘fault’ is the difference in speed of light and speed of sound, possibly explaining the temporal window of interaction
* Other effects that influence perception of sensory inputs, top-down versus bottom-up, e.g. cocktail party effect
* Attentional blink
  + Ressource model: ressources are to scarce to encode 2 or more targets
  + Gate model: Encoding temporarily ‘stops’ when target is spotted
* Mental representations: when the perception/representation of a flash is altered by a beep which follows it, it is actually the *memory* which changes. See **sensory memory** (*before* short-term memory)
* Multisensory neurons
  + Neurons which fire specifically when sensory information is integrated – found in many areas of the brain but especially at borders between main lobes