

9.63 Experiments Set 2

Presentations: Lecture #13

Experiment 1:

Beyond bisection hyperacuity: Given three points arranged in a line, humans possess the remarkable capability of very accurately determining whether the middle dot exactly bisects the imaginary line connecting the two outer dots. In fact, our accuracy on this task is finer than the diameter of a single photoreceptor in the retina. In this experiment, you will explore whether there is something special about bisection. Are we as good at determining whether the middle dot is at precisely a third of the distance from one of the outer dots? Or a fourth? In principle, given the ability to do bisection tasks, we should be able to perform these other tasks as well. Is this really the case? The results will have implications for the mechanisms underlying hyperacuity – an area of great interest in visual perception.

Experiment 2:

Face detection in the periphery: We are very good at discriminating between faces and non-faces in the fovea (i.e. looking directly at the patterns). How does performance change as the patterns are presented more and more in the periphery? A steep fall-off in performance in moving out from the fovea would indicate that somehow the central visual field is somehow privileged for face-detection. A more gradual decline would suggest that the face-detection computation can proceed over a large section of the visual field. These findings have implications for the processes underlying face-perception. We will provide you with the face and non-face patterns for use in your experiments.

Experiment 3:

Influence of auditory/gustatory context on recall: In the class, we discussed a study showing a significant influence of spatial context on recall. If one memorizes a list of items under-water, recall for the items is better under-water than on land and vice-versa. In this experiment, you will attempt to determine whether auditory context (what kind of music the subject is hearing at the time of memorization) or gustatory context (what kind of food – sweet or salty, the person is eating) has a similar influence. The choice of whether to use auditory or gustatory context is yours. This experiment will extend the classic study in an important way.

Experiment 4:

Haptic thresholds for distance discrimination: We believe that our fingers are exquisitely sensitive organs of touch. Just how sensitive are we? In this experiment, you will investigate sensitivity on a particular kind of task – determining whether the distance between two side by side lines is more or less than the distance between another pair of lines. What is the JND (just noticeable difference) in inter-line distance? Does the JND decrease with practice? Does practice with one finger transfer to other fingers on the same hand and different hand? This experiment will have important implications not only in terms of establishing sensitivity thresholds for touch, but also for the domain of perceptual learning. How should you go about creating pairs of lines with small differences in distances? One option is to have two straight edges (rulers) standing on their side and placed side by side. Instead of having them be exactly parallel, have them converge slightly. This will give you a range of distances across the length of the rulers.

Experiment 5:

Estimating gaze-direction: We are very good at determining where a person is looking. However, is there something special about this ability or is it a manifestation of a general talent for estimating positions of objects in the worlds, not just irises in eyes? Said another way, are people better at judging eye-gaze direction than similar changes in the position of a non-human object part?

Experiment 6:

Rock, Paper, Scissors

There has been evidence that humans are rather poor at generating a random list of numbers. They tend to actively avoid repeating themselves, which puts a bias into the process. The usual random number experiment just has people write down lots of random numbers as fast as possible. But does this generalize to slightly more natural tasks, such as the “Rock, Paper, Scissors” game? There is, from a computational point of view, no good reason to choose any strategy other than a random one in that game. In this experiment, you will investigate whether people in fact show something like the pseudo-random number bias explained above. If they do, then there is actually a non-random strategy in the Rock, Paper, Scissors game that will do substantially better than the pseudo-random or the actual random strategy. The results could have profound effects on basketball pick-up games.

Experiment 7:

Extraction of linguistic patterns with inadequate evidence

Children and adults have the remarkable ability to identify which language is being spoken, even if they don't know that language and have only heard it in very few instances. There are many signals to the identity of a language, including prosody, accent, and phonetic rules. In this experiment, we will focus on phonetic rules in order to see how quickly an adult can pick up on a pattern without being consciously aware of the explicit rules. Method: Make up some vocabulary, where the words follow certain phonetic rules (e.g., syllables only end in k, p, or m; or s can be followed by any phoneme except for t) which are fairly simple, but too subtle for people to figure out explicitly. Present the list of words to subjects as positive examples of the language (without giving any negative examples, mimicking the way we usually hear a language). Then have the subjects determine whether “new words” are part of the language. If subjects are able to discriminate possible words from impossible words after only seeing a small number of positive examples, this would tell us something interesting about language acquisition or even pattern recognition in general. Another possibility is to perform a similar experiment, but using abstract patterns instead of phonemes. This might be evidence for a general learning mechanism being at the root of linguistic abilities, rather than a language specific mechanism.