**Adaptive Staircase Experiment**

PSY310: Lab in Psychology

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**Introduction**

The adaptive staircase method was first developed by Thomas N. Corn Sweet in 1962 as a means of quantifying the sensory thresholds in psycho-physical experimentations. Before the development of the psychophysical method, other psychophysical procedures, like the method of constant stimuli, utilized a lot of trials for the direction of a person’s sensory boundaries. The introduction of the adaptive staircase method was a pioneered breakthrough since it enabled the researchers to hone in on the threshold in real time by altering the intensity of stimuli that the participants had to undergo. Not only that, but it also helped to save time and made the output more accurate.

The adaptive staircase approach war on varying the level of the participants’ engagement on the task throughout the study by altering the number of difficulties that a particular participant faces. It is made less obvious to make the level of difficulty higher in case the participant successfully identifies if this is what has been offered as the stimulus. However, when people are unable to define the stimulus, the task is done away with; hence, it’s easy to notice. This is done throughout the experiment up to a point where the subject can only identify the stimulus most of the time it is presented to them; that is the true measure of awareness.

The adaptive staircase approach can be applied in the following normal real-life uses. In audiology, it helps determine hearing thresholds to aid in the ensuing diagnosis of hearing impairments. In vision science, it quantifies contrast sensitivity which can be useful in the design of Visual displays of electronics. Further, this method is used in ergonomic studies to modify interfaces and the accessibility settings of sensory-impaired people. For instance, the understanding of the contrast sensitivity will help in the brightness of the screens or the designing of the fonts so that different visions users will be helped in their access to the technologies products.

**Method**

This experiment's participant was a 19-year-old female undergraduate student from Ahmedabad University, affiliated with the university's psychology department.

The experiment was conducted using PsychoPy (PsychoPy Builder(v2024.15)). An 11.5” monitor with a resolution of 1920\* 1080 pixels and a refresh rate of 60 Hz was used. It involved presenting a Gaussian mask (grayscale sine-wave gratings) with varying tilt angles as the visual stimuli (Figure 1). The task consisted of 100 trials, where each trial began with a fixation cross displayed for 500 milliseconds, followed by a Gaussian mask patch tilted either to the left or right, presented for 200 milliseconds. The subject’s main task was to press the left arrow key when the Gaussian mask patch was tilted to the left and the right arrow key when it was tilted to the right.



*(Figure 1)* *Image of stimulus used: a Sinusoid over a Gaussian mask tilted toward the right*

The initial tilt angle of the Gaussian mask patch was also varied using an adaptive staircase procedure depending on the subject’s response. The dependent variable showed that the tilt angle reduced after a successive correct response to make the exercise more challenging, whereas a wrong response led to an increase in the tilt angle, making it easier. The information that was gathered involved the response of the participant, response time, and the angle of tilt for the trial. The threshold for detecting the tilt direction was obtained using reversals or changes in response direction. In all cases, all the data were saved in CSV formats for the next phase of the analysis and purification. Some of the simpler measures calculated from this data mainly included the average tilt angle at the reversal points, which would give an approximate sensitivity level of the subject.

*Figure 2. A line graph representing the one-up and three-down procedure in the tilt in the stimuli throughout the procedure (i.e., number of trials).*

**Results**

The threshold was reported to be  3.4 deg, indicating that at this intensity, the participant could not detect or discriminate the presence of the signal. The participant responded with 78% accuracy in 100 trials (Figure 3.).

Responses

(0 - Incorrect Response;

1 - Correct Response)

*Figure 3. A graph representing the participant's responses to the stimuli over 100 trials on a binary scale, where 0 indicates an incorrect response and 1 indicates a correct response. The accuracy in discriminating the tilt of the stimuli was 78%.*

**Discussion**

From the data, it becomes evident that the participant had a threshold value of 3. 4 deg, with 78% accuracy; this is a very high value, which shows that ESP makes very high discrimination of the tilt of the stimuli. This staircase procedure has several advantages, but the validity is limited only to a specific Lab situation, whereas actual outside scenarios in the real world consist of hundreds of levels of stimuli and distracters in sinusoidal stimuli. And so the ability to give selective attention to the signal is incorporated here as well. Therefore, if one wishes to engage in further research concerning work with distractor stimuli, this will be valuable.

**References**

Cornsweet, T. N. (1962). The staircase method in psychophysics. *The American Journal of Psychology, 75*(3), 485–491. [https://doi.org/10.2307/1419876](https://psycnet.apa.org/doi/10.2307/1419876)