**Adaptive Staircase Procedure**

PSY310: Lab in Psychology

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**Introduction**

Tom Norman invented the adaptive staircase approach in 1962, which transformed the process of measuring sensory thresholds by making them accurate and saving more time. Rather than exposing experimenters to a long sequence of stimuli at constant intensities, this approach dynamically modifies the level in response to the participants responses. The process increases the intensity when a stimulus is missed the, but decreases it significantly if done properly. Finding the precise moment where the stimulus can be perceived 50% of the time is made easier with the help of this back-and-forth adjustments. As compared to previous lab experiments this one is better at detecting accuracy with better testing procedures.

. It is used by scientists to measure the sensitivity of our senses. They begin with a stimulus that is somewhat too powerful or too weak, as opposed to speculating. Then they modify it in light of the participants answers. They make it stronger if the participants are unable to see it. They weaken it, if the participants can. They continue to oscillate until they achieve the ideal balance, at which point the participants are able to identify the stimulus around 50% of the time.

This approach is more accurate and efficient than previous methods for assessing sensory perception. It advances scientific understanding of how the world's information is processed by human brains and how different senses come into play.

**Method**

An undergraduate student from Ahmedabad University, majoring in Finance participated in this experiment. A 20-year-old, Female. The participant was fully informed, with clear instructions and they participated with consent. The experiment was conducted using PsychoPy v2024 .1.5 (Peirce et al., 2019), with stimuli presented on a 14” monitor with a resolution 1000 x 600 pixels. The design displayed consisted of sinusoidal grating with a Gaussian mask, the grating size was displayed as 0.3 and the stimulus consisted of 8 lines (figure 1.1). Tilt intensities ranged from one-up, three-down staircase procedure, with initial tilt at 10 degrees, ranging between a minimum of 1 degree to maximum of 20 degree. The step type was linear, with step sizes of 2, 1.5, 1 and 0.5. The tilt was displayed for 300ms, tilted towards either left or right and the participant had to press left or right arrow key according to the direction of tilt displayed on screen. Each trial got over once the participant pressed either of the arrow keys with data being stored on Microsoft Excel to analyse the absolute threshold, accuracy and tilt intensity per trial.

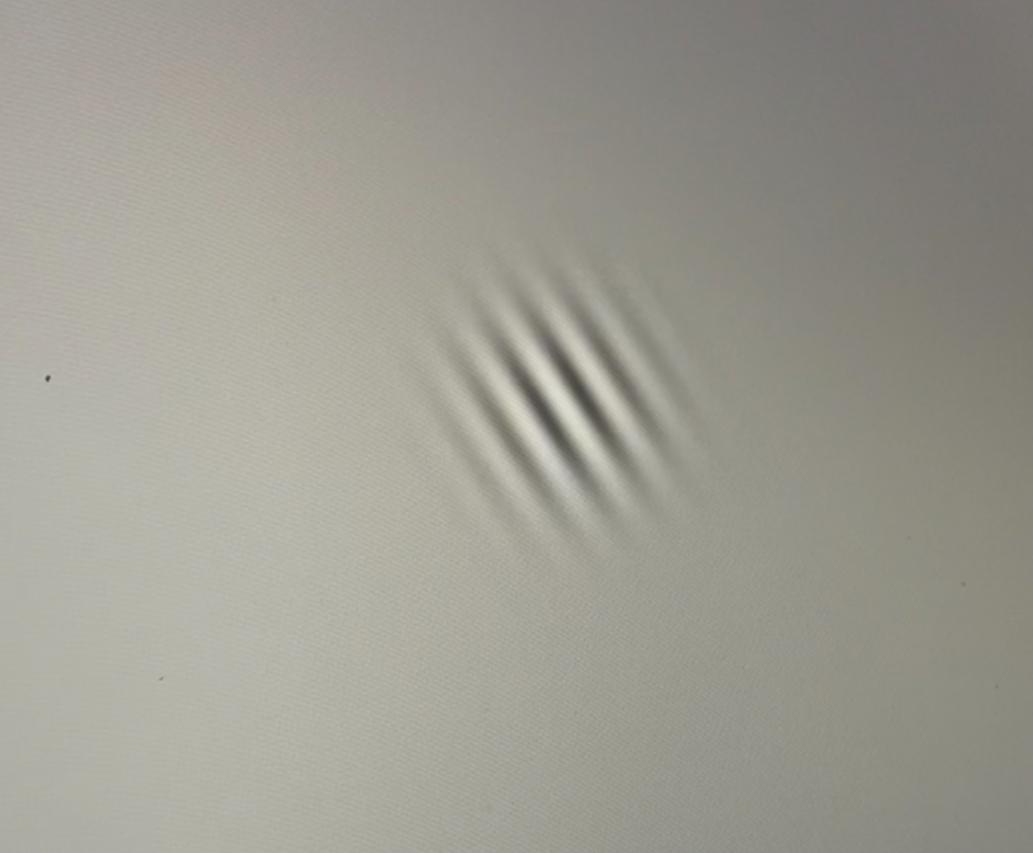


Figure 1.1- Image of Stimulus:- A sinusoid over a Gaussian mask tilted towards the left.

Figure 1.2- Line graph representing one-up and three-down procedure in the tilt of the stimuli presented of the number of trials i.e. 100

**Result**

The participant responded with 60% accuracy in 100 trials. (Figure 1.3)

Figure 1.3- A graph representing the participant’s response to the stimuli over 100 trials on a binary scale, with 0 being incorrect response and 1 being correct response. The accuracy in discriminating the tilt was 60%.

Describing a reversal, as where the participant goes from correct to incorrect and vice versa. Using last 5 intervals to get absolute threshold. It occurred in following trials: - 20, 19.5,19,18.5,18 (ignoring the negative sign, taking 0 as 1). The absolute threshold calculated by taking out average of these 5 values which came out to be 19.

**Discussion**

The result shows that participants threshold to detect the tilt was 19 degrees with an 60% accuracy rate. This suggests that the minimum intensity that the participant could detect of the stimulus was 19 at 60% of the time. This denotes that the participant found the experiment a bit challenging with inconsistent performance. The adaptive staircase procedure has merits of its own but it can only be operated best when the extraneous variables are controlled in a lab setting. The experiment can be modified for betterment with actually performing the experiment with a distractor as it is tough to sustain attention on the orientation of the stimuli with real life distractors present.

**References**

Smits, C., Festen, J. M., Swanepoel, D. W., Moore, D. R., & Dillon, H. (2022). The one-up one-down adaptive (staircase) procedure in speech-in-noise testing: Standard error of measurement and fluctuations in the track. *The Journal of the Acoustical Society of America*, *152*(4), 2357–2368. <https://doi.org/10.1121/10.0014898>