Perception: The Muller-Lyer Illusion

The development of classical psychophysics by Gustav Fechner in the mid-1800's laid the foundation for the emergence of psychology as a scientific discipline. This lab examines one of the methods introduced by Fechner-- the method of constant stimuli-- and shows that it can be used to measure the magnitude of an illusion. Psychologists study illusions to understand perceptions. The hope is that by understanding what causes illusory perception, we will also learn about true perception.

The method of constant stimuli uses a few values, usually from 5 to 9, of a stimulus' intensity. For example, 5 different line lengths might be used, or 5 different weights. In this regard, the levels of the stimuli are "constant," and thus the name, method of constant stimuli. An experiment with line lengths will be used as an example.

For the experiment, we present two lines on each trial. One line is the reference or "standard" line. The other is the "comparison" line. There are five comparison stimuli and they are randomly selected for presentation on each trial. The subject's task is to compare the comparison line to the standard line and make a judgement as to whether the comparison line is longer or shorter than the standard line. The stimuli are presented several times each, so that response proportions can be computed for each stimulus level. A graph of the proportion of "longer" responses, can then be plotted against the stimulus length. The data are often well described by an S-shaped curve, called an "ogive" or "sigmoid," or the "psychometric function." The line length that corresponds to a value where 50% of the responses are "longer" is called the point of subjective equality (PSE). The easiest approach is to simply estimate with a ruler from the graph, as we will do.

Exactly what is the PSE? Well, a question of interest in the simple line length experiments is as follows: What comparisons length does the subject consider to be equal to the standard length? If there is no illusion, and the standard length is 100cm, for example, then we would expect the PSE to be around 100, within the limits of sample variability. Remember that the PSE is the stimulus level that the subject calls longer half of the time and shorter the other half of the time. This is interpreted as showing that the subject considers the comparison stimulus to be equal to the standard stimulus. Of course, judgements are subjective, and thus the term, point of "subjective equality."

If, for the line length experiment, the obtained PSE is close to the value of the standard, then this can be interpreted as showing that there is no illusion for simple lines, which is typically what is found. On the other hand, if the PSE deviates noticeably from the standard, then this might occur because there is an illusion. The illusion can be quantified by subtracting the value of the standard from the PSE, and this is referred to as the constant error (CE). This brings us to the lab experiment.

Method

The Muller-Lyer Illusion board is used in this experiment. The board consists of two lines, one with outward pointing arrows on each end, which is the *comparison line*, and the other with inward pointing arrows, which is the *standard line*. On each trial, you will decide whether the comparison line is longer or shorter than the standard line. Even if they look about the same length, you must respond with either longer or shorter. Record your data on the provided data sheet.

At the end of the experiment, the instructor will call out the stimulus values in the order presented and you should write them down next to your response. You should then go through the data for each stimulus value and count up the number of "longer" responses and the

number of "shorter" responses. If the two do not add up to 10, then you have made a counting error and you should do a recount. Thus the data are the proportion of longer responses for each of the five stimulus levels.

Next, on the axes below, you should plot the response proportions against the stimulus levels, and fit an S-shaped curve to the data by eye. Of course, there is variability in samples, so don't worry if some of the points are far from the curve. You should then draw a line from 50% on the y-axis until it intersects the curve, and then drop it vertically to the x-axis. The approximate value of the intersection point on the x-axis is the estimated PSE. This is also the constant error (CE), which is an estimate of the magnitude of the illusion. See the sample figure located on the data sheet for an example of how to do this.

Discussion

Are you surprised at the size of the constant error, that is, the illusion? What does the constant error tell us about your perception of line lengths for the Muller-Lyer figure? Clearly, we are misperceiving the lengths of both lines. This experiment demonstrates an objective method of measuring this misperception, which is seemingly highly subjective.

Data Sheet

record an L if the comparison looks longer than the standard or an S if it looks shorter

trial	L/S?	trial	L/S?	trial	L/S?	trial	L/S?	trial	L/S?
1		11		21		31		41	
2		12		22		32		42	
3		13		23		33		43	
4		14		24		34		44	
5		15		25		35		45	
6		16		26		36		46	
7		17		27		37		47	
8		18		28		38		48	
9		19		29		39		49	
10		20		30		40		50	

Data Sheet: Muller-Lyer Illusion

Name _____ **Section** _____

differ by cm

no illusion

Comparison Length	-4	-3	-2	-1	0
Longer					
Shorter					
% Longer