National Autonomous University of Mexico

Faculty of Psychology

Title:

The Mirror Effect within Perception: Not another Recognition Memory study.

Author:
Adriana F. Chávez De la Peña
Undergrad Student
adrifelcha@gmail.com

Keywords:
Signal detection theory; Recognition memory; Perception; Mirror effect.

Abstract (100 words):
Within recognition memory studies where Signal Detection Theory has been applied to describe subjects' performance, a pattern of responses known as the Mirror Effect has shown that when comparing subjects' performance between classes of stimuli that are differentially recognized, this difference appears both for the identification of known and new items. However, the extensiveness of this pattern to other fields has not been explored yet. By using what is known about the Ebbinghaus illusion to design two levels of discriminability, evidence of the Mirror Effect in a detection task, confidence ratings included, that involves perception only is shown.

Summary (1000 words)

Introduction

Signal detection theory has been applied to Recognition Memory to describe subjects' ability to discriminate between stimuli that have previously been presented (old stimuli) from a new set of stimuli (Wixted, 2007). Within this field, it's been consistently found that when comparing subjects' performance across two classes of stimuli, where one is more accurately recognized (A) than the other (B), this discrepancy is shown both for the recognition of old items as old (Hits (A) > Hits (B)) as for new items as new (False alarms (B) > False alarms (A)). This pattern of responses has been identified by the name of the Mirror Effect (Glanzer, Adams, Kim, 1993) with evidence in favor of it reported across a wide range of procedures (Yes/No tasks, Confidence Rating, and Two-alternative forced choice) and variables influencing stimuli recognition.

Surprisingly, evidence for the Mirror Effect has only been collected within Recognition Memory studies. And so, most of the theories and models proposed to explain it tend to do it in terms of the study phase included in any recognition memory task, where subjects interact for the first time with the stimuli and, presumably, attend/process them differently leading to the different rates of response observed in the recognition phase.

The main goal of the present study was to explore the existence of the Mirror Effect within other areas where SDT has been applied. Thus, testing the assumption that the Mirror Effect depends on a previous-study phase to appear, while it could be understood as a more basic product of any SDT-like task with two or more levels of discriminability involved.

Method:

A perceptual task was designed to compare subjects' responses across two levels of discriminability that were constructed according to the literature that has explored the variables involved in the Ebbinghaus illusion. The focus was on the number of external circles, which has shown to be directly related to the intensity of the illusion (Massaro, 1971). The two levels were defined as follows:

- High accuracy (A): Ebbinghaus illusions with 2 or 3 surrounding circles.
- Low accuracy (B): Ebbinghaus illusions with 7 or 8 surrounding circles.

Two experiments were conducted, on each one participants had to indicate, pressing one of two keys, whether two circles appearing on screen were the same size (Signal) or not (Noise); these circles were presented on a bright color and identified by the name of 'central circles'. In Experiment 1 both circles were constructed as Ebbinghaus illusions, varying the number of surrounding circles on each trial.

Experiment 2 consisted of a single Ebbinghaus illusion-circle that had to be compared with an aisle, constant, reference circle. Both experiments included underestimation and overestimation-inducing Ebbinghaus illusion.

Each experiment included a total of 640 trials (320 trials for each class of stimuli, A or B, with 120 signal and noise trials respectively) presented at random. On each trial, stimuli were shown for only 1.5 seconds to prevent habituation to the illusion. Participants could enter their response ('Yes, circles are the same size' or 'No, they're not') either before or after stimuli disappeared from screen.

After the first response was given, a scale containing numbers from 1 to 3 was presented to indicate participants to grade how confident they were from their previous response by pressing one of the three possible response keys, (1-Low, 2-Medium, 3-High). However, the program registered these responses as part of a larger continuum going from 1 to 6, distinguishing 'yes' from 'no' responses:

a) If participants chose 'No' and pressed 3, it would be registered as 1 (Very sure noise), and so on.
b) If participants chose 'Yes' first and pressed 3, it would be registered as 6 (Very sure signal), and so on.

Participants had to press the space bar to indicate that they were ready to move from trial to trial. Response time was also registered.

Results:

Our procedure allowed us to look for evidence of the Mirror Effect, as usually reported in the literature (Glanzer & Adams, 1990), in terms of the rates of 'Yes' responses given across accuracy conditions (Yes(AN) < Yes(BN) < Yes(BS) < Yes (BS); A being 'high accuracy', B 'low' and 'S' for signal and 'N' for noise trials) and the mean confidence rate assigned to stimuli within each one of these (Mean(AN) < Mean(BN) < Mean(BS) < Mean(AS)). A response time analysis was also included.

Each experiment was conducted with 20 participants; in both cases, evidence for the mirror effect was found on at least 17 cases. 85% of the participants showed the expected pattern of 'Yes' responses across conditions, with a little bigger proportion of participants showing the expected mean confidence rate pattern (90%). Furthermore, no correlation between accuracy conditions and response time was found in any case. The attached Figure presents the mean performance of participants in Experiment 2.

The statistical data analysis was conducted as reported in the literature, in terms of the mean performance across subjects per condition, to make our results more comparable. However, we also included a Bayesian latent mixture model to test the idea that 'Yes' rates observed across conditions are indeed produced by different thetas.

Discussion:

The present study is the first to show evidence for the existence of the Mirror Effect patterns of response, on a signal detection task that does not involve recognition memory. The perceptual task here presented lacked of a pre-experimental phase where participants had the chance to manipulate how powerful the illusions included in each condition were, contradicting what has been proposed within recognition memory studies. The accuracy conditions here proposed were constructed merely on what is known about the variables involved in the Ebbinghaus illusion.

The fact that the Mirror Effect was found on a perceptual task, with accuracy conditions designed specifically in terms of the signal that participants are asked to detect, may suggest that there's a much more basic principle regulating the patterns of response observed.

References (5-10)

1. DeCarlo, L. (2007) The Mirror Effect and Mixture Signal Detection Theory. Journal of Experimental Psychology: Learning, Memory and Cognition. Vol. 33. No. 1. 18-33.
2. Gescheider, G. (1997) Psychophysics: The fundamentals. Lawrence Erlbaum Associates, publishers
3. Glanzer, M., Adams, J. (1990) The Mirror Effect in Recognition Memory: Data and Theory. Journal of Experimental Psychology: Learning, Memory and Cognition. Vol. 16. No. 1, 5-16.
4. Glanzer, M., Adams, J., Iverson, G. & Kim, K. (1993) The Regularities of Recognition Memory. Psychological Review. Vol. 100. No. 3. 546-567.
5. Massaro, D., Anderson, N. (1971). Judgmental model of the Ebbinghaus Illusion. Journal of Experimental Psychology. Vol. 89. 147 - 151
6. Wixted, J. (2007) Dual-process theory and signal-detection theory of recognition memory. Psychological Review. Vol. 114. No. 1, 152-176.