Right Left Confusion
and the Effects of Priming

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We try to validate the Right Left Confusion which has been explored in literature, specifically by Rigal [2] and Snyder [3] through experiments. We further ask the question if we can prime Right and Left with colour and the X axis in adults and reduce the response time hence, which has not been explored before. We find that on an average people prime both with colour and the X axis, though as individuals it is often that people prime well only with one of the two suggested primings. Also, it is observed that self- perception of this confusion (or lack of) does not correlate with actual data.

Right Left Confusion has been studied in the past and neurological studies have attributed it to the bilateral symmetry of the central nervous system. [4] Furthermore, another study suggests Right Left Discrimination requires activation of the parieto-temporo-occipital junction as well as the visual system including cuneus, precuneus, and gyrus lingualis as opposed to other areas involved in Spatial understanding. [5] Snyder [3] points out that unlike in spatial processes, gender based bias is not observed in Right Left Confusion. We shall see that our results indicate do indicate a gender based bias with females performing poorer. Nonetheless, all this suggests that Right Left Confusion cannot be simply correlated with poor spatial processes and has a different mechanism altogether. And thus, there is a need to understand it better.

Methodology

Subjects

The subjects were adults aged from 17 to 21 years, all pursuing undergraduate studies pursuing various majors and having sufficient exposure to the Cartesian Coordinates. There were a total of 20 subjects, 10 of them being females and 10 being males. Two out of these were ambidextrous or left-handed.

Tests and Procedure

Before the tests, the subject was asked Age, Handedness and was asked to rate themselves on a scale of 1 (less) to 5 (most) on how much they confuse left and right in daily life. Their Gender was noted.
Two Tests were conducted. The first one with the aim to establish Right Left confusion, through recognition of symbols with various symmetries consisted of recognition of certain pairs of letters. First the pair of letter to be shown was stated, after which the subject was shown a random string of letters of the mentioned pair, which they were to read out aloud. The response time was measured. Six such pairs of letter were shown from the letters b,d,p,q in Lucida Console due to the symmetry in the mentioned Font. Out of these two pairs bd, pq exhibited lateral symmetry while two dq, bp exhibited symmetry about the horizontal line, while the last pair bq,dp exhibited rotational symmetry by an angle of π. An example of the strings prompted at a time-

1) d d b d d b b d d b

2) p q q p p q p q p p

3) p b b p p p p b b p b

4) d q q d q d d q q d

5) p d d p p p d d p d

6) q b b q b q q b q b

(Test Images on Page three)
The second test consisted of showing six different pictures, each with twenty five images, where the subject was to utter certain words for which response times were measured. The first two images are taken from Eric H. Chudler's webpage [1] (Research Associate Professor, Department of Bioengineering, University of Washington). The Subject to say aloud where the hand is pointing with "Right" and "Left". In the second image they must similarly say aloud "Up" and "Down". The ratio of the response time for Image I and Image II is noted as "RL", where the division of response time of Image II acts as a normalisation for a person since each individual may have different processing speeds in absolute terms which cannot be compared.
Next, an image with arrow pointing right and left were shown prior to which the subject was asked to think of the Cartesian coordinates and relate positive with the arrow of the x axis and left as the negative axis, and was asked to then say aloud "Positive" or "Negative". This was done for priming. In succession, the original Image I was shown, but the subject was asked to still

say "Positive" or "Negative". The response time for this by that for Image II was noted as "+-".

Finally, for priming with colour, a sequence of twenty five circles either Red or Blue were shown while the subject was to say aloud "Red" or "Blue". After this priming, Image I was tweaked and all right pointing hands were coloured Red and all left pointing hands were coloured Blue and the subject was asked to as before say aloud "Right" or "Left". This response time over that of Image II was now noted as "Colour".

Results and Discussion

(Graphs on Page three) The first test helps establish RL Confusion. Ratios of time take versus average time over all pair-

db- 1.73
pq,db- 1.44
pb,dq- 0.71
pd,qb- 0.56

As can be noted the pairs with lateral symmetry have a considerably higher response time. Furthermore, the ratio of lateral to up-down symmetry is 2.03 which is in agreement to the mean ratio "RL" at 2.27, seen below.

A point of special interest is the disparity between db and pq, where both are laterally symmetric. This disparity might be accounted by the frequency of appearance in languages, though this is no where clear.

The second test has much more interesting consequences. It establishes RL confusion with RL being on an average 2.27, while it can be seen people prime with both color and X axis.

In must be noted though, that individuals who prime with color may or may not prime with X axis, and vice versa. This disparity can be explained due to different abilities of people in different tasks (Colour and Mathematics). Also subjects with low RL values near 1 seemed to do worse with priming due to absence of RL confusion in the first place.

RL $\in$ [0.93, 3.95] Mean: 2.27, Standard Deviation: 0.94
+- $\in$ [0.94, 2.58] Mean: 1.50, Standard Deviation: 0.45
Color $\in$ [0.7, 2.78] Mean: 1.57, Standard Deviation: 0.58

An interesting point to note is that our studies show gender disparity with females performing poorer with and without priming with X Axis, though they prime better with Colours than males.

Females, Males-

RL Mean: 2.51, 2.04
+- Mean: 1.62, 1.36
Color Mean: 1.52, 1.70

Conclusion and Possible Proposals

We validate RL confusion and quantify it in our own crude measure, through both the tests, that agree. Furthermore, we conclude that priming does have a positive effect on an average on RL Confusion. Though this is not enough. We note that RL Confusion is based on individuals and gender; and is also probably task specific (relating to body parts or Directions).

Further proposals would involve conducting better priming based on preliminary kind of RL Confusion, and also response times will be measures for only a single image with multiple instances of the same priming that the current work does not incorporate.

Acknowledgements

Eric H. Chudler
http://faculty.washington.edu/chudler/java/hands1.html

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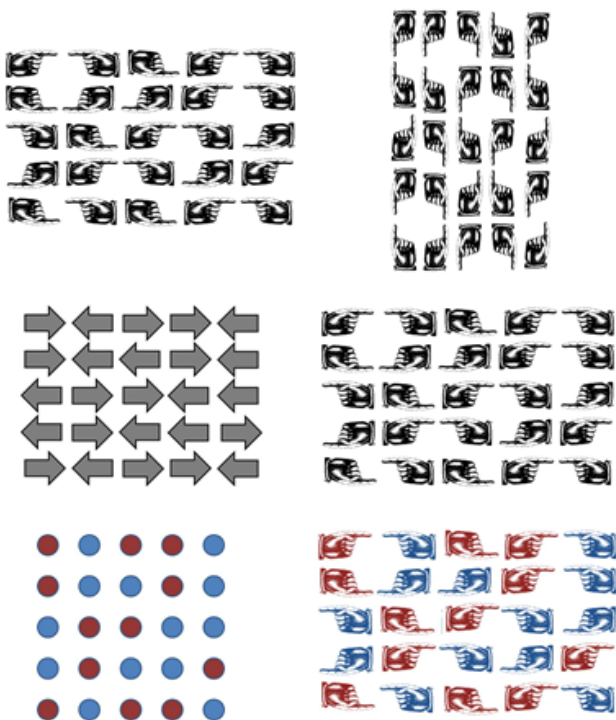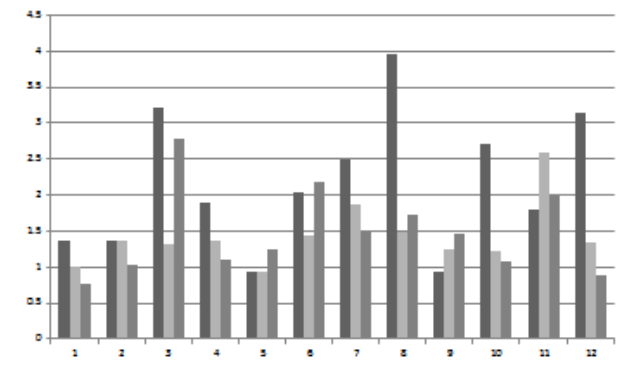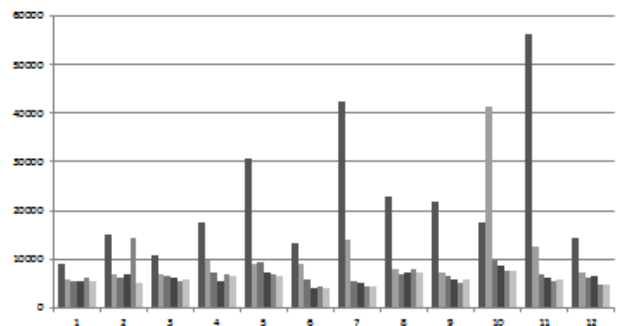
Image I (top left), II (top right), III (middle left), Iv (middle right), V (bottom left), VI (bottom right)

RL, + -, Colour for twelve different participants (Bottom, Test II); Response times for db,pq, bp, dq, dp, bq for twelve different participants (Top, Test I)