Hypothesis of Mirror Neuron Function

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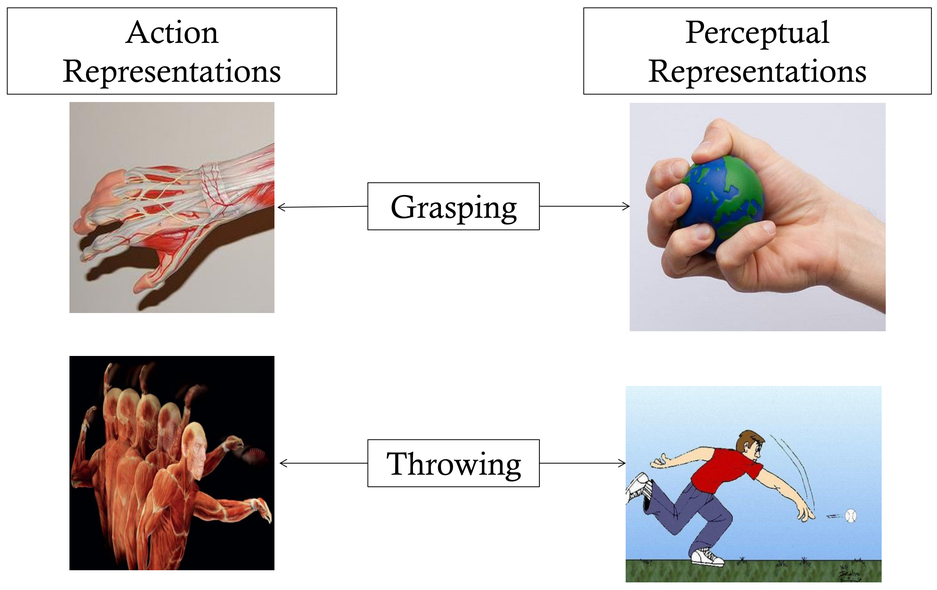
How do we perceive motion?

COMMON CODING THEORY[1][2]



Mirror Neurons are the neural basis of the common coding theory, as they fire both when a particular action is seen and when it is performed.

HYPOTHESIS

If indeed our motor system is involved in 'simulating' perceived actions in order to make predictions, then we should be *better at predicting outcomes of our own actions compared to actions of others.*[1]

METHOD

I followed the methodology of the experiment conducted in [1], in which subjects performed a two-alternative choice task as follows:

- 30 subjects were asked to throw darts at a dartboard which had been divided into two halves. They aimed either at the upper half or at the lower half. The successful trials were recorded.

- They were then shown edited clippings of the videos, in which the trajectory of the dart was cut off (**see sample video**).
- For each clipping, the viewer predicted which half of the board was aimed.
- Participants were divided into pairs**. Each participant viewed their own video and their partner's video, in the same order**.

Some changes were made from the protocol followed in [1]:

- A **sample video** was shown before the actual experimental trials. This is because a significant improvement in accuracy was seen from the first set of videos to the second.

Sample (6 trials) → Self/Other (24 trials) → Self/Other (24 trials)

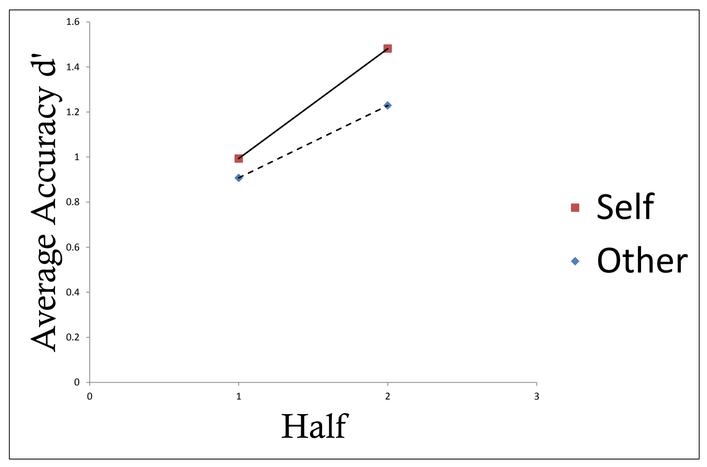
- It was explicitly stated that the order of videos was completely random and they could even be all up/all down. This is because the first few participants started counting the number of ups/downs that 'should' be there.

RESULTS

Sensitivity (d'): A standard psychophysics measure of accuracy in two-alternative choice tasks.

$$d' = z(u) + z(l)$$

z(.) = Inverse Normal Distribution
u = fraction of upper half throws guessed correctly
l = fraction of lower half throws guessed correctly



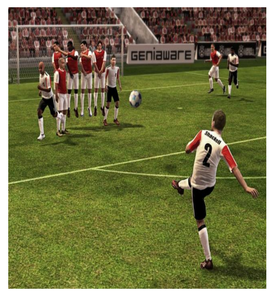
d' for Self increased by 49.3%

d' for Other increased by 35.3%

DISCUSSION

- Why does the self-other difference increase with time?
  Prediction of action consequences using the motor system requires **integration of first- and third- person information**, which probably becomes easier with time for a particular kind of stimulus

- What about subjects who are used to seeing themselves from a third person perspective, i.e. actors or sportspeople? Would the self-other difference be even more pronounced for them? Does the fact that it is unusual to see ourselves in a third person perspective make any difference?
- We often predict consequences of perceived actions, such as time people will take to cross roads, or trajectories of kicked balls. But this prediction is generally subconscious – we cannot help but predict! In my experiment, subjects are asked to consciously make a decision about the outcome of an action. I feel this might preclude the automatic recruitment of the motor system for perception.



REFERENCES

[1] Knoblich, Günther, and Rüdiger Flach. "Predicting the effects of actions: Interactions of perception and action." *Psychological Science* 12.6 (2001): 467-472.

[2] Macmillan, Neil A., and C. Douglas Creelman. *Detection theory: A user's guide*. Psychology press, 2004

[3] Jeannerod, Marc. *Motor cognition: What actions tell the self*. No. 42. Oxford University Press, 2006.