

Motivation

Mirror neurons are those which fire both when an action is performed by the subject and when the subject sees an action being performed.^[1] They are thought to play a role in action prediction and understanding the intent of others' actions^[2]. This hypothesis about mirror neuron function naturally leads to a view of action perception in which our own motor programs are activated and generate the "perception" of another's actions - *observed* and *executed* movements share the same neural network.^[2] Using this model of action perception, one can make predictions about

- 1) People's predictions of the outcomes of viewed actions - such as the accuracy of a dart throw^[3]
- 2) The ability to perform actions while viewing congruent/incongruent actions being performed by others^[5]

Background

Mirror neurons were first discovered by Rizzolatti et al. in 1996. Several functions were proposed for mirror neurons, the most prominent being to help us understand other's actions and their intended consequences by running our own motor programs for those actions.

Keysers et al.^[4] have proposed that mirror neurons for predicting a) the consequences of perceived actions and b) the next action in a series of actions can develop through associative learning. This hypothesis provides a neurobiological basis for the role played by mirror neurons in action interpretation and prediction of consequences.

The broader view that motor programs are involved in perception and consequence prediction underlies these hypotheses.^[3] This has been explored in several ways using psychophysics experiments. The particular experiment I would like to pursue is the prediction of action consequences tested by Knoblich et al. in 2001^[3]. If time permits, I would also like to carry out analysis of accuracy of performing an action while viewing someone performing congruent and incongruent actions.^[5]

Experiments

I will ask participants to perform a dart-throwing task where they aim to throw the dart at one particular half of a dart board. I will video-tape these performances and later show the clippings of successful hits to the participants, a) of their own trial and

b) of the trials of one other person. The clippings will be cut off just after the dart leaves the hand of the subject.

I will ask them to predict which half of the dart board will be hit. Based on their predictions, I will calculate the “sensitivity” of the observer (the d' from the article), i.e., the ability to correctly predict which half of the board will be hit.

In the version of this experiment performed by Knoblich et al, three “views” of the action were presented – one where the entire body of the subject was visible, one where his/her head was hidden and one where only his/her arm was visible. I will show the entire body of the subject as this was the view in which maximum prediction accuracy was obtained.

I also want to analyse the effect of the gender of the viewer and performer.

References

[1] Rizzolatti, Giacomo, et al. "Premotor cortex and the recognition of motor actions." *Cognitive brain research* 3.2 (1996): 131-141.

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

[4] Keysers, Christian, and Valeria Gazzola. "Hebbian learning and predictive mirror neurons for actions, sensations and emotions." *Philosophical Transactions of the Royal Society B: Biological Sciences* 369.1644 (2014): 20130175.

[5] Kilner, J. M., Y. Paulignan, and S. J. Blakemore. "An interference effect of observed biological movement on action." *Current Biology* 13.6 (2003): 522-525.