Implicit Learning of Social Prediction

Erin Heerey & Hemma Velani

Bangor University, School of Psychology

577.14 / FF133

Look at all those people. Thousands of social interactions are happening here. No two are the same, yet people still communicate with ease. If you look closely, you can see people...

...meeting old friends,

and new colleagues,

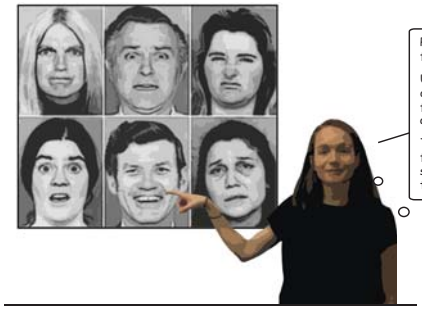
answering difficult questions,

and even flirting over the posters.

not quite believing what they are hearing,

How do people read their social partners so well?

One answer is that they learn to 'read' the subtle social cues on their partners' faces.



Paul Ekman has developed a 'dictionary' of emotional facial expressions to help with this.

Unfortunately, it only includes 6 displays, and most of the expressions people display are not these. In fact, the only display on Ekman's list that frequently appears in social interactions is the genuine smile.

To complicate matters more, expressions vary in form depending on the physical architecture of the sender's face and in meaning depending on the situation and sender.

Social behavior is complicated enough to do a person's head in!

But, there might be a more straightforward way to make sense of nonverbal behavior....

The brain is a learning machine. It might learn social cue-outcome associations during interactions. The degree to which this is possible should predict success both in the interaction and in the relationship.

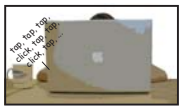
To test this idea, we created a game environment with a video-based avatar who could produce predictive social cues prior to making certain plays.

Hypotheses

1. Participants will learn to use a subtle social cue to predict another's behavior.
2. Explicit knowledge of the cue-outcome relationship will not be necessary for learning.
3. Success at predicting another's behavior will correlate with liking ratings.

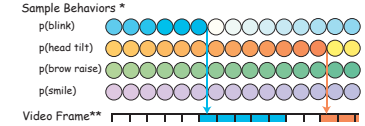
Avatar

- Programmed in Matlab
- Continuous stream of video
  - Produced from recordings of a 22-year-old male
- Behavior controlled by a hidden Markov process
- Resembled human behavior



Hidden Markov Process

Sample Behaviors *



* Behaviors: Neutral, blink, head-movements, smile, frown, concentration, interest, face-touch, 2 predictive cues (only 1 was predictive for each person, the other occurred but was not predictive of avatar behavior).
** Frame Rate: 15 frames/second

Participants

- Total N = 40 (but 5 didn't believe the avatar was real)
- Final N = 35
- F:M 21:14
- Age range: 18-25
  Mean = 20.63 (1.90)

The Set-Up

Game: Rock-Paper-Scissors

Participants see continuous video footage of the avatar during the game. Payoffs: Wins = 10 points; Draws = 5 points; Losses/Too Slow = -10 points
3 x 75-trial blocks; 25 of each play per block (random order).

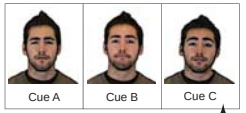
But, the results are only believable if participants think the avatar is real AND have no explicit knowledge of the cue....

We employed a careful debriefing procedure.

Predictive Cues

There were two possible predictive cues.

- One cue randomly assigned to be predictive of one of the avatar's plays
- The other cue occurred within the avatar's behavioral repertoire
- Predictive cues always occurred during the first trial phase
- Random assignment ensures experimenter is blind to cue condition.



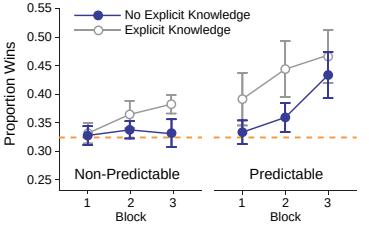
This cue was never seen.

Test for Explicit Knowledge

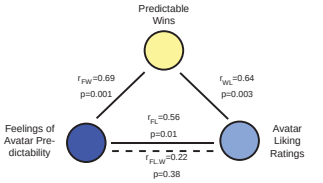
1. Participants rated how much liked the avatar (3 questions) and how much they "felt" he played predictably (3 questions) on a 7-point Likert scale.
2. The experimenter determined whether participants believed the avatar was real and noticed any predictive cues using a series of careful questions.
3. The experimenter informed participants about the avatar and asked them to guess the predictive cue from a set of three cue photographs.

16 participants guessed the cue.

Results



Participants learned to predict the avatar's next play on predictable trials, even in the absence of explicit knowledge of the cue (the dashed line shows chance performance).



The degree to which participants felt the avatar was predictable correlated with their liking ratings of him. This relationship was mediated by the degree to which participants were successful at predicting the avatar.

These results represent a step forward in understanding how the brain controls social behavior.

First, they demonstrate the involvement of a biologically plausible mechanism (learning) in adjusting moment-to-moment social behavior.

Second, they demonstrate that the learning of cue-outcome associations does not require conscious awareness, making this idea experientially plausible.

Third, they suggest that success at predicting a social partner may be advantageous because it facilitates liking - an important ingredient in social relationships.

Together, these findings have important implications for understanding the neural control of social behavior and offer a research method that achieves a high degree of experimental control without sacrificing ecological validity.

...hmmm... these findings do explain a thing or two about social behavior....

References

Behrens, T. E., Hunt, L. T., & Rushworth, M. F. (2009). The computation of social behavior. Science, 324(5931), 1160-1164.

Behrens, T. E., Hunt, L. T., Woolrich, M. W., & Rushworth, M. F. (2008). Associative learning of social value. Nature, 456(7219), 245-249.

Frith, C. D., & Frith, U. (2007). Social cognition in humans. Curr Biol, 17(16), R724-732.

Hampton, A. N., Bossaerts, P., & O'Doherty, J. P. (2008). Neural correlates of mentalizing-related computations during strategic interactions in humans. Proc Natl Acad Sci U S A, 105(18), 6741-6746.

King-Casas, B., Tomlin, D., Anen, C., Camerer, C. F., Quartz, S. R., & Montague, P. R. (2005). Getting to know you: reputation and trust in a two-person economic exchange. Science, 308(5718), 78-83.

Kliemann, D., Young, L., Scholz, J., & Saxe, R. (2008). The influence of prior record on moral judgment. Neuropsychologia, 46(12), 2949-2957.

Kringelbach, M. L., & Rolls, E. T. (2003). Neural correlates of rapid reversal learning in a simple model of human social interaction. Neuroimage, 20(2), 1371-1383.

Krumhuber, E., Manstead, A. S., Cosker, D., Marshall, D., Rosin, P. L., & Kappas, A. (2007). Facial dynamics as indicators of trustworthiness and cooperative behavior. Emotion, 7(4), 730-735.

Uleman, J. S., Adil Saribay, S., & Gonzalez, C. M. (2008). Spontaneous inferences, implicit impressions, and implicit theories. Annu Rev Psychol, 59, 329-360.

Yoshida, W., Dolan, R. J., & Friston, K. J. (2008). Game theory of mind. PLoS Comput Biol, 4(12), e1000254.

Economic and Social Research Council Grant RES-000-22-2262 to EH supported this work.

Contact info: e.heerey@bangor.ac.uk