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The Effect of Physical Attractiveness on Mirror Neuron Activity

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Abstract

Research suggests that how a person looks can affect how much empathy they receive from others, with evidence pointing to attractive people receiving the most empathy. This study extended that research by examining if the heightened empathy received by more attractive people may be based in neurological processes. Participants \( n = 19 \) were shown movie clips of young women of naturally-varying degrees of attractiveness making emotional expressions while having their brain activity monitored by an electroencephalograph (EEG). The EEG recording was used to examine the activity of mirror neurons, which have been shown to play an active role in the human experience of empathy, following the logic that if more attractive people elicit more mirror neuron activity, this may be the biological process underlying why they receive greater empathy from others. After a Fourier Transformation of the first five participants, the data suggested that attractive people do elicit more mirror neuron activity from others at a statistically significant level \( (p = .02) \). The remaining data must still be analyzed, but given the significance level of the results so far, the conclusion will likely remain the same, unless further analysis reveals an as-of-yet unanalyzed confound.
Introduction

Multiple studies have suggested that what humans perceive as physically attractive is related to naturally-selected signals representative of evolutionary fitness (Gangestad & Scheyd, 2005; Perrett et al., 1998). The relationship between masculine facial shape and immune function provides an example: Perrett et al. (1998) found that testosterone suppresses immune function, so a man with emphasized facial masculinity must have an exceptionally strong immune system to compensate for that suppression. If he did not, he would not survive long enough to reproduce. Therefore, someone who is attracted to a masculine facial shape is unconsciously attracted to high testosterone levels, which is a symbol of competent immune function. Choosing immunocompetent mates may improve their children’s immune function, allowing those children to survive for longer, reproduce more, and potentially pass on both strong immune systems and a preference for masculine faces.

Research has also suggested that attractiveness is related to “averageness” (Gangestad & Scheyd, 2005; Langlois & Roggman, 1990). Langlois and Roggman (1990) used a computer to digitally create composite faces. These composites came from “averaging” pictures of multiple actual people on top of each other, effectively producing “average” human faces. The digital images were consistently rated as more attractive than the faces used to create them. Thus, it would not be far-fetched to suppose that an average face is also the internalized model that humans use to represent faces. Like a computer compiling one face on top of another to create a more symmetrical, attractive composite, the human mind takes in hundreds, perhaps thousands, of faces on a daily basis and would realistically have the synthesizing ability to generate an averaged version of these faces. Thus, attractiveness may actually be part of a system that identifies the “average” face of those most like ourselves, an evolutionarily useful way to identify potential mates within the group with which we already share our survival resources, rather than mating with members of group who could potentially threaten our survival through their resource consumption.

Mirror neurons are a specialized brain cell which activate when someone performs an action as well as when someone merely views another person performing that action. Thus, these neurons allow
one to “mirror” the behavior of another individual in our own mind. As such, this system has been implicated in the neurological processes that underlie imitation, understanding the actions of others, interpreting language, communicating, and experiencing interpersonal empathy (Keysers, 2010; Oberman & Ramachandran, 2009; Preston & de Waal, 2000; Ramachandran, 2006; Rizzolatti & Craighero, 2004).

For this study, the relationship between mirror neurons and empathy is the most important element. To an extent, the activation of mirror neurons in the brain allows a person to vicariously experience the actions of others and improve their understanding of why the person is doing the action at all (Rizzolatti & Craighero, 1992). In essence, when mirror neurons are active, people are likely to be feeling empathy. These mirror neurons can be monitored with an electroencephalogram (EEG) by looking for the specific frequency known as a mu wave (Oberman & Ramachandran, 2009).

To integrate these lines of research, this study asked: Do attractive faces elicit more activity from the mirror neuron system? Given that mirror neurons have a role in empathy and that attractive people elicit more empathy, a person should display more mirror neuron activity when viewing someone who is more attractive. Participants in this study were asked to watch short videos of women of varying degrees of attractiveness while having their neurological function recorded by an EEG. Experimenters used a Fourier Transformation to find a suppression ratio between the amount of mirror neuron activity elicited by the most and least attractive women in the videos.

Method

Participants

Nineteen people of undergraduate age, primarily students of the University of Puget Sound or recent alumni, were recruited verbally or by email. The participants arranged a time to meet in the EEG laboratory individually with the researchers. For participating, each person received fifteen dollars.

Materials

EEG: A 32-channel Biosemi Electroencephalogram, with reference electrodes placed on the mastoid processes.
Stimulus Videos: A series of 147, 8-second-long, black and white video clips featuring women between the ages of 18 and 22 making one of seven emotional expressions: happiness, sadness, disgust, fear, anger, surprise, or neutrality. Each woman was displayed making each face once, and the videos were played in one of five random orders in order to minimize ordering effects. The videos were designed to be relatively standardized, with each woman in a black top with a white background. See Appendix A for visual.

Procedure

Participants were contacted either verbally or by email to schedule a time for participation. On the day of the study, participants entered the research suite, were asked to sit in a chair in front of a computer screen, and were given consent forms to sign. They were fitted with an EEG cap and then the electrodes were connected and checked for proper conductivity. When the EEG was properly fitted and functioning, each participant was given directions for what to do and not do while watching the videos, such as minimizing blinking as much as possible. For each clip, participants were instructed to indicate, using one of three arrow keys on a keyboard in front of them, whether the woman they were watching was responding to good news, bad news, or neutral news. The program running the videos was designed to run the videos in one of five random orders, and to give participants occasional breaks during which they could stretch, close their eyes, and otherwise readjust themselves to ensure they stayed comfortable during the study. When the video series ended, participants were shown pictures of the women they had just seen and asked to rate, on a scale of one to ten, how attractive each woman was. After rating the women, participants were debriefed and given a chance to ask questions, comment, or raise concerns. Before leaving, participants received fifteen dollars and were asked to sign a sheet stating that they had, in fact, received the money.

Results

The EEG automatically recorded digital data files of the participants' neurological function. These files were then spliced in order to ease data analysis. Using the participants' ratings of the women
in the videos, a scale of attractiveness was compiled. Each woman was assigned to part of a high, medium, or low attractiveness group based on the average rating she received. Data segments collected in response to women from the high attractiveness group were compared to those in the low attractiveness group using a Fourier Transform and a comparison of the area under the curve of the integral between 8 and 12 Hz, which includes the frequencies associated with mirror neuron function. The differences between the values of the integrals were used to run tests of statistical validity and construct a suppression ratio. This analysis revealed a statistically significant tendency for more attractive people to elicit greater mirror neuron activity from others within the first five participants whose data was analyzed.

**Figure 1**: Neural activity in response to more attractive and less attractive groups. The activity in the 7-13 Hz range indicates that there was more mirror neuron activity in response to the more attractive people, as shown by the relative suppression of mu waves. Although the difference is small, it is statistically significant.
In accordance with the hypothesis, the more attractive stimulus faces drew more mirror neuron activity from the participants of the study. This makes sense in light of the previous research, as cited in the introduction, and provides a decent neurological reason behind the psychological and social phenomena whereby attractive people receive more empathy from others than less attractive people do.

There is, however, a small possibility that when all of the data has been fully analyzed, the effect may lessen or disappear, and it may be possible that the effect is due to a confounding variable. For example, it is entirely possible that the women rated as more attractive were also more expressive, and therefore caused more mirror neuron activity simply because they gave more for the mirror neurons to respond to. If this is the case, it would provide its own set of intriguing future research questions, including but not limited to whether or not attractive people are statistically significantly more expressive than less attractive people, if this may be related to why they are considered attractive, and if attractive

**Figure 2.** The value of the integral from 7-13 Hz for both attractive (blue) and unattractive (red) faces for five subjects. The pattern of mu wave suppression is consistent across subjects. The significance of this difference is $p = .02$, despite the small number of subjects.
people still elicit more activity when they are intentionally not as expressive. Using the participants’ ratings of whether a subject was responding to good, bad, or neutral news, we should be able to gain some insight into whether or not this is a realistic concern.

Additionally, it would be useful to expand this study to include male subjects in the stimulus videos, and to analyze different groups of participants separately. The inclusion of males would ensure that this finding is accurate for more than just women, as it is entirely possible that women may be evaluated differently or on different criteria than men. Similarly, it may be useful to break down participants into more specific groups, such as dividing them by sexual orientation and analyzing whether or not this effect changes in response to whether or not the participant could be sexually interested in the subject. If the reason for this difference is indeed evolutionary, it may make sense that those most interested in mating with an individual would have the most mirror neuron activity in response to that individual.

Overall, this study provides a bridge between the neurological evidence that mirror neurons are involved in empathy and the psychological finding that attractive people receive more empathy from others, supporting the idea that increased mirror neuron activity would account for at least some of the increased empathic response evoked by attractive individuals. There is more data analysis that must be done and a potential confound to look into before the results are finalized, but so far they appear to be positive and significant.
Works Cited


Appendix A: