

Effects of brain exercise depend on opponent

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Playing games against a computer activates different brain areas from those activated when playing against a human opponent. Research published in the open access journal *BMC Neuroscience* has shown that the belief that one is playing against a virtual opponent has significant effects on activation patterns in the brain.

Dr. Krach and Prof. Dr. Kircher from the University of Marburg, Germany, led the research team. They performed brain-imaging studies on people playing a gambling game against opponents the subjects believed were either human or computer-controlled. According to Krach, "In our study we examined the impact of gender (women vs. men) and game partner (human vs. computer) on neural activity in the medial prefrontal cortex (mPFC)". The mPFC is an area of the brain that has been associated with the ability to create a 'Theory of Mind' - an accurate model of the thoughts, emotions and intentions of others.

In the game the subjects played, they had to decide whether to collaborate with their opponents to receive a share of the prize or betray them to win the full amount. If both players chose to betray, they would win nothing. Unknown to the players, however, they were always playing against a computer programmed to make random decisions in each round - even when they believed they were playing against another person. As Dr. Krach explains "By tricking the players into 'playing against' a series of random decisions, we averted a situation where two players might settle on an optimal strategy".

The authors found that some brain regions were activated regardless of

whether the players believed their opponent to be real or virtual. These regions are all associated with the 'Theory of Mind': the mPFC, the anterior (para)-cingulate cortex (ACC) and the right temporo-parietal junction. However, in two of these regions associated with planning and anticipation, the mPFC and ACC, activity was significantly more pronounced when players thought they were competing with another human.

The results also indicated that, relative to women, men had a larger engagement of some parts of the brain, including the medial frontal regions, when they believed they were playing a human. In discussing possible explanations for the observed increased brain activity in male players, Dr. Krach speculates that, "Women may not have been as engaged playing an alleged soulless computer. Furthermore, male and female subjects always believed they were playing a male contender in the 'human partner' tests. It has been documented previously that men and women play games differently in the presence of a male partner". However, in this respect more research is required to give any definitive answer to this question.

Are women better mindreaders? Sex differences in neural correlates of mentalizing detected with functional MRI, Soeren Krach, Isabelle Bluemel, Dominic Marjoram, Tineke Lataster, Lydia Krabbendam, Jochen Weber, Jim van Os and Tilo Kircher, *BMC Neuroscience* (in press), www.biomedcentral.com/bmcneurosci/

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