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# Oops, did I do that – or is there someone else in my head?

**Tübingen researchers describe connection between action and feeling of authorship - finding sheds light on delusions of external control in schizophrenia**

The feeling that your own actions are controlled by external forces is a common feature in schizophrenia. A research team at the Hertie Institute for Clinical Brain Research, the University of Tübingen and the Center for Mental Health at the Tübingen University Hospitals has now examined this phenomenon of "delusions of control" in more detail. In one study, it found that people who experience this delusion perceive the length of the time interval between their own actions and their consequences differently from healthy people. With their new findings, the researchers may be able to predict the likelihood of feelings of being controlled, and increase our understanding of this disorder of the self. This is relevant because concepts such as personal responsibility are anchored in the self and shape large parts of our social lives, up to and including the administration of justice, the researchers explain. The study has been published in the current issue of the journal PNAS.

## Perceived temporal connection

"To explore the feeling of action authorship, we focused on the phrenomenon of intentional binding," says joint study leader Dr. Axel Lindner. This term, he says, describes the perceived temporal proximity between an action and its consequence. Lindner cites the switching on of a lamp as an example: "I flick the switch and at the same moment the bulb lights up. The close temporal sequence helps me understand that it was me who turned on the light."

Yet there are situations in which the sequence is not quite so closely timed - such as with energy-saving lamps, which often only light up after a time delay. "Here, our brain subjectively alters the perception of the action and its consequence: turning on the switch is perceived as later and lighting up as earlier than is actually the case." A clever mechanism - but one that does not work in patients with delusions of control, as we have now discovered," says Lindner.

In collaboration with Professor Marc Buehner from Cardiff University (UK), the Tübingen team recruited 20 healthy subjects and 20 patients with schizophrenia. Ten of them suffered from feelings of being externally controlled. All test subjects completed the same task: they had to indicate when they saw a lamp light up by pressing a button with their right hand. There were three different experimental conditions: In one, the lamp was turned on by a switch with the test subject's left hand. In another, the subjects observed how a machine did the switching on for them. As a control, there were times in which the lighting of the lamp was announced only by a preceding cue stimulus.

"The important thing about this experimental setup was that the lamp had a fixed switch-on delay of half a second in all cases," says the study's first author Manuel Roth. "The interval between the three putative triggers and the lighting of the test lamp was thus always the same length."

## Intentional binding as a measurable phenomenon

However, the subjects perceived the length of the interval differently. When the subjects had to press a switch in advance, both healthy and schizophrenia patients with no delusion of control clearly showed intentional binding, the researchers report. Subjects signaled the light coming on significantly earlier than it actually happened. They also perceived the duration to be shorter than when either the machine pressed the switch or when only a cue stimulus was given in advance. Here, the participants perceived the period until the lamp lit up as longer.

In patients with delusions of control, however, the mechanism of intentional binding did not come into play. They perceived the time interval to be the same in all three cases. "In fact, after they had to operate the switch themselves, they reported that an external force - probably a computer - turned on the lamp." Accordingly, the weaker their intentional binding was, the more they experi- enced their own actions as externally determined in everyday life.

The researchers say this study underscores the importance of an intact perception of temporal prox- imity between action and

consequence for feelings of authorship over actions. The study also adds to our understanding of the diminished sense of agency in schizophrenia patients with delusions of control. The researchers hope that such simple mechanistic explanations can be used in the future to quantitatively assess this disorder of the self in schizophrenia and to predict the likelihood of its occurrence.

"Our study is so far purely basic research on a small group that cannot provide any immediate improvement for patients," say the neurobiologists Roth and Lindner. "However, the study provides important clues on how to improve their perception of self-action. Future studies will have to show whether this is possible." The work makes a psychological problem comprehensible using relatively simple mechanisms, says Lindner: "This insight alone could help affected patients and improve so- cial acceptance of the disease."


Publication:

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**Tübingen University Hospitals (UKT)**, founded in 1805, the University Hospitals are one of the leading centres of German uni- versity medicine. As one of 33 University teaching hospitals in Germany, it contributes to a successful combination of top-level medicine, research, and teaching. In 2001 the University of Tübingen and the Hertie Foundation founded the Hertie Institute for Clinical Brain Research (HIH) with the aim of translating the results of excellent neuroscientific research swiftly into clinical prac- tice for the treatment of neurological and neurodegenerative diseases. Website: www.medizin.uni-tuebingen.de/en/

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