The brain area with which we interpret the world

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When it comes to language comprehension, the anterior IPL in the left hemisphere of the brain becomes active (green). For attention, it is the anterior IPL in the right side of the brain (pink). If, on the other hand, social skills are required, the posterior parts of the IPL in both hemispheres of the brain spring into action simultaneously (orange, purple). Credit: eLife

Usually, the different areas in the cerebrum take on a very specific function. For example, they process our movements or things we see or hear, i.e. direct physical information. However, some areas of the brain come into play when dealing with more advanced mental tasks. They

process incoming information that has already been pre-processed and is thus already at an abstract level.

It was already known that the inferior parietal lobe (IPL) is one of these regions in the human brain. Nevertheless, it was unclear how this area is able to process such very different functions. In a large study, scientists from the Max Planck Institute for Human Cognitive and Brain Sciences (MPI CBS) in Leipzig and McGill University in Montreal have helped to solve this question. According to their findings, the different parts of the IPL specialize in different cognitive functions—such as attention, language, and social cognition, with the latter reflecting the ability for perspective taking. At the same time, these areas work together with many other brain regions in a process-specific way. When it comes to language comprehension, the anterior IPL in the left hemisphere of the brain becomes active. For attention, it is the anterior IPL in the right side of the brain. If, on the other hand, social skills are required, the posterior parts of the IPL in both hemispheres of the brain spring into action simultaneously. "Social cognition requires the most complex interpretation," explains Ole Numssen, first author of the underlying study, which has now been published in the journal *eLife*. "Therefore, the IPLs on both sides of the brain probably work together here."

Moreover, these individual sub-areas then cooperate with different regions of the rest of the brain. In the case of attention and language, each IPL subregion links primarily to areas on one side of the brain. With social skills, it's areas on both sides. Again, this shows that the more complex the task, the more intensive the interaction with other areas.

"Our results provide insight into the basic functioning of the human brain. We show how our brains dynamically adapt to changing requirements. To do this, it links specialized individual areas, such as the IPL, with other more general regions. The more demanding the tasks,

the more intensively the individual areas interact with each other. This makes highly complex functions such as language or social skills possible," says Ole Numssen. "The IPL may ultimately be considered as one of the areas with which we interpret the world."

Even in great apes, Numssen says, brain regions that correspond to the IPL do not only process purely physical stimuli, but also more complex information. Throughout evolution, they seem to have always been responsible for processing increasingly complex content. However, parts of the IPL are unique to the human brain and are not found in great apes—a hint that this region has evolved in the course of evolution to enable key functions of human cognition.

The researchers from Leipzig and Montreal investigated such brain -behavior correlations with the help of three tasks that the study participants had to solve while lying in the MRI scanner. In the first task, they had to prove their understanding of language. To do this, they saw meaningful words such as "pigeon" and "house", but also words without meaning (known as pseudowords) such as "pulre", and had to decide whether it was a real word or not. A second task tested visual-spatial attention. For this task, they had to react to stimuli on one side of the screen, although they expected something to happen on the other side. The third task probed their ability for perspective taking using the so-called Sally Anne test. This is a comic strip consisting of four pictures in which two people interact with each other. A question in the end could only be answered correctly if the study participants were able to put themselves in the shoes of the respective persons.

More information: Ole Numssen et al, Functional specialization within the inferior parietal lobes across cognitive domains, *eLife* (2021). DOI: 10.7554/eLife.63591

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