

Statements of Believing involve Attribution

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Introduction

Although believing is a fundamental brain function, it has been largely neglected as an object of research in the neurosciences and general scientific discourse. Here, we briefly describe how stating the content of beliefs involves attributions.

Implicit and explicit Beliefs

Believing denotes brain functions that afford the perception and appraisal of environmental information as detailed in the concept of credition (Angel et al. 2017). Specifically, people tend to believe that their perception of the objects and events in their environment is true and conveys a personal meaning. Accordingly, a belief is the product of perception integrated with an internal emotional value (Seitz et al. 2018). The percept is a probabilistic representation of the stimulus; the emotional value is what assigns the representation a greater or lesser degree of personal meaning. These personal probabilistic representations or “primal” beliefs are stored and updated within large-scale cortico-subcortical processing circuits (Seitz et al. 2019). They evolve on a pre-linguistic level allowing the individual to make implicit predictions about future events, to constrain behavior accordingly, and to update beliefs in light of new information. Based on broad empirical findings we have differentiated three categories

of beliefs in humans: empirical beliefs related to objects, relational beliefs related to interactions, and conceptual beliefs (Seitz & Angel 2020). Conceptual beliefs are based on narratives and ritual acts. They play a constitutive role in social contexts as they promote in-group cohesion and inter-group aversion. In any case, owing to their emotional loading, confidence, and certainty for the believing persons, beliefs are inherently subjective.

Importantly, humans can become aware of the content of their beliefs and phrase them as first-person statements (Oakley & Halligan 2017). When people say “I believe”, they state what they presume to be true, personally relevant, and trustworthy. Also, a belief may be attributed to someone else by inference based on the other person’s behaviour. In this latter case, people would use a third-person expression saying, for example „this is her belief“ or „he has that belief“. Both conditions reflect a personally relevant view with a high probability of corresponding to a graded degree of belief (Dietrich & List 2018). Specifically, the person assumes a high confidence in the accuracy of his or her belief; which differs from how one thinks about facts (van Leeuwen et al. 2021). As a consequence, however, attributions of the beliefs of others are third-person expressions that attribute a label to someone else’s verbal statements or behavior in a retrospective or post-hoc fashion.

Inferring Attributes

Believing is intimately linked with inferential information processing. This means that information that enters the brain can be processed, modified, increased or decreased, and so on, with diverse attributions made about it. Concerning the broad scientific discussion about attribution theories, we refer to the integrative work by Malle (2004). Here, we would like to focus on the pre-linguistic aspects. For instance, a person seeing a little balloon made of colored, partially transparent paper would predict that it is light weight, whereas a ball of identical size made of metal is expected to be quite heavy. Accordingly, the visual experience of an object’s shape, size, surface, and material, leads to an intuitive prediction of its heaviness that results in the individual fine-tuning the strength of his or her grip when attempting to grasp and lift it (Desmurget et al. 1997). When the information coming from the environment changes over time, people consider what is happening as an event with a perceived beginning and an end (Asprem & Taves 2022). These implicit perceptual accounts have been understood to become loaded with affirmative or aversive emotional valence resulting in primal beliefs about objects and events (Seitz & Angel 2020). People have an implicit understanding of belief and trust, although both are complex and elusive (Kappmeier 2016). Ethymologically, the meaning of the Greek term for believing (*pisteuein*, *pisteuein*) includes trust, whereas the meaning of the Latin term believing (*credere*) does not, but refers to knowledge and truth. The oscillation between Greek and Latin strands of understanding also has influenced debates in the Christian theology. The expression „I believe him“ is understood widely to be closely related to saying

„I trust him“. Ultimately, personal freedom requires mutual reciprocal trusting (Paloutzian et al. 2021).

When humans become aware of their own actions or internal narratives, they typically attribute a sense of agency to themselves and ascribe their own authorship to them. Moreover, they attribute agency to self whether the verbal descriptions of their actions and thoughts are in accordance with or deviate from the verbal statements of others. For example, inferring personal authorship for an event gives rise to intentional binding, a perceptual illusion in which one's action and the inferred effect appear to be close in time, with the sense of binding and self-report revealing different aspects of the sense of authorship (Ebert & Wegner 2010). When subjects caused a tone to sound by pressing a button, they judged the length of time of their button-press to be about 15 ms and the tone as sounding 46 ms earlier than when the button-press and tone occurred alone (Blakemore & Frith 2003). This temporal “attraction” was found to enhance the subject's experience of agency (ibid). Similarly, people anticipate their movements when required to tap according to a regular rhythm (Stephan et al. 2002). In contrast, there is a misattribution of authorship in verbal hallucinations such that self-talk becomes attributed to an alien agent (Langland-Hassan 2020). This false attribution appears to result either from a deficit of episodic memory recall or may be experienced as abnormal and, therefore, is attributed to a different agent. This abnormal attribution corresponds to a failure of the so-called belief evaluation system (Coltheart et al. 2011). This system was found to require long-distance connectivity in cortico-cortical and cortico-subcortical circuits that are disrupted in psychotic symptoms (Berkovitch et al. 2021). In delusion disorders, this evaluation has been impaired such that the afflicted person holds her/his false beliefs incorrectly, as if they were true (Sugiura et al. 2015, Connors and Coltheart 2011, Seitz 2021).

At this point, let us highlight that thoughts and actions have been described to result from unconscious neural processes, and conscious will is experienced as a result of what is apparent and not what is real (Wegner 2003). The temporal threshold that determines whether the content of a neural process remains in the subliminal or supraliminal realm is not clear-cut but depends on a number of determinants such as the modality and complexity of the stimulus and the signal-to-noise threshold of the stimulus in the environment. Concerning action generation, cortical brain activity needs to persist at least 500 ms so that an individual becomes aware of it (Libet 1985). This means that brain activity starts to change before an action by the person can be observed from the outside, as well as before the person becomes aware of it. Thus, perception of an intention rises through multiple levels of awareness for about 1.4 s, starting just after the bioelectric changes in the brain indicate initiation of movement (Matsushashi & Hallett 2008). This supports the argument by Libet (2006) that unconscious

cerebral processes precede a subjective sensory experience. In accordance with this, initiation of movement has been associated with increased activity in the pre-SMA area (Lau et al. 2004). Furthermore, subliminal conflict does not affect anterior cingulate activity, in contrast to a conscious conflict that does (Dehaene et al. 2003).

Self-Attribution

Accordingly, the neural processes of believing are intimately linked to the multi-layered model of the self-related sense of agency (Sugiura et al. 2015). Specifically, a person's self-identity can be considered as a multi-faceted attribution. For example, the so-called immediate self is the pre-reflexive point of origin for action, experience, and thought (Gallagher 2000). In the normal experience of voluntary action, the sense of agency and the sense of ownership have been said to coincide and become indistinguishable (Gallagher 2000). The dorsal medial prefrontal cortex contributes to the neural expression of the multifaceted self, including self-awareness (Gusnard et al. 2001, Northoff & Heinzel 2006). On the neural level the anterior medial frontal cortex is mainly involved in evaluating judgments, supporting its role in self-referential processes, and in the self-initiation of cognitive processes (Zysset et al. 2002, Northoff et al. 2009). Although the ventral medial prefrontal cortex was found to be recruited during the analysis of social content, the dorsal medial prefrontal cortex subserves the detection of self-relevance and may, thus, establish an intersubjective context (Schilbach et al. 2006). In essence, the medial prefrontal cortex, the central area of the so-called social brain, was found to maintain information about broad social categories as well as closeness of the self (Kampe et al. 2003, Mitchell et al. 2004, Courtney & Meyer 2020). In a neuroimaging study on psalm 23, there was a strong activation of the pre-SMA in the dorsal medial frontal cortex which was interpreted as an attribution reflecting the relation of the self to God (Azari et al. 2001). This extrapolates to the conceptual belief of God as the biggest and perfect "self", which revolves right back to earlier themes, concepts, implicit arguments about groups (which in this context can especially be religious groups), and trust within and between them. It also pertains to the intuitive/automatic emotional states that happen right in the middle of their transactions and relations out of which new meanings inevitably arise.

Conclusion

The multi-level study of believing and beliefs is an interdisciplinary endeavor. Although the content of specific beliefs may differ, the processes of believing are fundamental, universal, and immeasurably important. Future research that is multilevel and multi-disciplinary can show that gaining knowledge of believing processes will be well worth the effort.

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