

What are the main roadblocks, and how have we overcome them in the past?

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1. The frame of reference problem: We do not feel the Earth's motion, even though it spins eastward at approximately 1670 km/h, because we rotate with it and thus share the same frame of reference. In neuroscience, the inability of third-person observers to directly access a subject's first-person inner sensations presents a similar challenge. This reflects a fundamental mismatch of perspective: subjective experience studied from an external, objective viewpoint. In physics, inaccessible truths are often inferred from constraints imposed by observable phenomena. For example, Galileo argued for a heliocentric model based on indirect yet consistent observations. A similar shift in perspective may be required to understand the brain's inner workings.

2. The challenge of studying the "virtual" nature of inner sensations: We are no strangers to virtual constructs. Numbers, for example, are abstract entities that enable representation of real-world quantities. Negative numbers extend this abstraction further, existing only conceptually yet remaining indispensable in mathematics. The introduction of complex numbers, incorporating imaginary components, has enabled solutions to previously intractable problems such as the square roots of negative numbers. Analogously, once we understand where and how units of inner sensation are generated in the nervous system, we may be able to conceptualize a "virtual space" in which these sensations reside. This framework could enable the mapping, tracking, and systematic analysis of the forms and dynamics of inner experience.

3. The problem of access: How can we study phenomena that are not directly accessible to our senses? This is a longstanding challenge in science. DNA, for instance, cannot be seen with the naked eye, yet staining methods such as ethidium bromide allow it to be visualized under UV light. This illustrates a broader principle: inaccessible

phenomena can often be probed using indirect methods. Likewise, understanding inner sensations will likely require indirect, potentially multi-step, approaches. Although such methods may initially seem unfamiliar, they could eventually become standard tools in neuroscience, much as staining techniques did in molecular biology.