The Causal Effect of Theory of Mind On Consciousness

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Abstract and Proposed Experiment

This proposed study would seek to test for a causal relationship between theory of mind (ToM) and consciousness by conducting a single-variable experiment. Further, the theory proposed to explain this relationship includes that it must exist as a quantum superposition. The independent variable of ToM would be manipulated by randomly assigning participants to two groups. The two groups would represent a higher and lower level of the ToM variable by exposing participants to dramatic material chosen, in the first group, to evoke ToM at a high level; and in the second group, at a lower level. After viewing the material, subjects would receive the Reading the Mind in the Eyes Test (RMET) for theory of mind, demonstrating a higher and lower level of ToM corresponding to which material they viewed. The participants would then complete the Phenomenology of Consciousness Inventory (PCI). The researcher would then compare the scores on the PCI between the two groups, using appropriate statistical tests. If there is a statistically significant difference between the groups, it would suggest that the presence of theory of mind causes the existence of consciousness.

Introduction and Conceptual Framework

The study of consciousness has been fraught with seemingly unending confusion and difficulty. Attempts to define consciousness seem caught in an ontological trap: nothing in the human neurobiological substrate points to what academic philosophers have dubbed "qualia,' the sensation of individual experience. For this reason philosopher David Chalmers famously named finding a source for qualia the "hard problem" of consciousness.

This has not stopped physically minded researchers from looking for this source in the substrate. Physicist Sir Roger Penrose and colleague physician Stuart Hameroff have proposed a quantum-mechanical explanation by way of possible quantum effects in polymer cell components called "microtubules."

To say that parsimony has been lacking in even the questions researchers ask about consciousness is an understatement. I believe the bad questions hold clues to asking better ones. Removing bias here is mandatory. Why must we assume the source of qualia is observable? We seem to be using the lens of consciousness to try to apprehend the contours of the lens itself. A question based on a paradoxical axiom cannot be answered.

If we discard that axiom things open up. The question becomes, is there a logical rule that prevents a system from observing itself? The answer here seems to be an implicit "yes." Now at least we must confront a possible ontological barrier perhaps more fundamental even than the Cartesian Split—the original so-called "mind-body problem"—that appears to undergird the hard problem.

If in fact we are prevented from observing our own consciousness by way of a hard ontological limit, then we must instead seek avenues of inference. We can see that babies are not

born with mature human consciousness. We further see young children pass developmental milestones of intelligence, such as object permanence and ToM. There is ample evidence ToM is a very significant milestone. We also, in our mandatory confrontation with the quantum-mechanical "hard problem" known as the measurement problem, know that an experimenter's choice of experiment affects the outcome of certain fundamental tests. Why this is and what it means for humans was held by the quantum pioneers—and even the second generation of quantum researchers such as John Wheeler and Henry Stapp—as too fundamental to ignore.

Rather than attempting to directly solve the measurement problem, Wheeler gave us the great gift of his clarity and vision in examining the question. In his famous "It from Bit" paper (1989) he concludes:

> That which we call reality arises in the last analysis from the posing of yes–no questions and the registering of equipment-evoked responses; in short, that all things physical are information-theoretic in origin and that this is a participatory universe.

Quantum mechanics was able to move on from these difficult questions by virtue of the world-changing success of the theory, and third-generation researchers who asked questions in this direction were literally told to "shut up and calculate."

Stapp, in his many decades spent contemplating the measurement problem—including work with Wolfgang Pauli, Werner Heisenberg, and Wheeler himself—wisely kept consciousness at arm's length. As a mathematician, he was acutely uncomfortable with its ill-defined axioms. Instead, he made an intuitive connection between the measurement problem and a human person's ability to use the same volition involved in choosing an experiment to cause

movement in their physical body. He notes these are the only two unassailable examples of human volition affecting—and effecting—physical reality (2017).

In 1996, physicist Carlo Rovelli published a new interpretation of quantum mechanics cast in information-theoretic terms, which he named “relational quantum mechanics.” He thus further liberated quantum mechanical rules from their physical substrate.

At this point, we understand quanta and quantum systems quite well. We do not understand what separates quantum from quantum, and quantum systems from the larger systems that contain them. There is a hard limit here because the separator is not directly observable. We must infer separation. We also know that quantum systems evolve to produce specific quantum states. The success of the Schrödinger equation demonstrates this. This mechanism too is unobservable, however. Only the result of these separations can be seen.

We think of theory of mind—our inference about the observations of others—and our own empirical observations as separate. But are they? In relational quantum mechanics these things must not be separate. In fact, their relation joins them into one thing. Inferring observation is observation. This is consciousness.

In quantum mechanics, one thing can have complementary aspects and remain just one thing. That is called “superposition.” Consciousness develops in children by way of crossing the threshold we call “theory of mind.” We cannot experience the resulting superposition of quantum states. We must infer a separator. And we do, quite automatically, it seems.

In this context, our direct empirical observation is also an inference. Many will find this ontological ground unacceptably infirm. Saṃsāra—the Sanskrit word meaning “wandering” and “world”—comes to mind.

This experiment is designed to put us on a new path of consciousness research by testing the causal relationship between theory of mind and qualia.

Validity Issues

Construct Validity

Operationalizing a variable as poorly and inconsistently defined as consciousness is the key deficiency of my proposed study. In fact, I argue that we must infer consciousness; it cannot be directly observed. The study proposed here involves the phenomenology associated with consciousness, rather than consciousness itself. We know we are conscious, though we have trouble defining it; thus, studying the observable phenomena we associate with consciousness may be a more realistic goal than studying consciousness itself.

The phenomenology of consciousness inventory (PCI) is a tool that measures various aspects of human experience, such as attention, imagery, affect, volition, and altered state of awareness. It was developed by Ronald J. Pekala, a psychologist who was interested in studying the effects of hypnosis, meditation, and other altered states of consciousness on human cognition and behavior.

The development of the PCI began in the late 1970s, when Pekala was working as a biofeedback therapist and researcher at the Veterans Administration Medical Center in Coatesville, Pennsylvania. He noticed that different clients had different responses to biofeedback training, and he wondered if there was a way to measure the subjective differences in their experiences. He also wanted to compare the effects of biofeedback with other techniques, such as hypnosis and meditation, that could induce altered states of consciousness.

Pekala began to review the literature on the phenomenology of consciousness, which is the study of how people perceive and describe their own mental states. He found that there were

many existing scales and questionnaires that attempted to measure various aspects of consciousness, such as the Tellegen Absorption Scale, the Profile of Mood States, the State-Trait Anxiety Inventory, and the Harvard Group Scale of Hypnotic Susceptibility. However, he also found that these scales had some limitations, such as being too narrow in scope, too vague in wording, or too influenced by the theoretical biases of their developers.

Pekala decided to create a more comprehensive, precise, and objective scale for measuring the phenomenology of consciousness. He based his scale on the theoretical framework of Charles Tart, a pioneer in the field of altered states of consciousness, who proposed that consciousness could be described by two types of parameters: pattern and intensity. Pattern parameters refer to the qualitative aspects of consciousness—the type and content of mental imagery, the level and direction of attention, the degree and nature of affect, and the sense and locus of volition. Intensity parameters refer to theoretically quantitative aspects of consciousness such as the vividness, clarity, and strength of mental phenomena.

Pekala also drew inspiration from the work of Jerome Singer, a psychologist who studied the role of daydreaming and fantasy in human cognition and personality. Singer suggested that there were three types of mental imagery: positive-constructive, negative-destructive, and repetitive. He proposed that there were four dimensions of daydreaming: vividness, control, discomfort, and realism. Pekala incorporated these concepts into his scale, as well as other dimensions of consciousness derived from his own clinical and research experience.

Pekala developed a pool of 120 items that covered 12 major and 14 minor dimensions of consciousness. He then tested the items on a sample of 300 subjects who completed the questionnaire after undergoing various stimulus conditions, such as sitting quietly, listening to music, meditating, or being hypnotized. He performed a factor analysis on the data and selected

the 53 items that had the highest factor loadings and reliability coefficients. He also standardized the scoring procedure and created norms for different stimulus conditions.

The resulting self-report questionnaire—the PCI—was published in 1982. Since then, the PCI has been widely used by researchers and practitioners in various fields, such as psychology, psychiatry, neuroscience, education, and spirituality. The PCI has been used to study the effects of various interventions, such as hypnosis, biofeedback, meditation, yoga, drugs, music, and art, on subjective experience. The PCI has been adapted and translated for different languages and cultures and has been modified and extended to suit different purposes and populations.

The PCI has been studied and found to be valid (Pekala et al 1986). But what does it validly measure? It represents experience. Yet the measurement problem and the hard problem suggest experience alone cannot lead us to an understanding of consciousness. In the measurement problem of quantum mechanics, we are confronted with a physical externalization of our conscious decisions. In the hard problem, we are required to find a physical source for consciousness, when the framing of the problem itself in terms of a mind-body dichotomy prevents the discovery of such a source.

I propose here consciousness contains a necessarily hidden element: unconscious awareness—the precise awareness that exists before the ToM milestone is passed, and that continues to exist in superposition with the new "conscious" awareness achieved unnoticed by the discovery of the awareness of another. Thus, I'm proposing we study consciousness from a purely information-theoretic frame. This paper is a first step in that direction.

The Reading the Mind in the Eyes Test (RMET) is a tool that measures the ability to recognize and understand the mental states of others by looking at their eyes. It was developed

by Simon Baron-Cohen, a professor of developmental psychopathology at the University of Cambridge, who is known for his research on autism and ToM.

The development of the RMET began in the early 1990s, when Baron-Cohen and his colleagues were studying the cognitive and social impairments of people with autism spectrum disorder (ASD). They hypothesized that one of the core deficits of ASD was lack of ToM—defined here as the ability to infer the thoughts, feelings, intentions, and beliefs of others from their behavior and expressions. They also proposed that theory of mind was related to empathy, the ability to share and respond to the emotions of others.

To test their hypothesis, they devised a series of experiments that involved showing pictures of faces or eyes to people with ASD as well as neurotypical individuals and asking them to judge the mental states of the people in the pictures. They found that people with ASD performed significantly worse than controls on these tasks, suggesting that they had difficulty reading the mind in the eyes.

However, Baron-Cohen and his colleagues also noticed that some of the tasks they used were too easy or too hard for both groups, and that some of the pictures they used were ambiguous or misleading. They decided to create a more refined and standardized test that would measure the subtle and complex aspects of ToM and empathy. They selected 36 photographs of the eye regions of different actors and actresses and asked a panel of experts to generate four mental state words for each picture, one of which was the correct answer.

They then administered the test to a large sample of adults, both with and without ASD, and analyzed their performance and response times. The resulting test—RMET—was published in 2001. It was shown to be a valid and reliable measure of theory of mind and empathy, and it was able to distinguish people with ASD from neurotypical controls, as well as people with other

psychiatric disorders, such as schizophrenia, bipolar disorder, and borderline personality disorder. The RMET was also able to predict other social and cognitive outcomes, such as moral reasoning, emotional intelligence, and personality traits. Since then, the RMET has been widely used by researchers and practitioners in various fields, such as psychology, neuroscience, education, and medicine. The RMET too has been adapted and translated for different languages and cultures and has been modified and extended to suit different purposes and populations.

The RMET also presents validity issues. While an Italian study presents strong evidence of the validity of the test (Vellante et al 2013), by way of its valid construction further questions arise:

External Validity

The notion a researcher can use dramatic material to study ToM is grounded in "cinematic apparatus theory," a convergence of Marxist and psychoanalytic theory that characterizes film and audience as an ideological construct. Many studies have been conducted that connect film and ToM using this framework. The assumption being made is that audience members are making emotional inferences about dramatic characters. Whether the perception of others' emotions constitute true ToM is an open question. It is possible this falls short of ToM in that inferring another's inference—rather than their mere affect—is true ToM, which is a limit to construct validity as well.

The RMET test begs the question, can theory of mind be generalized to include non-human animals such as other primates? Even if we can produce an answer, what does the answer mean for human "consciousness?" Questions about ToM in relation to consciousness at this point are bound to exceed the scope of any one study because our definition of the consciousness variable is itself variable and in certain instances vague.

Temporal Validity: All scientific experiments assume the axiom of precedence. Thing do not depend upon each other simultaneously in science, at least experimentally. This is a deep problem only touched so far in theoretic terms in the aforementioned paper by Rovelli. (Though one could argue Gautama's "dependent arising" makes a similar claim.) In relational quantum mechanics, we are liberated from this axiom by virtue of the informational nature of quantum objects. For Rovelli, they have no independent physical existence; they only exist in relation to each other. That would be their simultaneous relation. Thus, I'm proposing such a relation between ToM and qualia. But my design is perhaps delivered from the realm of the merely unobservable by virtue of the accepted timeline of human development. Just because we can never directly observe the transition from singular awareness to the superposition that is consciousness doesn't mean we can't infer it. In fact, I believe we must!

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