Navigating the Mind: The Interplay of the Real, and the Imaginary

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2023 Fall - PSYC-1110G-U71-Introduction to Psychology

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December 3rd, 2023

Introduction

A general definition of the field of Psychology as, "...the scientific study of behavior and mental processes" could be stated more simply as, “...the scientific study of human behavior and the mind.” Mental processes are a derivative of the real or physical (brain) and the imaginary or human interpretation (mind) as delineated by Cartesian Duality. The result is a psychophysical individualistic and collective reality hurling us all on a probabilistic cosmic roller coaster through an uncharted space and time without a standardized coordinate system to guide us. What could go wrong? The real or physical space (x,y,z,t coordinates) is easily navigated in our daily lives with the aid of technology. Satellites and global positioning systems (GPS) utilize a standardized grid coordinate system of longitude and latitude, time derived by atomic clocks and with the inclusion of the Gregorian calendar, we have all the information we need to navigate anywhere or when (present, future) on planet Earth.

I will meet you at (32.284823222826475, -106.75686820989503) on December 21st, 2023, at 8:27pm (MST) or simply Starbucks at the NMSU campus, Las Cruces. This statement communicates all of the information required for anyone to navigate a complex physical space and time and is standardized to facilitate a mutual understanding of a location and future meeting. The physical world is an extremely large space covering 197 million square miles and consists of 525,600 minutes in a single year but is dwarfed in comparison by the complexity of the psychophysical imaginary space and time of the mind, which is unbounded and infinite. In much the same way we can easily communicate physical coordinates, a systemization would provide a quantitative foundation to communicate and explore the limitless

reaches of that which lies beyond the boundaries of our physical senses yet is a determinant of our conscious physical interaction with the real, the imaginary -the mind.

The Real (x,y,z). Where am I?

Rene Descartes first formalized a two dimensional coordinate system of real numbers (x,y) in mathematics bearing his name, the Cartesian plane. Euclidean space may also incorporate a third dimension (z) whereby cartesian or polar coordinates using Euler's formula may be used to represent physical locality. Minkowski space-time is based on Euclidean space. Coordinate systems are integral to the standardization and communicability of information for navigation and understanding quite literally where and when we are -a coffee shop in NM, on the planet Earth, in the Milky Way galaxy about 2.35 million light years to the nearest spiral galaxy, Andromeda on the twelfth month, December (Decem - 10th month in the Roman Calendar), 21st day, Thursday (Thor's day named after the Germanic god of thunder) two thousand twenty-three years from the date Dionysius believed Jesus was born or simply the Winter solstice.

The temporal data 12/21/2023 @ 8:27pm (MST) required to complete the coordinate system whereby it is given context and meaning is derived in an arbitrary manner, inherently has underlying superfluous information embedded in it, but at the same time is efficient only through its wide adoption as a standard facilitating communicability. As can be seen from the various descriptions of a date and time, arranging a simple meeting would be chaotic without standardization. A standardized coordinate system is needed in Psychology for many of the same reasons. Without efficient, standardized communication, effectively

conducting quantitative analysis in accordance with the scientific method would prove challenging.

The brain is a complex organ which dominates our perceptions of physical reality, coordinating raw sensory stimuli, energy waveforms collected by sensory organs which evolved over time to encompass five basic domains: (eyes,sight; nose,smell; ear,hearing; skin,touch and tongue, taste). Each of the senses provides information to the brain with respect to our locality and a physical representation of our environment. All sensory windows are responsive to energy in wave form. (Green, E.J., 2002) The physical senses provide us a glimpse into various forms of energy evolving in time, sensory data.

Imagine a solitary unobserved universal camera operating with a shutter speed of h-bar (Plank's constant divided by 2 pi) capturing a myriad of evolving waveform data (light, sound, energy, radiation, pressure). The uninterpreted image slices captured by our universal camera stack up in time -analogous to our current space time model of the real. The uninterpreted images, or waveform data have no meaning outside of consciousness. The human brain has to interpret the sensory waveform data relative to our identity in order to give it meaning. Our identity is nothing more than the stack of external images relative to our interpretation from our inception at birth till our death. Our interpretation of the next image is dependent on our interpretation of all of the previous images. Our individual interpretations (identity) also exist as quantum information stacked in time, the imaginary. Oddly enough, although my Starbucks event is in the future, I can clearly see in my mind an image of myself sitting at a table enjoying the Winter solstice with a cup of coffee. Did I travel in time, is this image real?

The Imaginary (i). What am "i" thinking?

> "As a man who has devoted his whole life to the most clear-headed science, to the study of matter, I can tell you as a result of my research about the atoms this much: There is no matter as such! All matter originates and exists only by virtue of a force which brings the particles of an atom to vibration and holds this most minute solar system of the atom together. . . ." Max Plank (Hess, V.F., 1921)

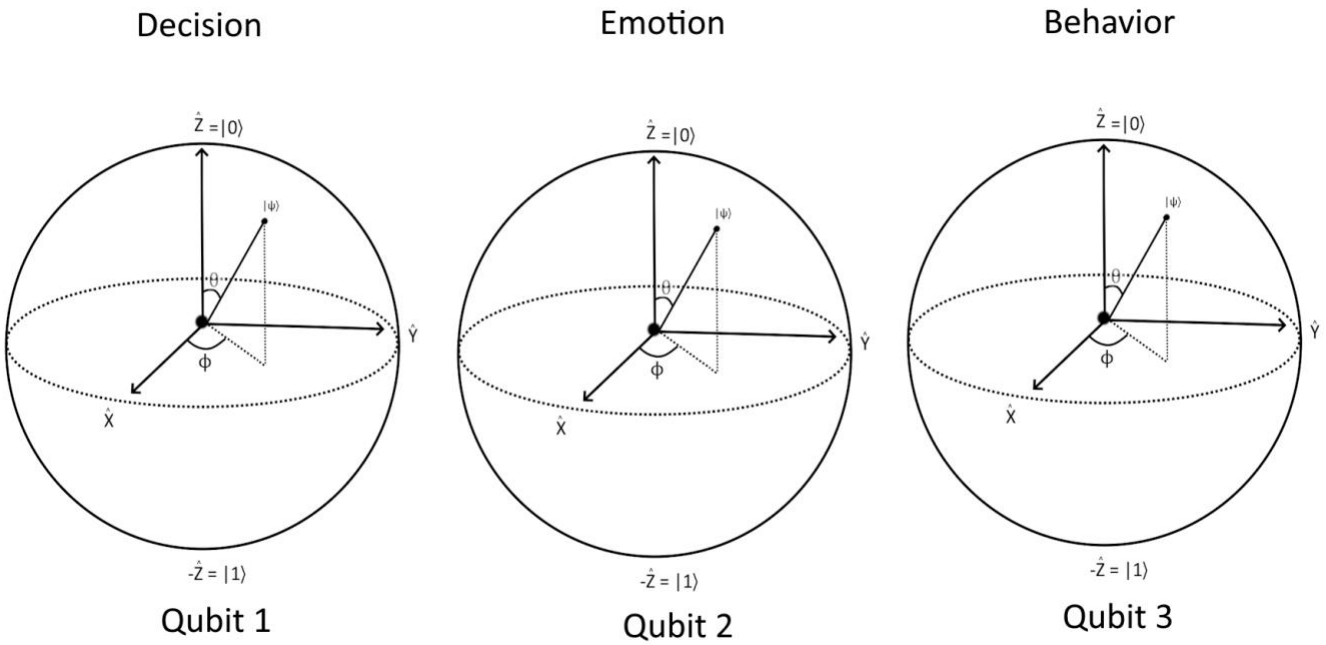
Rene Descartes is known to have used the term imagined or "imaginary" to refer to the square root of negative one or simply the imaginary unit "i". The term stuck and imaginary numbers were conceived of the mind. The imaginary unit or "i" is an integral component of Schrodinger's Equation, waveforms "i sinθ", complex numbers "a=bi", Euler's Formula "e^{ix} = cos x + i sin x", polar coordinates, and ultimately the Bloch Sphere representation of a qubit. The fundamental mathematical machinery of Quantum Mechanics is a product of the mind (imagination), dependent on the imaginary "i" and still left open to various interpretations as even Schrodinger couldn't provide a rationalization for the inclusion of "i" in the fundamental equation of Quantum Mechanics that bears his name, other than the mathematical necessity to create a wave.

The Oxford English Dictionary ("OED") defines mental as "of or relating to the mind." (OED, 2023) Mental processes is a good catch-all term incorporating cognition, emotions, imagination, thought, etc.., however defining the "mind" within the construct of a physical realm is a nebulous task. Mind is defined as "the seat of awareness, thought, volition, feeling, and memory; cognitive and emotional phenomena…" (OED, 2023) None of the items listed in the definition are tangible. The items that make up the definition of mind, may not be directly viewed by an observer as part of a physical reality, in this sense they are imaginary. However, memories, thoughts, feelings, and cognitive phenomena do exist in a stream of

consciousness as part of a person's identity, which is expressed through behaviors and actions that may be definitively observed in the physical "real" world.

A majority of a person's life is experienced in the imaginary, governed by their internal perceptions of external reality (thoughts) formed by their identity which relative to the real observable external universe does not exist. For example, if two people Bob and Alice are viewing a painting at an art gallery, Alice may decide that the artwork is pleasing to her, it makes her feel good and she is going to buy it. It fits with her sense of identity. However, Bob decides that the painting displeases him, it makes him feel bad and he is never going to buy it. He does not identify with it. If neither Bob nor Alice communicates their inner thoughts to one another, they remain imaginary outside of the realm of the observable, yet they are real from either individual's perspective. Assuming no other observers of the painting, is the painting a good or bad painting? If Bob and Alice are the only observers of the painting in a two-person universe, objective reality as it relates to the painting being good or bad is a function of their perceptions as the sole arbiters. Wave interference can be constructive for example Bob and Alice both like the painting, it makes them both feel good, and they both want to buy it creating a larger combined wave. Wave interference may also be destructive, as in the original example where Bob and Alice have dual opposite views, resulting in them canceling each other's perceptions out with respect to quantifying an objective reality concerning the painting being good or bad. If Bob and Alice communicate with respect to the painting, communication can influence and flip the decision, emotion and/or behavior vectors. A three-qubit model could be used to express a person's interpretation of the painting with the following wave equation (bra-ket/Dirac notation):

$|\psi\rangle = \alpha|000\rangle + \beta|111\rangle \qquad \alpha + \beta = 1$



Decision - Qubit 1 [0 = Like it], [1 = Don't Like it]
Emotion - Qubit 2 [0 = Feel Good], [1 = Feel Bad]
Behavior - Qubit 3 [0 = Buy it], [1 = Don't Buy it]

Both Bob and Alice are viewing the same external image and yet their perceptions are dual opposite. Their identities are now entangled by the experience of both viewing the painting as they each have formed a psychophysical interpretation of what the artwork means to them. The act of studying the painting has also changed their identity.

When the Imaginary Becomes Real and the Real, Imaginary. Who am I?

I think, therefore I am. But who exactly am I? Interestingly, the etymology of the word "Psychology" points to the Greek words "psyche" [soul] and "logos [to study]" (Schacter, Gilbert, Nock, & Wegner, n.d.). Quite literally a study of the soul. The "soul" poses a problem for any type of scientific research because it is purely imaginary. It can't be measured, although

some research has tried. The soul is an idea that cannot be empirically proven, yet there are billions of people on the planet who believe they have a soul. Their belief forms part of their identity. Maybe they do?

People's behaviors are influenced by their beliefs. As long as they believe in their mind that the soul is an inherent part of their human make up, perhaps even immortal it will affect their individual as well as collective actions/behaviors, decisions and emotions. Everyone is influenced by the imaginary! At what point does the imaginary transcend into physical reality? If human behaviors and actions flow from the mind or the imaginary, they are inevitably destined to manifest into physical reality in some individualistic and/or collective malevolent, benevolent or innocuous form.

The Measurement Problem, A Coordinate System of The Mind.

The measurement problem with respect to Quantum Mechanics is presented in the paradox of the Schrodinger's Cat thought experiment, whereby the observer's measurement collapses the wave function of a two-state system into a finite state of the cat being alive or dead. Prior to the observer's measurement, the cat's state which is entangled with a decaying radioactive atom is in a probabilistic state of being either alive, dead or both alive and dead, a superposition. The act of the observation always results in a collapse of the wave function and an observed state of the cat being alive or dead.

The behaviors, emotions and decisions of a person are analogous to the state of the cat in the box with the decaying radioactive isotope. They are in a probabilistic state of mind until they manifest into an action or measurable behavior. Otherwise, the thoughts, feelings and

potential behaviors remain solely isolated in the mind; from the perspective of any other observer are purely imaginary, a set of probabilities residing in the subconscious until they are revealed in speech, body language or any form of communication or measurable action at some point in time. When resultant behavior or actions do manifest, they are always bounded by duality, just like Schrodinger's cat being alive or dead. Consciousness is the link between mind and matter and the real and the imaginary. Thinking is a quantum event, and although we may not directly detect it in others, it does manifest itself in what follows. The idea is father to the word, and the word is father to the act. (Green, E.J., 2002) Can human behavior and actions be modeled, influenced and/or modified? You bet. That is why the scientific study of human behavior and the mind is important and a suitable, general definition of the field of Psychology.

Conclusion. What should I do?

Human perception (awareness), much like subatomic particles such as a quanta of light (photon) may behave in a real sense as a particle or as a probabilistic waveform. An analogous dualistic construct would be the human brain (real) and mind (imaginary) -a waveform of probabilistic behaviors, emotions and decisions bounded by duality. Under the Newtonian model of classical physics the future is deterministic, for example the billiard balls moving on a table could be projected into the future with respect to their location in four dimensional space as denoted by x,y,z,t using classical Newtonian equations. The brain is made of matter and operates in conjunction with the body using electro-chemical processes that are subject to the classical physical laws that govern the universe. Instead of a few billiard balls on a table, picture billions of neurons firing electrical impulses subject to the laws of classical

physics, no different than electrons traversing a silicon wafer. Neurons and the electro-chemical impulses would act predictably. If the physical apparatus of the brain was the sole driver of consciousness, human behavior would be predictable just like the billiard balls and the outcomes deterministic; free will would be an illusion. (Green, E. J., 2002) It is clear that the duality of classical physics/quantum mechanics is required to explain natural phenomena in the physical universe, it stands to reason that the same dynamic exists with respect to the body (brain)/mind duality as behaviors, emotions and decisions are a quantum phenomenon, waveforms bounded in duality. Any mental state including one's perceptions of a painting or even mental disorders as defined by the DSM can be expressed as a waveform. A standardized coordinate system of the mind would provide a valuable tool for researchers looking to apply the principles of Quantum Information Science and related quantum computing technologies to advancing the field of Computational Psychology.

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