Foundation for Mind-Being research

SEGMENTS FROM A COURSE ON THE NATURE OF MIND-BEING

The Relationships and Evidence: Consciousness, Science, Spirituality, and Nature of the Universe

Search for a Scientific Theory of Consciousness
Slides from FMBR Lecture by Federico Faggin
November 20, 2015

Foundation for Mind-Being Research

Where science meets consciousness...

The Search for a Scientific Theory of Consciousness

with ***Federico Faggin***

The study and debate about the nature of consciousness has been primarily a philosophical and religious one until 20 years ago when a few neuroscientists started the search for neural correlates of consciousness. Today most educated people are aware of the mystery of consciousness, yet the overwhelming majority of them believe consciousness to be the result of the operation of the brain, despite the absence of any real evidence to support that claim. A few researchers believe instead that consciousness may be an irreducible property of nature.

This talk will first describe the essential and unique aspects of consciousness that need to be explained by a successful theory, and the main ideas and research directions behind the current efforts toward the development of a scientific theory of consciousness. The bulk of the talk will be the presentation of a conceptual framework developed by the author that defines the critical requirements for a mathematical theory of consciousness, and is a necessary guide to the creation of a mathematical theory of reality under the assumption that consciousness is an irreducible property of nature. The talk will conclude with the author's views about the possible future developments in this field.

Born in Vicenza, Italy, ***Federico Faggin*** received a Laurea degree in Physics, summa cum laude, from the University of Padua (1965), and in 1968 he moved to Silicon Valley, California, where he now lives. Faggin gave life to a large number of state-of-the-art products and technologies since he was 19 years old, notable among them are: the design and construction of a small transistorized computer (Olivetti, 1961); the MOS Silicon Gate Technology (Fairchild, 1968); the world's first microprocessor (Intel, 1971); several highly successful microprocessors, among them the Intel 8080 (1974), and the Zilog Z80 (1976). Faggin also founded and directed Zilog, Inc. (1974), Cygnet Technologies, Inc. (1982), and Synaptics, Inc. (1986), where the Touchpad (1994) and the Touchscreen (1999) that have revolutionized the way we interface with our mobile devices were developed. He is currently dedicated to the science of consciousness through the Federico and Elvia Faggin Foundation. Federico Faggin received many international prizes and awards. Distinguished among them are the Marconi Prize (1988), the Kyoto Prize (1997), the induction into the US Inventors' Hall of Fame (1996), the 2009 National Medal of Technology and Innovation from President Barack Obama, the Enrico Fermi Award (2014), and many honorary degrees in science and engineering.

Friday November 20, 2015, 7:30-9:00PM
Unity Palo Alto Y.E.S. Hall
3391 Middlefield Road, Palo Alto
Free to members, $15.non-members,
$5. Students with I.D.

THE SEARCH FOR A SCIENTIFIC THEORY OF CONSCIOUSNESS

Federico Faggin

President, Federico and Elvia Faggin Foundation

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INTRODUCTION

- Until 25 years ago, the study of consciousness was generally considered an inappropriate subject of scientific inquiry
- New instruments made possible to correlate brain states with states of consciousness, and a few neuroscientists and psychologists started exploring this subject
- Today, the study of consciousness is *beginning* to be accepted as a legitimate research subject, primarily by neuroscience
- Most scientist, however, do not believe that consciousness is an ontological aspect of nature
- Therefore consciousness is not considered a problem of physics. Only a handful of physicists have a different view…

- There are many ideas about the nature of consciousness in the philosophical and spiritual literature. The Vedas, more than 5000 years ago, gave us a particularly poignant account about the primacy of consciousness

- The prevalent scientific view today is based on materialism: everything that exists is made of quantum fields that originate space-time and matter. Therefore consciousness must be (by definition) an emergent property of a complex organization of matter; consciousness must be entirely produced by the brain

- However, if consciousness is produced by matter, current physics should be able to completely explain how it works. But this is not the case

- On their end, neuroscientists have been telling us to be patient, confident that when they will finally understand how the brain functions, the mystery will be finally resolved

- However, there are many anomalous phenomena of mind-matter interaction that cannot be explained with current physics, but there is no theory that can explain them
- This evidence suggests that “consciousness” cannot be entirely produced by the brain
- Given the huge intellectual investment in the current materialistic paradigm, and the difficulty in reliably repeating anomalous phenomena, this evidence is summarily dismissed
- Thus, if we want a theory starting with non-materialistic principles, we need to develop a consistent mathematical *model* of consciousness with the following properties:
  - It must make all the experimentally verified predictions that have already been made by the existing physical theories

- It must make new *crucial* testable predictions *not made* by current theories, AND
- Such predictions must be experimentally verified, thus *falsifying* the existing theories
- Only after such experimental verification can the model be properly called a *theory*
- If the new model succeeds, the young physicists are likely to accept the theory while the older generation will resist

- **This is what has always happened in science. This is what it means to playing the game of science by the rules of science**
- **Only then will such a theory have a chance of changing the dominant materialistic worldview and unify science and spirituality**
- **The bar is very high indeed, but short of a miracle, I am convinced that there is no other way to change the current paradigm**

WHAT IS CONSCIOUSNESS?

- Each one of us has a "sense of self." That's how I *know* within myself that I exist as an independent, sentient self
- But how do I know I exist? Because that "sense of self" is the *feeling* that carries the knowing. *I know because I feel*
- Knowing then is a special kind of feeling. Without feelings, I could not know I exist; nor could I know anything else
- The capacity to feel is an *irreducible* property of a *self*. I know I am a self because I feel so *within*. My experience has an *inner* and an *outer* dimension
- The essence of consciousness then is the capacity to feel. That's what makes a self *sentient*. That's what gives *meaning* to our life

- More generally, we can say that consciousness is the capacity of a self to perceive, know, and experience through *feelings*
- Now on the word feeling will be used in the most general sense to indicate any inner and outer physical sensations and feelings, emotions, thoughts, and spiritual feelings
- What something feels like is called *quale* (plural, *qualia*); for example, the smell of a rose, the taste of bacon or the feeling of a thought crossing our mind, are qualia
- We perceive through qualia; we know through qualia; we find self-fulfillment through qualia. Without qualia we would be robots, zombies; a machine; a set of action-reactions
- Consciousness empowers us to *reflect* before we *act* by translating our perceptions into an integrated "feeling-picture" that allows us to make decisions based on comprehension

- **Let's consider the difference between the "perception" of a robot and the perception of a human being. Suppose a robot is asked to read a book aloud. Then:**
  - The vision system of the robot would produce an "image" of the page and send it to memory (but no *feelings* are associated with the image)
  - The text recognition software would then isolate and recognize each word in a sentence, trying to "understand" the sentence in order to give the proper voice intonation. But understanding is not possible without consciousness; only imitation-understanding
  - The text-to-speech software module would then produce a verbal sentence with a make-believe prosody
- **Now suppose a human being is asked to do the same thing. Then:**
  - The person would *automatically* produce a *qualia-image* of the page

- The person would mentally read the sentence, translating it into a *meaning* (an integrated feeling). To give the correct intonation requires conscious understanding – comprehension – of the text
- Each word would then be automatically voiced with the correct prosody because of *comprehension*. Humans combine automatic (conditioned responses) and *conscious* perception-action, mediated by comprehension. Humans are *semantic/syntactic* entities

- **The process "action—conscious-reflection—response" is not possible for computers. Computers (even though they are programmed by human beings) have *no self* and can only *imitate* conscious behavior. Computers are *syntactic* entities**

- **Notice that information in a computer is in the form of digital electrical signals. But electrical signals by themselves do not produce feelings**

- **Materialism leads us to believe we are machines, but no machine has feelings. A machine is just a blind chain of conditioned responses; there is nobody home; it's dark inside**

- We are led to conclude that consciousness must be a fundamental and *irreducible* property of a self. Self and consciousness are *inseparable*; one implies the other
- However, the self is "more" fundamental than consciousness since a self is endowed with other irreducible properties not shared by consciousness; specifically: identity, free will, and action
- Consciousness endows a self with sentience: perception, comprehension and experience. We could also say that consciousness is the *focus* of the self; the direction in which the self focuses its attention
- Since self and consciousness are inseparable, all inner reality results from the interplay of five fundamental, irreducible, and interdependent aspects, like five facets of a whole: Identity, perception, free will, comprehension, and action

FUNDAMENTAL PROPERTIES OF SELVES

- *Identity*: the capacity of a self to be identified within itself as itself. Uniqueness, independence, agency are properties of identity
- *Free will:* the capacity of a self for independent, voluntary action. Intention and attention are expressions of the free will of a self
- *Perception*: the capacity to feel
- *Comprehension*: the capacity to know, i.e. to perceive a pattern, an inner structure, within a perception. Comprehension is a perception within a perception – a *recursive* property
- *Action* is the capacity to *materialize* an inner structure into an outer material structure

MATERIALISM

- The conceptual framework of physics is based on concepts derived from the human experience of the *outer* world: space, time, matter, force, energy, action, motion, etc.
- It is based on reductionism, physicalism (a monism based on a “material” origin for everything in existence), a few fundamental principles, the use of mathematics based on classical logic, and giving ultimate authority to experimental verification to determine the truth of a theory
- In the last century the conceptual framework of physics has seen dramatic changes with the emergence of general relativity (GR) and quantum physics (QP). The debate on many issues is still going on (the measurement problem in QP, the Big Bang, dark energy and dark matter, many paradoxes, the inability to unify QP and GR, and so on…)

ESSENTIAL COGNITIVISM

- We start by recognizing that *feelings* are the "substance" out of which all our conscious experience is made
- We recognize that there is no known physical principle that can explain how electrical activity in the brain can produce *feelings*, qualia
- We recognize the *fact* that we experience both *inner* and *outer* realities, but physics assumes that only outer reality exists and its theories only predict outer, "objective" reality
- Given the impossibility of explaining how consciousness (the capacity to feel) may emerge out of atoms and molecules banging against each other, a new theory based on the *postulate* that consciousness is an *irreducible* property of reality is the *only* other possible solution

WHERE DO WE START?

- What if the energy of the Big Bang, the energy that created space, time and matter is conscious energy? In other words, what if the physical space, time, matter, and energy are emergent properties of this "conscious energy"?
- Then physics would need to start with a completely new framework based on concepts arising out of the deepest human experience of the *inner* world: self, identity, free will, consciousness, perception, comprehension, etc.
- Therefore, the new model *must* explain how the outer world of space, time, energy, and matter (STEM) emerges out of the inner world of "conscious energy"
- This is exactly like what we would expect current physics to be able to explain: How the *inner* conscious world emerges out of STEM (but it cannot by design!)

- **To pursue this path, the fundamental concepts of physics should then be derived from a set of fundamental cognitive concepts, just like the cognitive concepts should now be derivable from the fundamental concepts of physics**
- **We then need a new mathematical model that contains the current theories of physics as limit cases of a broader theory**
- **The new model must explain both the inner and the outer aspects of reality, and should be founded on:**
  - A *monism* based on an extra-physical indivisible Wholeness at the origin of everything that exists: conscious energy, *One*
  - A few fundamental *cognitive* principles
  - Holism, rather than reductionism
  - The use of mathematics based on non-classical logic
  - Explain both the inner and the outer aspects of reality
  - Make testable predictions that can falsify current theories

PROPOSED CONCEPTUAL FRAMEWORK

- The new conceptual framework starts with *One*, an indivisible Wholeness existing before space, time and matter, and out of which everything that exists is "made"
- The "substance" of One is extra-physical dynamic and *aware* energy (*Energy*) with unlimited creative potential. (The energy of the Big Bang is this cognitive or conscious energy)
- All manifestation is driven by the urge of One to know and fulfill itself. This is the fundamental cognitive principle
- Each *self-perception* of One creates a new and unique consciousness unit (CU) – an elementary self out of which all other selves are "made"
- The CU is an infinite quantum of *cognitive* Energy permanently "shaped" by that self-perception

- Each CU is an irreducible *part-whole* of One with its own unique cognitive frame of reference through which it can perceive Energy and *know* itself
- CUs combine into higher order selves, and *through them* One can then perceive and know itself
- Knowing requires a knower (a self) with the capacity to perceive the *inner structure* inherent in a perception (a multidimensional feeling). Knowing (comprehension) is then like a self-perception inside a self-perception. Perception is thus a *recursive* property of consciousness
- Each self shares the same urge of One to know itself. This means that each self can *unfurl* the truth about itself. This truth is a *dynamic* and *subjective* truth, far from the concept of static and objective truth we generally have. In this model there is no *absolute* truth

- A CU can then be described as an “atomic” (irreducible), self-consistent, dynamic, and independent *cognitive unit*; an elementary self; a “face” of One
- All selves exist in *superposition* in an extra-physical *semantic* space called *cognitive space*, C-space, where time doesn’t exist. Though time doesn’t exist, however, there is *becoming* i.e. change without time
- The Energy of C-space is *permanently* shaped by the self-knowing and experiences of the selves. It is perceived by all selves as feelings
- Within this conceptual framework, the fundamental cognitive unit is the *self*

THE NEED FOR COMMUNICATION

- Although each CU can perceive (observe) the totality of Energy through the unique cognitive filter of its own identity, it cannot *communicate* with other CUs: To communicate the CUs need some symbols, some tokens
- Out of their own substance (Energy), the CUs shape some *dynamic forms* to be used as communication tokens. These tokens are called energy units (EUs)
- EUs are dynamic structures of Energy serving as *symbols* that stand for the CUs' feelings. They are like the words of the human language
- EUs allow CUs to communicate with each other and thus to enter into deep *relationships* where each CU can fully comprehend its own feelings and the feelings of the partner, through commonalities and differences

- Complete comprehension of two CUs in a relationship gives rise to *a new independent self of a higher order* (2nd order) which then continues its own independent self-knowing without subsuming the component selves
- Then two 2nd-order selves can similarly combine to create a 3rd-order self, and this process continues ad infinitum
- With EUs, the CUs *co-evolve* a hierarchy of selves and a hierarchy of tokens, in step with *the evolution* of their own self-knowing
- The *syntactical* space of tokens is called *information space* or I-space. I-space is a public extra-physical space with no time
- Once a sufficient number of hierarchical levels of selves and tokens have developed, the communication tokens can also be used as *structural elements* to build many different physical universes (space, time, and matter)

- Each universe is constructed by the cooperation of many orders of selves with the common purpose of having their own “learning” experience
- Physical universes allow hierarchies of selves to cooperatively interact with other selves via hierarchies of tokens to advance their own self-knowing, eventually producing higher-order selves
- Physical universes provide then the necessary *feedback* for the selves to know themselves through powerful cognitive experiences.
- The hierarchical nature of the selves will then be reflected in the hierarchical nature of communication tokens with their associated syntactical rules. The semantic space *co-evolves* with the syntactic space; one reflects the other

ACTION

- *Action* is the result of the urge of One to know and fulfill itself, leading to the manifestation of "material forms" (the communication tokens) in which to express itself. The material forms act like mirrors, reflecting to the self the "structure" of its own self-knowing
- Any material manifestation, however, will fall short of fully expressing the self, leading the self to seeking expression in evermore complex, new material forms
- Action is then the never-satisfied excess of inner potentiality trying to express itself in outer form. It is the inner source of never-ending evolution and transformation of all selves and thus of One. Notice that One is far from omniscient
- Therefore, it is impossible to fully know the self by studying only its outer forms

THE NATURE OF REALITY

- The ultimate reality is then the *semantic* reality of the selves in C-space
- I-space, the *syntactic* space, exists "inside" C-space, in superposition with it
- All inner and outer realities emerge by the interaction between selves in C-space and tokens in I-space
- *Two or more* selves can also "materialize" a *portion* of themselves in a physical world to interact with other materialized selves and experience the "material" consequences of certain cognitive structures within them
- The materialized self (ego) is a *provisional* self "made" of a small portion of the combined consciousness of two or more selves, intersecting the areas needing greater comprehension

- The ego is that portion of the materialized self that identifies with the physical body. The ego will focus its consciousness primarily on the information coming through the sensory-brain system of the body, creating a perception of I-space reality in C-space that ***feels like*** a physical world. This is called *P-space* (physical space)
- The selves that materialize a portion of themselves witness the consequences of their not-yet-fully-understood aspects through the physical manifestations of their provisional selves. Many life-cycles are needed to achieve full comprehension, giving rise to a new higher-order self
- The physical universe then acts like a ***virtual reality*** world with the purpose of providing the necessary feedback to the selves to increase their own self-knowing and self-fulfillment, and give birth to new higher-order selves

- Space, time, matter, and objects are thus "***illusions***" manufactured by the sensory-brain system of the body as it processes a particular set of I-space symbols into the symbols that the ego perceives as the "real" world
- Note that the information processed by the body comes exclusively from a small subset of the set of I-space tokens that constitutes a particular "physical" universe
- Each materialized self thus "creates" a unique "world," called P-space, *correlated* with the unique P-spaces of other similar selves, through the cooperation of many orders of lower-level selves
- P-space is thus a ***projection*** of a small subset of I-space tokens into the consciousness (existing in C-space) of the materialized self, giving the *appearance* of a real world
- The "objective" physical laws derive then from the hierarchical ***syntactical*** laws of the I-space tokens

SUMMARY OF THE PROPOSED FRAMEWORK

- The fundamental cognitive principle driving all manifestation is the urge of One to know and fulfill itself
- Each self-knowing of One gives rise to a new self
- The need of the selves to communicate produces I-space. I-space exists *within* C-space and is the *syntactical* space containing the symbols used by the selves to communicate
- All universes (P-spaces) *emerge* by the interactions of selves occurring between C-space, the semantic space, and I-space
- Physical reality emerges in the consciousness of a particular materialized self when the self identifies with the material body. It is a projection of I-space into C-space *for each self*
- The ultimate reality is not physical reality but the extra-physical *semantic* reality of selves existing in cognitive space

WE NEED A NEW MATHEMATICAL THEORY OF REALITY BASED ON COGNITIVE PRINCIPLES

- Since the entire conceptual framework of physics is based on the absence of consciousness, we must start with a new framework defining a new set of *fundamental cognitive concepts* to guide the creation of new mathematical model
- The conceptual framework I have described postulates that all inner and outer realities emerge by the interaction between selves in C-space and tokens in I-space. Physical universes are then created by those interactions much like virtual realities, necessary to advance the fundamental cognitive principle
- How do we convert this *model* into a new mathematical theory of reality?
  - First we need a new logic, called *cognitive logic*, based on an extension and formalization of the logic of quantum information

- The cognitive logic will suggest new mathematical objects to formulate a broader theory of I-space that contains quantum physics (QP) and general relativity (GR) as limit cases
- Just like QP reduces to classical mechanics when h = 0, and GR reduces to Newtonian space and time when c = ∞, the new theory must have one or more novel parameters
- The model must show how space, time, matter, etc., as well as physical laws, emerge from the new cognitive principles

- **The new model must**
  - Unify QP and GR into a broader theory
  - Make testable predictions not made by either QP or GR
  - Resolve many existing paradoxes and conflicts (for example the measurement problem) and have far vaster explanatory power
  - Unify inner and outer realities into a comprehensive theory
- **Only I-space, being a syntactical space, can be described by a mathematical model. C-space is beyond the reach of mathematics**

CONCLUSION

- The views expressed here are the result of a personal journey that started more than 25 years ago
- There is ample evidence that science will not be able to explain the nature of consciousness solely based on materialistic principles, despite many promises to the contrary
- Therefore, we need to vigorously pursue development of a *mathematical* theory of reality that starts with the primacy of self and consciousness, and is driven by *cognitive principles* rather than materialistic ones
- This model has the potential not only to unify physics, but also to unify science and spirituality, healing the split that has divided humanity for millennia

- This model may bring a completely new perspective to the study of biology, neuroscience, medicine, cognitive science, psychology, sociology, economics, and even robotics and information science
- Current science depicts a world deprived of purpose and meaning by insisting on materialistic principles that I believe have run their course
- It is time to scientifically explore and understand what gives *purpose* and *meaning* to all existence