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The Synergistic Integration Theory of Brain Phenomena

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Introduction

The Theory of Synergistic Integration was introduced in my article *The Development of Mind (Note 1: Reichborn-Kjennerud, Gunnar (June 2016)).* In this article the concept has been further developed and applied to other conscious phenomena of the brain. In simple terms, it attributes the conscious experiences we have to synergy effects of integrating extensive interconnected and related neuronal brain areas, rather than to a smaller number of local neuron groups or isolated neurons..

This puts the hard problem of consciousness in a little different light.

Synergistic Integration

The image of a scene perceived in the mind is not a simple collection of elements of the scene.

Signals from the eyes go to tuning neurons in layers of the visual cortex which extract various bits and pieces of info from the image on the retina, like detecting an edge between a dark and light area. These types of info do not by themselves give rise to a conscious perception of the image. They proceed to further reaches of the brain and activate a vast number of interconnected sets of neurons, the activation of which are also unconscious. But together they combine to create a conscious perception of the original image. By synergy the perception is of a higher level than the bits and pieces of info by themselves. No computation need be supposed to have taken place. The bits and pieces from the eye and from the interconnected sets of neurons are integrated synergistically and appear to the mind like a puzzle appears when all the separate pieces have been hooked together. Or like a mosaic consisting of hundred thousands of groups of neurons all activated simultaneously and in parallel, It is a conscious perception in that the image now makes it possible for the seer to navigate in his world. But being thus conscious of a scenery has nothing to do with consciousness in general, which has more to do with the act of reflecting on what is being seen.

A bird flying at high speed through the woods can see the trees, but is not conscious of the trees in the sense that a human being would be. Otherwise there cannot be much difference between bird and man as far as seeing is concerned.

Birds have two eyes. Consequently, it can perceive depth like we do. That is of course why it has two eyes. It would not be able to navigate through the woods at high speed without being able to

perceive depth and colors.

Perceiving depth is a prime example of synergistic integration of disparate sets of neurons. Each eye has its own brain region and sets of neurons, and the images from the eyes entering into these regions are both flat and two-dimensional. And yet, they wondrously appear before the inner eye with depth qualities they don't possess by themselves. This is a concrete example of synergistic integration of synaptic neuron sets, including neurons sets representing other aspects of depth vision, like the varying size of objects on approaching an object.

The perception of depth is not an automatic feature. Using a stereoscope and two photos, displacing the photos just a little results in losing the depth illusion and seeing two separate flat pictures.

There are numerous examples of other synergistic integrations being at play.

Optical illusions like Schroeder's reversible staircase or Thiery's cubic figure are examples of similar synergistical integrations. The geometric figures of parallelograms can integrate unconsciously with stored neuron groups representing a previously observed staircase seen from above, as well as with groups representing a staircase seen from below. The illusion varies depending upon which groups the geometric figure is being integrated with.

Red, green and blue color signals from the cones of the eye are forwarded to respective brain areas. There is no cone for yellow. Yellow may thus emerge as a synergistic integration of the red and green brain areas.

Halucinations occur when there is synergistic integration of brain areas representing the objects you are looking for and brain areas representing obects you unconscioously perceive as very similar. Like intensely looking for a friend in a crowd, or hungrily seeking food in a barren desert.

Dreams can be regarded as synergistic integration of random brain areas, in the process creating novel experiences out of stored experiences.

A deja-vu experience can occur when there is synergistic integration of brain areas representing a novel emotional state and brain areas representing memories you unconsciously perceive as very similar.

Intuition is a synergistic integration of brain areas related to the situation at hand.

Synergistic integration of brain areas occurs when a piece of music acquires a depth and a solemnity not apparent by the simplicity of notes or chords being played, typically on hearing a piece like *Claire de Lune* by Claude Debussy.

Pieces like Ludwig van Beethoven's Symphony No. 5 or Edvard Grieg's Piano Concerto in A Major

evoke strong feelings because they integrate synergisitically with brain areas unconsciously representing grand sceneries or grand emotions, storms, temperamental scenes, and so on, even giving some people goose pimples.

It is hard to imagine that these phenomena of the brain are facilitated by any type of computation. Neuronal signals flow through the brain in all directions and may cause excitations of neurons in thousands of places within the brain, simultaneously and in parallel. They all contribute more or less subconsciously to the resulting mosaic of a conscious perception which is more like a complex signal than part of any consciousness, a signal that is seed for causing new flows of neuronal signals causing new mosaics.

Such signals may not be conscious perceptions at all. I have experienced an act of seeing which has been completely unconscious. In a rushhour when traffic was exceedingly slow I saw a red car enter my lane in front of me. I then fell into a deep state of thinking of a problem I was working on when I suddenly realized that I had a white car in front of me. I had not seen the car entering my lane, but had undoubtly been maneuvering my car and must have been using my eyes and subconsciously been seeing the white car and letting it pull over.

That makes me believe that birds are not necessarily conscious of what their eyes see when they fly through the woods. Their brain mosaics depicting the scenery they fly through may act as normal neuronal signals to their motor brain areas just guiding them to fly between the trees. As unconsciously as a robot vacuum cleaner avoid obstacles, or as a garden robot grass cutter does it.

It is impressive how seemingly complex tasks can be performed automatically and subconsciously. I have seen navy operators receiving and decoding morse signals through their headphones and rapidly typing the messages they receive down on typewriters while at the same time totally unencumbered carrying on conversations with us onlookers. It seems you only need to make a conscious effort when you are learning something new, and in the process are altering the synaptic levels of your neuron networks.

Except of course, in the act of thinking. When you think, the seleciion of words cannot be automnatic.

When you *think,* you do so in terms of words. But you don't perceive the words as spelled-out text in a visual form. You perceive them as inaudible sounds, and when you are thinking, you are seemingly speaking to yourself. So the thinking process occurs in the brain areas devoted to hearing and to the use of your larynx. Incidentally, if evolution had not provided us with a larynx, we would not be able to utter intelligible words, and there would be no languages, no words and no thinking. Which means that we can date our culture back to a finite number of thousands years.

Sounds are stored in groups of neurons which are interconnected to thousands of other groups

giving the sounds specific meaning, when they represent words. We are thinking by having neural signal flow sequentially activating stored words.

Activities in the brain, despite constituting only 2 % of the body weight, account for about 20 % of the total body energy consumption, the energy being mostly used for firing neurons and sending signals, which is the basis for thinking and generating conscious or unconscious thoughts.

Such prominent activity must be sensed and perceived as something, as are most other bodily activities (like those mentioned in Note 2 *The Nature of Consciousness. (Reichborn-Kjennerud (February 2016))*. And since such activities are driven by neural signals known to be able to evoke conscious perceptions, we automatically become able to consciously perceive our thinking processes. That is, continuously to consciously perceive our thoughts as they develop and arrive at conclusions. By being consciously perceived, this creates an illusion of consciously creating the thoughts by a putative "I", and the illusion of having a consciousness. (Note 2: *The Nature of Consciousness. (Reichborn-Kjennerud (February 2016)).*

The thoughts are created by a synergistical integration of the neuronal word groups and the groups containing details of the very thought subject which is driving the thought process.

There is no consciousness or consciousness *process* per se, but the term can be used to name the phenomenon of being able to have conscious perceptions. This phenomenon is what constitutes the "*hard*" problem.

The Hard Problem

The hard problem seeks an explanation of *qualia*, a term used for the subjective conscious objects of our mental mind, observed and perceived introspectively before "*our inner eye*". Like the color *red*, which does not exist in the "real world", where the term *red* is used for electromagnetic waves of a certain wavelength, which, when reflected from a surface and hitting the eye, creates a vision of red color in our mental mind.

The various brain phenomena described above, qualify as qualia, non-physical entities of the physical brain, perceived consciously..

Our physical mind contains just biologic neurons and biologic connections between them, yet they seem somehow to be able to generate qualia. But so far no physical mechanism has been found that can explain how the brain's neural networks generate them. They are not induced electromagnetic fields, which, if they exist, operate locally. Nor can there be any quantum-mechanical effects, which would be local as well. The reason there cannot be any physical

mechanism for this must simply be that qualia are non-physical objects. And for qualia to occur, thousands of neuron groups must act in concert. Qualia cannot even be scientifically proven to exist, although everybody can perceive qualia privately, introspectively.

Most likely, neurons by themselves are not capable of generating qualia. We must look further. We have seen that conscious experiences occur when thousands of brain areas synergistically integrate and interact with each other, simultaneously and in parallel, They do so in concert without relying on individual neurons.

Simple conscious perceptions like color and depth are created using relatively few brain areas. These seem to more like hardwired integrated areas, possibly because they started to evolve several hundred million years ago, with creatures like the dinosaurs, whereas areas involving, say, thinking cannot be more than a few ten thousand years ago.

The perception of red color can have evolved in conjunction with observing fire and blood, explaining why this color has a more exciting effect than other colors.

The conscious perception of depth must have been evolved in conjunction with navigating in the wild, observing trees and rocks and how these observations changed with distance. These conscious perceptions are obviously illusions, as we have seen in a stereoviewer, where we can turn the perception of depth on and off by just manipulating the position of the photos

The color red as it appears before our inner eye seems so real, it takes an effort to accept that it is nothing more than an illusion. And that goes for all the conscous perceptions we experience. They are all illusions. Everything seen in front of *our inner eye* or heard by *our inner ear* are illusions.

For, say, birds these illusions are not necessarily conscious, but they must appeared to them as qualia. That is, *qualia are illusions automatically accompanying our sensory inputs in conjunction with the synergistic integration of associated brain areas.* They are not a necessary product of evolution, and they have no practical usefulness by themselves. They just pop up before our inner eye when brain signal flow is intense enough.

Does this make much of a difference? Not to me. It does nothing to lessen my pleasure of listening to music by Johann Sebastian Bach or Antonio Lucio Vivaldi. I love illusions like that.

Conclusion

Consciously perceived phenomena of the brain can be explained in terms of synergistic integration of related brain areas. This is obviously a rich field for fMRI studies which hopefully can give a lot more interesting information about the various phenomena in question. Such studies have already shown that thinking of just one object can cause excitations of neurons in as many as 80.000 different places in the brain.

The qualia we perceive seems to be naturally occurring illusions, passively accompanying the neural activities in these brain areas, having no evolutionary significance or purpose. And leaving no *hard* problem to be solved.

For many people this may be hard or even impossible to accept, and they will keep searching for some solution. And the comfortable illusion of an immortal soul will prevail. Which, incidentally, while we are at it, may be a synergistic integration of a fear of death with brain areas dealing with utopian ideas.

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Note 1: Reichborn-Kjennerud, Gunnar (June 2016) The Development of Mind *The International Journal of Research in Economics and Social Sciences (IJRESS) Volume **6** (Issue 6) ISSN 2249-7382,* or at Academia.edu.

Note 2: Reichborn-Kjennerud, Gunnar (Februay 2016) The Nature of Consciousness *TheThe International Journal of Research in Economics and Social Sciences (IJRESS) Volume **6** (Issue2) ISSN 2249-7382,* or at Academia.edu.