Sensory hubs drift around brain although they should not

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Abstract

Sensory hubs of the sensory cortex responsible for integrated brain function are found to behave in an unexpected manner. According to the textbook wisdom, sensory hubs responsible for sensory percepts should be static structures. Sensory hubs are however drifting in a time scale of months. The phenomenon is called representational drift.

In this article a model for the drift is discussed. The TGD based model for the brain relies on the notion of the magnetic body (MB) carrying phases of ordinary matter with a non-standard value of Planck constant $h_{eff} = nh_0$ behaving like dark matter. MB with $h_{eff} > h$ is in the role of master and receives sensory information from BB and controls it. This leads to a radically new view about information processing in the brain.

MB would take care of the necessary teaching of the neurons of the shifted sensory hub - in analogy with associative learning. In the teaching MB would use virtual sensory input to the neuronal hub, which is also necessary for the generation of sensory mental images as standard mental images. The standard mental images could be genetically inherited and represented at MB using "dark genes".

1 Introduction

Sensory hubs (https://cutt.ly/dnDuKXk) of the sensory cortex responsible for integrated brain function are found to behave in an unexpected manner (see https://cutt.ly/DnDuJpz). According to the textbook wisdom, sensory hubs responsible for sensory percepts should be static structures. Sensory hubers are however drifting in time scale of months. The phenomenon is called representational drift.

Sensory hubs are groups of highly connected neurons believed to be responsible for the integration of sensory experiences. They are present already from childhood and shift during childhood from the primary sensory areas receiving the sensory input from thalamus to the association areas. The connectivity strengthens, especially at frontal areas, from birth to adulthood. Note that also this shifting can be interpreted as a representational drift but in longer scale. Could this kind of evolution of the sensory hubs be present also in time scale of months and make the drift necessary?

1.1 The findings

The popular article describes some examples of representational drift. The odor specific sensory hubs found by the team led by Carl Schoonover and Andrew Fink to drift around the piriform

cortex is the first example. The findings are described in the article is the first example. The findings are described in the article "Representational drif in primary olfactory cortex" [J1](`https://cutt.ly/MnDiCZx`).

1. It is odor specificity that drifts. Sensory hub is clearly like a moving vortex in a flow - moving self-organization pattern of water flow rather than moving water. The connection structure between neurons essential for the formation of associations as learning is drifting. The drift seems to involve learning, which cannot be induced by the ordinary sensory input. Could there be a "teacher" that provides virtual sensory input? Learning analogous to that encountered in AI comes first in mind.

2. In the case of odor perception studied for mice, daily sniffing slows down the drift. Why would the sensory input slow down or even prevent the virtual learning that seems to be present? Could the real sensory input interfere with the virtual sensory input?

3. Experiments using weak electric shocks to induce conditioning of neurons of the hub, show that the conditioning is preserved in the drift. Is it really neurons that are conditioned at the fundamental level? Could the conditioning takes place at some other, in some sense higher level?

   Emotions are involved with conditioning. Who is the experiencer of these emotions? Does this higher level entity, kind of Mr. X, teach also the conditioning to the recruited neurons of the drifted sensory hub.

   Interestingly, the analogy with dark matter is noticed by Schoonover and Fink. Maybe they suggestt that something analogous to dark matter might be involved with living matter.

Also other examples are discussed.

1. Hippocampal place cells are mentioned as a second example. Motion of an organism from position A to B is represented by certain place cells of the hippocampus, which are firing during the movement. The locus of firing place cells drifts slowly. Standard neuroscience interpretation would be as an overwriting of memories. Mice moving in a T-shaped maze are mentioned as an example. The neuronal groups in the posterior parietal cortex involved with spatial reasoning are drifting.

2. Representational drift in the visual cortex is slower or not present. Could the slowness and possible absence be due to the more complex and precise organization? Or could it be due to the presence of a continual visual input interfering with the virtual sensory input needed for the drift?

   However, for the mouse that watched the same movies over many days, the drift took place. Pan-psychist might imagine that the neurons or something else related to the sensory hub got tired or bored while seeing the same movie from day to day and became a poor perceiver so that fresh neurons had to be recruited?

1.2 Questions

These findings just describe raise the following questions:

1. How the representational drift is possible? The new neurons must learn associations and become conditioned. Ordinary sensory input cannot take care of this. Is there some kind of virtual sensory input from mysterious Mr. X present, which teaches the conditionings giving rise to specific sensory perceptions?

   How can the conditionings be preserved in the drift? Does this Mr. X also teach the conditionings to the recruited neurons by using virtual sensory input inducing them.

2. Why does the drift occur and what would cause it? Could the neurons of the sensory hub get "bored" and become non-alert perceivers so that new neurons must be recruited? Or could one think that serving as a hub neuron or its MB is hard work and also neurons or their MBs must have "vacation" and rest.

3. Why sensory input slows down the drift? Does it interfere with or prevent the learning process of the recruited neurons?

4. Could the analogy of drifting sensory hub with a moving vortex, self-organization pattern of flow, serve as a guideline? Note that incompressible hydrodynamical flow is mathematically highly analogous to a magnetic field. Could one see neurons as particles of an analog of hydrodynamic flow or perhaps its counterpart at the level of magnetic field?

These purposefully leading questions should make it easy for any-one familiar with the TGD based view about neuroscience to guess the TGD inspired model for the representational drift. Before introducing the model, some basic ideas about the brain in the TGD Universe are discussed.

2 TGD based view about representational drift

2.1 TGD view about sensory perception and emotions

The representational drift provides a new challenge for the standard dogma that sensory qualia are somehow constructed at neuronal level in the brain. There is also the problem that the neuronal stuff looks the same in all sensory areas: how could this give rise to so different sensory qualia.

Magnetic body (MB) defines the basic notion.

1. Magnetic body (MB) carrying $h_{eff} = n \times h_0$ phases behaving like dark matter has IQ characterized by n, which is identifiable as a measure of complexity of an n-D extension of rationals associated with the polynomial defining a region of space-time surface assignable to MB [L4, L5].

   $h = 6h_0$ is an assumption consistent with the findings of Randell Mills [L1] but it is quite possible that h_0 can be smaller than $h/6$.

   n characterizes also the scale of quantum coherence at MB and this quantum coherence induces the ordinary (non-quantal) coherence of biomatter. By its higher IQ MB serves as a boss for layers of MB with smaller IQ and at the bottom of hierarchy is the ordinary matter with $h_{eff} = h$.

   MB has an onion-like hierarchical structure and has both "small" parts with size scale of brain structure and "large" parts having size scale even larger than scale of Earth which corresponds to EEG frequencies around alpha band. Also highly connected neuron groups have both "small" MB and "large" MB. "Small" MB would have flux tubes parallel to axons and these flux tubes could induce the self-organization leading to the formation of axons and synaptic contacts.

2. The primary sensory qualia are at the level of sensory organs and the brain builds only cognitive representations (also secondary sensory representations not directly conscious to us are possible) and pattern recognition by receiving the input from the sensory organs and providing feedback as a virtual sensory input to sensory organs [L2]. REM dreams and hallucinations are a good example of an sensory experience due to mere virtual sensory input. Also imagination can be understood. The picture generalizes to the level of motor actions.

   Phantom limb serves as an obvious objection: if the sensation is sensory memory this objection can be circumvented. Sensory memories can be produced by electrical stimulation of temporal lobes artificially.

3. In the TGD framework the sensory data are communicated to MB by EEG and its fractally scaled variants, where the fundamental representations reside. Communication by dark Josephson photons [K1, K2].

4. Neurons are analogous to RAM memory which is organized at the MB. Sensory perceptions are kind of artworks representing standardized mental images analogous to standard patterns in pattern recognition. The selection of neurons in sensory hub can be dynamical so that drifting is possible.

Neurons need not be even near to each other physically: it is enough that the data from the neurons contributing to the same subself are communicated near to each other at MB to form a quantum coherent structure.

There is indeed evidence that neurons in the brain obey an effective hyperbolic geometric determined statistically [L6]. Neurons functionally close to each other are near to each other in this geometry. Their images at MB would indeed be near to each other and this geometry would be hyperbolic as a geometry of hyperboloid of Minkowski space. One weird finding conforming with this picture is that salamander survives in a process reshuffling of its neurons [L6] .

5. Sensory perceptions as standardized mental images created bu a combination of a real sensory input communicated to MB and inducing as a response virtual sensory input from MB via brain to sensory organs as dark photons signals [L2]. This process is analogous to pattern recognition. Pattern recognition involves teaching period and MB could serve as a teacher.

6. Emotions are associated with conditionings and they would represent higher level sensory perceptions of MB and be essential for the conditioning. The "big" part of MB would be responsible for higher level emotions and "small" part for more primitive emotions like hunger and first essential for conditioning of neurons.

2.2 The TGD inspired model model for the representational drift

The basic ideas of the TGD based model of representational drift should be rather obvious from foregoing.

1. Sensory hub is a higher level structure controlled by its MB. It is MB that experiences emotions as higher level sensory experiences by entangling with sensory organs and receiving sensory input also as dark photon signals. The highly connected flux tube structure of MB induces the neuronal connections of the sensory hub. Structural hubs are present from birth. Either the small MB of the sensory hub or its big brother would control the sensory hub by sending control signals and virtual sensory input.

2. Sensory hubs are present already in childhood. This suggests that standardized sensory mental images could be genetically determined and therefore inherited. This requires a realization of the genetic code at the level of MB.

   The TGD inspired view about genetic code indeed predicts that genetic code is realized at the level of MB universally in terms of the tesselations of the hyperbolic 3-space H^3 [L7]. Dark proton triplets represent genetic codons and also dark genes as higher level units are realized. Chemical realization would be a secondary representation mimicking this fundamental genetic code. Dark photon communications would be realized in terms of dark photon triplets and also now also dark 3N-photons representing genes would be realized as analogs of Bose-Einstein condensates.

   Also basic emotional patterns could be genetically coded and inherited to some degree. This might relate to the epigenetic inheritance of moods. The TGD based model for the genetic code indeed leads to this picture. It should be noticed that in zero energy ontology (ZEO) not only structures but also temporal patterns (functions, behaviors) are inherited [L3, L8].

3. Representational drift requires that the connection structure for the neurons of a new hub is recreated by learning. Ordinary sensory input cannot generate the hubs with standardized sensory mental images at neuronal level.

   Does MB as a boss teach standardized mental to neurons by using virtual sensory input just at it would do to induce standardized mental images? This would be analogous to teaching in associative learning used in AI.

4. Why does the drift occur? Why would MB recruit new neurons and teach them to produce standardized mental images?

   Does something happen to the neurons of the hub such that drift becomes necessary? In TGD framework consciousness is universal so that one can ask what if I were a neuron of

sensory hub. Could the MBs of neurons get bored or tired as I would do, and lose their alertness after experiencing the same mental images again and again? The notion of aging is a universal phenomenon in TGD view about life and consciousness [L9]: could the MBs of the neurons of the sensory hub begin to suffer from problems caused by aging?

The sensory hubs shift from the primary areas to the associative cortex during childhood and their connectivity increases. Could this mean some kind of personal evolution at the level of the sensory hub, analogous to professional at the level of human society.

To sum up, MB might be doing for the brain the same as we are now doing for robots, that is teaching them. Could our AI technology be an externalization of what MB is doing for the biological body?

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