

- Evolution and Mirror Neurons. An Introduction to the nature of Self-Consciousness -

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Abstract:

Self-consciousness is a product of evolution. Few people today disagree with the evolutionary history of humans. But the nature of self-consciousness is still to be explained, and the story of evolution has rarely been used as a framework for studies on consciousness during the 20th century. This last point may be due to the fact that modern study of consciousness came up at a time where dominant philosophical movements were not in favor of evolutionist theories (Cunningham 1996). Research on consciousness based on Phenomenology or on Analytic Philosophy has been mostly taking the characteristics of humans as starting points. Relatively little has been done with bottom-up approaches, using performances of animals as a simpler starting point to understand the generation of consciousness through evolution. But this status may be changing, thanks to new tools coming from recent discoveries in neurology.

The discovery of mirror neurons about ten years ago (Gallese et al. 1996, Rizzolatti et al. 1996) has allowed the built up of new conceptual tools for the understanding of intersubjectivity within humans and non human primates (Gallese 2001, Hurley 2005). Studies in these fields are still in progress, with discussions on the level of applicability of this natural intersubjectivity to non human primates (Decety and Chaminade 2003). We think that these subject/conspecific mental relations made possible by mirror neurons can open new paths for the understanding of the nature of self-consciousness via an evolutionist bottom-up approach.

We propose here a scenario for the build up of self-consciousness through evolution by a specific analysis of two steps of evolution: first step from simple living elements to non human primates comparable to chimpanzees, and second step from these non human primates to humans. We identify these two steps as representing the evolution from basic animal awareness to body self-awareness, and from body self-awareness to self-consciousness. (we consider that today non human primates are comparable to what were pre-human primates).

We position body self-awareness as corresponding to the performance of mirror self recognition as identified with chimpanzees and orangutans (Gallup 1982). We propose to detail and understand the content of this body self-awareness through a specific evolutionist build up process using the performances of mirror neurons and group life. We address the evolutionary step from body self-awareness to self-consciousness by complementing the recently proposed approach where self-consciousness is presented as a by-product of body self-awareness amplification via a positive feedback loop resulting of anxiety limitation (Menant 2004).

The scenario introduced here for the build up of self-consciousness through evolution leaves open the question about the nature of phenomenal-consciousness (Block 2002). We plan to address this question later on with the help of the scenario made available here.

Key Words: *self-awareness, self-consciousness, evolution, mirror neuron, non human primate, intersubjectivity.*

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II) Consciousness and Evolution

II.1) XXth century Philosophical approaches to Consciousness.

- * Mostly based on Phenomenology and Analytic Philosophy where:
«Biological considerations as such, and evolutionary ones in particular, were judged irrelevant to genuine philosophy».
- * Evolutionary approaches to **consciousness** have been limited.
- * Studies on **animal consciousness** have been focused on **phenomenal consciousness**.

II.2) Rationale for an Evolutionary Approach to Self-Consciousness.

- * Evolution is a scientific reality: Matter, Life, Humans.
- * Discovery of **Mirror neurons** introduces natural intersubjectivity that can be used for the build up of the notion of **Self** in living elements.
- * Toward a Science of **Consciousness** 2005 to focus on Methodological and Conceptual Issues.
- * Evolution toward **Self-consciousness**: a concept for the XXIth Century Philosophy of **Consciousness**.

NB: Mirror Neurons:

- * A class of neurons that discharge not only when a monkey executes goal-related hand action, but also when observing other individuals executing similar actions.
- * Such Mirror Effect exists also for other body movements (mouth) and seems to exist for feelings.
- * Exist also for Humans.

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III) Proposed Evolutionary Scenario for Self-Consciousness. Mirror Neurons

III.1) Evolution of what ?

Consciousness ?, Representation ?, Data Processing ?, Communication ?, **Awareness** ?, ... ?

III.2) Evolutionary Stages: Basic Life, Prehuman Primates, Humans

Basic Life	=>	Pre-Human Primates	=>	Humans
- Environment Awareness - Body Awareness (Senses and Proprioception)		- Body Self-Awareness (Group Life & Mirror Neurons) (Intersubjectivity & Anxiety)		- Self-Consciousness as Evolution of Body Self-Awareness (Anxiety Limitation as Evolutionary Engine)

III.3) Definitions:

Basic Life: Designates living elements that can receive information from the environment by their senses, and from their body by proprioception.

Body Awareness for subject: information about his body made available by senses and proprioception. No notion of Self/I/Me. No need of language.

Body Self-Awareness for subject: Information about his body as similar to the bodies of conspecifics in the environment. Brings up notions of Self within subject. MSR level. Language is favored.

Self-Consciousness: Is « the possession of the concept of the self and the ability to use this concept in thinking about oneself ». Language is needed.

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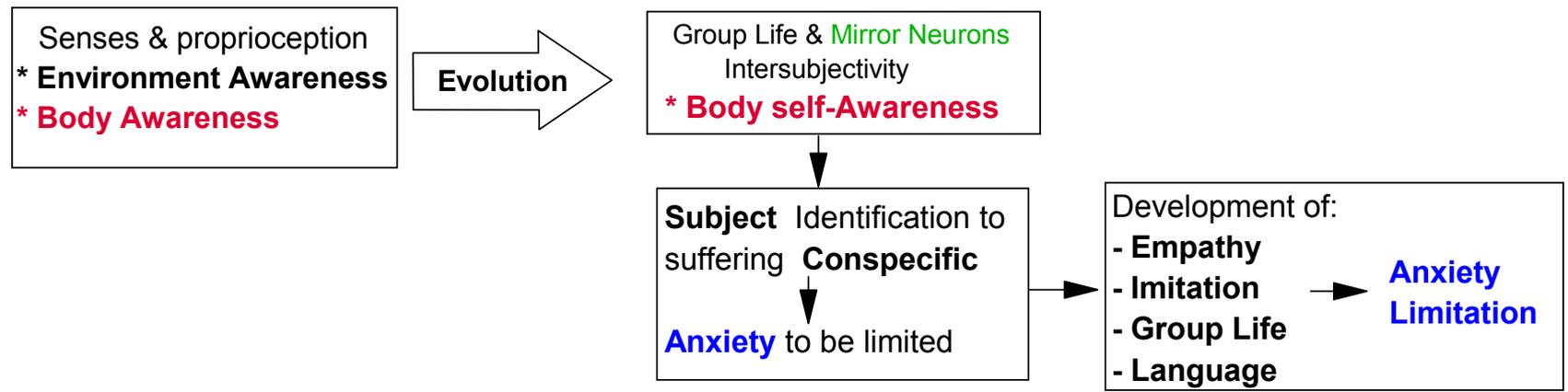
IV) Evolution from Basic Life to Pre-Human-Primate

IV.1) Pre-Human Primate (Australopithecus) close to Great Apes performances wise.

IV.2) Mirror Neurons: from **Body Awareness** to **Body Self-Awareness** and **Anxiety**

- Basic Life -

- Pre-Human Primate -



Body Self-Awareness for subject: Information about his body as similar to the bodies of conspecifics perceived in the environment.

Comes from intersubjectivity allowed by **Mirror Neurons**. Subject feels what observed conspecific is feeling and progressively identifies with conspecific. **Body Self-Awareness** introduces the notion of Self within the subject. MSR level. Language is favored.

Anxiety for subject: comes from identification to suffering conspecifics (dangerous environment).

Tools for **Anxiety Limitation** will be developed by subject and by group.

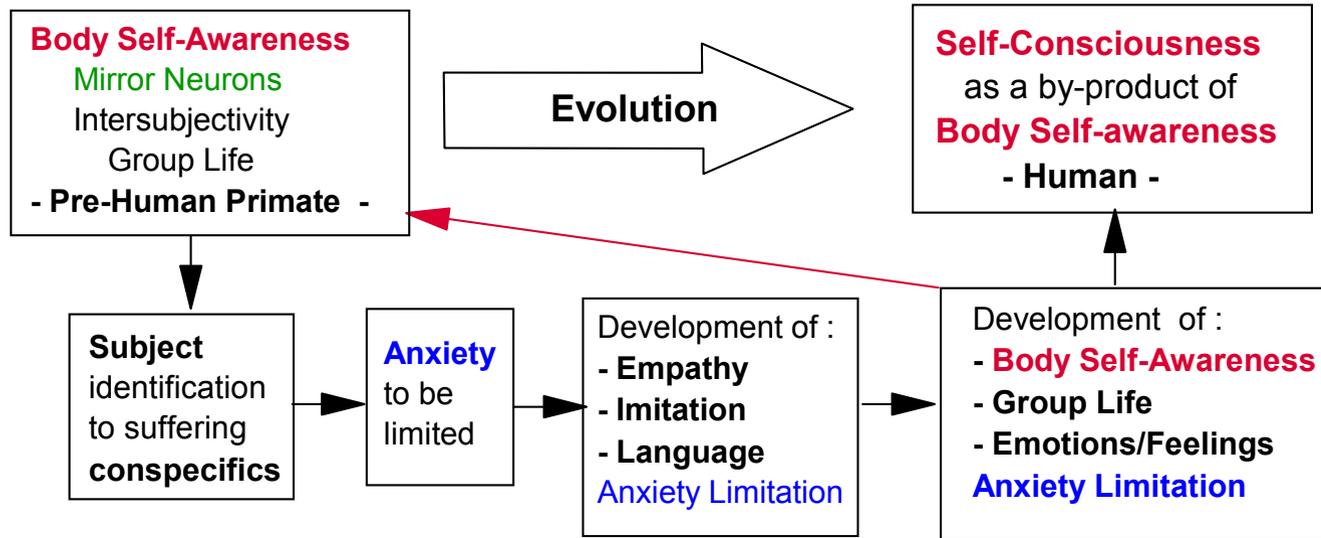
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V) Evolution from Pre-Human Primates to Humans:

V.1) From Body Self-awareness to Self-Consciousness



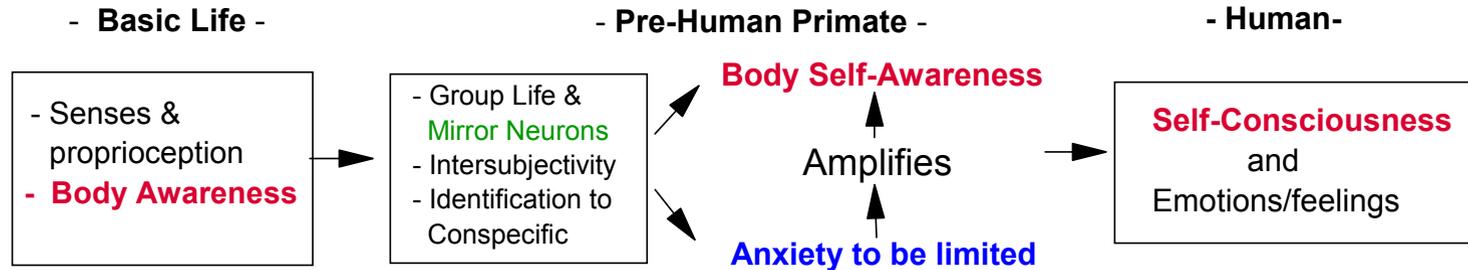
V.2) Anxiety Limitation as an evolutionary engine

- * Development of Empathy, Imitation, Language, Group Life, Emotions/Feelings, **Body Self-Awareness** => Positive evolutionary feedback. **Anxiety limitation** as evolutionary engine. Still on going process.
- * Evolution to Humans: **Self-Consciousness** as a by-product of **Body Self Awareness** evolution.
- * **Self-Consciousness** is rooted in **Body Self-Awareness**, Mirror Neurons, Group Life, **Anxiety limitation**.
- * If **Anxiety** not acceptable/limitable, pre-human primate has to find a niche (chimps) or disappear.

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VI) Summary and ContinuationVI.1 ProcessVI.2 Self-Consciousness

- Is rooted in **Mirror Neurons**, Group Life, Intersubjectivity, **Body Self-Awareness**, **Anxiety Limitation**.
- Is a by-product of **Body Self Awareness** development via **Anxiety Limitation**. Process still on going.

VI.3 Anxiety Limitation

- Implemented by development of Empathy, Imitation, Language, Group Life, Emotions/Feelings, **Body Self-Awareness**.
- Is an evolutionary engine. (Positive evolutionary feedback on **Body Self-Awareness**). Process still on going.

VI.4 Continuation

- Develop and consolidate the notion of **Body Self-Awareness**.
- Consider Intersubjectivity as an evolutionary event for a Science of **Consciousness**.
- Look for **Phenomenal Consciousness** as a possible variation/consequence of **Self-Consciousness**
- Consider **Evolutions of Consciousness** beyond today status of humans.
- Position **Evolution toward Consciousness** as a concept for the XXIth Century **Philosophy of Consciousness**.
- Identify types and levels of **Anxiety/Anxiety Limitations** thru evolution.
- Consider cases where **Anxiety** is not acceptable/limitable (pre-human primate to find a niche (chimps) or disappear).
- Look at psychosis as related to **Mirror Neurons** problem and linked to a deficiency in **Anxiety limitation**.
- Look at **Anxiety Limitation** as possible root for a phylogenesis of emotions/feelings and for a psychology of motivation .
- Re-address impulse of life/death thru generic **Anxiety Limitation** constraint.
- Consider ontogenetic consequences in parallel to phylogenetic ones.