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A Common Origin of Neural and Subjective Aspects of the Human Mind

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Abstract

An attempt is made to identify a common origin for the emergence of the rich cognitive and subjective aspects of human mind. In an earlier paper we had suggested that the appearance of modern human cognitive capacities was rather recent –early upper paleolytic- and that the novel neural mechanism that allowed them, arouse from epigenetic and anthropological influences on the connectivity in brains that had already evolved extensively. We now suggest that similar anthropological influences determine the ego ideal and the superego of Freudian metapsychology, conditioning repression which is considered to be the specific element of human subjectivity.

Keywords

Human Emergence, Brain-Mind, Cognitive Capacities, Subjectivity, Unconscious, Repression

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1. Introduction

A major goal of contemporary psychology and neuroscience is to provide a unitary vision of the complexity of human mind. The challenge is to reveal the continuity between brain and mind and relate neural structures, cognitive capacities and subjective experiences. Growing efforts towards this unitary vision have been recently deployed: neuroscientists, psychologists and psychoanalysts try to overcome mutual reticence and try to understand their different languages, methodologies and paradigms.

In this quest, freudian met psychological concepts have been revisited in more organic approaches stemming from animal behaviour, child development, neuropsychology and other neural or biological aspects (1). These interdisciplinary attempts are often referred to as neuropsychoanalysis as recently overviewed in Fotopoulou et al.(2). Despite these efforts, the distance between paradigms and methods remains large as indeed expected in trying to correlate the complexity of human psychology with an underlying neural base shared, in many aspects, with primates and other animals.

This paper focalizes on a single, albeit crucial, aspect: the emergence of modern human beings with their exclusive rich cognitive and subjective attitudes. The neural pathway for the emergence of the modern cognitive human has been elaborated with T. Shallice (3) and briefly summarized in the next section. The starting point of the argument is the identification of specifically human cognitive capacities distinguished from protocapacities of animals and hominin ancestors as inferred from pale anthropological data. Let's immediately recognize that it is much harder to establish an analogous identification at the psychodynamic level: the access to animal subjectivity is far from simple and its distinction with the rich and complex human one is difficult to trace. It is not surprising that in establishing the psychoanalytic construct for the dynamical vision of the human psyche, Freud and followers paid practically no attention to eventual animal roots of their metapsychology.

In order to proceed towards the proposition of a specifically

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human subjective property, I will start summarizing in section 3 neural correlates of some psychoanalytic concepts. Analysing, in particular, inhibitory aspects in the confrontation of the drive's action with reality in humans and other animals. I will then discuss in section 4 the variety of dictates of human ego ideal and superego that condition drives, generating repressive mechanisms to block the forbidden ones to reach conscious awareness. I will indeed recognize repression as the specifically human psychodynamic mechanism and represent some of its aspects. In section 5 I will finally recognize that both neural and subjective human transitions proposed may be attributed to a common anthropological cause, thus establishing an extra step in the continuity between brain and mind.

2. The Emergence of Modern Cognitive Humans

Ref.(3) starts discussing, and then identifying, the specifically human cognitive capacities as distinguished from animal and hominin protocapacities. It was remarked that their fluidity and recursivity properties allow also their combination into an abstract projectuality, conveniently defined. The word abstract was used to distinguish it from concrete projectuality, available also to animals similarly for all individuals of the same species and essentially wired even if needs exposure to be learned. Abstract projectuality goes well beyond satisfaction of direct natural needs; it allows humans to establish complex novel objectives as well as to produce strategies to achieve them. A strategy implies an optimization program processing the parameters that are pertinent to the project. The choice of relevant parameters as well as the values, or costs, assigned to them in the optimization procedure depend on the subject, his project and his priorities. They are not natural (4) thus not directly determined by external reality.

In a useful analogy, human projectuality could be represented as a topographical map in the multidimensional space spanned by the parameters relevant to individual projects, where the height (level) represents the sum of the values (costs) assigned to the different parameters at that point. Projects would appear as local minima in that individual topography, strategies as the pathways leading to them with predicted efforts represented by the altitude differences each pathway has to overcome. If the effort turns out to be too heavy and frustrating, a change of pathway in that topography would represent a change of strategy to reach the goal, while the change of objective would be a modification of the aimed local minimum. Both changes imply a view from above the topographical map.

Humans change strategies to reach their goals if they turn out to be inefficient or unsatisfactory, even without new elements that could induce reconsideration. This capacity of strategy change without external inputs is the mental process we assigned to humans (investigated in laboratory conditions in ref. 5). It necessitates a novel setting of neural operations that, in the current models for conscious neural processing, implies an internally generated change of supervisory operation (6)-thus a supervisory operation latching a new one- or a configuration change in the global neuron workspace model (7).

Paleoanthropological data[1] sets our emergence as cognitive modern humans at a rather recent time, 40.000-70.000 years ago, in a period in which the genetic and anatomic modern homo sapiens was already around since at least 100.000 years. The novel neural mechanism, not being attributable to a speciesation, was speculatively proposed (3) to be caused by a phase transition due to a further connectivity increase in an already highly developed and connected brain. The mechanism was inspired by a physics network model (8), encouraged by the fact that brain connectivity is a late phylo and ontogenetic process, piloted also by a variety of epigenetic and extrasomatic influences. If some convenient attitudes yield to competitive advantages in an evolutionary context, their adoption quickly spreads even if these changes are transmitted through cultural influences. Despite an apparent similarity with Lamarckism, the idea of a phase transition gives relevance to a culturally induced change if it adds coherently to a phylogenetic development that provides the extra contribution that allows to overcome a critical threshold. And provides also a reasonable origin to the universality of some basic funding human cultural codes as banning anthropophagy and incest, not even codified by commandments and laws.

Our hypothesis can be considered as a (neural) model for an exaptation mechanism to which modern human emergence is sometimes attributed (9,10). In the absence of a specific mechanism, exaptation is the evocation of a magic stick, if not just a synonym for "origin of evolutionary novelties" (11). Furthermore, assigning exaptation to language as often done(12,13) reduces the problem to the emergence of

[1] To the paleoanthropological arguments quoted in Amati&Shallice(3), we here add that recent studies have strengthened the vision and dating of the emergence of modern cognitive human and its evolution out of Africa. Indeed an optical stimulated luminescence technique (30, 31) has allowed scientists to date and follow bursts of human innovation techniques. Analysis of neutral genetic markers as mt-DNA and Y chromosome (32), linguistic characteristics as numbers of phonemes (33), environmental drastic changes (34), demography evolution models (35) and geographic patterning, enable one to follow the rise, fall and evolution of modern humans –in particular represented by the L3 haplogroup- around the world (36). Thus from an African genetically and anatomically modern sapiens (200-280 kys ago) the emergence of cognitive modern humans through punctuated bursts (80-60 kys ago) of cultural innovations correlated with demographic expansion and their subsequent rapid diffusion (60-50kys) away from Africa to Eurasia and then Australia and America (10, 13, 33). I am grateful to Telmo Pievani for illustrating to me these recent anthropological findings.

language, which in itself is as complex as the whole human symbolism, and cannot be attributed (14) to an exaptation in the communication system as an eventual completion of a vocal trait or even of a putative adaptive gene evolution as was proposed for the allele *FOXP2*.

3. On Neural Correlates of some Psychoanalytic Concepts

Let's start with the concept of drive, the basic motivational force that activates the psychic dynamics in the freudian approach. Drives can be thought as an evolution of original primitive animal instincts into a developed motivation, produced by an affective-instinctual infrastructure of human mind in both unconditioned and learned aspects (in Fotopoulou& al.(2): Solms&Zellner ch.4, Pfaff & Fisher ch.5, Watt ch.6, Panksepp&Biven ch.9). This development starts from bodily demands that stem from homeostatic requirements that involve ancient sub-cortical brain regions. The next step includes sensory stimuli that produce basic primordial sensory affects, promoting learning and cognitive integrations through basal ganglia. This produces, at least in mammals, neocortical awareness and executive cognitive functions. This affective neuroscientific pathway assigns a central role to feelings, with a specific taxonomy(15), giving rise to motivations and drives.

Damasio and Carvalho(16) have recently suggested that the development of this underlying feeling system may be rooted in a single cellular neural signal transmission mechanism, complementary or even alternative to the usual synaptic one. This through an amplification of minor homeostatic signals into a system level phenomenon, attributed to ephatic transmission of unmyelinated chemosensitive axons. Property suited to axons relevant to interoceptive and feeling systems for which conduction speed is less important than membrane access. Anyhow, this progression from homeostatic signals, carried by sub-cortical brain regions, up to feelings and drives is a property we reasonably share with a variety of animals.

Another concept that has been tackled from both neuro and analytic sides is that of self. The neuro approach, mainly developed by Panksepp(15) and Damasio(17), assigns to the self the mechanism that makes the organism aware of the signals that constitute feelings and emotions. Therefore has to be rooted in very ancient neural structures (brainstem circuitry). Opinions differ on the ways in which this central core is connected (Panksepp) or evolves (Damasio: from a proto-self, to a core self, to the autobiographical self) in order to represent the foundation for all forms of consciousness. These differences relate also to the diversity of opinions of psychoanalysts for whom the self represents a part of the ego system (18).

Let us now turn to the unconscious that includes a variety of aspects. It is reasonable to start with the exclusion from awareness during automatized procedures, due to lack of attention or lack of sensorial availability. This may happen in a variety of conditions, among which sub-threshold stimulations, distracted or contradictory stimuli, and anomalous conscious conditions as anaesthesia or neural impairments. Brain imaging techniques have allow great progress in understanding the brain mechanisms that determine how external and internal stimuli go beyond unconscious processing and thereby gain access to a consciously reportable subjective experience. A variety of studies using subliminal stimuli or interfering distractor procedures in mammals and humans in normal conditions as well as in sleep, anaesthesia, impaired conditions including coma and vegetative states, made it possible (cf. for instance the review of Dehaene&Changeux(19)) to identify a variety of interconnected brain regions participating in a hierarchy of processes. Unconscious perception dealt with by parallel processing, quickly handled by automatized and short-lived circuitry, is then followed by more differentiated and specialized systems. These integrate unified serial processing with long distance synchronization and large scale networks whose collective participation lead to sustained, and eventually reportable, conscious experience. A similar mechanism was found in neural recording in a visual masking paradigm with monkeys (20), the last sustained phase being associated with conscious visibility. This multilevel mechanism, involving a variety of brain networks, is the basis of current theoretical models of neural conscious processing as the Supervisory System(6, 21)or the Global Neuron Workspace (7).

The psychoanalytic unconscious has yet deeper connotations. Initially proposed by Freud in 1900, it represents the essential arena of human psyche and is characterized by a complex and rich dynamic system that cannot be reduced to an awareness dichotomy. In order to avoid the dubious border between conscious, preconscious and unconscious processes, Freud reconfigured his model of the mind in a more functional form (Freud 1923, SE-XIX(22)) into a two steps process. A primary one, identified with the id and governed by the pleasure principle, in which instinctual drives, desires and feelings, generally unconscious, remain rather vague, superposed, without competitions and conflicts, not represented, timeless and not constrained by logical rules. In the energetic picture dear to Freud, these drives are characterized by free energy, freely transferrable from one drive to another. They are then confronted with the secondary

process identified with the ego -that may also remain unconscious- governed by a reality principle. The drives that are allowed through are then represented with logical consistency, time sequence, and constraints due to external conditions and are invested with a bound energy at the expense of the original free one. This secondary process avoids a hallucinatory satisfaction of primary drives. Drives prevented entering the secondary stage remain unrepresented in the primary reservoir. It looks reasonable to think that this process that starts from needs that stem from the body, processed by brainstem and limbic brain regions, and only subsequently represented and confronted with reality through a more developed brain processing, qualify for a non specifically human functioning that we essentially share with other animals, mammals in particular.

This two-stage pattern gave much confidence to the neuropsychoanalytic community as providing a common neural and subjective basis to consciousness. To the point of assigning (23) to the major nodes of the default mode network (DMN) the ego role of constraining emotional and hedonic primary processes stemming from brain limbic regions. Others have seen in the secondary inhibitory action the basis of the psychoanalytic repression to which Freud gave a funding role in the human psyche (Bazan& Snodgrass, ch.18 in Fotopoulou et al.(2)). But if this two-stage confrontation between instinctual drives and reality is also at work in the animal realm, an extra gear should be invoked to characterize the richness of the human psychodynamics

Despite Freud and followers never giving much attention to what is specifically human and what is not, I stress that a non-trivial extension is needed in order to produce repression. This extension represents a basic new component of the human ego that goes beyond the inhibition provided by the secondary stage reality principle. Attitude partially shared at a quantitative level by authors that, however, attribute the change (Solms&Zellner, ch.12 in Fotopoulou et al.(2)) to a greater maturation of neocortical association systems, rather than to a qualitative discontinuity as I will argue here.

4. Repression as the Basically Human Psychodynamical Element

In humans, drives are conditioned by a variety of elaborated requirements that originate from ideals and expectations, both external and internal, of endogenous, relational and cultural origin that Freud categories as ego ideal and superego. The union of these two ego aspects (their separation being more subtle, Sandler (24) ch.3 &6) contains narcissistic ideals, identifications, moral codes, dogmas, taboos, etc., often unconscious, that involve strong constraints carrying a variety of emotions. Drives that acquire representation violating those conditions are then repressed, not allowed to emerge to satisfaction, or even open awareness, by the tough confrontation with the ego under the powerful dictates –usually unconscious- of ego ideal and superego. Humans thus need a repressive mechanism to strongly fight the pushes of “forbidden” drives and their representations to reach conscious awareness.

Through splitting (Freud 1938, SE XXIII, p275(22)), this defence system may act on forbidden drives, keeping them down, or by disavowing reality (Verleungung) thus allowing them out by somehow overcoming the original interdiction. In the first case the group of repressed representations constitute a separate psychic construct (Freud OP p 68-9(25)), relocated among primitive processes in the id. These relocated drives differ from the non-represented really primitive “volatility” drives discussed before (26). In particular, the energy invested in these representations remains bound to them and continues to oppose the repressive forces. Disavowal, instead, acts on reality (Freud 1938, SE XXIII, p203(22)) having thus so evident consequences –including psychotic mechanisms- that it would be “reasonable to consider it as a founding element of human reality more than a fact of perception” (27). Interestingly, despite Freud giving no emphasis to which characteristics of his metapsychology are specifically human, he recognized that “the theory of repression is the angular stone over which stands the whole building of psychoanalysis” (Freud SE,XIV p16 (22)).

Considering this statement as an endorsement, I will assign to repression the specifically human subjective element: the basic extra component of our psyche generated by the ego ideal and superego. Before discussing its anthropological origin let me briefly recall some psychodynamic aspects of repression.

Repression implies a hard confrontation between the drive push for conscious realization, and the ego counteraction required by the strong dictates of ego ideal and superego to defend the individual from the anxiety that the awareness of the forbidden drive would cause(28). Thus pushing the drive back to the unconscious where it will strive again and again to get out despite opposition. This implies energy consuming contrapositions, with hard negotiations that may identify lateral paths of pseudo satisfaction (regressions) or outcomes that may partially realize the libidinal requirements in more tolerable directions (sublimations). Ways out that lead to the clustering of the energy involved in the confrontation into a defensive compromise or even into a disavowal action on reality as mentioned before. These are all result of tough internal conflicts essentially built, as extensively discussed in

the psychoanalytic literature, at early stages of child development.

In a pictorial metaphor it is as if the energy stored in a (unconscious) volcanic magma contrasts the crust pressure that contains it. Possible breakings generate new craters, lava outcomes, telluric shifts and other consequences that modify the crust, reshaping the topography that represents the new structural equilibrium of forces. This strictly individual structure, resultant of psychodynamic tension compensations, represents the neurotic (or psychotic) characteristics of each human being.

5. Anthropological Grounds for the Identification of Specifically Human Psychodynamic and Cognitive Properties

The basic argument for this identification lies in their common anthropological origin. But before discussing it, let me notice some interesting similarities in the outcome of our preceding arguments.

Both cognitive and psychodynamic pathways to modern human emergence we have discussed, lead to topographical pictorial representations: the projectuality map of section 2 in the first case and the just discussed equilibrium with repressed drives in the second. It is tempting to identify these two topographies as outcomes of the same process followed in the dual neural and subjective perspective. Let me indeed notice that both represent specifically human individual characteristics –one own projects and one own neurosis- that specify each one's identity irrespectively of many other properties.

Let's now discuss the common anthropological ground of the neural and subjective human transition we described. Environmental and social changes determined (around the beginning of upper paleolythic) the sedentarity and extension of social groups and thus a variety of social habits. They included familiar structure and cohesion, raising methods, novel parento-filiar relations, externalization of matching requirements and other collective and basic universal taboos as banning anthropophagy and incest. Universal human characteristics not even codified by commandments and laws; taboos that when violated yield psychological consequences that may be more devastating than legal ones. These characteristics are usually supposed to underlie the specifically human social and moral constructs that constitute the superego and ego ideal and thus the Freudian repression theory, corner stone of human psychodynamics.

On the other hand, as discussed in section 2, the same changes could have influenced aspects of brain development more sensitive to epigenetic and extra-somatic stimuli as brain connectivity, adding them to the already well-developed ones of phylogenetic origin. This combination could have led to overcome a brain connectivity critical threshold, yielding to a phase transition that, as usual, gives rise to new long-range coherent correlations

It is noteworthy that the concept of phase transition has also been recently invoked (29) in the transition from primary to secondary processes we briefly discussed in section 3. This is supposedly an order-disorder transition in an entropic development of a (Bayesian) brain under the control of the DMN essentially identified as the neural basis of the Freudian ego. Despite a superficial similarity, this is an essentially different process than the phase transition invoked here for which we proposed connectivity as the critical parameter. The two attitudes are not antagonistic, a variety of phase transitions are a common phenomenon in nature: if the first seems to be shared in a wide animal realm, the one we propose should be exclusive to us modern humans.

6. Conclusion

We propose a recursive loop that holds together the emergence of anthropological, neural and subjective aspects that characterize modern humans, differentiating us from hominin ancestors and other animals. To recapitulate: we have identified some basic social habits that should have influenced aspects of brain development more sensitive to epigenetic and extra-somatic stimuli as brain connectivity, adding them to the already well-developed ones of phylogenetic origin. This combination could have led to overcome a brain connectivity critical threshold yielding to a phase transition that, as usual, gives rise to new long-range coherent correlations; a common process in nature in which a small micro change may give rise to a large macro one. It is to this putative neural operation that we assigned (3) the emergence of modern human cognitive capacities, thus reinforcing the evolutionary advantage of the original anthropological discontinuity that originated it. On the other hand, besides potentiating epigenetic neural processes, those anthropological changes influenced –and keep influencing- the subjective psychological dynamics thus shaping the human internal world and its complex psychic structure. Thus cultural, neural and subjective factors complement and bootstrap each other in the process of modern human emergence. Shaping the fertile entangled aspects of the human brain-mind connection that provides –unique in the animal realm- the seminal rich variety of motivations and capacities.

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