Evolution in the brain, Evolution in the Mind: John Hughlings Jackson and the Origins of Psychoanalysis (and of Neuropsychoanalysis)

Abstract:

This article first aims to demonstrate the different ways the work of the English Neurologist John Hughlings Jackson has influenced Freud. It will be argued that these can be summarised in five points. It is further argued that the framework proposed by Jackson continued to be pursued by 20th century neuroscientists such as Papez, MacLean and Panksepp into tripartite hierarchical evolutionary models. Finally, the account presented here will shed some light on the similarities encountered by neuropsychoanalytic researchers between contemporary accounts of the anatomy and physiology of the nervous systems on the one hand, and of Freudian models of the mind at the other. These, I will demonstrate, are more than similarities. They have a historical underpinning to them, as both accounts originate from one common source: John Hughlings Jackson's tripartite evolutionary hierarchic view of the brain.

Word count: 10,177

As new methodologies for the neural sciences were developed throughout the 20th century, thus allowing researchers to study the underlying physiology of complex phenomena that were previously almost exclusively studied by psychoanalysis, a branch of researchers with a psychoanalytic or psychodynamic theoretical background have progressively developed an interest in these methods as a means of testing their own theories. This is illustrated by the increasing popularity of the neuropsychoanalytic movement (for a review, see Fotopoulou et al. 2013; Mancia 2006; Leuzinger-Bohleber et al. 1998), as well as by a growing body of clinical and conceptual studies that uses neuroscientific methods as to test psychoanalytic theories[1]. The interdisciplinary enterprise counts today, in fact, with two journals solely devoted to the field[2], as well with an international society.

However fruitful this interdisciplinary project proves to be, it has also brought much conceptual confusion, as it would be expected from disciplines that developed almost completely independently for over a century. This has generated extensive debate – sometimes of a heated nature (Cf. Blass & Carmeli 2015; Blass & Carmeli 2007; Yovell et al. 2015; Mancia 2007; Pugh 2007; Ramus 2013). Possibly driven as a means of clarifying its epistemological framework, the interest in the origins of psychoanalysis, and particularly in Freud's scientific beginnings and early influences, has again become the focus of historical research in recent years.

One such example is found in the work of the founder of the neuropsychoanalytic movement, the neuropsychologist and psychoanalyst Mark Solms. In his initial writings, Solms first delved into the prehistory of psychoanalysis (Solms, 2000a,

[1] The Neuropsychoanalysis Association maintains a long and updated list of studies in https://npsa-association.org/education-training/suggested-reading/

[2] 'Neuropsychoanalysis' and 'Frontiers in Psychoanalysis and Neurosciences'

2000b, Solms & Saling, 1986, 1990) before engaging into work aiming to combine both fields (Solms, 2014; Solms & Panksepp, 2012; Solms & Turnbull, 2002; Zellner, Watt, Solms, & Panksepp, 2011). In his words:

> I want first of all to take you backward into history, to trace the origins of psychoanalysis to a particular branch of neuroscience, and to show you how the psychoanalytic method grew out of that branch; then I want to trace subsequent developments in that field to show you that it still remains the natural point of contact between our two disciplines. In the process, I hope to be able to demonstrate that – just as we find in our clinical work – a problem, which seems insolubly complex in its present, mature form, frequently turns out to have a relatively simple structure when one traces it back to its origins (Solms 2001 p.180).

We see here an instance where the historiographic work in psychoanalysis serves as a preliminary stage in a determinate project, i.e., that of demonstrating that 1) psychoanalytic ideas (in particular the models of the mind) have their origins in the neurosciences and are still influenced by them; 2) that because of this common origin, shared ideas in the disciplines developed in parallel; and foremost 3) that because of this parallel development, the disciplines can be joint together again in the present.

Solms is not alone in this enterprise. Another notable example is found in the work of George Makari. As the historian Patricia Cotti argued in her extensive review of Makari's book (2008) for this journal, 'history, depending on how it is told, can permit or not the realization of the scientific potential of psychoanalysis' (Cotti 2012 p.145).

In this line, both Makari and Solms can be thought as 'developing a new historiography, [which] repositions psychoanalysis among the sciences' (ibid., p.134). The present paper may be understood as in line with this particular approach to the history of psychoanalysis as regards the two first points, while leaving the third one as an open-question.

Amongst the early influences, the work of one author seem to have raised particular interest in scholars, partly due to the wide influence of his constructs in central psychoanalytic ideas, and partly due to his influence being still relatively unexplored. John Hughlings Jackson (1835-1911), 'the father of English neurology' (Critchley & Critchley, 1998), was a talented neurologist and neuropathologist who is today best remembered for his contributions to the understanding of epilepsy and for co-founding *Brain: A Journal of Neurology*, still today one of the most influential in the field. His name is also attached to the description of a characteristic symptom in focal motor seizures ("the Jacksonian March") and to a type of psychomotor seizure of the temporal lobe ("Jacksonian Seizure"). But more than a neurologist, Jackson demonstrated in his writings a talent for philosophy – a field for which he almost abandoned medicine early in his career (Hutchinson, 1911) – and in particular epistemology and philosophy of mind (c.f. Jacyna, 2011; Smith, 1982).

Scholars have collectively singled out five main areas where Jackson has influenced Freud. First, it has provided Freud, while still a researcher in neurology, with a dynamic framework of the functioning of the nervous system that sharply contrasted with the Austro-German School of which he was originally affiliated, and which was consistent with his empirical findings (Solms & Saling, 1986, 1990). Secondly, Jackson provided Freud with a theory on the relation between mind and brain that would prove capital in his distanciation from neurology and development of a pure psychology (Fullinwider, 1983; Makari, 2008; Solms & Saling, 1986; Stengel, 1963). Further on, the hierarchy of the nervous system proposed by Jackson, based on Spencerian ideas, would also provide Freud with the central tenets for his hierarchical models of the mind (both the topic and the structural) (Modell, 2000; Wiest, 2012). Freud's theories on regression and repression also bear many similarities with Jackson's, and can be understood as a consequence of this hierarchical perspective on brain evolution (Fullinwider, 1983; S. W. Jackson, 1969; Linn, 1960; Stengel, 1963; Sulloway, 1979, pp. 270–2). Lastly, in a previous paper, I also explored the influence of Spencerian and Jacksonian ideas on evolution in Freud's social theories (Niro Nascimento, in press).

Comment [NL1]: Insert Jacques Nassif: 'penser Charcot avec Jackson, et Jackson en function the Charcot'.

Although the collective effort of scholars demonstrates the relevance of Jacksonian ideas for Freud, to my best knowledge, all contributions so far have focused on only one or two of these points and no work has yet collected them all together. Given the pivotal role played by the English neurologist, it is an important and valuable task to aggregate and summarise these findings so that we can better evaluate not only the historical but also the contemporary relevance of his work for psychoanalysis, and in particular for a better understanding of the neuropsychoanalytic project, which I will try to demonstrate in the second half of the paper.

However, in order to properly grasp the influence Hughlings Jackson's work had for psychoanalysis, we must first begin by revisiting Freud's medical education so as to contextualize the problems he was addressing at the time.

Freud's Medical Education

After having worked in the physiological laboratory of Ernst Brücke (1819-1892) for almost seven years, between 1876 and 1882, a period also deeply influential to his psychoanalytical work but outside of the scope of this paper (cf. Amacher, 1965; Bernfeld, 1944, 1949), Freud was advised by Brücke to give up his hopes in attaining a salaried position at the department and move over to a private clinical practice so as to earn a living and be able to fulfil his long desire to marry his fiancée (Freud, 1925). Following this advice, he joined the General Hospital of Vienna in 1882 initially as an *Aspirant* (an unsalaried position). He completed internships in surgery, internal medicine (under Hermann Nothnagel), psychiatry (Theodor Meynert), dermatology (Hermann von Zeissl), and neurology (Franz Scholz), being promoted in 1883 to *Sekundarartzt* in the psychiatric department led by Theodor Meynert (1833-1892), where he worked until 1886 (Guenther, 2012). Under Meynert, Freud would study the human nervous system – he had so far with Brücke studied solely lower vertebrates (Freud, 1877a, 1877b, 1878) –, and in particularly the spinal cord and medulla oblongata (Freud, 1884, 1886a, 1886b, 1888; Freud & Ossipowit, 1886).

It is worth noting that at the turn of the century the fields of neurology and psychiatry hadn't yet taken on the shape by which we know them today. Until the eighteenth century specialization in medicine was poorly perceived by both the general public and medical establishment, and didn't start taking place until the early nineteenth century as the number of general practitioners increased and doctors had to find a way of standing out from the competition (Scull 2011, 72). Specialization would not reach psychiatry until the mid to late nineteenth century, as the alienists or maddoctors progressively moved away from the asylums and into private practice for the middle and affluent classes (Scull 2015, 260ff). In German-speaking countries, psychiatry moved into academia with the appointment of Wilhelm Griesinger (1817-1868) in Berlin as professor of psychiatry in 1865. Griesinger sought to emulate the approach that put German general medicine into the forefront by positing the unity of mind and brain – and thus of psychiatric and neurologic illnesses – which set the research framework for the next generation for names like Alois Alzheimer, Emil Kraepelin and Theodor Meynert (Guenther, 2012, 2015; Hirschmüller, 1991; Lesky, 1965). This approach helped raise the field to new levels of recognition in the scientific community, which in turn led professionals abroad to adopt the German title for the new specialty – *Psychiatrie* – in order to profit from the newly acquired credibility.

With Meynert's appointment as chair of psychiatry in Vienna in 1870, basic research in neuroanatomy was placed centre stage, even more pronouncedly than in other German-speaking universities. Psychotherapy and clinical work were put into secondary place for research into the localisation of neurological causes of psychiatric and neurological impairments (cf. Guenther, 2012, 2015; Hirschmüller, 1991; Lesky, 1965). By the time Freud joined the psychiatric clinic, Theodor Meynert was one of the most influential neuroanatomists in the world, having developed a model of the global functioning of the nervous system that strictly correlated psychical functions with anatomical locations in the brain. In his model, the nervous system was thought of as organised in the shape of a multi-tentacled cephalopod ('a *Mollusca*'), where the body of the animal was the cortex, and the tentacles were afferent and efferent nerve fibres connecting the cortex to the sense organs. For Meynert, the cortex, 'the seat of the soul' (Meynert, 1892a, p. 10), was a '*tabula rasa'*

(Meynert, 1884, p. 141) – on which sensation was imprinted and associated. In this cortico-centric framework, all psychical processes are cortical – subcortical structures were believed to be innate and have only the function of passive (i.e., reflexive) transmission.

In Meynert's view, sensations ~~was~~ are transmitted unmodified from the sensory organs to the cortex – he used the term projection, and a projection is nothing but a copy –, where, following the corollary of English associationist psychology, they are~~it is~~ associated with other sensations via association bundles, thus forming ideas, which are finally discharged through afferent fibres leading to motor innervations. Meynert and his followers, such as Carl Wernicke and Ludwig Lichtheim, used this model as basis for research aiming to localise complex psychological faculties, and language in particular, to specific areas of the brain. Meynert even indicates in a number of passages that not only are representations localized within specific cortical areas (ibid., p.140) but also within neurons (Meynert, 1884, p. 152, 1892b, p. 24).

This model would be the subject of Freud's criticism in three works – his 1887 unpublished manuscript *Critical Introduction to Neuropathology*, the 1888 dictionary article *Gehirn* (Brain), and his 1891 monograph *On Aphasias*. Freud's criticism is concentrated on two points, central to this overly simplified localisationist framework. He first demonstrated, based on his previous anatomical studies of the spinal cord and medulla (Freud, 1882, 1884, 1886a, 1886b; Freud & Darkschewitsch, 1886; Freud & Ossipowit, 1886) that, contrary to Meynert's beliefs, the cortex is not directly connected to the periphery. He proves this by showing that the fibres stemming from the sensory organs are occasionally disrupted in nuclei of grey matter, where they are involved in a complex interconnection with fibres arriving from other sources. Thus, he concluded, some other form of transmission must occur, and he had reason to believe that these structures played an active role, integrating and thus functionally changing sensory information as they carried it. The nervous system was thus not simply a passive carrier of sensation, but an active organiser. This led him to conclude that the periphery must be contained in the cortex not as a projection (*Projektion*), but as a representation (*Repräsentation*), i.e., not in an exact topographical map, but as a functional rearrangement:

> ‘‘For Meynert, who in describing pathways is mainly concerned with their cortical connections, a fibre or a fibre tract retains its identity even after having passed through an unlimited number of nuclei. This is indicated by his phrase: “the fibre passes through a grey substance”. This naturally gives rise to the impression that the fibre remains the same on its long way to the cortex […]. *This view can no longer be maintained*. [...] If we follow the course of a sensory afferent tract as we know it, and if we regard its frequent interruptions in grey nuclei and its arborisations through them as characteristic, we cannot but assume that the functional significance of a fibre on its way to the cerebral cortex has changed each time it has emerged from such a nucleus [...] We can only presume that the fibre tracts, which reach the cerebral cortex after their passage through other grey masses, have maintained some relationship to the periphery of the body, but no longer a topographically exact image of it. (Freud, 1891, pp. 52–4)

Next, Freud criticis~~z~~ed Meynert’s conflation of physiology and psychology. 'In psychology’, Freud wrote, ‘the simple idea is for us something elementary which we can sharply distinguish from its connections with other ideas. Thus we are led to believe that their physiological correlate, the modification occurred in the centre by the excited nerve fibre endings, is also something simple, which can be localized at one point. Such a transfer is of course totally unauthorized' (1891, p. 57). Thus, for the Freud from 1891, physiology and psychology operate at different levels of explanation, using different languages, that cannot be equated. The best one can do is to establish correlations~~,~~ but, due to the nature of the object studied, these are not static but of a dynamic nature. Thus even though a psychological faculty – for instance, language – can be said to be located in the brain, this doesn't mean that it is found in a single simple anatomical location. Different parts of the brain would have different and distinct roles in underpinning what is experienced on a psychological level as a single and unified phenomenon. Such an approach can be understood as the forefather of the notion of distributed processing, now a central tenet of the neural sciences (Kandel & Schwartz, 2013).

Therefore, what Freud needed to complete his criticism of Meynert's model was a new framework in which (1) the cortex is not perceived as central and directly connected to the periphery, and (2) that separated the realms of physiology and psychology. Until the publication of *Gehirn,* in 1888*,* he didn't have available such a model to replace Meynert's. Thus, in this work, his critique remains only negative, and he is obliged to state that 'at the present, the Meynert scheme is not to be replaced by another' (Freud, 1888, p.58). Such a framework would be provided by his reading of Hughlings Jackson, and the result was presented in his monograph On *Aphasias*, three years later.

Hughlings Jackson and the hierarchical organization of the nervous system

Jackson's evolutionary hierarchy of the nervous system is based on Spencer's initial insight that 'if the doctrine of evolution is true, the inevitable implication is that Mind can be understood only by observing how Mind is evolved' (Spencer, 1869, p. 291). Spencer's *Synthetic Philosophy* was founded on the idea of a natural law of evolution, which in its most simple form stated that 'all things are growing or decaying, accumulating matter or wearing away, integrating or disintegrating' (Spencer, 1897, p. 292). This fragment, however, conceals the arrow of nature: progress. This, for him – borrowing the notion from the German embryologist Karl Ernst von Baer (1792-1876) –, consists of the passage from the homogeneous to the heterogeneous, from the simple to the complex. And for Spencer, though regression and dissolution into simpler forms does occur under special circumstances, evolution, heterogeneity, complexity and progress are the rule rather than the exception in the grand scheme of things:

> 'this law of organic progress is the law of all progress. Whether it be in the development of the Earth, in the development of Life upon its surface, in the development of Society, of Government, of Manufactures, of Commerce, of Language, Literature, Science, Art, this same evolution of the simple into the complex, through successive differentiations, holds throughout' (Spencer, 1857, p. 10)

The influence of Spencer's ideas in Hughlings Jackson's work has already been ably treated in length by Smith and others (Franz & Gillett, 2011; Jacyna, 2011; Lopez Pinero, 2010; Smith, 1982a, 1982b; George K York & Steinberg, 2002; Young, 1990), so I shall not delve into the topic in greater length. But it is worth remarking that the influence was openly and repeatedly emphasised by Hughlings Jackson himself: ‘I need scarcely mention the name of Herbert Spencer, except to express my vast indebtedness to him’ (1932, p. 395).

Jackson’s model differs from the localizationist model of Meynert in a number of ways. First, he conceptualized the nervous system as a sensorimotor machine, functioning according to the law of reflex action, and solely responsible for the observable events of movement and sensation. This aimed at freeing neurology from psychological concepts, clearing up the epistemological confusion that permeated the ‘psychologico-materialist theories’ (ibid., p. 28) such as that of the German school. In his words, ‘there is no physiology of the mind any more than there is psychology of the nervous system’ (1890, p. 7). Such theories, he argued, were ‘not really clear: they hinder progress in neurology’ (1932, p. 28). Although he decided to remain exclusively in the field of neurology, with this reformulation he has also removed the necessity for psychology to have recourse to physiology, thus allowing researchers such as Freud to build models of the mind based exclusively on psychological methods.

Secondly, and most important for our purposes, rather than mapping the cortex as the focal point of the entire nervous system as did Meynert~~ did~~, Jackson portrays ~~it~~ the brain in terms of an organizational hierarchy with increased complexity. Influenced particularly by Herbert Spencer, who as noted before understood the process of evolution as consisting of the passage from the homogeneous to the heterogeneous and from the simple to the complex (Spencer, 1897), Jackson divided the system into three levels, reflecting different stages of complexity in the evolution of the species. Lower centres, mainly subcortical, were thought to be responsible for representing each body part in a very simple – i.e., point by point –, but uncoordinated fashion. Middle centres re-represent these parts in more complex combinations, thus increasing its co-ordination (J. H. Jackson, 1932, p. 100). Finally, he attributes to the highest centres, in the frontal and lateral lobes, the task of re-re-representing with the greatest complexity the body parts, giving way to complex phenomena such as the whole body, cognition and consciousness. He went so as far as to assume that the re-re-representation of the heart was the 'physical basis of the time constant' (ibid.: 102).

The passage from the lower to the higher is accompanied, as we see, not just by increasing complexity and heterogeneity, but also by increased integration. The highest levels, in this sense, are 'potentially the whole organism; the whole organism is "potentially present" in them. They are the unifying centres of the whole organism, and thus the centres whereby the organism *as a whole* is adjusted to the environment' (J. H. Jackson, 1932, p. 82). A higher strata is more complex because it integrates excitation from various centres from below, thus allowing it to increase its malleability and adaptation to the environment, providing us with less stereotypical responses. Thus for him (and echoing Spencer):

> '(1) Evolution is a passage from the most to the least organised. "Highly organised" is frequently used synonymously with 'very complex'; but by degrees of organisation I mean degrees of perfection of union and certainty of action of nervous elements with one another. Using the term organised in this sense I say that the highest cerebral centres are the least organised (the "most helpless centres"), although they are the most complex, whereas the lowest centres are the most organised, although the least complex. In other words, we may say (2)

> that the evolutionary ascent is from the least to the most modifiable. If the highest centres were not modifiable, we should be very simple machines; we should make no new acquirements. If the lowest ("vital") centres were to become modifiable as the highest are, life would cease' (J. H. Jackson, 1932, p. 395)

The dynamic aspect of Jackson's model lies in ~~that~~ the fact that the higher levels are responsible not only for generating events themselves but also for inhibiting excitation arriving from the lower portion. In fact, cohesion and integration at the upper levels are achieved via inhibition and modulation~~s~~ of the lower strata. The higher level could in this sense propagate or inhibit stimulation from the lower centres so as to generate more adapted responses. This helped explain the appearance of positive symptoms after brain damage, when only negative symptoms were expected to occur – this happened, according to Jackson, because once the functioning of a higher layer was lost, reflexes generated in the lower levels that were previously inhibited were now liberated to be expressed. The same structure was believed to operate in mental disorders; when a higher level lost its function, medium and lower process continued to function normally, leading to positive symptoms such as delusions and hallucinations. Thus symptoms can be seen as lower levels functioning without upper inhibitory or modulatory control (J. H. Jackson, 1932, p. 50).

Regarding the contemporary discussion on the localisation of psychological functions, Jackson developed a mid-stance position, between equipotentialism and localisationism. Equipotentialism, which Jackson called Universalisation (1932, p. 385), is the theory according to which the brain has no specialised areas. Impairments, in this sense, are thought of as a result simply of the volume of brain mass damaged, rather than of the location of the damage. Localisationism, on the other hand, as in Meynert's model, argues that each location is responsible for a single function. Gall's phrenology, in this sense, was the most extreme version of the localizationist tradition, while Flourens' equipotentialism stood for the other extreme. By the time Freud started working at the University of Vienna, such extreme positions in any of the traditions had become relics of the past. The discussion now centred on whether the brain was composed of different centres responsible for elementary psychological functions, whereas complex functions were the result of associations between such centres, or if there were no such centres at all – the whole brain was nothing but an association machine. *Zentrenlehre*, or doctrine of centres, was the name given in Germany to the first side of the debate. Opponents such as K. Jaspers and A. Meyer described the doctrine as a *Hirnmythologie* – a mythology of the brain[3].

As the studies on brain lesions showed, there was indeed a correlation between the site of the lesion and the loss of particular functions, such as speech, but these were neither exclusive nor completely accurate. Different patients with very similar damages still presented different types of function-loss. Jackson thought this meant that the representations of the body or psychical faculties in the nervous system must have different weightings, so that no function is represented exclusively at one single anatomical location. Representations are thus not located in centres, as the *Zentrenlehre*, such as that presented in the Meynertian doctrine, lead us to believe:

[3] On this Jaspers says: 'These anatomical constructions […] became quite fantastic (e.g. Meynert, Wernicke) and have rightly been called "Brain Mythologies." Unrelated things were forcibly related, e.g. cortical cells were related to memory [Erinnerungsbild], nerve fibers to association of ideas. Such somatic constructions have no real basis. Not one specific cerebral process is known which parallels a specific psychic phenomenon' (Jaspers *in* Guenther, 2015, p. 13)

> 'I do not believe that words or syllables have nervous arrangements in the sense that there is one little nervous centre for each syllable or rather single articulation [...] *I believe that each unit of every nervous centre is the whole of that nervous centre in (different) miniature.* [...] But a certain quantity of nervous arrangements, implying a certain quantity of energy, is required for every operation' (J. H. Jackson, 1879, p. 333, my italics).

This view helped explain the plasticity found on patients with brain lesions, who, even though ~~they~~ still missed the respective brain part that first led to the loss of function, sometimes could recover the function partially or even completely (J. H. Jackson, 1879a, p. 203). Moreover, Jackson thought it was possible that some symptoms generated after a lesion (in particular 'positive symptoms', i.e., increased activity) could be caused by the 'release' the inhibitory effects of the lost area. In sum, Jackson warned his colleagues that localisation of function and localisation of symptoms were not identical. (Finger, 2001, p. 56ff).

The nervous system thus – in Jackson's framework – functions dynamically, changing its own operation according to its circumstances. If 'each unit of every nervous centre is the whole of that nervous centre in miniature', when a unit more directly related to a certain function is impaired, other units which formerly had lower weighting in the execution of the function are capable of compensating for the loss, as long as the amount of energy left is still enough for the operation. Jackson called this the *Principle of Compensation* (J. H. Jackson, 1876). That is, Jackson develops a mid-stance position between equipotentialism and localisationism by arguing that although brain areas do become specialised for certain functions, this is not a rigid process. The function itself is shared amongst a range of other areas that have lower participation in the function, but that could take over the function should the main area be compromised.

Jackson repeatedly uses the analogy of the brain as a highly developed bureaucracy – either the government of a nation (1932, pp. 22, 58) or the command structure of the navy (ibid., p.55). It is important to recognize that Jackson's analogies are with committees, not with a single autocratic ruler: 'there is no autocratic mind sitting at the top to receive sensations as a sort of raw material, out of which to manufacture ideas, etc.' (ibid., p.97-8). When one member of the admiralty board is indisposed, the other twenty-three, he says, compensate by working a little harder and the navy functions nearly as well as usual. If, however, the entire higher command is removed by an enemy action or a gunpowder plot, the consequences are likely to be serious. The state or the navy is now controlled by the next-highest level in the command structure. This level does the best it can, but through either lack of training or breakdown in communication, is unlikely to govern as expertly as the defunct uppermost stratum. The best that this lower level is able to achieve is probably comparatively poorly adapted to the prevailing circumstances. These poorly adapted responses are, for Jackson, nevertheless the "fittest states" of which the reduced organization (brain) is capable (Smith, 1982b, p. 252). The metaphor however does not imply that Jackson was subscribing to a form of neurological homunculism. The centres are mechanisms, each level below more simple and rigid. Therefore, it is the hierarchical architectonics of the nervous system – and not a special quality of the units in the higher levels in themselves – that generate increasing complexity and flexibility. Jackson here provides a hierarchical account not so distant from that presented more recently by the philosopher Daniel Dennett (Dennett, 1969, 1993, 1996).

A similar explanatory structure was used to account for hallucinations accompanying some post-epileptic patients. ‘The consciousness of the neurological patient is the consciousness of the lower regions of the brain, which have been uncovered by progressive inactivation of the higher levels. What we term “hallucination” and the like is the best effort of these lower strata to make sense of the information input, it is the fittest state of the lower level’ (J. H. Jackson, 1932, p. 47). Consciousness being a function of the highest layers, and the highest layers being potentially a re-representation of whole body, if a higher layer suffers some damage – structural or functional – consciousness becomes a function of the now highest level. However, as the centres at that level may not be fully suited to integrate stimuli from all other centres, it may incur in incoherencies caused by lack of inhibition and integration.

Freud and Hughlings Jackson

In “On Aphasia”, Freud explicitly follows a very similar view of the brain as hierarchically composed through successive evolutionary stages:

> "The whole organization of the brain seems to fall into two central apparatuses of which the cerebral cortex is the younger, while the older one is represented by the ganglia of the forebrain[4] which have still maintained some of their phylogenetically old original functions"
>
> …
>
> "Of the large subcortical nuclei, only the optic thalamus is connected with the cerebral cortex; it is atrophic in cases of congenital

[4] Freud is probably referring to the basal ganglia, as he mentions the striatum in the previous paragraph.

> malformation of the cerebral cortex; the striate body, however, remains intact in cases of lobar degeneration, while it is found to be atrophic in patients with congenital cerebellar atrophy. Thus a formidable portion of the brain, i.e., the corpora striata, the pons and the cerebellum, can be differentiated, as an organ of unknown functions, from the rest of the brain with which it has a great many connections, though developmentally and functionally it is fairly independent of it" (Freud, 1891, pp. 49–50)

Here we see that Freud understood the central nervous system as composed of two semi-independent structures; the phylogenetically younger cortex, and a subcortical and more ancient area, stretching from the basal ganglia to the pons. This evolutionary hierarchical understanding of the brain becomes an essential element, as we will see, of his models of the mind.

Freud however in '*On Aphasia'* presents little on the top-down regulation of basal strata. This would be included in his unpublished '*Project'*, from 1895. There, Freud would hypothesise how primary process mechanisms give path to secondary process via delayed gratification and interaction with reality, which takes place via a theory of learning also presented there. Even before the *Project*, however, Freud already gave the topic some attention. In 1893, in a paper on the topic of childhood diplegia (Accardo, 1982), Freud again applied Jackson's theory of hierarchical levels – this time in the motor system –, while stressing the notion of dissolution to interpret the deficits as the consequence of deficient central inhibition.

In the *Project*, Freud for the first time attempts to describe the functioning of the whole brain. He once again takes a developmental approach to the understanding of the differentiation of functions in the brain, which, he argues, is 'like everything else, something that has come about gradually' (Freud, 1895, p. 302). These are initially based, Freud implies there, in the brain's hierarchical anatomy. He follows a very similar distinction between lower and higher structures as previously presented in his Aphasia monograph:

> In fact we know from anatomy a system of neurones (the grey matter of the spinal cord) which is alone in contact with the external world, and a superimposed system (the grey matter of the brain) which has no peripheral connections but to which the development of the nervous system and the psychical functions are attached (ibid., p.303)

Freud here calls this lower system the 'primary brain', and argues that because it is directly connected to the interior of the body and shut off from the external world, it should be understood as a 'sympathetic organ' – i.e., responsible for signalling the body's 'endogenous excitations' (ibid., p.302). An increase in excitation, Freud says, is experienced as painful or unpleasurable, while pleasurable sensations are the subjective side of a quantitative experience of pacification. The pacification of the endogenous sources of excitations, in turn, can only be brought about by an 'alteration in the external world (supply of nourishment, proximity of the sexual object)', which requires a 'specific action', such as feeding or nurturing. At first, 'the human organism is incapable of bringing about the specific action. It takes place by extraneous help, when the attention of an experienced person is drawn to the child's state by discharge along the path of internal change' (ibid., p.318). This constitutes the first 'experience of satisfaction' of the infant, who is now capable, via a 'basic law of association by simultaneity', of ~~associating~~ linking the wish (satisfaction) with the object that pacifies its wishes (specific action). As the association is one of memory

(memory of the experience of satisfaction being contiguous with the experience of the specific action), when an increase in endogenous excitation occurs again, thus generating a wish, it triggers a wishful activation of memory traces, which in turns produces the ‘same thing as a perception – namely a hallucination’, i.e., a fantasy of wishfulfillment (ibid., p.319). As more memory traces are gathered, the totality of these associations generates a specific form of organisation, responsible for the secondary function of the brain. This organisation is what Freud calls the ego. The ego is therefore this ‘network of cathected neurones well facilitated in relation to one another’, i.e., an organisation of neurons generated via multiple experiences of associative learning.

Freud further argues that the neurons themselves are incapable of differentiating between memory and perception, which is why hallucinations, dreams and symptoms are experienced so vividly. It is only with the emergence of the secondary process inhibitory activity of the ego that such a differentiation is effected. It is therefore ‘the inhibition by the ego which makes possible a criterion for distinguishing between perception and memory’ (p.326). This is why Freud claims that ‘if an ego exists, it must inhibit psychical primary processes’ (p.324). This mechanism provides the brain with ‘indications of reality’, which allows it to learn and make use of reality as to satisfy its urges. Therefore, Freud provides his reader here with a model by which the higher levels of the brain learn to inhibit and regulate the bottom layers, and hereby integrating the system into a coordinated whole (i.e., the ego) that learns to employ the body to act on the environment as a means to satisfy its wishes.

If the lower levels are remnants of more primitive stages of evolution, and brain damage in the upper levels ‘releases’ the effect of those stages, Jackson conjectured that disorders operate in a process opposite to evolution. He called this process dissolution, again influenced by Spencer (Spencer, 1869). There is clear a parallel here with Freudian notions. Freudian nosology is based on the idea of regression – i.e., the set of symptoms of each disorder is explained by the stage of psychic development to which the patient has regressed:

> ‘The flight from unsatisfactory reality into what, on account of the biological damage involved, we call illness, [...] takes place along the path of involution, of regression, of a return to earlier phases of sexual life, phases from which at one time satisfaction was not withheld’ (Freud, 1910, p. 48)

The narcissistic neuroses (psychosis in general), for example, represent in Freud’s theory a partial regression to the stage of primary narcissism (Freud, 1911). The following passage by Ferenczi, Freud’s greater collaborator in the 1910’s and with whom he most freely discussed speculative analogies between individual, social and phylogenetic development[5], makes the argument particularly clear:

> ‘[W]e suspect that the wish-constituent of the neurosis, [...] depends on where the fixation-point is in the phase of the development of the sexual hunger, while *the mechanism of the neuroses is probably decided by what stage in the development of the ego the individual is in*

[5] Freud’s unpublished and highly speculative metapsychological manuscript on the transference neuroses – his ‘Philogenetic Phantasy’ (Freud, 1987) –, for instance, was discovered by the historian Ilse Grubrich-Simitis amongst the Ferenczi literary estate (Grubrich-Simitis, 1988).

> *at the time of the determining inhibition*. It is very well thinkable that with the regression of the sexual hunger to earlier stages of development the level of the reality-sense that was dominant at the time of fixation also becomes renascent in the mechanisms of the symptom-formation. [...] Hysteria and the obsessional neurosis, for example, would according to this conception be characterised on the one hand by a regression of the sexual hunger to earlier stages of development (auto-erotism, Oedipusism), and on the other hand in their mechanisms by a relapse of the reality-sense to the stage of magic gestures (conversion) or of magic thoughts (omnipotence of thought). I repeat: It will need much longer laborious work before the fixation-points of all neuroses can be established with certainty' (Ferenczi, 1952, pp. 234–5, my italics).

In a letter to Karl Abraham, Freud makes it clear that regression was a concept inherited from 'the *evolution and involution* of the English authors' (Freud, letter from 26 July 1907, italics in English in the original), that is, Jackson and Spencer. Earlier, in his monograph on aphasias, he had already acknowledged the influence of the English neurologist:

> 'In assessing the functions of the speech apparatus under pathological conditions we are adopting as a guiding principle Hughlings Jackson's doctrine that all these modes of reaction represent instances of functional retrogression (*Rückbildung,* disinvolution) of a highly organized apparatus, and therefore correspond to previous states of its functional development. This means that under all circumstances an arrangement of association which, having been acquired later, belongs

> to a higher level of functioning, will be lost, while an earlier and simpler one will be preserved' (Freud, 1891, p. 87)[6].

Building on these elements, we can trace some parallels between Freud's models of the mind and Jackson's model of the nervous system. Like Jackson, Freud, in his topographic model, ~~which he later~~ developed in the structural model, has described the mind as operating in three hierarchical levels, evolved out of the subject's own ontogeny (personal history), as well as out of its phylogeny (history of the species). Like Jackson, Freud places consciousness, and later the ego, in the highest layer, controlling and inhibiting excitation from the lower levels. The highest layer in both authors servers not only to control and inhibit excitations from bottom levels, but has also the additional task of unifying what are at the lower levels completely uncoordinated stimuli. In fact, in both authors this unification is achieved *via* the mechanism of inhibition, i.e., unification is the goal, and inhibition is the mechanism by which the mind or brain achieves it. Like Jackson, Freud claimed that disorders of consciousness 'released' phylogenetically older and more primitive processes to appear. For a long time, Jackson even claimed that just as the highest level of the nervous system has a mental concomitant (consciousness), so the lower levels must also have one (an "unconscious consciousness") – a view he would come to disregard as incoherent (G.K. York & Steinberg, 1993). More than simply parallels, the correspondences in the models of the two authors indicate a strong influence,

[6] Freud provided no references to Jackson here. He mentions Jackson again on pages 61 and 88, but only on page 56 does he make reference to a specific article: "On Affections of Speech from Diseases of the Brain" (J. H. Jackson, 1878). This is the only piece we can know with certainty that was read by Freud. He again quotes the same paper in his metapsychological essay on "The Unconscious", from 1915 (p.206). Further mentions to Jackson are also present – without specific references – in "On the Psychical Mechanism of Hysterical Phenomena: A Lecture" (Freud, 1893, p. 35) and "The Interpretation of Dreams" (Freud, 1900, p. 568).

specially taking into consideration Freud's understanding of the general anatomy of the brain.

As historian Roger Smith demonstrated in his thorough account of the uses of the notion of Inhibition in the sciences of the mind and the brain, the notion was 'Insert discussion on inhibition in 19th century neuropsychiatry here. Roger Smith 1992.

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On the subject of mind-brain relation, Freud explicitly follows Jackson's so-called "Doctrine of Concomitance" in 'On Aphasia'. The doctrine is a type of psychophysical parallelism which aimed at separating the realms of psychology and physiology, and so liberated neurologists from the widely speculative task of looking for the location of psychical events in the brain, opening the way for a pure physiological neurology. According to the doctrine, brain and mind operate completely correlated, but causally unrelated – like two clocks initially set to the same time:

> 'The doctrine I hold is: first, that states of consciousness (or, synonymously, states of mind) are utterly different from nervous states; second, that the two things occur together – that for every mental state there is a correlative nervous state; third, that, although the two things occur in parallelism, there is no interference of one with the other. This may be called the doctrine of Concomitance' (Jackson, 1884: 72).

Freud's position as presented in 'On Aphasias' is remarkably similar, as a number of scholars (Fullinwider, 1983; Makari, 2008; Solms & Saling, 1986, 1990; Stengel, 1963) have already observed:

> ‘The relationship between the chain of physiological events in the nervous system and the mental processes is probably not one of cause and effect. The former do not cease when the latter set in; they tend to continue, but, form a certain moment, a mental phenomenon corresponds to each part of the chain, or to several parts. The psychic is, therefore, a process parallel to the physiological, “*a dependent concomitant*” (1891, p. 55, italics in English in the original).

The Doctrine of Concomitance played an essential role in the creation of psychoanalysis. It allowed Freud to develop a pure psychology separated from physiology – but one that paralleled its models. After his monograph on the aphasias, he tried to develop a physiologico-speculative model of the whole brain that explained his clinical cases (i.e., the *Project*). As he realised that he would not achieve his initial aims, he gave up the project and progressively moved over to the field of psychology, until, in 1900, in *The Interpretation of Dreams*, he wrote the famous passage that consolidates the arrival of psychoanalysis:

> ‘I shall entirely disregard the fact that the mental apparatus with which we are here concerned is also known to us in the form of an anatomical preparation, and I shall carefully avoid the temptation to determine psychical locality in any anatomical fashion. I shall remain upon psychological ground, and I propose simply to follow the suggestion that we should picture the instrument which carries out our mental functions as resembling a compound microscope or a photographic apparatus, or something of the kind’ (Freud 1900, p. 536).

Hughlings Jackson and MacLean's Triune Brain Theory

Hughlings Jackson's insights on the evolutionary hierarchy of the brain have also had a strong impact in the emerging neurosciences, both in Europe and in America (Joynt, 1989; Wallesch, 1989). For instance, the founder of the neurological clinic that would later become the Department of Neurology at Harvard Medical School, James Jackson Putnam (1846-1918), studied and worked with Hughlings Jackson, who was a lasting influence throughout his life (Joynt, 1989). Perhaps not coincidentally, Putnam became later in his life an enthusiast of psychoanalysis, being instrumental in organising Freud's visit to the United States in 1909. Their meet during the visit led to a personal friendship, developed via multiple letters (Putnam, 1971), and subsequently to the formation of the American Psychoanalytic Association, of which Putnam was a founding member. Further, as Roger Smith explored at length, the Jacksonian evolutionary understanding of the brain was deeply impactful in British neurology and psychiatry, being a major influence to authors such as David Ferrier, Sherrington, Henry Head, Maudsley, and Rivers (Roger smith, 1982, p. 163ff.).

There is not enough space, nor is my goal here, to develop a complete account of the impact of Jackson's work for neurology and the neurosciences. The aim in this last section is simply to schematically describe a parallel branch of the neurosciences in the 20th century that converges again with psychoanalytic ideas in the present, particularly in the field of neuropsychoanalysis. As we will see, he was an inspiration to researchers – especially of emotions –, who thought of the brain as hierarchically organised by evolution.

In a 1937 paper, the American comparative brain anatomist James Papez (1883-1958) relied heavily on Jackson's evolutionary ideas to outline a circuit that accounted for emotion. He hypothesised that the hippocampus, the cingulate girus, the hypothalamus, the anterior thalamic nuclei, and the connections between these structures formed 'a harmonious mechanism which may elaborate the functions of central emotion, as well as participate in emotional expression' (Papez 1937, p. 743).

A similar structure to the one referred to by Papez had already been described in 1878 by the French anatomist Paul Broca, who coined the term *le grande lobe limbique* to describe the circular edge or border (Latin *limbus*) structure that surrounded the lower threshold of the hemispheres. Broca, however, established no connections between the area and emotion, believing instead the structure to be associated primarily with the sense of smell – as the term *rhinencephalon* (rhino=nose), which is sometimes used synonymously with the limbic system, implies (Finger, 2001, p. 286ff). It would fall to the American neuroanatomist Paul MacLean (1913-2007), who had previously studied with Papez, to bring back the usage of the term in a paper from 1952. MacLean called it "the limbic system" while expanding the structure to also contain the hippocampal gyri, the amygdala, the septal nuclei, the epithalamus, parts of the basal ganglia and several nuclei of the hypothalamus (MacLean, 1952, 1990).

Perhaps not by accident, MacLean belongs to a line of scientists, in which we can also place Hughlings Jackson and Freud, that moved to the field of neuroscience only after long contemplating a career in philosophy. In his writings, MacLean demonstrated an inclination to speculative work characteristic of a philosopher. MacLean described the brain as a conglomerate of three hierarchical structures or semi-independent brains, which he called, progressively, the reptilian or visceral brain[7], the old (or paleo-) mammalian brain, and the new (or neo-) mammalian brain. The reptilian brain, located in the brainstem, was considered responsible for instincts and stereotypical behaviour. The middle level, composed of the limbic system, was responsible for emotional expression, simple feelings, and reproductive behaviour. The paleo-mammalian brain was formed by the neocortex and represented the source of higher thoughts, of problem-solving, reason and verbal language.

Not accidentally, MacLean's triune brain theory shows direct correspondence to Jackson's model. The English neurologist was always a strong influence, being the most quoted author in the best-selling book *The Triune Brain in Evolution* (1990), in which MacLean says that his 'argument is in line with Hughlings Jackson's classical concept that the nervous system represents a hierarchy of levels and that a loss of structures at higher levels gives release to the activity of those at lower levels' (1990: 59).

A further feature of the triune brain theory – and one that was already present, even though less explicitly, in Jackson – is that the different layers of the brain are potentially in conflict as they are unable to communicate effectively with one another. The causes are chemical, anatomical and functional. First, since each level operates via a different set of neurochemistry, they function as partially independent brains. Secondly, the lack of major associative pathways between the component brains extends the possible miscommunication. Third, MacLean believed that because only the neocortex is capable of using symbolic language, that puts it in a special position in relation to the other two layers, which in turn generated a 'conflict between what we feel and what we know' ~~(MacLean, 1977: 214)~~. In this model, only the

[7] In later works (P. MacLean, 1990), MacLean changed the name of the first structure to 'protoreptilian Complex' or 'R-Complex' to acknowledge the recent discoveries that mammals did not descend directly from reptiles, but from mammal-like reptiles (the *therapsids*) – a common ancestor to both mammals and reptiles.

neomammalian cortex ‘looks inward to the inside world’, so that ‘this new development makes possible the insight required for the foresight to plan for the needs of others as well as self’ (MacLean, 1977: 214). And in a tone that strongly reminds us of the Freudian Superego, ‘this added dimension has ironically increased the suffering that we feel when torn by conflict between our own selfish concerns and concern for others’ (ibid., p.217-8).

The similarity between his model and Freud’s did not go unnoticed to MacLean, who quoted Freud when talking about duality and conflict, as well as in his paper on the evolution of psychosexual functions in the brain (Maclean 1977, p.218; Maclean 1994, p.111). MacLean even identifies the Id with the reptilian brain at points and, in a commentary to the *Psychoanalytic Quarterly*, he declared his hopes that “just as the physicist feels assured when he can correlate observable events with the movement of electrons which he cannot see, so it is reassuring to us that we are getting nearer the day when we shall be able to correlate the profound, though intangible, insights of Freudian psychology with brain structure and brain function” (1953, p. 53).

Given the prominence of psychoanalytic thinking in the mid-20th century, it is no wonder the American anatomist would be somewhat familiar with Freudian ideas. However, it is also worth noting that MacLean worked with Karl H. Pribram (1919-2015), with whom he published two papers early in his career (Maclean & Pribram, 1953; Pribram & Maclean, 1953). Pribram was a Viennese-born American neuroscientist who also wrote extensively on psychoanalytic theory (Pribram, 1962, 1965, 1981, 1989, 1998; Pribram & Gill., 1976). In fact, the two shared a lifelong professional dispute and personal friendship, described in Pribram’s exposé on his relationship with MacLean. Pribram compared their relationship to that of Pasteur-

Koch and Freud-Jung, with the difference that 'in the MacLean-Pribram adventures […] Paul, through his charm and graciousness, has made it possible for us to remain friends despite what have often been painful differences' (Pribram, 2002, p. 7). Curiously, however, MacLean's work was never taken up by psychoanalysis but for few exceptions without ~~further~~ any substancial impact ~~on~~ to psychoanalytic theory.

Despite its popularity, the triune brain theory faced much controversy from the neuroscience community[8], never having been widely accepted, except in some circles – and even then only cautiously. One of these was the new field of Affective Neuroscience, a meanwhile established field in the neurosciences.

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From the Triune Brain to Panksepp's Affective Neuroscience

Following the path laid by Jackson and MacLean, Jaak Panksepp (b.1943), the Estonian-born pioneer in the field of affective neuroscience, ~~also~~ again proposed a tripartite hierarchical model of the brain. As with his predecessors, the different hierarchies are representative of different stages of evolution. In his seminal textbook '*Affective Neuroscience'* (1998), Panksepp discloses his debt to the triune brain theory: 'many others along the way have helped me better understand the nature of emotions and the nature of scientific enterprise that must be pursued in order to understand the deep, neurological nature of human emotionality. Foremost among those have been the writings of Maclean' (p.ix).

[8] For criticisms, see (Reiner, 1990), (Campbell, 1992) and (Butler & Hodos, 2005). For a review of the criticisms, with replies, see (Cory Jr., 2002).

Panksepp's model, in fact, is better understood as an expansion on MacLean's – but with some caution regarding ~~the~~ some anatomical inaccuracies present in the previous model. On the triune brain theory, Panksepp says that 'this three-layered conceptualization helps us grasp the overall function of higher brain areas better than any other scheme yet devised. Of course, exceptions can be found to all generalizations, and it must be kept in mind that the brain is a massively interconnected organ whose every part can find an access pathway to any other part' (ibid., p.70). However inaccurate in its details, for Panksepp the triune brain still represents a powerful tool for a macro understanding of brain architecture and its functioning and development: 'although the triune brain is largely a didactic simplification from a neuroanatomical point of view, it is an informative perspective. There appears to have been relatively long periods of stability in vertebrate brain evolution, followed by bursts of expansion' (ibid., p.43). MacLean received Panksepp's work well (P. MacLean, 2001).

The model is constructed on the notion of 'nested hierarchies', where lower functions are 'embedded and re-represented in higher brains functions, which yield not only traditional bottom-up controls but also top-down regulators of emotionality' (Panksepp & Biven, 2012, p. 77). It is worth noting that although Panksepp does not seem to acknowledge the influence of Jackson in his writings, even the terminology used is equivalent to that of Jackson, who first thought of the upper levels as representing and re-representing lower strata (1932, p. 104ff.). And even though Panksepp places less emphasis than MacLean on the conflict generated by communication between levels, especially considering that his work is strongly focused on the lower level and its forms of bottom-up control of the brain, he recognises that such a hierarchical structure provides 'two-way avenues of control that can be seen to be forms of “circular causality” that respects the brain as a fully integrated organ that can have dramatic intra-psychic conflicts’ (Panksepp & Biven, 2012, p. 77)

The bottom level, responsible for ‘primary-process’ or ‘basic affects’, is situated very low and medial in the brain and is shared with all mammals, which affirms its ancient nature in brain evolution. It manifests, according to Panksepp, ‘evolutionary memories’ (ibid., p.13) that are the basic affective operating systems of the brain. These were built, he says, from ‘earlier reflexive-instinctual abilities’ (Panksepp, 1998, p. 50), which, through evolutionary modification and coordination of pre-existing capabilities, provided the animal with ’greater behavioural coherence and flexibility in a variety of primal situations’. The basic systems are subdivided into three general types of affect: 1) sensory affects (pleasant-unpleasant feelings), 2) homeostatic affects (hunger, thirst, thermoregulation, etc.), and 3) emotional affects (emotion action systems). Panksepp further breaks down the emotional affects in seven basic action systems for coordinating emotionality in the brain of mammals (cf. Panksepp, 1998; Panksepp & Biven, 2012). These can be thought of as “survival tools” that regulate: foraging for resources (SEEKING), reproductive eroticism (LUST), protection of the body (FEAR and RAGE), maternal devotion (CARE), separation distress (PANIC/GRIEF), and vigorous positive engagement with conspecifics (PLAY). The affect designators of the seven system are written in upper case letter to differentiate them from our simple vernacular folk psychology. These refer instead to specific neural systems that are assumed to be a major source for the emergence of the vernacular terminologies but which are in this context restricted to its neuro-functional referent (Panksepp, 1998, p. 51).

The next layer, of secondary-process emotions, based on the basal ganglia, is responsible for three types of basic learning mechanisms in the forms of classical conditioning, instrumental and operant conditioning, as well as emotional habits. In a way that strongly reminds us of the Freudian theory of learning presented in *the Project*, ~~T~~these mechanisms for learning can link external perceptions with associated feelings, thus generating a top-down control of basic affects on the grounds of previous experience. On top, we find the tertiary level, which is programmed by life experiences through the neocortex, engendering our higher cognitive processes such as thinking, ruminating, and planning. Although the neocortex in healthy development becomes the dominating level in adulthood, it is the ‘ancient feeling states [that] help forge our memories in the first place. New memories could not emerge without the underlying states that allow animals to experience the intrinsic values of life’ (Panksepp & Biven, 2012, p. 66).

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It is this framework, developed in the 80’s and 90’s via evidence gathered primarily from comparative neuroanatomy and experiments on electrical stimulation of the brain of mammals (in particular rats), that became the initial foundation for Mark Solms’ (and later Panksepp’s) attempt at joining psychoanalysis and neuroscience together (Panksepp & Solms, 2012; Solms, 2000b; Solms & Panksepp, 2012; Solms & Turnbull, 2002; Zellner et al., 2011). This was based on identifying Panksepp’s primary process emotional action systems as an updated and more accurate version of the Freudian drives, which still maintained some of its essential elements and general organisation – such as that of an evolutionarily constructed tripartite model of the brain and mind:

> Viewing Freudian drive theory from the perspective of affective neuroscience, we are sure we are not alone in suggesting that the equivalent of Freud's libidinal drive at the instinctual level is the SEEKING system, the most basic emotion command system in Panksepp's taxonomy. The general pleasure-seeking tendency of the libidinal drive, which has a source and an aim but is inherently without an object, seems to correlate remarkably well with the 'objectless' action tendencies that Panksepp attributes to the SEEKING system. This system is an all-purpose system, activated by a variety of needs, that energizes forward-moving, foraging, and effortful behaviour aimed at any number of goals, rewards, or objects. (Solms & Zellner, 2012)

The goal of course is not simply to provide "hard science" evidence to Freud's concepts or to map them to the brain, but also to extend and correct psychoanalytic knowledge of the underpinnings of our subjective experience based on methodologies considered more appropriate for the task. The question of how many drives there are and how they relate to one another has been the subject of extensive debate in psychoanalysis at least since Freud's early disputes with Jung (Makari, 2008). In some contemporary psychoanalytic schools, the notion of drive disappeared altogether. Neuropsychoanalysis, at least in the version exemplified by the work of Mark Solms, operates in the belief that Panksepp's taxonomies of drives provides a more accurate description. Thus it is argued that:

> A reworking of drive and motivational theory in psychoanalysis, away from an outdated and clumsily mechanistic dual-drive theory (which does not adequately conceptualize fundamental social connection needs) towards a more multifactorial and multi-axial theory of motivation and affect would significantly reduce metapsychological

> sources of potential confusion in the clinical practice of psychoanalysis and bring psychoanalysis more fully into register with moderate neuroscience findings. (Watt, 2012)

Neuropsychoanalysis in this sense reformulates Freud's original taxonomy of life and death drives into a more complex one, where libidinal drives (SEEKING, LUST) coexist alongside social (CARE, PLAY) and negative drives (RAGE, FEAR). A deeper understanding of these underlying motivational systems provides us with improved accounts not only of their basic elements, as well as with their interactions (as the systems interact with one another in excitatory and/or inhibitory ways) – and subsequently of psychopathologies and treatment.

Tripartite Structures

The account presented here sheds some light on the similarities encountered by neuropsychoanalytic researchers between contemporary accounts of the anatomy and physiology of the nervous systems on the one hand, and of Freudian models of the mind at the other. These, I tried to demonstrate, are more than similarities. They have a historical underpinning to them, as both accounts originate from one common source: John Hughlings Jackson's tripartite evolutionary hierarchic view of the brain.

Tripartite structures were new to neither Freud nor Jackson. Throughout the last two and a half millennia authors have attempted to explain our conflictual nature in models of three elements that compose our sense of agency. After delving into tripartite structures of the brain in Spencer and Jackson (Smith, 1982a, 1982b), the historian CUM Smith extended his research to the origins of tripartite structures of the mind and soul in antiquity. There, he argues that such models have been present in w~~W~~estern c~~C~~ivilization since classic Greece, and that it may be time to overcome them:

> ‘It is thus not surprising to find that tripartite classifications crop up time and again in the history of neuropsychology’. […] ‘It may be [...] that the Western mind has been conditioned to accept tripartite schematics by its millennial experience of tripartite social stratifications. Perhaps it is now time to discard such age-old and nowadays unconvincing analogies and acknowledge that the brain and the mind have a far more intricate dynamic.’ (Smith, 2010).

This is a plausible hypothesis. A range of authors, from Plato (cf. *Republic*, Book IV) to Panksepp, passing through Jackson, Freud, MacLean and others[9], have indicated our condition as one of conflict between essentially three parts that compose our subjectivity. One could argue, with Smith, that these authors were culturally conditioned to choosing the number three. Based on what we have seen, however, another hypothesis presents itself with equal credibility. As Affective Neuroscience seems to indicate, it is possible to speculate that what different authors identified as tripartite structures of the soul, mind or spirit, may in fact be different analogies that reflect something structural in the evolutionary history of the architecture of our nervous system.

[9] A full list would be too large and outside of the purpose. But it includes authors in ancient philosophy (from Plato and Aristotle to Galen), Christian theology (the separation of body, soul and spirit), philosophy (Mendelssohn (1755) for instance, divided the human psyche into cognition, affection and conation), psychology (Pavlov's division into second signalling systems, conditioned reflexes, and unconditioned reflexes), the neurosciences (as per Jackson, MacLean and Panksepp) and, of course, psychoanalysis.

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