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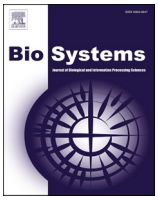

Archetypes and code biology

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ABSTRACT

As a clinical psychologist, I observe stereotyped formulas of behavior in action every day in the consulting room, despite differences in age, race, or culture; they present themselves as codified rules or typical modes of behavior in archetypical situations. Such circumstances coincide with what C.G. Jung defended: the existence of *archetypes* stored in an inherited/phylogenetic repository, which he called the *collective unconscious* – somewhat similar to the notion of an *ethogram*, as shown by ethology. Psychologists can use a perspective to facilitate understanding the phenomenon: the *code biology* perspective (Barbieri 2014). This approach can help us recognize how these phenomenological events have an ontological reality based not only on the existence of organic information but also on the existence of organic meaning.

We are not a *tabula rasa* (Wilson 2000): despite the explosive diversification of the brain and the emergence of conscience and intentionality, we observe the conservation of basic instincts and emotions (Ekman 2004; Damasio 2010) not only in humans but in all mammals and other living beings; we refer to the neural activity on which the discrimination behavior is based, i.e., the *neural codes*. The conservation of these fundamental set-of-rules or conventions suggests that one or more neural codes have been highly conserved and serves as an interpretive basis for what happens to the living being who owns them (Barbieri 2003). Thus, archetypes' phenomenological reality can be understood not as something metaphorical but as an ontological (phylogenetic) fact (Goodwyn 2019).

Furthermore, epigenetic regulation theories present the possibility that the biomolecular process incorporates elements of the context where it takes place; something fundamental to understand our concept – the archetype presents itself as the mnesic remnant of the behavioral history of individuals who preceded us on the evolutionary scale. In short: brains are optimized for processing ethologically relevant sensory signals (Clemens et al., 2015).

From the perspective of the corporeal mind (Searle 2002), in this paper, we will show the parallels between code biology and the concept of the archetype, as Jung defended it and as it appears in clinical practice.

Foreword

(a) For the sake of clarity and transparency, I argue that psychology is a branch of biology.

(b) In this realm, and following the perspective of John Searle (2002) contextualized by the ideas of Gregory Bateson (1979), Antonio Damasio (2010) and Gazzaniga (2019) among others, I argue that the 'mind' is *caused* by the brain, in a body, and in a context. In other words, the 'mind' is the name we give to *the brain's functioning, in a body, and in a context.* Like 'digestion,' it is the name we provide for the digestive system's functioning – i.e., the functioning of a *mechanism.* To this extent, 'mind' or 'digestion' has no reality by itself; that is, we cannot hypostatize the words – they are just labels.

(c) Last but not least – as Marcello Barbieri clearly states: "mechanism is not *reductionism*, because a machine is a machine not when it is reduced to pieces but when it is put together into a working whole" (Barbieri 2015, p. 16).

Introduction

"As living beings, we have a built-in drive to make sense of the world" (Barbieri 2008, p. 181).

As suggested by C.G. Jung, archetypes can be understood as biological programs inherited from our evolutionary past. Nevertheless, if in his time Jung's hypothesis presented itself as fantastic, today, with the use of the latest developments in code biology, we can find a scientific foundation for them.

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In this paper, we present the hypothesis of archetypes as neural codes, which in our view is the best way to justify scientifically various phenomena of human behavior: namely those who are automatically activated in contexts of ambiguity. In fact, archetypes can find their empirical foundation in the inescapable existence of neuronal codes, as codes in the word's true sense (in its semiotic sense). In turn, neuronal codes can find indirect proof of their existence in archetypes' phenomenology as they present themselves in daily human life and the psychologist's clinical practice.

So, in the first part of our paper, we present the reality of neuronal codes while the most parsimonious explanation of various behavioral phenomena. In part two, we present the theory of archetypes and the collective unconscious as a biological repository of phylogenetically inherited behavioral patterns. Finally, in part three, we draw the parallels between the two perspectives and the advantage of such integration for the future of psychology as a science and therapeutic practice.

1. The neural code framework

Modern neuroscience has been able to gain significant insights by looking inside the brain, surpassing the behaviorist tradition that conceived the brain as a black box and the mind as a *tabula rasa.*

One of the essential insights is that complex behaviors are often driven by an internal model (dynamic latent variables), which integrates sensory information over time and facilitates long-term planning to reach subjective goals (Zhengwei et al., 2020). Nervous systems are complex cellular structures that allow animals to represent and interact with their environment (internal and/or external). "Several structures in biological systems work in codified forms. At the molecular level we could describe, for instance: the genetic code, the regulation of gene expression, the hormone-receptor signaling system, the histone code, the epigenetic code. And, at higher levels, other codes can be described, such as: language, sexual selection, social conduct; amongst many others" (Farias et al., 2020).

An older but equally important fact is that the astonishing diversity of nervous systems architectures present in all animal clades has prompted the idea that selective forces must have shaped them over evolutionary time (Martinez and Sprecher 2020) – Darwin *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life* (1859) stressed the role of natural selection in shaping the brain over evolutionary time – which leads us to conclude that there is no one only version of reality that can be derived from sensory input. Thus, what different organisms represent or do with sensory input will differ depending on their *Umwelt* (von Uexkull) and their evolutionary needs (De-Wit et al., 2019): animals perceive affordances, anticipatory properties of interaction that depend on their own *Umvelt* (internal environment) and not just on the physical or external environment.[1]

So, the human brain has the capacity to elicit behavior – or, rather, have a human behavioral ability. One of the leading hypotheses about how the brain shows cognitive capabilities and can elicit behavior is via computation (experimental data in neuroscience are interpreted in terms of certain key concepts, such as those of 'computation,' 'representation,' and 'coding'). Computation can be understood as the manipulation of 'symbols' (arbitrary formal objects) based on rules operating only on the symbols' shapes ('syntax'), not their meanings ('semantics'), to generate specific symbolic outputs from certain symbolic inputs – that is what algorithms do (Harnad 2019). Thus, computation is generally taken to be representational in nature.

Representation, as Baker et al. (2021) put it, can be taken to be a state or set of states within the brain that an animal uses as standing for something else, acting as a kind of description or image of entities outside the brain, and allow for behaviors that are not just responses to immediate stimulation. So, if an animal possesses a representation of something, it can be used to make predictions or elicit behaviors that have an anticipatory component.

Of course, the representation must in some way relate to the items being represented; that is: the neural activity may be taken as representations of the things in the outside world that the activity is correlated with: "often neurally transmitted information is further interpreted to be an 'encoded' version of the features of the outside world. This notion of a 'neural code' assumes that the relevant information from the environment is transduced by peripheral sensory mechanisms and encoded into the format in which the neurons communicate, and further that this neural activity is subsequently decoded by downstream process in the brain. The notion of a neural code is ubiquitous in neuroscience, and may even be used interchangeably with a neural representation" (Baker et al., 2021).

We agree that in several cases, there is some terminological inconsistency in neurosciences and that in some cases, the term 'code' is used to describe the relationship between neural activity and sensory input when the word 'correlate' would be more appropriate (according to Romain Brette (2019) criticism). In fact, "the term *neural code* is used fairly often in the scientific literature and stands for the unknown mechanisms by which the intermediate brain transforms the signals from the sense organs into subjective experiences such as feelings, instincts, and sensations. The term, however, is potentially ambiguous because it may indicate either a universal code or a set of rules that animals use to create their species-specific representations of the world" (Barbieri 2015, p. 117). So, as the linguists Lakoff and Johnson (1980) have argued, the metaphors that pervade our language are not neutral; on the contrary, they form the architecture of our conceptual system – a metaphor is not just words arbitrarily chosen to designate an object: it is a model of the object. Still, they are of extraordinary heuristic value.

Aware of the difficulties, let us ask: *what is a code?* "The coding metaphor assumes that neural codes represent information about the world, which the brain uses to produces adapted behavior" (Brette 2019). "A code is, quite simply, a set of rules. One could interpret the 'neural code' as the set of rules which neurons obey (…). Far from being a metaphor, we argue that the term 'neural code' is literally applicable to the rules governing the relationship between environmental stimuli and neural activity" (Schultz and Gava, 2019). Or, briefly: "a neural code is a correspondence between sensory inputs (or an external property) and a coding variable" (Brette 2019). To sum up, we can say with Barbieri that *a code* is a set of rules that establish a correspondence between the objects of two independent worlds, and can be described as a mapping between signs and meanings. Saying that there is a correspondence between object 1 and object 2, is equivalent to saying that object 1 is the *sign* of object 2, or that object 2 is the *meaning* of object 1 (Barbieri 2003,

[1] "Let us say that truth would mean a precise Correspondence between our description and what we describe or between our total network of abstractions and deductions and some total understanding of the outside world. Truth in this sense is not obtainable. And even if we ignore the barriers of coding, the circumstance that our description will be in words or figures or pictures but that what we describe is going to be in flesh and blood and action-even disregarding that hurdle of translation, we shall never be able to claim final knowledge of anything whatsoever" (Bateson 1979, p. 27).

2015).[2]

Even though the brain is a dynamical system coupled to the environment by circular causality, or more accurately, the brain-body-and-environment *is a system*,[3] and perhaps it might be more productive to talk about 'representational processes' than 'representations,' even so we must address a kind of natural repertoire of behaviors, behavioral rules or internal representations emerged through Darwinian selection or acquired in an epigenetic way (Neumann-Held and Rehmann-Sutter, 2006; Rodriguez 2019) acting in a causal mode.

So, we can understand representations as *anticipations of potential interactions and their expected impact on the future course of processes of the system* – that is, forward-looking teleological views, sometimes called goal-contribution views (Baker et al., 2021). That is evident in systems that exhibit goal-directed behavior, namely the basic feelings and instincts (understood as functional components that contribute to specific goals in such systems), representing a limited number of universal outputs.

"What we observe, in short, is a universal set of sense organs on one side, a universal set of animal instincts and feelings on the other side, and a set o neural processes in between. The most parsimonious explanation is that the neural processes in between are also a universal set of operations. And since there is no necessary link between sense organs and instincts or sense organs and feelings, we conclude that the bridge between them is provided by the rules of a *universal neural code*" (Barbieri 2020, p. 83. See also: Barbieri 2015; 2019); or, more appropriately – as Barbieri states – a variety of neural codes.[4]

2. The archetypal framework

As a clinician (clinical psychologist) over the years, it has intrigued me that countless patients in the face of certain (emotional) circumstances activate stereotyped modes of behavior (impulsive forms) elicited by external triggers, which they were not aware of except spending great metacognitive efforts. Just as *anger* – and the remaining primary emotions (*joy, sadness, disgust, fear,* and *surprise*) – is activated from emotionally activating stimuli (Ekman 2004), so are much other behavior that, not fitting into the primary emotions, fit into an *instinctive* or *archetypal* label. So, the relationships between daughter-in-law and mother-in-law, the boy son and his mother, daughter and father, husband and wife, relationships between siblings … when not adequately clarified, can elicit predetermined stereotyped cognitions and correlate behaviors. In other words, once the archetypal mechanism is activated, individuals start to act from some ancient algorithm and begin to ignore the new inputs to the system.

Cognitive-behavioral psychology, the mainstream in contemporary psychology, could not elucidate (me) about this phenomenon. My disappointment with academic psychology led me to look for answers in ethology, which guided me towards evolutionary psychology, biosemiotics, and code biology. I found a genuinely integrative vision of knowledge in the field of psychology in analytical psychology, as proposed by C.G. Jung. He considered a dynamic polarity within the psyche (and between individuals) in the manner of a homeostatic – or self-regulating – system. As Anthony Stevens recognizes, "there are marked similarities with Bowlby's view that behavioral systems like those operating between a mother and her infant function cybernetically through positive and negative feedback to achieve a form of a behavioral homeostasis. Of his own approach, Bowlby writes: 'By utilizing the concept of feedback, it gives as much attention to the conditions that terminate an act as to those that initiate one. (…) In terms of control theory and evolution theory, the model links (…) to the main corpus of present day biology'". And Stevens concludes: "In essence the same could be said of the approach of Jung, except, of course, that it was formulated much earlier and before cybernetics came of age" (Stevens 2002, p. 79).

As Bowlby and the ethologists, Jung conceived relationships as dependent on a series of goal-directed behavioral systems that operate cybernetically and, later on, through a feeling-brain. Thus, the exposure to behavioral patterns releases corresponding feelings and behaviors. The universal occurrence of such responses (as the existence of innately determined physiological or anatomical systems) left us in no doubt that they were innate and that they had evolved as a result of their survival value for the species; which puts (development) psychology at the heart of biology – where it rightly belongs.

Such instinctive behavior demonstrated by a hummingbird building its nest represents the prehistory of the conscious mind: nest-building is a form of goal-corrected behavior implicit in the organism's structure, yet, as Stevens points out, birds function *as though they were conscious* of what they are doing:

> "In human beings, as a result of evolution, the 'basic protoplasmic process working towards goals' has developed the potential for wide consciousness of its own activity, and it was this capacity which so deeply excited Jung. It is to Jung that we owe the extraordinary insight that *we can ourselves perceive our own phylogeny as a personal revelation:* that we can extend consciousness so as to intervene creatively at the juncture where phylogeny becomes ontogeny. Biology, archaeology and anthropology offer objective, scientific descriptions of the evolutionary process: but in our personal ontological development we can, each and every one of us, catch glimpses of this process as a subjective psychic experience. As the archetypal sequences (the basic 'protoplasmic pattern') unfolds in the life-cycle of the individual, it is at the same time represented in consciousness (…): the symbolisms thus brought into being are not mere luxuries to be shared in an analytic hour, but an integral expression of the 'basic protoplasmic purpose' in humanity" (Stevens 2002, p. 85).

Here is Jung's theory of 'archetypes' operating through a 'collective unconscious': Jung asserted that all essential psychic characteristics that distinguish us as human beings are determined by *genetics* (collective unconscious) and are *in us* (in the form of the archetypes) from birth. As such, *archetypes are biological entities,* and like all biological entities, they have a natural history: they are subject to the laws of evolution – archetypes evolved through natural selection and natural conventions. Likewise, ethology teaches that each animal species is uniquely

[2] "The link between sign and meaning, in turn, calls attention to a third entity, i.e., to their *relationship*. A sign is a sign only when it stands for something that is *other than itself*, and this *otherness* implies at least some degree of *independence*. It means that there is no deterministic relationship between sign and meaning. Different languages, for example, give different names to the same object precisely because there is no necessary connection between names and objects. A semiotic system, therefore, is not merely a combination of two distinct worlds. It is a *combination of two worlds between which there is no necessary link*, and this has an extraordinary consequence. It implies that a bridge between the two worlds can be established only by *arbitrary* rules. A link between signs and meanings, in other words, can be produced only by *conventions* or *codes*. This is what qualifies the semiotic systems, what makes them different from everything else: *a semiotic system is a system made of two independent worlds that are connected by the conventional rules of a code*. A semiotic system, in conclusion, is necessarily made of three distinct entities, and is represented by the triad: *'signs, meanings, code'*."Here at last we have a definition where it is mentioned explicitly that a code is an essential component of a semiotic system. It is the rules of a code that create a Correspondence between signs and meaning, and we can say therefore that an act of semiosis is always an act of coding, i.e. it is always a convention" (Barbieri 2008, pp. 181–182)."Evolution, in short, is not produced only by natural selection but *by natural selection and by natural conventions* (…), which in no way is a belittlement of natural selection. It is only an extension of it" (Barbieri 2008a, p. 29).

[3] Circular causation features prominently in the 'enactivist' framework, where an organism's action and perception are constantly shaped by mutual interaction with its environment (Varela et al., 1992).

[4] Research on neural codes awarded the Nobel Prize to the couple May-Britt Moser and Edvard Moser and their former supervisor, John O'Keefe, in 2014.

equipped with a repertoire of behaviors (*ethogram*) adapted to the environment in which it evolved; and we are no exception. Moreover, in terms of our primary emotions, our inner environment seems to continue to be that of the savannah, from which it seems that our corporeal minds have not yet left.

So, even allowing for our greater adaptive flexibility, once certain emotionally competent stimuli are in action, behavioral algorithms *encoded* in our organism are put into operation in response; that is, archetypal behavioral motifs emerge, and we started to act according to codified rules since eons. We pay little attention to this inner theatre, to this behavioral algorithm that once activated runs till the end, but occasionally – more often if in analysis – one finds oneself suddenly on stage, committed to a part of the performance.

> "Once one conceives of archetypes as the neuropsychic centres responsible for co-ordinating the behavioral and psychic repertoires of our species in response to whatever environmental circumstances we may encounter, they become directly comparable to the 'innate releasing mechanisms' responsible for Lorenz's 'species-specific patterns of behaviour' and Bowlby's 'goal-corrected behavioral systems'" (Stevens 2002, p. 17). Or, in Jung's words:

> "It was this frequent reversion to archaic forms of association found in schizophrenia that first gave me the idea of an unconscious not consisting only of originally conscious contents that have got lost, but having a deeper layer of the same universal character as the mythological motifs which typify human fantasy in general. These motifs are not *invented* so much as *discovered;* they are typical forms that appear spontaneously all over the world, independently of tradition in myths fairy-tales, fantasies, dreams, visions, and the delusional systems of the insane. On closer investigation they prove to be typical attitudes, modes of action – thought-processes and impulses which must be regarded as constituting the instinctive behaviour typical of the human species. The term I chose for this, namely 'archetype,' therefore coincides with the biological concept of the 'pattern of behaviour.' In no sense is it a question of inherited ideas, but of inherited, instinctive impulses and forms that can be observed in all living creatures" (CW 3, para. 565).

In another passage, Jung states: the archetype is "an inherited mode of psychic functioning, corresponding to the inborn way in which the chick emerges from the egg, the bird builds its nest, a certain kind of wasp stings the motor ganglion of the caterpillar, and eels find their way to the Bermudas. In other words, it is a 'pattern of behavior.' This aspect of the archetype, the purely biological one, is the proper concern of scientific psychology" (CW 18, para. 1228).

This *proper concern of scientific psychology* made me understand the obvious, only masked by the socio-historical view that has plagued psychology since the days of behaviorism: the 'basic' behaviors that I observed in people in consultation, enlightened people in all other domains, were the remnants of these behavioral shortcuts elicited in (arche)typical situations. Shortcuts and short-circuits are activated in conditions of behavioral ambiguity. In the face of doubt, in cases of emotional delicacy, we trigger ancestral behaviors. Evolutionary psychology was correct, ethology was correct, Jung was correct. Phenomenologically, they are correct. It was what I observed and that I continue seeing in consultation, again and again, countless times.

3. The pattern that connects

> "What pattern connects the crab to the lobster and the orchid to the primrose and all the four of them to me? And me to you? And all the six of us to the amoeba in one direction and to the back-ward schizophrenic in another?" (Bateson 1979, p. 8, p. 8)

> "We have to go on developing psychosomatic models in the same spirit as Bowlby or Jung: they may be judged by those who come after us as absurdly crude, but then so were the early astronomers' models of the universe and the early cartographers' maps of the world. Crude models are at least a beginning" (Stevens 2002, p. 73).

The difference that made *me* the difference was the recognition of how *encoded* our behavior is and, in that sense, how much we can be victims of ourselves if we do not know it. Such a framework made me realize that: if someone does not clearly see[5] the (emotional) path he should take, automatically activates internal (emotional) behavior algorithms, i.e., in a compulsive and stereotyped way 'jump to conclusions' (simply a coding-and-decoding mechanism); *induced* in emotionally dense and confusing contexts, these straightforward *deductions* lacks the subtlety of the *abduction* category. What is interpreted, in short, is not the world but pre-*representations* of the world in the absence of more precise data. If these 'guesses' are good enough for practical purposes in several cases, in so many other cases are not, and we started acting as mere cybernetic mechanisms in an action-reaction mode, unaware of new data that may enter the system. As E.O. Wilson stated in 1978: "the question of interest is no longer whether human social behavior is genetically determined; it is to what extent. The accumulated evidence for a large hereditary component is more detailed and compelling than most persons, including even geneticists, realize. I will go further: it already is decisive" (Wilson 1998, p. 19). Here, Jung's theory bridges reality.

The conservation of these fundamental sets of rules or conventions suggests that one or more neural codes have been highly conserved and serves as an interpretive basis for what happens to the living being that owns them (Barbieri 2018, 2019). Thus, the phenomenological reality of archetypes has to be understood not as something metaphorical or at least acquired ontogenetically (Merchant 2019; Hogenson, 2019) but as an ontological (phylogenetic) fact (Goodwyn 2019) – what becomes understandable through code biology mindset. Furthermore, the theories of epigenetic regulation present the possibility that the biomolecular process incorporates elements of the context where it takes place; something fundamental to understand the genesis and the evolution of the archetype – the archetype presents itself as the mnesic and codified remnant of the behavioral history of individuals who preceded us on the evolutionary scale (which, today, would remove Jung's fear of being connoted with Lamarckism). In fact, "human nature is the epigenetic rules, the inherited regularities of mental development. These rules are the genetic biases in the way our senses perceive the world, the symbolic coding by which our brains represent the world" (Wilson 2000, pp. vii-viii), which was later defended by the evolution of sociobiology: evolutionary psychology (Cosmides and Tooby 1997). In short: brains are optimized for processing ethologically relevant sensory signals (Clemens et al., 2015).

> "As we know, there is no human experience, nor would experience be possible at all, without the intervention of a subjective aptitude.

[5] "Confirmed by ethological research, which has demonstrated that living organisms are highly selective of those environmental stimuli to which they respond. Such selectivity is inevitable: any physical environment possesses immense perceptual complexity and it is essential that the organism should confine its attention to those aspects of the environment that are most relevant to survival. Thus, ethology teaches that all organisms are programmed to perceive the world in specific ways, to select and respond to *key stimuli* which possess special significance within the context of the organism's *Umwelt*. This highly specialized ability depends on the existence of central mechanisms for receiving and processing information so that all the stimuli bombarding the organism at any moment can be 'filtered', the significant stimuli eliciting attention while the rest are virtually ignored. In all species, stimuli capable of passing the filter possess the power to release certain specific patterns of behavior in the organism perceiving them. It was to explain this process that Niko Tinbergen proposed his hypothesis of an innate releasing mechanism (IRM for short). It is through the operation of such *innate mechanisms* that ethologists believe many patterns of social behavior to be activated" (Stevens 2002, p. 63).

> What is this subjective aptitude? Ultimately it consists in an innate psychic structure which allows man to have experiences of this kind. Thus the whole nature of man presupposes woman, both physically and spiritually. His system is tuned in to woman from the start, just as it is prepared for a quite definite world where there is water, light, air, salt, carbohydrates, etc. The form of the world into which he is born is already inborn in him as a virtual image. Likewise parents, wife, children, birth, and death are inborn in him as virtual images, as psychic aptitudes. These *a priori* categories have by nature a collective character; they are images of parents, wife, and children in general, and are not individual predestinations. We must therefore think of these images as lacking in solid content, hence as unconscious. They only acquire solidity, influence, and eventual consciousness in the encounter with empirical facts, which touch the unconscious aptitude and quicken it to life. They are in a sense the deposits of all our ancestral experiences, but they are not the experiences themselves. So at least it seems to us, in the present limited state of our knowledge" (CW 7, para. 300).

In another step of his work, Jung points out

> "the existence of *a priori* instincts common to man and animals alike, or that they have a significant influence on personal psychology. Yet instincts are impersonal, universally distributed, hereditary factors of a dynamic or motivating character, which very often fail so completely to reach consciousness that modern psychotherapy is faced with the task of helping the patient to become conscious of them. Moreover, the instincts are not vague and indefinite by nature, but are specifically formed motive forces which, long before there is any consciousness, and in spite of any degree of consciousness later on, pursue their inherent goals. Consequently they form very close analogies to the archetypes, so close, in fact, that there is good reason for supposing that the archetypes are the unconscious images of the instincts themselves, in other words, that they are *patterns of instinctual behaviour* (CW 9–1, para. 91).

With Barbieri (2009) help, we can conclude that life is matter controlled by symbols – that is, life is symbolic without necessarily passing through the human (conscious) perspective. As such, we can now understand how an enlightened individual can act in tortuous ways, because: via mere *computation* – the manipulation of 'symbols' (arbitrary formal objects) based on rules operating only on the symbols' shapes ('syntax'), not their meanings ('semantics'), to generate specific symbolic outputs from certain symbolic inputs – we can emit a behavior (activation of emotional algorithms) that is not a 'real reaction' to something in particular but a reaction based on a phylogenetic *a priori*.[6] Sometimes, someone's behavior "may in many instances seem absurd to a rationalist, or be deemed 'neurotic' by a psychiatrist, but in fact such behavior reflects biological wisdom. For what the individual is responding to are the natural cues, or 'sign stimuli,' commonly associated with danger in the environment of evolutionary adaptedness. Very often these cues do not betoken any danger, but they could do: therefore, it is not inappropriate for the individual to respond to them with wariness or fear on the principle that it is better to be safe than sorry" (Stevens 2002, p. 65).

There is a minimal conflict between the Jungian and biological assumptions regarding our phylogenetic roots. These deep structures, inbuilt determinants or predispositions of the human psyche, the innate factor that French structuralists were looking for, in fact they exist and can be called archetypes. We can say that from a biological standpoint, the archetype is an ancient, genetically determined releaser or inhibiter. From a psychological point of view, archetypes find their rationale given that "the survival of the species, and the life of each member of the species, depends upon our capacity to 'know' situations, to recognize the essence of what we may find ourselves up against, and our ability to select from a vast repertoire of possible responses the behavior and strategy most suited to the problem in hand. The relationship between the archetype and the conscious experience of individual members of the species lies at the very heart of Jungian psychology" (Stevens 2002, p. 61).

In a series of lectures given in Basel in 1934 at the *Society of Psychology*, Jung stated: "the human nervous system has three subdivisions: a brain, seat of consciousness, a spinal cord, sensitive and motor and the sympathetic, which is a particular nervous system. Thus, we are simultaneously crayfish (through the sympathetic system) and saurians (through the spinal cord). Still, we think we live through the upper layer of our psyche as if we were just conscious beings, similar to these little angels, whose corporeality is reduced to a head and two wings as if the rest of our body and our psychic did not exist" (Jung 1962, p. 446).

From these metaphors, it stays clear that Jung's model proposes a phylogenetic structure filled out in ontogenetic development. Such a structure is made up of archetypal units which possess the dynamic property of seeking their own actualization (mental evolution) in the behavior through external and internal triggers, as they live out the human life-cycle within the context of their environment. When analyzing the origin and evolution of codes, it is possible to glimpse that the overlap of new codes over earlier/ancient ones often increases the complexity of the previous codes, operating to adjust better and fine-tune them. These inter-related codes start to interact to form a macro-code composed of multiple, overlapping coding systems (Barbieri 2014). To this overall process, Jung gave the name *individuation*.[7]

[6] "When a man experiences passionate attraction to a woman, it is because she seems to embody his Anima, and she appears to him more beautiful, more numinous than any other woman around – often to the stupefaction of his friends who completely fail to understand what he sees in her. (George Bernard Shaw once described love as 'overestimating the difference between one woman and another'!) This is the phenomenon of *archetypal projection* – but only those who have had the experience of falling hopelessly in love can know what the phenomenon is like. Enormous power seems to be possessed by the woman on to whom the archetype is projected, and the man who does the projecting is quite unable to use his critical faculties, because the archetype, once constellated, has him in its grip. Whatever conscious reasons he may advance in explanation of his choice, they are in fact secondary – rationalizations merely: the primary motivation lies in the numinous quality of the activated archetype" (Stevens 2002, pp. 76–77).

[7] From his side, Barbieri presents three levels or logical types of descriptive propositions relatively to three different stages of *mental* evolution – the first, second and third cognitive system. In this quest of mental evolution, the Jungian theory of the archetypes shows us that (and the clinical practice proves that), the various levels can be coexistent, but one must also deal with the complicating possibility of one system having conflicting goals."1. *The first cognitive system*This is the system that gave origin to sensations and consists in two great subsystems, because the sense organs deliver information either about the outside world or about the interior of the body. (…) The basic animal brain – the instinctive brain – came into being when the primordial intermediate brain split into feeling brain and cybernetic brain, and these started producing the conscious and unconscious instincts that apparently exist in all triploblastic animals (vertebrates and invertebrates).2. *The second cognitive system*This is the system that allows a large number of animals to *interpret* the signals from the environment by using processes of abduction implemented by neural networks. The faculty of interpretation did not appear full blown but evolved in stages, and we can still see the descendents of creatures that represent intermediate levels in this step-by-step evolution. Snakes, for example, stop chasing a prey when it disappears from sight, whereas other animals deduce that the prey has temporarily been hidden by an obstacle and continue chasing it. Some can even follow its footsteps, which reveals a still higher level of interpreting power.3. *The third cognitive system*This is language, a system that evolved only in our species and allowed it to build (…), an entirely new world of symbolic objects that we call *culture*.There have been, in conclusion, three major transitions in the evolution of the brain, and each of them gave origin to a new type of neural processing that was, to all effects, a new cognitive system" (Barbieri 2015, pp. 125–126).

4. Archetypes and instincts

The distinction between *instincts* and *archetypes* is still an open question, and here we can only point out some of their most general characteristics and correlations. To this purpose let us start by quoting three selected paragraphs from the eighth volume of Jung's *Collected Works*.

[273] *Instincts are typical modes of action, and wherever we meet with uniform and regularly recurring modes of action and reaction we are dealing with instinct, no matter whether it is associated with a conscious motive or not.*

[280] *Archetypes are typical modes of apprehension, and wherever we meet with uniform and regularly recurring modes of apprehension we are dealing with an archetype, no matter whether its mythological character is recognized or not.*

[281] *The collective unconscious consists of the sum of the instincts and their correlates, the archetypes. Just as everybody possesses instincts, so he also possesses a stock of archetypal images. The most striking proof of this is the psychopathology of mental disturbances that are characterized by an irruption of the collective unconscious. Such is the case in schizophrenia; here we can often observe the emergence of archaic impulses in conjunction with unmistakable mythological images.*

Archetypes, like instincts, are behavioral programs or algorithms, typical reactions, or behavior patterns. However, in the case of humans, patterns of imagery representations, aesthetic and intuitive reactions, and conceptual formulations are also manifested. So, archetypes are universal prototypes (Gestalt-schemas – namely images, emotions and actions that are capable of being conscious) that are used to interpret sensations and observations.

In other animals, such as the behavior of spider weaving, the flight pattern of bees, or killing the chicks of other males, as in the cases of gorillas and lions, the behavioral program is presented as a closed algorithm. Instinct, seen from a biological point of view, is something extremely conservative, so much that it seems to be almost unalterable. In Man, the functionality of instinct presents 'certain fallibility'; so, in humans, in addition to the instinctive characteristics, the archetype also manifests 'superior' features.

So, it may be that the clarification between instincts (almost closed algorithm) and archetypes (*once upon a time* a behavioral novelty, i.e., a more flexible algorithm) can be solved by the development of the 'organic codes' *paradigm* (Barbieri 2003) that proves the emergence of evolutionary novelties that remain as (more or less flexible) *codifications*.

Conclusion

"Evolution, in short, is not produced only by natural selection but *by natural selection and by natural conventions* (…), which in no way is a belittlement of natural selection. It is only an extension of it" (Barbieri 2008a, p. 29).

The hypothesis that archetypes are biological programs inherited from our evolutionary past, makes human behavior understandable, especially in situations of high emotional density in which we act according to old rules or patterns. Given that mainstream contemporary psychology gives little or no importance to the archetypal framework, it fails to understand human behavior in-depth. Accordingly, analytical psychology can become the new paradigm in psychology, bringing together the partial views of cognitive-behavioral psychology, psychoanalysis, humanist psychology, social psychology, and others' perspectives in psychology at a superior abstraction level.

We are, therefore, at the shores of a new psychological era. The awareness of the archetypes makes them evolve into more adaptive and updated forms with the reality we live in. In fact, "teleological views are (…) prevalent in the study of more complex behaviors with high contextual variability. However, in such cases, it becomes highly non-obvious which goals an organism pursues and which mechanisms it relies on to do so, and also non-obvious how such mechanisms served the reproductive successes of its ancestors" (Baker et al., 2021).

We are called to mediate the very mechanisms of evolution, realizing with the aid of knowledge (metacognition) what *patterns of behavior* are still helpful. Minding the gap, our destiny will not continue to be constricted by instinctual blind forces (inadequate patterns or archetypes only suitable for an ancient time) but by renewed algorithms that will be, in time, the 'new' *arche*types of future generations.

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This manuscript is an original and has not been submitted to, nor is under review at, another journal or other publishing venue.

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References

Baker, B., Lansdell, B., Kording, K., 2021. A philosophical understanding of representation for neuroscience. https://arxiv.org/abs/2102.06592 retrieved at 2021-04-05.

Barbieri, M., 2003. The Organic Codes: an Introduction to Semantic Biology. Cambridge University Press, Cambridge.

Barbieri, M., 2008. Is the cell a semiotic system? In: Barbieri, M. (Ed.), Introduction to Biosemiotics: the New Biological Synthesis. Springer, Dordrecht, pp. 179–207.

Barbieri, M., 2008a. In: Barbieri, M. (Ed.), The Mechanisms of Evolution: Natural Selection and Natural Conventions, The Codes of Life: the Rules of Macroevolution, pp. 15–35.

Barbieri, M., 2009. A short history of biosemiotics. Biosemiotics 2, 221–245.

Barbieri, M., 2014. From biosemiotics to code biology. Biol. Theory 9, 239–249.

Barbieri, M., 2015. Code Biology: A New Science of Life. Springer, Dordrecht.

Barbieri, M., 2018. What is code biology? Biosystems 164, 1–10.

Barbieri, M., 2019. A general model on the origin of biological codes. Biosystems 181, 11–19.

Barbieri, M., 2020. In: Lacková, L., Rodríguez, C., Kull, K. (Eds.), Code Biology: A Bird's-Eye View, Gatherings in Biosemiotics XX. University of Tartu Press, Tartu, pp. 72–91.

Bateson, G., 1979. Mind and Nature: A Necessary Unity. E.P. Dutton, New York.

Brette, R., 2019. Is coding a relevant metaphor for the brain? Behav. Brain Sci. 42, E215. https://doi.org/10.1017/S0140525X19000049.

Clemens, J., et al., 2015. Connecting neural codes with behavior in the auditory system of drosophila. Neuron 87, 1332–1343.

Cosmides, L., Tooby, J., 1997. Evolutionary psychology: a primer. Retrieved from. http://www.cep.ucsb.edu/primer.html ([Google Scholar]).

Damasio, A., 2010. Self Comes to Mind: Constructing the Conscious Brain. Pantheon - Random House, New York.

De-Wit, L., et al., 2019. Is information theory, or the assumptions that surround it, holding back neuroscience? Behav. Brain Sci. 42, E223. https://doi.org/10.1017/S0140525X19001250.

Ekman, P., 2004. Emotions Revealed: Recognizing Faces and Feelings to Improve Communication and Emotional Life. Henry Holt and Company, New York.

Farias, S., Prosdocimi, F., Caponi, G., 2020. Organic codes: a unifying concept to life? Preprints 2020110412. https://doi.org/10.20944/preprints202011.0412.v1.

Gazzaniga, M., 2019. The consciousness instinct: unraveling the mystery of how the brain makes de mind. Farra, Straus & Giroux, New York.

Goodwyn, E., 2019. Comments on the 2018 IAAP conference on archetype theory: defending a non-reductive biological approach. J. Anal. Psychol. 54 (5), 720–737.

Harnad, S., 2019. Codes, communication and cognition. Behav. Brain Sci. 42, E231. https://doi.org/10.1017/S0140525X19001481.

Hogenson, G., 2019. The controversy around the concept of archetypes. J. Anal. Psychol. 54 (5), 682–700.

Jung, C.G., 1962. *O Homem à Descoberta da sua Alma.* Porto. Tavares Martins.

Lakoff, G., Johnson, M., 1980. Metaphors We Live by. University of Chicago Press, Chicago.

Martinez, P., Sprecher, G., 2020. Of circuits and brains: the origin and diversification of neural architectures. Front. Ecol. Evol. 27 https://doi.org/10.3389/fevo.2020.00082.

Merchant, J., 2019. The controversy around the concept of archetypes and the place for an emergent/developmental model. J. Anal. Psychol. 54 (5), 701–719.

Neumann-Held, E., Rehmann-Sutter, C. (Eds.), 2006. Genes in Development: Re-Reading the Molecular Paradigm. Duke University Press, Durham.

Rodriguez, P., 2019. La semiosis 'social' de las biomoleculas. La trama de la Comunicación 23 (1), 67–86.

Schultz, S., Gava, G., 2019. Neural codes: necessary but not sufficient for understanding brain function. Behav. Brain Sci. 42, E241. https://doi.org/10.1017/S0140525X1900147X.

Searle, J., 2002. Consciousness and Language. Cambridge University Press, Cambridge.

Stevens, A., 2002. Archetype Revisited: an Updated Natural History of the Self. Brunner-Routledge, London.

Varela, F., Thompson, E., Rosch, E., 1992. The Embodied Mind: Cognitive Science and Human Experience. The MIT Press, Cambridge.

Wilson, E., 1998. On Human Nature. Harvard University Press, Cambridge, MA; London, UK.
Wilson, E., 2000. Sociobiology: the New Synthesis, Twenty-fifth anniversary edition. Harvard University Press, Cambridge, MA; London, UK.
Zhengwei, W., et al., 2020. Rational thoughts in neural codes. In: Proceedings of the National Academy of Sciences of the United States of America, 24, vol. 117, pp. 29311–29320, 47.