

Darwinism as a Decryption Key for the Human Mind

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Abstract

The essay summarizes some of the key results and debated issues of Darwinian psychology over the past 150 years. Comparative psychology, psychological anthropology, research into the ontogeny of the mind, evolutionary interpretations of knowledge, and the study of individual differences are the main areas where evolutionary explanations remarkably influence traditional psychology. All five of them show up in twentieth century developments within the framework of overall selectionism, the idea that in all aspects of life—including human culture or habits—there is a certain diversity and variety not only in the form of living things but also in the form of “living-things-made” material, cultural or virtual, all of them being subject to natural selection. Some issues of overall selectionism, having been introduced by Karl Bühler, Karl Popper, and Donald Campbell, or by the genetic epistemology of Jean Piaget, are compared in this essay to the latest debates and ideas about the message of evolution by Daniel Dennett, to the coordination of evolutionary models, the theories about the social mind and its development, and the genesis of culture and evolution in rivaling models of human architectures, as in the one proposed by Michael Tomasello. Some of the continuously debated issues have been escorting us since the 1880s, such as the relative significance of nature or culture, the causal relations between different levels of selection, and the like. They all mean a real challenge to the unbounded and unanchored psychological and epistemological theories.

ALL OR NONE, THE MIGHTIEST OR A NUISANCE?

Freud's *bon mot* about the three blows—coming from Copernicus, Darwin, and himself—on humanity's narcissism might have, mistakenly, put the emphasis evenly on all three of them. Copernicus, removing the Earth from the center of the universe declared human world as an insignificant nook in it; Darwin, erasing the essential distinctions between humankind and animals, tossed man from the podium erected for the masterpiece of creation; and Freud, stressing the dominance of the unconscious in governing human behavior, deprived men from being a rational creature.

Darwin's role in this painful act of ruining old myths about ourselves might have been underestimated, for the Darwinian attitude now seems to be crucial among others in psychology and in the social sciences, at least for two reasons. It provides psychology with one of its basic interpretive approaches about the (i) unfolding, and about the (ii) shaping forces of the mind. Owing to the naturalistic interpretation of these theories, the issue of continuity or discontinuity between natural history and human history and between an assumed human nature and the realities of contemporary social life has constantly arisen.

NOT DARWIN AGAIN?

The evolutionary ideas have clear structures and messages for psychological theorizing:

- Anything related to "mental" has to have a biological function.
- Every mental category should be judged as a real-time process.
- Every mental capacity or mental process has to be interpreted at least from two developmental perspectives: that of phylo- and ontogenesis.' Human adult memory, for example, is to be compared to the memory processes, both of animals and children of different ages.
- The concept of variety and variation are key features of mental life.

In all these, psychologists fit very well into the conceptual reconstruction of the Darwinian thought by Lewontin (1970). They postulate that the phenotypic, observed variations within individuals (such as the color of the eyes) represent a general adaptive frame for the human mind and for the heritability of these variants, through selection or social modeling. The Darwinian thought has become crucial for the interpretation of behavior and individual learning, extending the adaptive and selective explanations to the individual life cycle as well.

Throughout the nineteenth and twentieth century developments, four main lines of the Darwinian influence offer themselves to be differentiated: (i) the "hairy ideas" of comparative psychology, matching human behavior to that of hairy ancestors, monkeys, or apes; (ii) functionalism and the idea of adaptation; (iii) the issue of epistemology and the organization of knowledge; and (iv) the study of individual differences in cognition and personality. In this essay, we focus on the first three.

Darwinian psychology, with its animal- and human-centered approaches, certainly did—as Table 1 summarizes—achieve some unquestionable results. Most of the results, however, have created their own controversies and challenges about the universality of their applications.

Table 1
Basic Achievements of Darwinian Psychologies, and Their Debated Aspects

Achievements	Debated aspect
Instrumental learning	The tower of generate-and-test (Dennett)
Species-specific behaviors	Human sociality
Critical periods of development	Types, definitiveness of closure in humans
Attachment and its types	Transitiveness over the life cycle
Hierarchy in the mind	Alternative organizations
Social learning	Cause or effect of culture
Altruism, empathy	Human specificity
Bell curve of abilities	Ethnic differences
Varieties of personality	Nature/nurture
Variable adaptation	Evolutionary pathology

Out of the many controversies around the Darwinian path of psychology, three are highlighted in this essay:

- Darwinism as a worldview, as a status of the mind;
- biological and cultural evolution;
- evolutionary specificities of the social mind.

DARWINISM AS A WORLDVIEW, AS A STATUS OF THE MIND

Modern theories of evolution try to strip evolutionary approach of all kinds of ideological contents, as the Nobel laureate Francois Jacob (1982), among others, surveyed it. The issue of worldview, the relation of Darwinism to progress and to the conservative versus progressive interpretations still reemerges from time to time, as the fierce debates between Dennett (1994) and the late Gould (1996, 2001) about the place of progress in the Darwinian grounds have shown recently (Popper, 1972). The four aspects of Darwinism still in the focus of our concepts about humanity are mechanical algorithms, general adaptation models, the place of selection, and the idea of progress in nature and society.

Daniel Dennett (1994) reminds us of what a great strike on human vanity was the idea that our entire self, both from a biological and a psychological aspect, might be a mere outcome of blind and aimless *algorithms*; mechanical, aimlessly organized changes. Instead of divine order and goals, natural selection's meaningless and slow processes are at work. Some intellectuals, frightened of these radical ideas, introduced different "skyhooks" to resolve the dilemmas of the 150-year history of Darwinism. Skyhooks are supportive devices postulated on a different sphere of being that represent divine

providence, a supreme being to introduce some order into the evolutionary chaos, or speed up the process of evolution. When Dennett criticizes the “skyhooks,” he allows for the postulation of “cranes,” accelerator tools offered by conceptual and material culture, the world of Popperian and Gregory-type creatures in the phrasing of Dennett (1996). For Dennett, *cranes* refer to a metaphor for manmade cultural tools.

The adaptive aspect of Darwinism, in a nineteenth century terminology utilitarianism and instrumentalism, represent a further challenge, as Catania (2013) has recently summarized it. This aspect has two elements. The first is the evaluation of “teleology” from an internal perspective. As the contemporary cognitive scientist, Gary Cziko (2000) pointed out, there is a need to combine Darwinian mechanistic explanations with the image of the human body as a Claude Bernardian equilibrating system. The Darwinian blind mechanism can construct self-sustaining homeostatic internal machineries, in a way as, for example, the self-sustaining machinery of circulation regulation has been created.

THE DAWN OF SKYHOOKSIES

The other aspect of adaptationism is the issue of its universality in explaining our preferences and mental architectures. Anything existing must have a function as a result of evolutionary selection. This issue is best seen in the contemporary exaptation-adaptation debates. According to a model phrased by Gould and Vrba (1982) as an alternative to universal adaptation, some life-forms have not arisen because of specific evolutionary pressures. Some of our attributes might be mere side results (exaptations) of selections directed toward other functions, as opposed to ultra-adaptationism. How ridiculously circular or Panglossian it would be to argue that acoustic language evolved only because—compared to gestural language—it was advantageous to talk in the dark as well! It sounds as a just-so story ... However, arguing with exaptations might also be too cheap sometimes: Having a hard time explaining something as an adaptation, we merely claim that it has been selected for something else, leaving the “else” unspecified. For example, it is easy to say that for enjoying musical structures we do not have to postulate that music used to have an original adaptive advantage.

In his provocative book (1994) Dennett, rendering this adaptation-exaptation debate, put Gould and Chomsky alongside Karl Marx and the modern Catholic creationist Teilhard de Chardin, as believers in hidden “skyhooks.” In the interpretation of Dennett, Gould—as a real believer in progress, committed to left-wing ideology—cannot help searching for design, pattern, and sense everywhere in evolution. Stephen Jay Gould in his last books (1996, 2001) tried to fight back to his rivals by showing that he was by far not

a believer in purpose or teleology in evolution. It is not our mission to make a judgment about contradicting approaches, we just would like to point out that the debate over design and adaptation is not over yet.

The tension between adaptationist and exaptationist interpretations is most clearly presented in the issue of language. The traditional innatist ideas of Chomsky (1986) reflect a kind of biologism apparently bearing an ambiguous, or as Cziko (1995) would claim, providential vision of language. The least flattering label of providentiality was earned by Chomsky for his claims that modern language, with its complex grammatical structures, might have come as a result of a mutational accident, with no clear adaptive advantages. The communicative needs of our ancestors could have been handled with much simpler structures. As Maynard-Smith (1995, p. 32) noted “If the ability to learn a language is innate, it is genetically programmed, and must have evolved. But Chomsky refuses to think about how this might have happened.” The essential features of human language for Gould, and possibly for Chomsky as well, would have an exaptationist origin. However, Chomsky (2005; Chomsky & McGilvray, 2012) has recently reinforced his vision that innatism might well be an issue of a harmony with physical laws, and the structural features of language might well be caused by external physical laws rather than biology. Chomsky’s distaste for functional explanation comes back in different forms.

According to the modern adaptationist views on language (Pinker, 1997), one should look for the original adaptive advantages of articulated language in a contemporary sense, with phonetics, words, grammar, and propositional semantics. Exaptation theories claim that for coordinating actions one would not need such articulate syntactic rule systems as found in present-day languages. No direct selection pressure was ever present, for example, regarding the intricacies of word order. According to the adaptationist view promoted by Pinker, the ancestors, showing more elaborate syntax, had more success both in action coordination, and in their mating as well.

BIOLOGICAL AND CULTURAL EVOLUTION

There are two basic approaches regarding the extension of the Darwinian concept of culture. The first—representing unilineal (classical social) evolution—declares that cultural development is aligned in a single line that moves from the most primitive to the most civilized. Several varieties of these linear ranking of societies were proposed, not missing colonial overtones to underpin the supremacy of Western people. These ideas of a “Darwinized” cultural supremacy were criticized by Franz Boas, a German-American anthropologist, the founder of modern anthropology. Boas (1911) replaced linear evolution with the idea of the equivalence of

cultures, including historical particularism and the diffusion of cultural patterns. Thus, in his vision, a potential equivalence appears regarding cultures as well as regarding languages when extremely complex grammatical structures are studied in illiterate cultures. As Lewis (2001) carefully analyzed his writings, Boas was not, at the same time, an anti-Darwinist, as he was praised or criticized to be by many later anthropologists. According to Boas, the original message of Darwin was the need to study changes, the denial of fixed features, and in general an association between evolutionary theory and the pragmatic conception of man and society. In 1909, in a 50-year anniversary talk, he clearly showed how he perceived the application of Darwinism to social science. "Unconsciously the line of thought underlying the theory of the development of animal forms was transferred to the development of types of culture. [. . .] the mental life of man was treated as having its germ in a very primitive social life, from which, by gradual stages, the present forms have developed. This led to the assumption that [. . .] all human culture has passed through the same stages. [. . .] in the mental life of man, many of the traits [. . .] may be better interpreted as due to parallel but independent mental development" (Boas, 1909, p. 12).

SELECTIONS ALL AROUND THE PLACE

An appealing image of Darwinism applied to culture is the all-encompassing emphasis on the *blind mechanisms of selection* that holds universally for all aspects of life, including the mind. There is but a single principle behind all the beautiful variety of living forms. That makes Darwin an aspirator of simplifying meta-theories in psychology as well, trying to reduce all manifestations to only a handful of principles, representing strict determinism: humans are driven by preexisting structures (e.g., instincts). Darwin, along these lines, becomes a propagator for biological constraints in the mind, and many times for an ideological base for social conservatism with the emphasis on "the struggle for life," and the "survival of the fittest."

The selectionist meta-theory is put into a broad framework of possible processes of modification by Gary Cziko (1995). In all kinds of "knowledge change" processes, he claims, one should differentiate between static externalism (providence) where knowledge is predetermined before the knowing system gets into interaction with the environment, and instructionism where the environment instructs, teaches the organism. For most of the history of behavioral sciences, *instructionism* was, and still is, a more interesting alternative to providence. In instructionism the source of knowledge is the environment, and an empty organism filled with information from outside is postulated. Most of traditional empiricist learning theory is instructionist, but even present-day alternatives to the innatist models of development

(Elman *et al.*, 1996), although they disregard the concept of empty organisms, still consider, just as connectionist models that postulate all learning to be a modification of specific connections in neural networks, that the most important inner models are reflections of real-world contingencies.

Selectionist models in this general sense assume an active organism creating internal models, from those the environment selects the relevant ones. The interesting new development during the past two decades was the extension of the selectionist model to the development of behavior. The parameter setting approach to language acquisition is a prime example: environment certainly plays a role in language acquisition. It does not create structures *ex nihilo*, however, would consolidate the parameters of the system that are activated as options within the system itself; these are evolutionarily given organism-based hypotheses. Chomsky (1986) and his followers (Changeux & Dehaene, 1989; Mehler & Dupoux, 1994; Piatelli-Palmarini, 1989) are in nontrivial harmony here with the ideas promoted by Popper (1972) a few generations before.

HISTORICAL TRIP IN THE GROUND OF UNIVERSAL SELECTION THEORIES

In the 1920s to 1930s, before the extended Darwinian theory, supported with genetics, took shape, there had been a nontrivial downfall of evolutionary thinking both in the biological and the social sciences, for the double reason of the dissemination of the Standard Social Science Model (SSSM). The SSSM claims that cultures are arbitrary conventions acquired and maintained by their members, and biological constraints play a limited role in forming them. This notion was combined with the post-war pessimism, leading to the victory of idealist and sometimes antiprogressive intellectual models. There was a group of psychologists, biologists, and philosophers in Vienna, however, who maintained some radical aspects of the Darwinian theory, extending it not only to psychology but to epistemology as well. They entertained two issues being crucial and relevant for the possible naturalization of culture: (i) a multilevel theory of selection; (ii) continuity between elementary and symbolic, cultural forms of behavior.

Karl Bühler, the leader of the Vienna Institute of Psychology and a central figure in this extension, collaborating with the Vienna School of Neopositivist Philosophy, postulated three “concentric” levels of selection. “For me, in Darwinism the concept of play field seems to be productive. Darwin has basically known only one such play field, while I point to three of them [...] These three play fields are: instinct, habit and intellect” (Bühler, 1922, p. VIII). Thus, for Bühler the important element in Darwinian metatheory was the flexibility and the potential for change.

The three basic cycles of this model are distinguished (Bühler, 1922, 1936), as shown in Table 2.

The essence of these models is the proposal for an optimized mechanisms of change, in two separate steps. The first one generates variations, the second is responsible for selection; selection itself would not be able to inhibit the generation of novelties. The separation of the two cycles, where the first phase is responsible for creating new reactions to environmental challenges, the second for adequacy, the accommodation to the environment, seems evident.

1. *Darwinian Selection Cycle*. Changes here are comparatively slow, because the generators of change are random mutations, changes involve high risks, and our fate is at stake.
2. *Learning Mechanisms*. On the basis of environmental feedback, out of the many solution attempts produced from the reaction repertory of the organism, the ones leading to success (obtaining food, obtaining the praise of the teacher) also lead to the stabilization of adaptive, fitting habits—as the trial-and-error conceptions of Thorndike’s and Baldwin’s showed. The goal is the survival of the individual. As these processes are based on neural mechanisms rather than on changes in the genome, changes in this cycle are much faster, occurring in the magnitudes of hours, or, in higher order mammals, in the magnitude of a few minutes.
3. *Thinking*. Humans, and to a certain extent nonhuman primates as well, form particular representations of the world. Mental representations due to their structural features lead to even more novel representations. Thoughts in a way tend to have their own life. While learning requires hours-minutes, insightful understanding—once we have the representation systems—might need only seconds.
4. *Culture*. Although it might seem strange to interpret culture as a selection system, and to extend the model initiated by Bühler, several broad

Table 2
The Reconstructed Theory of Bühler about Three Cycles of
Selection (Pléh, 2008)

Features	Instinct	Habit	Intellect
Pool of selection	Individuals	Behaviors	Thoughts
Means of selection	Darwinian selection	Reinforcement	Insight
Proofs	Species-specific behavior	Associations new combinations	Detour
Originator	Volkelt, Driesch	Thorndike	Köhler
Organization	“Naturplan”	Associative net	Mental order

theories take this risk. Culture might be taken as a system where different formats are produced, and where some of those—according to the world of integrative mechanisms of culture and to the context of social communication—will be taken as valid, while some others as invalid. When, for example, a new way of making an origami rose is introduced, more and more people will copy it in a reliable way, so sooner or later it will replace the old way of folding.

Culture on the other hand can be interpreted as a system that combines blind habits with rational insight. This combination is either based on general imitation, on rational argument, or on constrained imitation emphasized by Richerson and Boyd (2005), Boyd and Richerson (2009).

Work initiated by Bühler was further developed in the frame of naturalized (and therefore psychologized) epistemology. Psychology in this way would become an interpretation of Kantian epistemology as in the *épistémologie génétique* it is proposed by Piaget (1972), or a Darwinian interpretation of mental architecture as proposed by Popper (1972) and Campbell (1974) in their evolutionary epistemology.

For Popper, himself a student of Bühler (Pléh, 2008), a crucial aspect was to separate the production and selection; he also proposed an organizational similarity of several cycles, from genes to social selection. Mid-twentieth century evolutionary epistemologists, most notably Donald Campbell (1974), worked out these ideas in more detail into a general theory of “trial and selection”-based systems. These principles can be seen as the most abstract generalizations of the Darwinian ideas, from genetic adaptation to scientific discovery. Campbell also claims short-cutting mechanisms between the different levels that have trial and error elements in them, replacing, for example, spatial locomotion by mental search, where one’s ideas are being risked rather than one’s own life.

A much sensitive issue with all these selection models remains, whether they are merely homologs, results of organizational constraints, or whether there are certain causal relations between them. This is crucial not only for biology or for the relationships between genetics and learning but it is also crucial regarding the evolutionary underpinnings of culture. Do “intelligent” solutions also come around as consequences of selections?

Since Franz Boas laid the foundation for the concept of cultural relativism, the emphasis on the equality of cultures and languages has been overextended, questioning the legitimacy of applying evolutionary theory on human societies. According to Steven Pinker (1997), a present-day critique of this rather extreme approach, although the SSSM treats humans as flexible beings with a relativistic praise of the power of cultures, it entails two hypotheses about Darwinism: (i) mind is originally nonsocial, and (ii) there

is discontinuity between culture and nature. One form of the second thesis emphasized the role of interpersonal interactions in implementing cultural determination, from James Mark Baldwin (1894) through Georg Herbert Mead (1934), Henri Wallon (1941), Lev Semjonovich Vygotsky (1987), up to Michael Tomasello (1999). According to it, knowledge would be interpreted as inherently social, not as a result of some unidentified process of social instruction, but rather something that comes through interactions with others, as an integral part of the individual mind.

Continuity or discontinuity between evolution and human history is still a central topic. Within the frame of Campbell, it is an issue of relationships between different layers of selection. A generation later, Hull (1982) analyzed the presumed contrast between nature and culture; he pointed out that a naïve opposition is based on an oversimplified interpretation of biological processes, as indicated in Table 3.

In contrast to the naïve opposition, biological categories (species) are not sharp. On the level of concept formation, both biological and cultural (e.g., scientific) categories are dynamically changing, “historical” entities. As far as change is concerned, scientific communication corresponds to genetic lineages. Human communities are not constant, as biological species are not unchangeable either: They may divide when communication stops, the same way as species, due to isolation bifurcate. Also, regarding the time scale, certain genetic changes may be very fast in some species. As far as intentionality and goal directedness are concerned, both Hull and the diffusion theories are in accord with the views of Dennett (1987, 1996). Humans apply the “intentional stance” in a flexible way, but it does not entail by any means that teleology would be valid in the real world. As Dennett (1990) pointed out, there is no real difference in the interpretation of evolution, the interpretation of one another as intentional agents, and the interpretation of cultural

Table 3
The Emphasis on Differences between Biological and Cultural
Evolution and Their Critique by Hull (1982)

Opposition	Biological evolution	Cultural evolution	Hull's criticism
Category boundaries	Biological: sharp	Fuzzy, mushier categories	Species is a dynamic concept as well
The course of change	Darwinian: selectionist	Lamarckian: instructionist	Instructions in culture not omnipotent
Teleology	No goals	Goal-driven processes	Culture has accidental features as well

objects in literary criticism. Regarding all these, one can take the intentional stance, but only as an interpretive strategy. Thus, in this regard, there is no difference between biology and culture.

EVOLUTIONARY SPECIFICITIES OF THE SOCIAL MIND

The evolution of social interactions and the social nature of the human mind are of central importance even in present-day evolutionary discussions. The division is rather traditional. According to one of the possible interpretations, the human mind, as an individual biological organization, is controlled by a social-cultural environment and develops a social attribute [see SSSM mocked by Pinker (1997)]. This approach sees no continuity between evolution and history, and treats our social nature as entirely constructed. The other interpretation would see similarity or continuity between biological evolution and social history, and would differentiate between elementary biological sociality and the societal mind. As Humphrey (1976) initiated the renewal of this biological theory a generation ago, even in antropogenesis, the challenges of crucial adaptation and crucial environment were created by our conspecifics. The original function of intellect was to give orientation in social life, either in a positive way, via imitation, empathy, role modeling and similar functions, or in a “negative way,” by means of manipulation, by development of what is called today a Machivellian intelligence.

The vital issue is whether one could, and should, see the continuity between biological evolution, hominid development, and cultural differentiation and change. New approaches assign sociality to the individual mind and try to elaborate a theory of primary sociality on a biological basis. These attempts usually rely on the analysis of primary attachment processes, the formation of the theory of mind, and the unfolding of intentional attribution of conspecifics. They all entertain a set of commitments toward the following:

- Humans are by necessity social beings, society itself being merely a modulation or a derived feature of this primary sociality.
- The roots of this sociality have to be looked for in individuals.
- One can talk about emergent interactionism of a sort in this sense.

According to these theories, basic forms of sociality would also originate in biologically organized modules. Both the external and the internal order might have an evolutionary explanation. Recently, Tomasello (1999) has emphasized that culture-building capacity is an innate biological feature of the human mind. Cultural learning—as a biological adaptation—forms the basis of culture, not the other way round. Similarly, the natural pedagogy approach of Csibra and Gergely (2009) presupposes that cultures that

are built up and maintained by an evolutionary learning process use the evolutionarily given constraints of mutuality and learning from adult cues (Gergely & Csibra, 2006).

Csibra and Gergely show that an apparently abstract dry philosophical theory of Agency can become a generous inspiration for evolutionary ideas regarding the genesis of the social mind. Not only do they support the idea of a naive psychological mind-reader module as an independent adaptation (Leslie, 1987), but they claim that human infants are prewired with a natural pedagogy stance. They form a peculiar learning niche together with the environment, causing species specific peculiar ways of learning (Bolhuis, Brown, Richardson, & Laland, 2011).

Interpreted in this way, the issue of culture is the issue of how to build different varieties of cultures, and what advantages are brought about by the mere existence of a culture, and of the representations that are liberated from the constraints of the here and now (Bickerton, 2014). This has always been a sensitive issue for biologists, as Tivadar Huzella, a Hungarian biologist, phrased it, raising the issue of relating biological and social memory: “man is storing the experience of his ancestors in costumes, writings, science and art. This ability for ‘external memory’ is what actually differentiates man from the animals” (Huzella, 1936, p. 197).

Merlin Donald (1991, 2001) claims similarities between biological and cultural evolution, but at the same time believes in the distantiation of them with the advent of culture. According to Donald (2001, p. 300), the peculiarly human development leads to the birth of *hybrid minds* who live in *cognitive communities*. “The evolutionary origins of language are tied to the early emergence of knowledge networks, feeling networks, and memory networks, all of which form the cognitive heart of culture. Language was undoubtedly produced by Darwinian selection, but evolved indirectly, under conditions that favored those hominids who could make their shared cognitive networks more and more precise ... The great divide in human evolution was not language, but the formation of cognitive communities in the first place. Symbolic cognition could not spontaneously self-generate until those communities were a reality. This reverses the standard order of succession, placing cultural evolution first, and language second.”

IS THERE A FUTURE OF DARWINIAN PSYCHOLOGY?

The real challenging issues for the future are as follows:

- Clarifying multiple mappings between evolutionary tools and social roles. This would, among other things, have to clarify whether the postulated different levels of selections are merely analogies, or there are

common causal mechanism relating them to one another. We would also hope to find new explanatory mechanisms of the relationships between models of biological change, and the spread of cultural knowledge.

- Offering accurate interpretation of EvoDevo-Brain-genes interface. One of the interesting central topics today is to see how patterns of gene activation and individual life events “correlate” in unfolding the brain and behavioral individuality.
- Creating possibilities to combine theoretical functionalism with individual variation research; discovering how genetics and “embriology” contribute to the unfolding of psychological individuality. The intense study of epigenetic unfolding as shown by Charney (2012), indicates that psychologists have to become aware of the possible new interpretations of their classical doubts regarding straightforward genetic determinism.

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