

# Creativity, a Profile for Our Species



# Creativity, a Profile for Our Species:

*Social and Neurocognitive Issues*

By

Jorge A. Colombo

Cambridge  
Scholars  
Publishing



Creativity, a Profile for Our Species: Social and Neurocognitive Issues

By Jorge A. Colombo

This book first published 2020

Cambridge Scholars Publishing

Lady Stephenson Library, Newcastle upon Tyne, NE6 2PA, UK

British Library Cataloguing in Publication Data

A catalogue record for this book is available from the British Library

Copyright © 2020 by Jorge A. Colombo

All rights for this book reserved. No part of this book may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the prior permission of the copyright owner.

ISBN (10): 1-5275-4420-6

ISBN (13): 978-1-5275-4420-8

With love:  
To my wife, Beatriz.  
To the memory of my parents and my brother, Emilio.  
To my children and grandchildren.

‘Public educational policies aimed at promoting/enforcing solidarity, knowledge and the practice of imagination and *divergent thinking* or *conceptual expansion* can only attain their objectives as long as they are integrated with equity in social construction. Social marginalization, indigence, poverty, class privileges, and prejudices are their most significant opponents’ (Colombo, 2019).

‘Indeed, it is hard to think of a mental phenomenon (creativity) so central to the human condition that we understand so little’ (Dietrich and Haider, 2017).

# TABLE OF CONTENTS

Acknowledgements .....	x
Foreword: Creativity and ‘Degrees of Freedom’ .....	xi
Prologue (I): Creativity, an Evolutionary Plus .....	xv
Prologue (II): Creativity and Cultural Relativism .....	xxi
Chapter 1 .....	1
Origin	
Chapter Overview: When our animal species emerged. First clues of cultural development. Debate on the <i>Big Bang</i> emergence of culture. How does one measure the success of a <i>creative</i> and its product given so many factors involved and the variable ‘cultural weight’ it may carry?	
Chapter 2 .....	8
Identity Metamorphosis: The Cranium as a Structural Fetish. The Emergence of Localizationism	
Chapter Overview: Initial construction of possible sources of our behaviours. Science and politics. The emergence of the brain as the substrate for strategic behaviour. Localizationism.	
Chapter 3 .....	18
Brain and Mind: Biological and Cultural Evolution	
Chapter Overview: Brain-mind correlations. The bio-social interaction. The sociocultural environment as the gate for individual gene expression. An <i>iconocratic</i> culture. Graphism and parietal art. Cultural <i>Big Bang</i> ?	

Chapter 4 .....	39
Creativity	
Chapter Overview: Characterizing creativity: a plus for our animal condition. A comparative approach.	
Chapter 5 .....	48
Brain and Creativity: Measures of Creativity	
Chapter Overview: Neurobiological substrate and attempts to measure creativeness.	
Chapter 6 .....	58
Promotion of Creativity	
Chapter Overview: Attempting to promote creativeness within the socialization process: tensing the rope. Public policies and the promotion of creativity. Imagery and creativity.	
Chapter 7 .....	61
Famous Brains	
A. The Case of Vladimir Ilyich Ulyanov—Lenin— (1870-1924)	
B. The Case of Albert Einstein (1879-1955)	
C. Famous Brains due to Brain Damage:	
a. The Case of Louis Victor Leborgne—‘Tan’— (1766-1861)	
b. The Case of Phineas Gage (1863-1860)	
c. The Case of Henry Gustav Molaison (1926-2008)	
Chapter Overview: Biases in analyzing the brain: attempts to correlate brain structure with talent in the cases of Lenin and Einstein. Media promotion of icons and the collective construction of knowledge. How pathological cases helped advance the understanding of brain function.	
Chapter 8 .....	93
Creativity and Psychopathology	
Famous cases of <i>creatives</i> :	
A. Johann Wolfgang von Goethe (1749-1832)	
B. Maurice Ravel (1875-1937)	
C. Vincent Van Gogh (1853-1890)	
D. Wolfgang Amadeus Mozart (1756-1791)	

Chapter Overview: A discussion regarding the ‘Mad Genius’, and a brief historical perspective of how famous cases of *creatives* were affected by altered moods and behaviours.

Chapter 9 ..... 105  
Concluding Comments

Chapter Overview: Further notes on brain development and the concept of *free will*. Degrees of freedom and neurobiological scaffolding. What paths should we follow as members of a macrobiological, dominant species? Emotional or rational taming of ancestral animal drives? Sharing and cooperativeness, or profit? Development of technological aids, or *technocracy*? How do we deal with our potential evolution?

Bibliography ..... 114

## ACKNOWLEDGMENTS

To Professor Karl Zilles (Germany) for his constructive criticism and suggestions made on segments of this book.

To Flavia C. Abdullah for English language editing.

To Fundación Conectar, for aid on access to research issues.

## FOREWORD

### CREATIVITY AND ‘DEGREES OF FREEDOM’

Creativity has been associated with cognitive and behavioural disinhibitory processes (Martindale, 1999; Carson, 2014). Nevertheless, inhibitory mental processes are not only fundamental to rational behaviours but also socially adaptive practices. Hence, the promotion of creativity must overcome the limits imposed by socialization. An undue imbalance of both domains will tense both processes.

This notion cannot be reviewed without considering *ab initio* our construction of the concept of ‘freedom’ or, more accurately, of our ‘degrees of freedom’ (Colombo, 2013) and our self-awareness of the construction of inhibitory codes and rules in our *socialization* process. It is a process that this author finds too close to *domestication* and fencing creativeness.

The constant dynamic of ‘trial and error’ characterizes the evolutionary process—benefitting the opportunities of the fittest for specific conditions of time and place. In the case of being human, it has led to the development of a complex architecture of the mind—an expression of a modulable, neurocognitive substrate in a growing social interactive complexity and apt to provide adaptive solutions to the demands of survival and affirmation of identity.

Each species of the *Natural Kingdom* has these mechanisms adapted to the conditions of their structural and physiological needs and their natural niche. In all of them without exception, some conditions reduce their degrees of freedom, according to the characteristics of their species and the expression of a behavioural phenotype that tends to meet their reproductive and survival needs. An unstable internal state of conflict/tension ensues as long as it does not entirely satisfy the demands. Its final solution will be obtained by consummation—achievement—, failure with reprogramming the behaviour, or the replacement of the objective that reduces or eliminates such a conflict/tension condition. In extreme cases, it would result in extinction either as an individual or as a species. Successful behavioural strategies within any given cultural framework would depend on overcoming the successive hotbeds of conflict/tension with the consequent

hedonic content of the reward based on achievement.

In future chapters, the proposal regarding possible brain structure-function, or brain-mind relationships<sup>1</sup>, will be considered. The main thrust is aimed at analyzing from a neurocognitive approach the social and cultural impact of brain-mind interactions on our construction of a *creative* species. Also, to raise our awareness on possible evolutive paths that appear to emerge from our current standing as a dominant species.

\*

In its common operational use, the concept of ‘freedom’ of thought assumes not to depend on external conditioning. This limited concept would not consider the origin or nature of the construction of our introspective thoughts and overt behaviour. In this context and perhaps unwittingly responding to a dualistic conception of the human condition, when we speak of ‘freedom’ we usually idealize our real capabilities and place them within the social context of our interactions. Consequently, we incline to ignore our inevitable potential limitations: those that come from our ancestral origin and biological constitution and our personal sociocultural history. Based on these considerations, the current operative concept of ‘freedom’ would instead tend to build a metaphor; the literary construction of a utopia to which its common use has endowed it with the notion of a false reality. In other words, such an idealistic concept of freedom is a term to be used in a sociopolitical context, in fictional or poetic constructions, and a literary context in general. How would such freedom limitations impact our *creative* drives?

## **Creativity vs. Social Domestication**

Theories on the evolution of *H. sapiens* tend to agree that its brain development correlates with the increasing complexity of its social construction and the relative sophistication of its mind and language. Complementary hypotheses to that theory show evidence on the emergence of neural circuits involving prefrontal cortical regions and interactive

---

<sup>1</sup> See an interesting approach in Gazzaniga (2010) and Bassett and Gazzaniga (2011): ‘The brain is a complex temporally and multiscale structure that gives rise to molecular, cellular, and neuronal phenomena that together form the physical and biological basis of cognition’. With a similar approach, it would be possible to imagine that further knowledge of the cerebral organization would promote the progressive formulation of theoretical models and simulators closer to the capacity of self-referential activity.

neuronal-glia ensembles (modules?). These would be coactivated by processes related to norms and social rules of the permitted, the forbidden, the cooperation, the hierarchies, and the development of adaptive social behaviours. An interesting review by Barbey et al. (2009) proposes an integrating vision of the neural processes that would have evolved in part with the emergence of the *social human*. However, this would imply a correlation between processes that, in principle, do not share the same *tempo* in its evolutionary development during the approximately last 200,000 years since the attributed emergence of *H. sapiens*. Those processes are specifically in reference to the cultural and neurobiological dimensions.

Hence, at some point in evolution, the basic configuration of distributed circuits was already expressed at which point specific brain circuits would have experienced a continuous adaptive process in an interactive bio-social context. This would have allowed for brain reprogramming during the last tens of thousands of years via epigenetic reconfiguration processes of its software organization in accordance with the social and physical demands. In other words, the characteristics of the *H. sapiens* brain would not depend solely on the structural (e.g., relative size or volume) modification of specific regions/cortical areas, but also on the generation/reformulation—neuroplasticity—of distributed nervous circuits.

\*

One of the ‘engines’ in the development of the human species is, without a doubt, the exercise of its *creative* capacity and initiative. In the course of these pages, we will attempt to draw a perspective of its impact on our humble and hazardous origin, and also a less idealized perspective of our assumed potential based on the achievements and acts exercised by our civilization.

\*

## **The Two ‘Tectonic Plates Metaphor’**

In this context, a metaphorical construction with evolutive and geological flavor is proposed. We would live through the consequences of the interaction of two *plate tectonics*—*biological* and *cultural*—; each with a different history, construct, and adaptive dynamic. A high degree of individual and social maturity would be needed to solve such interaction without grave disturbances. However, this aim should not obstruct the mechanisms that tend to optimize the expression of two essential components for our species, i.e. creativity and cooperation.

The complex debate resides in how social norms and rules could be avoided from coming into conflict with the optimization of that *creative* capacity and initiative; say, with the *genius* of our species. It is evident that the current conditions—so dissimilar between communities, so materialistic and consumerist, politically so hypocritical and socially inequitable—would require broad, progressive cultural changes.

From the above, a series of tentative conclusions can be drawn; some of them directly related to the viability of certain concepts in vogue and the formulation of public policies:

1. The concept of ‘freedom’ must be assumed within the reality of the biological and historical configuration of the human being. Therefore, its limits are subjected to this conditionality.

2. On biological grounds, individual behavioural trends would depend on the interaction and dynamic configuration of distributed cortical and subcortical nervous circuits.

3. This configuration is a function of genetic programs and of sociocultural factors that act throughout life, but mainly during the period of parenting and adolescence; thus, conditioning *creative* thinking.

4. Education in its sociocultural dimension acts by formulating or reformulating those configurations (item 3) and, therefore, enhance or limit access to *creative* thinking and identity development.

5. Poverty and marginality reprogram circuits and redirect the ‘degrees of freedom’ as a function of the knowledge-deprived medium; thus, affecting *creative* thinking. Beyond constituting unacceptable social conditions, indigence, poverty, and marginality create an actual risk of social harm on the human brain and mental potentials.

6. Poverty and marginality contribute to reducing the phenotypic richness of the species, enhancing the trend towards unique and prevalent thinking and, therefore, are counter-evolutionary factors.

7. Education supporting creativeness, independent thinking, and the construction of identity requires social equity and specifically aimed programs that are not limited to ‘gifted’ children.

8. Minorities have limited access to critical knowledge expansion and information.

9. This segmentation produces a favorable environment for the reduction of ‘degrees of freedom’ in major sectors of the world’s population and, consequently, also a loss of ‘degrees of creativeness’. These circumstances have sociopolitical consequences on the structure and dynamics of gregarious communities with a hierarchical organization.

## PROLOGUE (I)

### CREATIVITY, AN EVOLUTIONARY PLUS

This book has been inspired by the multiple sources of evidence imposing on vast segments of our world community a cognitive deprivation on the construction of identity, the access to critical knowledge, and the construction and expression of the *creative* potential (Colombo, 2007, 2015). Also, it is dangerous to build up a segmented or *balkanized* humanity as opposed to a *globalized* one, based on limited or no access to fundamental human values and needs, as well as to critical knowledge and information.

Cultural banalization, poverty/indigence/marginalization of vast populations, social prejudices and privileges, and a prevalence of financial, ideological, and religious fundamentalisms are at the base of such unethical and counter-evolutive, regressive engines (Colombo 2010, 2013, 2015). These represent the instruments for domestication and suffocation of the species' *creative* potential, which pave the road towards the emergence of fundamentalisms and the surrender of identity.

Survival of the fittest in the *Natural Kingdom* is a consequence of evolutionary and environmental events and processes. In this particular case, aptitude is not defined *a priori*, but *a posteriori*, once it is exerted and it proves its adaptative efficacy. Supposedly, the results would ensure the best genetic options for the existing physical conditions. Otherwise, eventually, individuals or species would cease to exist. Successful survival strategies would vary according to their characteristics and the demands placed by a given ecological niche. Each species is in continuous interaction with its *habitat*, and its equilibrium is usually reached upon a relatively unstable condition. Hence, adaptive processes are continuously required. For our *Homo* species, the most successful survival equation would be composed of various components such as solidarity, resilience, cognitive flexibility, and creativity. The combination of these profiles generates diverse individual and social phenotypes.

A new species emerged from the long chain of ‘trials and errors’ of the various evolutive series of *Homo*. It progressively disregarded the limitations imposed by the *habitat* and natural laws. Human tribes possessed an extraordinary added value; an optimized potential ability to generate an ample spectrum of adaptive behavioural strategies on their natural *habitat*. These generated diverse types of community organizations and communication means which prevail among our species. After all, our sophisticated human behaviour is built from an ancient heritage of basic animal behaviours and trends that have been exercised for millennia and installed on a biological substrate.

During the process of evolution, dynamic changes in neurobiological processes allowed for the emergence of expanded cognitive domains. These would have taken place via two basic processes: *exaptation*—when neural circuits or structures associated with given functions are later recruited for other functional means—and *emergency*—when new connectivity is involved, whether implementing structural or reinforced synaptic pathways. This resulted in typical variant traits that we consider as *human*; e.g., creativity, art, and solidarity, which seem to be under siege by other behavioural vectors associated with culturally camouflaged, ancient animal primal drives or raised by related cultural constructs. Among them are material accumulation, territorial prevalence, and privileged access such as reproduction, knowledge, critical access to information emotional contention, and food accessibility. These developed into deviant individual/group behaviours such as cruelty, social inequity, and belligerent fundamentalisms.

\*

Within this complex context, let us examine creativity; a mental process whose expression is maximized in the anatomically modern *H. sapiens*. This implies that the capacity and the productive expression of divergent thinking and conceptual expansion, either material or virtual, is a cognitive process that is not evaluated by the *intelligence quotient* (IQ) although it is somehow associated with it. However, Guilford (1967) proposed the possibility that an IQ may be a prerequisite for *divergent thinking* performance (see also Benedek et al., 2014). Hence, we must differentiate between ‘intelligence’ as characterized by *g* or general cognitive ability and ‘creativity’, although both appear to share some cognitive modules (working memory, attention) and distributed neural components. Kennett et al. (2018) recently stated:

High-level cognitive constructs, such as creativity and intelligence, entail complex and multiple processes, including cognitive control processes.

Recent neurocognitive research on these constructs highlights the importance of dynamic interaction across neural network systems and the role of cognitive control processes in guiding such a dynamic interaction’.

Although the concepts of *inventiveness* and *creativity* have close meanings and have occasionally been used interchangeably, the former could be considered as part of a *creative* process. Nevertheless, some operational processes suggest conceptual differences. Inventiveness would be more related to material products resulting from the ability to combine existing elements. Creativity could be defined as the generation of new, ideational or material products following a mental process of *divergent thinking* or *conceptual expansion* (see later, Fink et al., 2009; Zaidel, 2014; Maysseless et al., 2014). As it will be reviewed later, creativity shares some mental processes involved in the construct of *intelligence*.

\*

How can we conceptualize the ancestral shell engravings from a probable *H. erectus* in Java soil (Joordens et al., 2015) which is dated as being approximately  $0.54 \pm 0.10$  million years and has a minimum age of  $0.43 \pm 0.05$  million years? As the authors quote,

‘The manufacture of geometric engravings is generally interpreted as indicative of modern cognition and behaviour’.

Should we consider such products as evidence of *creative* expression? If so, this would have taken place well before the emergence of the *H. sapiens* and its ‘Mad Genius’ complexities (see further chapters). So, too, it goes for the lithic development at different evolutionary stages. Analyzed from our era, both types of events would meet some of the criteria that define *creative products*.

According to Zaidel (2013, 2014), creativity would express itself in the production of a new and positive product for society, beyond whatever would be familiar and usually accepted. It appears, then, that in this concept ‘social appraisal’ represents a significant factor. The cultural impact—its relative cultural dimension—is not only related to its nature or intrinsic values, but also circumstances associated with social receptivity and the personal public profile of the *creative*.

This *cultural relativism* suggests the convenience of attempting to avoid the use of popular words that lack objectivity, such as *genius* and its subliminal association with *intelligence*. Hence, the distinguishing factor that identifies creativity as bound to those ideas, actions or products implies

a departure or fracture from current trends in cultural-theoretical concepts and material and instrumental developments. However, detection of *creative* individuals or their products could sometimes go undetected in our ‘daily *creative* lives’. For example, let us consider the universe of inputs that have been forgotten, omitted from historical memoirs, but yet belong to the vast cradle of human knowledge and inventiveness from where human culture emerges. Innovation is considered to be an expression of *creative* behaviour which presupposes a *creative* individual with experience and memory acting in a socioecological context, i.e., there is no such thing as *tabula rasa* from where the *creative* event emerges. We consider creativity as the mental expression of brain activity; genetically, introspectively and socially configured.

\*

In their evolutive journey, human communities developed imaginary but possible worlds and instrumental and esthetic products, thus providing a universe of behavioural alternatives. This took place at a faster rate with the emergence of language and graphism; two foundational events of our complex mind and cultural construction. Such a journey allowed our species to succeed in surviving among extremely different ecological niches once we abandoned the African cradle. This plastic, imaginative, and productive behaviour, captured in our cultural heritage, increased the number of possible survival alternatives. Phenotypic, ethnic, and cultural varieties are intrinsic components of our adaptive capacity as a species. At the center of this cultural potential resides creativity; its power engine.

\*

Throughout human civilization, its evolution as a collective would not have had a chance unless a variety of talents on different domains and cultural contexts were present and in conditions of expressing their material or conceptual products. This has been attained in differing sociocultural domains; whether an artistic<sup>2</sup> or literary expression, via science or

---

<sup>2</sup> What motivations did the parietal painters of Altamira and the Chauvet-Pont d’Arc had—some 36,000 years ago—in southern France to leave their marks in spaces that do not seem to have been their habitats, and of animal images with a surprising expressiveness of movement? What mindset or under what mental conditions did they have to succeed in travelling beyond time barriers with expressions of their mental states that reached our era? For what reasons did they not use their abilities to leave similar images of themselves? Was it because of some magical beliefs toward human representations? (see in <http://archeologie.culture.fr/chaudet/en/>)

technology, from nomadic or sedentary communities to complex social organizations whether they be feudal, autocratic, democratic, socialist, capitalist, federative, colonialist, matriarchal or patriarchal organizations.

The essence of such a variety is that it generates adaptative alternatives for our species. This statement blatantly opposes the idea of any form of fundamentalism as it may be applied to cultural domains or social organization models. It also opposes the socialization of the individual becoming one of domestication. In fact, the action derived from *divergent thinking* is not widely and readily accepted among the above mentioned social constructions.

Let us imagine the existence of rigid behavioural patterns, values, and priorities that are immutable through time whether they are moral or physical, have social or political structures or are cultural idiosyncrasies. Perhaps we cannot imagine any worse future for humans than wandering as anomic creatures in uniform, rigid, and entirely predictable communities. In such a case, predictability would emerge at the expense of suffocating *creative* behaviour, which is a fundamental evolutionary core of our species.

Creativeness should be a social value. Beyond any ethical or ideological consideration, the freedom to express creativity becomes an *evolutionary imperative* that is intrinsically identified with the evolutive success of our species. Such implied expanded *degrees of freedom* (Colombo, 2013) broaden the spectrum of possible trials and errors that characterize the process of natural evolution. Its restriction would hamper evolution and make human beings and their communities more fragile; it would limit their adaptive capacity and the hypothetical emergence of new successful phenotypes or, if placed in a more general evolutionary context, of future *H. sapiens* subspecies, for the evolutionary engine has not run out of fuel with the emergence of our species and our civilization. In this regard it ought to be considered that we do not represent a ‘biological and social’ dead end, but the intermediary product of an evolutionary process based on *blind variation* and *selective retention*. Hence, we should be wary of how general trends imposed by public policies could affect this process.

\*

In a social context, a decrease in the *degrees of freedom* would only lead to violence in order to survive or prevail; whether it is self-inflicted or takes place against other cultures, or by interacting with the environment. In our present, it is not variety that places our future at risk, but ideological proposals that foster the hegemonic ‘single thought’, or express financial, ideological or religious fundamentalisms.

Uniformity represents a menace to the survival of our species's nature and an *immoral, counter evolutive action* (Colombo, 2010). It would endanger our species's capacity to develop a rich menu of adaptive strategies and the continuous evolutive process necessary for the emergence of hypothetical new *Homo* subspecies. Restriction of the species' s options to evolve based on fundamentalist premises would hamper the evolutive future of our species, a universal value if there is any. This includes the emotional manipulation of fears and suffocating cognitive awareness and critical knowledge via poverty, marginality or cultural banalization.

\*\*\*

## PROLOGUE (II)

### CREATIVITY AND CULTURAL RELATIVISM

‘Children living in poverty generally perform poorly in school, with markedly lower standardized test scores and lower educational attainment. The longer children live in poverty, the greater their academic deficits. These patterns persist to adulthood, contributing to lifetime-reduced occupational attainment... The influence of poverty on children’s learning and achievement is mediated by structural brain development’ (Hair et al., 2015).

In modern times, a central problem in any social construction—especially at all levels of formal education—is how to deal with the promotion and expression of creativity. This is in addition to the implementation of policies to curb poverty, marginality, and school dropout rates. Creativeness usually carries a potentially disruptive or confrontational aspect. Hence, a significant pedagogical challenge is how to avoid its cancellation or curb the *productive* expression of *divergent thinking* and *conceptual expansion*, and how to include them within the context of an educational program aimed towards solidarity and social responsibility.

To educate implies to impart students with productive guidelines of thinking, with logical structures and study habits, to provide significant information and, in a sizeable dimension, to socialize or accommodate the student with the complexities of the environmental ‘reality’. The latter creates the risk for *domestication* (Colombo, 2013) in its most crude version, as it hampers the development/construction of the personal identity and the full expression of individual creativeness. Differences in personalities among students result in significantly different responses towards codes and rules; in some cases resulting in reactive, defiant responses and others creating submissive or introspective behaviours. These emotional components will affect the probability of expressing *creative* or innovative thoughts.

Besides the above considerations, the development of financial and sociopolitical structures has led *Homo* to develop a segmented world community. This has impacted educational access and process, health security, and access to critical knowledge and has increased the ecological risk. In other words, it has generated conditions that interfere with the construction of identity and the development of individual talents, has limited individual options, and has affected the quality of our habitat. Struggling to have access to basic survival needs constricts the chances for an optimized individual and effective community development. These conditions acquire a dramatic character on communities in which poverty and indigence often last several generations. Besides poverty, there are other means by which motivation towards knowledge and creativity is discouraged, such as cultural banalization and unscrupulous propaganda promoting consumption and the accumulation of material goods.

We have been told that the modern world is *globalized*. This may be true for communication among particular socioeconomic segments dealing with cultural, financial, and commercial deeds; a concept associated with international commerce and financing, and with socioeconomic conditioning. Unfortunately, according to the present standards of developed countries, approximately one-third of the world population lacks the basic needs for an acceptable quality of life concerning public health, education, and access to critical knowledge and current information (Colombo, 2015). In fact, access to communication does not necessarily imply a critical assessment of information; additionally, it tends to travel through selected channels and social strata. Basic tenets and equities of our society are controlled by a vicious segmentation of the human population (Colombo, 2010, 2013, 2015). Therefore, entire communities are condemned to a complicated future. As anthropologist Stephen Gould would state (1996);

‘Few tragedies could be less important than those that reduce life possibilities; few injustices could make more profound that negation to provide the possibility of attempting or have hopes due to limitations imposed from outside and falsely identified as innate of the individual’.

In Colombo (2007), we considered that ethnic variability represents a plus for our species. It involves characteristics of the human species which ought to be protected from devastation as those derived from social prejudices, political and financial dominance, famine or marginality. As with poverty and indigence, they result in inadequate physical-, cognitive- and emotionally raising environments that reduce or cancel the degrees of freedom and creativeness—fundamental factors on the evolution of our species—and, hence, represent counter-evolutive conditions.

These comments pose a conflictive alternative; how to deal pedagogically with combining the promotion of inventiveness and creativity when at the same time they present a potential threat to the socialization process. Inventiveness and creativity imply a state of mind; an attitude towards learning and knowledge which does not easily reconcile with traditional academic formats, nor with certain social structures.

\*

### **A metaphor to conceptually visualize the interaction between the promotion of *socialization* and *divergent thinking***

In order to optimize the construction and expression of individual identity, the dilemma imposed by social and individual development must be properly resolved. This involves different environments such as those for family and school that are implied in cultural<sup>3</sup> construction.

Cognitive priming usually relates to the generation of a doubt; a mental attitude that can be trained or suffocated. Once installed, a process ensues. Let us metaphorically represent it with a crystal container of variable thickness—social codes and rules—into which an inflatable balloon—creativity—is introduced when a divergent thought ensues. This event starts a ballooning effect that impacts on the crystal container. The result will depend on its thickness and the pressure inside the balloon—the personality traits. A crack on the crystal could spur a series of events aimed at either patching the crystal cover or allowing full expression of the *creative* pressure inside. This metaphor introduces the factors of conditional cultural circumstances, as well as others related to the *creative* personality and its self-assuredness.

In more general terms, the two most typically universal *creative* processes would be represented by the *biological adaptation* in the *Natural Kingdom*, and by *cultural evolution* in human civilization (Boesch, 2011). It is a matter of debate whether both respond to similar Darwinian processes regulated by *blind variation* and *selective retention* (Campbell, 1960, cf. Jung et al., 2013; Simonton, 1999, 2010; Gabora, 2004, 2010; Sowden et al., 2014).

\*

---

<sup>3</sup> Culture (material, symbolic, or social) is a differentiated collective practice that is transmissible to other members of the group. It is systemic and adaptive and involves some sets of shared significance (Kitayama et al., 2011).

The development of psychometric evaluations applied to the concept of 'intelligence' has stirred debates regarding its true meaning (Hampshire et al., 2012). The numerical result has generated a classification of potential performances according to a given statistical percentile of the distribution. If 'intelligence' is meant as the processing of behavioural fluidity and executive behaviour, creativeness in specific cultural domains should not be confused with it.

In such a dynamic field of research in neuroscience, as is the study of human and comparative cognition, the focus will be placed on certain nodal points in the evolution of thoughts in this field and the cultural relativity of current concepts regarding 'brilliant minds'. As an example; from a physical or material point of view, the cranium and the brain have been objects of special attention in the construction of collective imagery regarding *special minds, specific behaviours*, social icons, those attributed with hierarchical rights or powers, and those with so-called 'genial' talents.

We will delve more in-depth into the issue of whether, under current circumstances, the expression of creativeness is exclusive to carriers of *special minds/brains*, or whether it should be considered an essential expression typical of our species. However, there are individual variations of this expression since it is influenced by genetic heritage, breeding conditions (physical, emotional, cognitive), the cultural context in which it exists, and the manipulation of their social projection by the media via commercial or ideological premises. These considerations pose a critical analysis regarding cultural relativism, comparative cultural criteria of value assignment, and epigenetic factors involved in individual and ethnic development.

\*

Issues normally related to brain evolution and organization carry an implicit debate regarding its relationship with the mind. The historic dichotomy between brain and mind, and body and *spirit*, has led it into an *epistemological trap*: an implicit dualism and *a priori* rejection of integrated arguments considered to be reductionist in a derogatory manner. To some extent, this takes place due to the lack of conceptual bridges or theoretical models of the brain that would link behavioural domains with its complex organization of molecular and electrochemical biological dynamics and neural, conditional micro-connectivity.

From a strategy of 'diffuse modeling', behaviour could be construed at the brain level based on a dynamic constellation of distributed neurobiological processes (McClelland and Rumelhart, 1989; Rocha et al.,

2011; Singer, 2013). A dynamic level of virtual constructions—whether symbolic, cultural, or introspective—are necessarily linked and dependent upon an acting brain with its biological codes. Otherwise, what would be the supportive template of the various constructions and expressions of cognitive and emotional behaviours? As it occurred with other historical debates, further solid progress in our understanding of brain function and organization will be needed. In the meantime, the debate continues with interfering dualist arguments associated with the consideration of humans as the product of ‘intelligent design’ and other mystical proposals.

Natural evolution has slowly—perhaps erratically—delivered a *Homo* species capable of generating virtual constructions, analytical power, and progressively complex instruments and technological developments. This potentiates its naturally analytic, *creative* and exploratory activities. Scientists have studied matter to the level of fleeting particles of probabilistic existence which would appear to the layman as virtual events. How is it possible then that such concepts of a physical nature be the result of complex interactions generated by a device of biological nature? Someone would have suggested that given this extraordinary event, one would either reject or abandon the search for its understanding or, rather, persist in developing an ever-increasing comprehension of the events of Nature. The latter implies not closing doors to the unknown by providing them with fantastic attributes with little or no rational comprehension and dissociating the neurobiological substrate from its mental doings.

This represents a reaffirmation that in the causal and probabilistic world in which we live, our species has progressively thrown light on the ignorant flood of supposedly unreachable mysteries. This road implies the importance of not falling into emotional ambushes based on fears and mystical proposals.

\*

Further on, we will review several concepts related to the ‘unique character’ of individual brains and minds and the basis on which these were built. We will also attempt to provide an evolutive and neurocognitive approach to the issue of creativity and the brains of the *brilliant minds* condition, before reviewing particular cases that became notorious for different reasons.

\*

Lastly, below are a few lines from a poem from the Russian poet Vladimir Mayakovsky (1893-1930) (Fig. Prologue-1) which is a literary example of the feelings that a *creative* mind might express in response to an imposed reduction of the ‘degrees of freedom’. Mayakovsky is considered to be an outstanding figure of Russian culture; his brain was incorporated into the *Brain Pantheon* of the *Brain Research Institute in Moscow* (see later).

‘If the heart  
Is everything in life.  
What for,  
What for is money collected.  
How do you all dare to sing?  
Who has given you the right to do so?  
Who ordered you to intimate with days?  
¡Lock the sky in pipes!  
¡Warp the earth in twisted streets!

...  
So, I will stay  
abrupt and sharp like a hedgehog.  
¡Tongue spit the gossip!  
At bay in a land corner  
I drag my daily yoke  
And in the brain sounds implacable:  
‘The law’,  
And another chain in the heart:  
‘Religion’.

(Translation by the author from a Spanish version from V. Mayakovsky, *Obras Escogidas*, Volume I, Editorial Platina, Bs. As., 1957)



Fig. Prologue-1. V. Mayakovsky (1893-1930)  
(<http://www.libreteriausados.com.ar/Biografias/Vladimir-Mayakovski>)

# CHAPTER 1

## ORIGIN

‘...our ancestors weren’t evolving toward something; they were just surviving as *Australopithecus* or *H. erectus*. No single trait they acquired was a turning point, because there was never anything inevitable about the outcome...And is still evolving now’ (Strauss, National Geographic, 2015).

‘*Ex terra ad astra*: A mere 12,000 years separate the first bow and arrow (87) from the International Space Station’ (Ambrose, 2001).

\*

Our genus *Homo* developed following five massive extinctions that wiped out between 70-90% of existing creatures. According to several scientists, the sixth great extinction is underway after having been triggered by human activity (anthropogenic). We emerged as a species of the genus *Homo* from the evolutionary haze of natural history following catastrophic events. Pangea was already fractured into various segments millions of years before when, in the ever-changing genetic kaleidoscope, the *Homo* species would seem to have found their cradle in African soil<sup>4</sup>.

Although it is debatable as to whether basal primates found their origin in the Asiatic or African continent, the emergence of larger anthropoids and hominids would have evolved in Africa, and these would have migrated to the European and Asiatic continents (see Colombo, 2013). According to current views, anatomically modern *H. sapiens* did not emerge without genetic contributions from other ancestors. A viable genetic exchange would indicate that we were dealing with related species from which we did not differentiate enough to turn infertile during any such exchanges. This would have occurred at least with *H. Neanderthal* and *H. Denisovan*. Hence,

---

<sup>4</sup> For some genetic anthropology authors, chimpanzees also belong to the genus *Homo* as humans do. It is also sustained that a period of two million years would be necessary to confirm a genetic divergence of species. If so, several fossilized species ought to be considered as *H. sapiens*. See in Curnoe and Thorne (2003) and Chaimance et al. (2012).

we carry contributions from the ‘other *Homo*’.

\*

The development of parietal art (see note 2), shell and bone engravings, collars, and lithic instruments address the ancestral evidence of the early evolution of creativity and inventiveness and the early emergence of material culture among *Homo* species; some of them presumably belonging to *H. erectus* some 540,000 years ago on the island of Java (Nature Editorial, 2018). The detection of cave paintings in Spain dated via uranium-thorium to be older than 64,000 years placed them as the oldest ones and of probable Neanderthal origin (Hoffmann et al., 2018). In this regard, some recent developments have indicated that Neanderthals were active and predated *modern H. sapiens* on these types of expressions.

Based on topological geometry and Piagetian concepts (Wynn, 1981; Wynn and McGrew, 1989; cf., Hovers and Braun, 2009), these authors concluded that lithic instruments built during the Olduvian lithic manufacture period (related to the archeological site *Olduvai Gorge*, East Africa), dated 2.5-2.6 million years, would be typical of a mental organization comparable to the chimpanzee. Those from the late Acheulian period (*Saint Acheul*, France), which expressed a comparatively advanced topological capacity based on relationships between structure, shape, and space, were perhaps closer to those with modern human cognitive abilities. Some of Wynn’s premises have been questioned by authors who doubt artisans from the Olduvian period succeeded in producing intentional, preconceived morphotypes. According to Wynn (1981, 1989) (see in Purcell, 2006), the Acheulian period is characterized by lithic instruments in which they express criteria of symmetry and shape; relationships not attributable to accidental manufacture.

\*

In scientific quarters, the mechanisms that motorized the *Homo* evolutionary process are still debatable. As it is implied in the previous paragraphs, a material and virtual culture introduced humans to a different evolutive road, and, hence, it should be incorporated/integrated with predominantly biological evolutionary concepts.

According to modern critics of neo-Darwinian quarters, Darwin’s natural selection concepts of evolution that are prevalent in classical biology presuppose that the phenotypic variation is the result of adaptive processes that took place following randomized and accumulated mutagenic

alterations at the DNA level. These produced slow changes in natural selection, which depended on the survival success or failure of the carriers of such mutations. However, genetic theory by itself does not appear to be enough to explain all aspects of evolution (Laland et al., 2014), given the apparent lack of agreement among the number of phenotypic variations in humans and the low mutagenic ratio of potentially advantageous DNA mutations.



Fig. 1-1. Jean-Baptiste Lamarck (1744-1829)  
(‘Jean-Baptiste Lamarck’ by Jules Pizzetta-Galerie des naturalistes, Paris : Ed. Hennuyer, 1893. Licensed under public domain via Wikimedia Commons.  
[https://commons.wikimedia.org/wiki/File:Jean-baptiste\\_lamarck2.jpg#/media/File:Jean-bappte\\_lamarck2.jpg](https://commons.wikimedia.org/wiki/File:Jean-baptiste_lamarck2.jpg#/media/File:Jean-bappte_lamarck2.jpg))

In recent decades, a revival of the neo-Lamarckian theory (Fig. 1-1) seems to have taken place based on the heritability of acquired characters in the form of epigenetics (Waddington 1947, 1953 quoted by Jablonka and Lamb, 2002; Jablonka and Lamb, 1998; Jablonka and Raz, 2009; Daxinger and Whitelaw, 2012; Skinner 2015). This is defined as the heritable molecular processes adjoining the DNA that regulate the genome expression independently from the mitotically stable DNA (Skinner et al., 2015), in addition to the mutations mentioned above. This process has also been defined as any heritable, potentially stable change in the gene expression of the cellular phenotype taking place without changes to the DNA base pairs as described by Watson and Crick (Bohacek and Mansuy, 2014). Such epigenetic processes include DNA methylation, histone changes in nuclear chromatin, and the non-coding of ribonucleic acids

(RNA)<sup>5</sup>. On empirical grounds, some species are genetically capable of generating transgenerational phenotypic changes. However, its presence at the human level has not been confirmed, and it remains debatable (Dias et al., 2014, 2015; Heard and Martienssen, 2014).

Recently, other molecular components—micro RNA and circulating exosomes<sup>6</sup>—have been added as messengers with the capacity of affecting genomic DNA expression (Théry, 2011; Sharma, 2014, 2015; Boston Biotech Watch, 2011). As a reminder, chromatin represents a protein and DNA-linked receptors that affect DNA expression. DNA plus chromatin are the constituents of chromosomes (see **Box Chromatin-DNA Relationship**).

The source of potential epigenetic factors includes chemicals, nutrition, stress, temperature, and sustained cultural conditions resulting in the promotion or inhibition of gene expression. Hence, one should include the persistence of physical, cognitive, and emotional conditions, i.e., those capable of affecting phenotypic expression. In this regard, Cole (2009), Lubin et al. (2011), Graff and Tsai (2013), Rudenko and Tsai (2014), and Jablonka and Lamb (2009) have made observations on epigenetic modifications affecting the synaptic substrate of cognitive functions, such as learning processes and memory formation. These changes in DNA expression can be operative at the cellular level in specific brain regions (e.g., the hippocampus).

According to Cole (2009), socioenvironmental conditions regulate human gene expression, which in turn affect hormonal and cell receptor's activity involved in the activation of transcription factors. Additionally, they condition gene expressions adapted to cultural imprints. In this regard, Jablonka et al. (2009) propose the existence of four types of heritability (evolution in four dimensions): genetic, epigenetic, behavioural and symbolic. Each one provides variations on which natural selection would act.

This sociogenetic or biosocial interaction is of vital importance to understand a series of individual and collective processes in the field of brain and behavioural organization. Considering present knowledge and the different susceptibilities of genetic mechanisms between somatic and germinal cells, Heard and Martienssen (2014) quote a statement of S.J. Gould (1980):

‘...evolution of human culture, in strong opposition to our biological history, is of Lamarckian character. What we learn in one generation we transmit it

---

<sup>5</sup> Capable of regulating gene expression, but they do not codify for protein synthesis.

<sup>6</sup> Small vesicles of endocytotic origin released into the bloodstream by several cell types.