Chapter 6
The Descent of Man: Darwin and Psychology

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Abstract The aim of this article is to review the psychological evidence presented by Darwin in *The Descent of Man, and Selection in Relation to Sex*, as well as the complex reciprocal relationships between evolutionism and psychology. The theory of evolution by natural selection has been, is, and will be fundamental for psychology, since it allows us to better understand the behavior and psychological processes of humans and other animals. The influence of the theory of evolution on psychology has been very diverse. On the one hand, the recognition of the similarities between humans and other animals due to biological continuity has encouraged experimental studies to understand the causal mechanisms of behavior, justifying the use of laboratory animals as models to study the basis of human psychological processes. On the other hand, the idea of continuity in the psychological capacities of all animals gave rise to animal psychology and comparative psychology, which study the similarities and differences between the psychological processes and behaviors of different species. The recent incorporation of the evolutionary perspective for understanding the design of the human mind by evolutionary psychology deserves a separate mention. Darwinian approaches to the study of human behavior are a source of much controversy and have given rise to conflicting positions ranging from euphoric acceptance to furious rejection.

Keywords Psychology · Mind evolution · Psychobiology · Evolutionary psychology · Theory of mind

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6.1 Introduction

Darwin's contribution to biology is indisputable, his theory revolutionized the discipline and laid the foundations for transforming it into a science; however, his influence on psychology is not as well known, nor as accepted, although it is a subject on which many articles have been published. Already in 1909, to celebrate the centenary of Darwin's birth, the journal *Psychological Review* published a special issue on the influence of Darwinism on psychology, sociology, and philosophy. The same happened in 2009, when countless activities were organized around the world to commemorate the bicentenary of Darwin's birth and the sesquicentenary of the publication of *On the origin of species* (*Origin* henceforth). From the perspective of psychology, the nine articles published in a special issue of *American Psychologist* (Dewsbury 2009), the official academic journal of the American Psychological Association,[1] should be highlighted. However, it is no easy task to assess the impact of Darwinism in psychology, because the positions on the subject are radically opposed depending on the psychological subdiscipline and the theoretical and/or political positioning of the authors, and because it is such a broad topic that it would be enough for a book (or several).

When I re-read Darwin's *The descent of man, and selection in relation to sex* (*Descent* from now on) to write this essay, I was struck (to the point of making me feel uncomfortable) by how old-fashioned his ideas about human races or class and gender differences are, which obviously cannot be properly assessed without taking into account their historical and social context (Shields and Bhatia 2009 make a very interesting analysis of this issue), but I was also surprised by how modern some of his ideas about the behavior and mental processes of animals (including humans) are and how many of the debates and controversies of that time are still alive.

6.2 *Origin*: From Species to Man

In *Origin* the word "man" appears 56 times, but practically all of them speak of man as the agent that selects, not as the object of the selection process. Darwin makes lavish use of the analogy between the mechanism of natural selection and the "artificial" selection exercised, consciously or unconsciously, by humans on domesticated species of animals and plants, favoring the survival and reproduction of individuals with the desired characteristics. However, Darwin was perfectly aware that humans were the product of evolution and should be included, along with the rest of living beings, in any explanation of their origin. In fact, the last chapter of the book, in which he presents the final conclusions, includes the only paragraph

[1] Incidentally, the British Psychological Society did not see fit to devote a special issue, or even an article, to Darwin in the *British Journal of Psychology*. In fact, it is curious that no article containing the word Darwin in the title has ever been published in the journal.

dedicated to human evolution, in which he also anticipates the implications of the theory of evolution for psychology:

> In the distant future I see open fields for far more important researches. Psychology will be based on a new foundation, that of the necessary acquirement of each mental power and capacity by gradation. Light will be thrown on the origin of man and his history (Darwin 1859, p. 488).

The end of this paragraph is one of the most quoted sentences in Darwin's work and he himself quotes it in the introduction to *Descent* (Darwin 1871). In this book Darwin fully immerses himself in the implications that the theory of evolution by natural selection has for understanding human nature and the origin of our species, and delves into the mechanism of sexual selection. Darwin knew that his theory would generate much controversy and opposition, it had taken him two decades to put in order all the data that supported it and decide to publish them in *Origin*, and including the evidence on human evolution could generate even greater social rejection. He was not wrong. The fact that he did not explicitly leave humans out of the scope of his theory (quite the contrary, as the quoted sentence of the conclusions indicates), was interpreted by many of his detractors as a tacit support for the origin of man from other animals. It is curious to see how some of the critical reviews of *Origin* go so far as to claim that Darwin said what he did not dare to say:

> Mr. Darwin boldly traces out the genealogy of man, and affirms that the monkey is his brother, and the horse his cousin, and the oyster his remote ancestor. The human body, in his view, is only a slowly developed zoöphyte, out of which it has grown by a process as natural and uniform as that by which a calf becomes a cow; and, by a parallel advancement, the human mind has become what it is out of a developed instinct (Anonym 1860, p. 475)

What had changed in 1871 to lead Darwin to publish a whole book devoted to human evolution? As Darwin himself acknowledges, what encouraged him to publish it was the good reception that the theory of evolution was having among most naturalists, but also the fact that several works had been published that provided evidence of evolutionary continuity between our species and the great apes, for example, those written by Thomas H. Huxley or Ernst Haeckel, the latter so appreciated by Darwin that he claimed that if he had read it before starting to write *Descent* he would never have written it, which is surely more a polite comment than a reality.

A criticism repeated at that time by many detractors of the idea of the origin of man from other animals was that, although similar in anatomy, humans possessed unique mental capacities and moral faculties incomparable to those of any other species, which highlighted the fact that we had been created in the image of a superior being. Even some naturalists and thinkers who accepted that the rest of living beings could have evolved by natural selection doubted that this mechanism could explain the origin of our species or our mental capacities. To Darwin's surprise, Alfred R. Wallace himself, co-discoverer of the theory of evolution by natural selection, considered that the human mind was too complex to have evolved gradually and that we should accept an evolutionary discontinuity between the mere sensitivity present in other animals and human rational intelligence. Darwin admits

that man possesses mental capacities superior to those of other animals, but he considers that the differences are of degree. For him there are no exclusively human mental capacities; indeed, the existence of similar mental capacities between man and other primates is a clear proof of their evolutionary continuity.

In *Descent*, Darwin devotes two chapters to presenting evidence that "there is no fundamental difference between man and the higher mammals in their mental faculties" (Darwin 1871, p. 35). In the first of the chapters, he practically takes for granted that we share the same senses, that we have a few instincts in common related to survival and reproduction (in the next chapter he deals at length with the social instinct) and that we experience the same emotions (he does not elaborate much this point to which he will devote his next book *The expression of the emotions in man and animals*, Darwin 1872, *Expression* from now on). However, he devotes most of this chapter and the whole of the following chapter to providing examples of the existence in different animals of the "more intellectual faculties and emotions," which he considers basic to the development of the "higher" mental faculties, and to demonstrating that those faculties that were considered exclusively human were not such. He concludes that both the complex emotions (including wonder and curiosity) and the more intellectual faculties (imitation, attention, memory, imagination, and reason) are present in all vertebrate animals (especially primates), although to different degrees, and that within each species there is inter-individual variation (on which natural or sexual selection can act). One by one, he dismantles the assertions made by different authors about the insurmountable differences between human capacities and those of other animals. The use of tools, the capacity for abstraction, self-awareness, language, the sense of beauty, and human religiosity would have precursors in more rudimentary mental abilities present in other animals. Special mention deserves for Darwin the moral sense, which he relates to the origin of sociability, and to which he devotes a whole chapter and part of another. The chapter begins with the following sentence:

> I fully subscribe to the judgment of those writers who maintain that of all the differences between man and the lower animals, the moral sense or conscience is by far the most important. (Darwin 1871, p. 70)

It is interesting how he begins by underlining his agreement with the statement, and then goes on to expose as highly probable that any animal endowed with strong social instincts and advanced mental capacities should inevitably possess a sense of morality.[2] Social instincts, such as the urge to help our fellows and compassion (empathy), along with the importance we attach to the approval and disapproval of our actions by others would have served as the impetus and guide for basic rules of right and wrong, from which the moral sense would have evolved. Life in society

[2] Throughout the book Darwin uses this resource on numerous occasions: claiming to agree with a socially accepted idea, to then generate doubts about it or directly provide evidence that contradicts it.

would not only have driven the evolution of morality, but also of human[3] intellectual faculties, aspects that are addressed in Chap. 5, concluding that in man these faculties would have been gradually perfected through natural selection acting on individuals or groups (tribes).

> It must not be forgotten that although a high standard of morality gives but a slight or no advantage to each individual man and his children over the other men of the same tribe, yet that an advancement in the standard of morality and an increase in the number of well-endowed men will certainly give an immense advantage to one tribe over another. There can be no doubt that a tribe including many members who, from possessing in a high degree the spirit of patriotism, fidelity, obedience, courage, and sympathy, were always ready to give aid to each other and to sacrifice themselves for the common good, would be victorious over most other tribes; and this would be natural selection (Darwin 1871, p. 166)

It is evident that Darwin was particularly concerned with the evolution of morality and social instinct, and he devotes a third of the first part of the book to this subject. *Origin*'s main message emphasized competitive relationships, mainly between individuals of the same species.[4] Natural selection favors selfish individuals over altruistic ones. The problem is that in nature there are numerous examples of cooperative behavior and apparent altruism in social species of zoological groups as diverse as insects, birds, and mammals. Darwin was aware of the problem, and many of his detractors had used it to attack his theory. Even today the evolution of cooperation and altruism in social species is a topic of great interest and controversy among behavioral scholars, ethologists, and psychologists alike. Interestingly, although theories have been refined and evidence has accumulated to support them, all the mechanisms proposed by Darwin to answer this problem continue to be the subject of study and debate by different disciplines. In *Descent* Darwin puts much emphasis on the psychological causal mechanisms ("proximate" causes in the sense of Mayr 1961) that would drive social animals to behave altruistically, such as empathy or compassion[5] (a key component of his idea of social instinct) and feelings of satisfaction or remorse (depending on whether one acts following the instinct or not), aspects that still arouse considerable interest from psychologists (Jensen 2016). In different chapters, Darwin introduces, sometimes without much emphasis, explanations related to most of the "ultimate" causes (Mayr 1961) that are still considered relevant today, such as kin selection, reciprocity, reputation and intergroup selection, the latter being the most controversial today (West et al. 2007; Kurzban et al. 2015). Darwin was also concerned about the philosophical, social and political implications

[3] Many cognitive psychologists now agree that the main driver of the evolution of intelligence was the social environment. The effective management of the demands of the social environment would have driven the evolution of the brain and intelligence in different species of social animals (Byrne and Whiten 1988; Dunbar and Shultz 2007).

[4] Although in the popular imagination natural selection is often associated with examples of evolutionary pressures exerted by individuals of one species on another (e.g., predator-prey or parasite-host relationships), it was clear to Darwin that the greatest competition was between individuals of the same population.

[5] "Sympathy" in the original.

of his theory, which both Wallace and some of his most fervent followers had already pointed out. At stake was to understand the origin of our goodness and hence perhaps the emphasis on the importance of social instinct and morality as central elements to what makes us human. For Darwin, human nature includes competitive tendencies, but also prosocial ones, the latter being the highest, the most genuinely human.

6.3 Acceptance of the Theory of Evolution and Its Impact on the Beginnings of Psychology

The theory of evolution received important criticism from theologians, philosophers, and naturalists, but it was well received by the psychologists of the time (Angell 1909). In the nineteenth century, psychology is in the process of independence from its philosophical matrix, to become a scientific discipline. Several decades before the publication of *Descent*, psychology had already begun its transformation into an experimental science and aspired to explain mental processes from their physiological mechanisms, to which the studies of various authors with training in medicine and physiology had contributed. The experimental work of Hermann L. F. von Helmholtz, Ernst H. Weber, and Gustav T. Fechner, the fathers of psychophysics, had provided quantifiable data on the relationship between the mental (sensory experiences) and the material (external reality in the form of stimuli varying in controlled characteristics). On the other hand, observational studies on the effects of acquired brain damage in humans by authors such as Paul Broca, who is considered the father of neuropsychology, had demonstrated the association between areas of the brain and specific cognitive functions. Broca was a fervent Darwinist and the recognition was mutual (Broca is cited 14 times in the second edition of *Descent*).

Among the first to apply the theory of evolution to psychology we find Herbert Spencer who in several of his publications and especially in his *The principles of psychology* (1855) defends the continuity of all mental phenomena from the contractions of a polyp to the evolution of thought and the need to consider mental processes as adaptations to the environment. The book is written before the publication of *Origin* and in it he sets out his own ideas about evolution based on Lamarck. For Spencer, complex mental phenomena arise from the association of simple phenomena such as sensations and this association occurs because organisms are in a process of progressive adaptation to the environment, adjusting the subjective experience to the environment; these adjustments could be passed on to offspring (Young 2000). For Spencer the laws of evolution are universal, the processes of integration and differentiation generate changes that affect different levels of organization from the solar system to human societies, through the Earth, climate, plants, and animals. Spencer will apply his laws of evolution not only to psychology, but to many other disciplines such as philosophy, education, biology, sociology, and ethics (Holmes 1994). Although Spencer is considered the father of social

Darwinism, his view of evolution was more Lamarckian than Darwinian, as evidenced by his strong defense of the inheritance of acquired characters in his writings and his criticism of natural selection to which he devotes the text "The inadequacy of natural selection" (Spencer 1893). Spencer was the one who formulated the phrase "survival of the fittest," which Darwin incorporated in the fifth edition of *Origin*. Spencer's work had a great influence on Darwin, who quotes him nine times in the second edition of *Descent* and prompted him to include the possibility that some modifications in morphological characters or habits acquired throughout life could become hereditary (Darwin 1871).

The definitive impulse to experimental psychology came from the hand of Wilhelm M. Wundt with the publication in 1874 of his book entitled *Grundzüge der physiologischen Psychologie* (*Principles of Physiological Psychology*) and the creation of his psychological research laboratory in 1879. One of his disciples Edward Tichener is considered the founder of the structuralism school, whose aim was to identify the basic elements or structures of psychological experience through introspection, and on which Darwinism had little impact beyond assuming our kinship with the rest of living beings and placing psychology within the natural sciences. Darwinism had a much greater impact on functionalism, a theoretical current that arose in the USA at the end of the nineteenth century and which stated that the aim of psychology was to understand the function of mental processes, their adaptive value. In 1890, William James published *Principles of Psychology*, one of the most important books of psychology, with a clear influence of the work of Spencer and Darwin. In his book, James argues that mental processes such as emotions, selective attention, and consciousness are adaptations of the mind that have evolved by natural selection. These processes allow organisms to process information about the environment helping them to generate adaptive behaviors that contribute to their survival and reproduction (Ludden Jr 2019). James drove the development of the American school of psychology, which came of age in 1892, with the founding of the American Psychological Association (APA).

For much of the twentieth century, the predominant theoretical approach in the study of behavioral mechanisms was behaviorism, led by American psychologists John B. Watson and Burrhus F. Skinner, influenced by the reflexology of Russian researchers Ivan M. Séchenov and Ivan P. Pavlov. For the behaviorists, introspection, which had been the preferred methodological approach of 19th century psychologists, did not provide reliable data. The only possible scientific approach was the objective observation and quantification of changes in behavior in response to different stimuli or environmental modifications, in controlled experiments. Behaviorists are evolutionists, but they consider that the evolutionary process would have generated a reduced repertoire of basic and innate mental abilities that would include the most elementary sensory processing and a few general rules for learning and reasoning. According to their approach, heredity and instincts would not be important in explaining human behavior (a view opposed to Galton's, which we will discuss later); what we are and what we do is a consequence of our experiences, which shape our behavior in response to positive or negative reinforcement. Human

behavior, personality and intellect would be the result of culture and the nurturing environment.

6.4 The Theory of Evolution and the Psychological Disciplines

Beyond his influence on the theoretical currents of the young psychology, Darwin's work had an important impact on the origin of several of the disciplines that constitute the field of study of psychology, and one of them is developmental psychology. William T. Preyer's pioneering studies on the psychological development of the child (*Die Seele des Kindes*, *The Soul of the Child*; Preyer, 1882) were inspired by the observations on the development of the psychological capacities of his children that Darwin had published in *Descent*, *Expression* and above all in a scientific article based on the annotations on his firstborn son that he published in the recently founded psychology journal *Mind* (Darwin 1877), and which is considered the first systematic study of developmental psychology. Darwin was methodologically innovative, applying to infant behavior the same systematic observation and structured description (detailing the exact time of appearance or disappearance of each behavior) that he used for the study of nature; a method copied by later psychologists (Lorch and Hellal 2010). However, Darwin's theoretical contribution to developmental psychology is more controversial, with some authors arguing that Darwinism was highly influential, while others argue that his contribution was very partial and mostly erroneous (Vidal et al. 1983; Charlesworth 1992). At the end of the decade of 1890, some psychologists bet on introducing the evolutionary approach in its full extent to the studies of human psychological development, naming this new approach evolutionary developmental psychology (Geary and Bjorklund 2000; Hernández-Blasi et al. 2008).

Darwinism had a decisive influence on the origin of another discipline of psychology: differential psychology (Mukiur 2009). Francis Galton, Darwin's cousin, is considered the father of this discipline, which studies the psychological differences between individuals or groups. After reading *Origin*, Galton was very impressed by the explanatory power of natural selection to understand the evolution of living beings and aspired to apply its principles to the study and advancement of our species. For natural (or artificial) selection to act on a character, two conditions had to be met: it had to vary between individuals and this variation had to be heritable. Galton set out to demonstrate that human psychological capacities fulfilled these two premises, using quantitative measures of psychological traits (based on questionnaires) and developing statistical techniques that were very advanced for his time. He was the first to carry out studies on heritability, to demonstrate the relative influence of heredity and environment ("nature" *vs.* "nurture"), based on genealogy studies and comparing twins. His methodological contributions were very important, but Galton's ideas were burdened by the classism and racism of the time, which led

him to conclude that the fittest individuals, i.e. those endowed with better qualities, belonged mostly to distinguished families, i.e. the wealthier social classes. Furthermore, he concluded that intelligence and other psychological characteristics were mostly inherited (innate) and that the environment was of little importance. Therefore, the abilities of our species could be improved by techniques of "artificial selection" or eugenics. Eugenic ideas were very well accepted, especially among the ruling social classes, but also among the emerging middle class across the political spectrum. Many philosophers and thinkers supported it. Galton proposed a positive eugenics (favoring the reproduction of the most intelligent), but many theorists and politicians of the late nineteenth century and much of the twentieth century opted to apply a negative eugenics (sterilization or elimination of individuals carrying "undesirable" characteristics).[6] Those considered unfit for reproduction included criminals, people with physical or mental disabilities, and members of disadvantaged social groups (the poor, immigrants, and ethnic minorities). From the second half of the twentieth century, eugenics went from being considered morally desirable[7] to ethically unacceptable, partly because of the horror generated by the Nazi extermination camps. The rejection of eugenics and its consequences has led many psychologists to overlook Galton's contributions to psychology (some articles and books on the history of psychology do not even mention him). Darwin himself did not support eugenics, although he thought that the relaxation of natural selection on our species could harm it; he did not consider acceptable the intervention of the state on reproduction, nor the withdrawal of help to the weakest ("which would deteriorate the noblest part of our nature" in Darwin's own words) (Paul 2003). Darwinism has been used to defend the most diverse political and social causes, which has generated an atmosphere hostile to the application of Darwin's ideas to the scientific study of human societies. In fact, it is among social psychologists where we find the most radically anti-Darwinist positions.

One of the fields in which evolutionary thought has most influenced is the study of animal behavior, which has traditionally been addressed by two disciplines: ethology and animal psychology. Within the latter, comparative psychology is the current in which the evolutionary perspective has been more present (Colmenares 1996; Burghardt 2009). Comparative psychology would have its genesis in the descriptions of the behavior of various animal species made by Darwin in the chapter on instinct of the *Origin*, but especially in *Descent* and *Expression* (Gottlieb 1979). Following the path initiated by Darwin, George J. Romanes aimed to demonstrate the continuity in psychological processes between animals and man, as well as their phylogenetic origins, by collecting information on the maximum number of species,

[6] Although forced sterilization is now a legally and socially rejected practice, it is still applied in many countries to specific population groups, as reflected in the report of the joint statement that the World Health Organization (2014) on the elimination of forced sterilization. https://www.who.int/reproductivehealth/publications/gender_rights/eliminating-forced-sterilization/en/.

[7] "Since the object of all social morality is the good of the human race, and since eugenics also has no other end in view except the improvement of the human race, it is plain that social morality and eugenics are indissolubly connected," p. 26 of the article published by Inge (1909).

analogously to what was being done in comparative anatomy. He published three books on the subject: *Animal Intelligence* (1882), *Mental Evolution in Animals* (1883), and *Mental Evolution in Man* (1888). In them he compares the behavior of several animal species with human behavior and elaborates a theory on the evolution of intelligence. Between Darwin and Romanes there was a deep friendship and mutual recognition. *Mental Evolution in Animals* includes as an appendix a posthumous text by Darwin, which he wrote as part of the chapter on the instinct of the *Origin* instinct and did not finally include.

Later comparative psychologists, concerned with applying maximum objectivity to the study of animal behavior, criticized Darwin's and Romanes' contributions for basing their proposals on anecdotal observations, for their mentalistic approach and their anthropomorphic interpretations (Angell 1909; Fitzpatrick and Goodrich 2017). One of the most incisive critics was C. Lloyd Morgan, who laid the foundation for the application of rigorous methods to the study of comparative psychology. In order to avoid errors in the interpretation of animal behavior, he proposed the principle known as "Morgan's canon," published in his *Introduction to Comparative Psychology* (1894). Humans tend to attribute mental states, thoughts, feelings, and intentions to other human beings. This ability is now called Theory of Mind (Premack and Woodruff 1978) and is considered to be of great adaptive value in allowing us to predict the behavior of others and act accordingly. However, this tendency to mentalize the actions of others is not limited to individuals of our species, but we apply it to other living beings or even inanimate objects. The problem is that it can lead us to attribute to animals capabilities that they do not possess. This error is called anthropomorphism and is what Morgan's canon aims to avoid by applying the principle that an action should not be interpreted as the result of a higher psychic faculty, if it can be interpreted as the result of a lower one in the psychological scale. Although Morgan accepts that all living beings are genealogically related, he considers that the differences that separate human beings from the rest of nature cannot be ignored. In one branch of a phylogenetic tree, novelties may appear that do not appear in others, so that a shared genealogy does not imply that there are no qualitative differences between the traits of related species. Morgan does not exclude the possibility of interpreting animal behavior as the result of higher mental processes, but to accept this hypothesis requires empirical evidence of the existence of these psychological processes in that species and this evidence could only be obtained through the application of rigorous experimental methods (Colmenares 2015; Fitzpatrick and Goodrich 2017). Morgan's work directly inspired Thorndike's experimental studies on animal learning and was an important stimulus for the behaviorist movement.

Compliance with the dictates of Morgan's canon is still considered a fundamental requirement when investigating animal minds (Shettleworth 2010; Colmenares 2015; Fitzpatrick and Goodrich 2017). However, there are more and more critical voices with its postulates. We find them among philosophers of science (for example, Daniel Dennet, Elliot Sober and Simon Fitzpatrick), but also among biologists and psychologists studying comparative animal cognition (Frans de Waal, Gordon Burghardt, Kristin Andrews, and Marc Bekoff, among others). Some authors have

argued that the application of a "critical" anthropomorphism would not only not be a mistake to avoid, but could help us to better understand animal behavior and to generate useful hypotheses for subsequent experimental testing (Burghardt 1991; de Waal 1999). A frequent criticism is that the application of the canon can avoid overestimating the mental complexity of animals, but it can also underestimate it, and it would be as bad to attribute cognitive abilities to animals that do not have them, as not recognizing them in animals that do have them (de Waal 1999; Sober 2005; Andrews and Huss 2014). Also, it has been criticized the lack of clear criteria to consider a mental ability as superior or inferior to another, and that this classification would rely on an anthropocentric view (Sober 2005). These criticisms have been countered by other authors, such as Wynne (2004, 2007), who defend the validity of Morgan's canon against the risk of falling into a folk psychology. Although all comparative psychologists assume that there are very large differences between humans and other primates in cognitive abilities, some agree with Darwin in considering that they are of degree, i.e. quantitative, while others consider that the differences are qualitative and represent a clear discontinuity between humans and other animals (Premack and Woodruff 1978; Colmenares 2015).

6.5 Evolutionary Psychology: A New Theoretical Approach

In the last decade of the twentieth century, a new psychological current emerged with force, which calls itself evolutionary psychology and has as its main objective to discover and understand the design of the human mind and its adaptations. The principles on which it is based can be summarized in the following statement: our neural circuits are the result of an evolutionary process and have been "designed" by natural selection to solve the problems that our ancestors have faced throughout our evolutionary history. Evolutionary psychologists believe that our brains are made up of cognitive modules, highly specialized mental algorithms, which have evolved independently to appropriately solve the problems our ancestors faced: finding a mate, finding food, defending themselves from enemies, raising children, etc. The anthropologist John Tooby and the psychologist Leda Cosmides were the main theorists of this perspective and they propose that in order to understand our behavior in the present, we have to take into account that it is generated by information processing mechanisms that exist because they solved adaptive problems in the past, in the ancestral environments in which the first humans evolved and, therefore, could be neutral or maladaptive in the present (Tooby and Cosmides 1990, 2005). An important novelty of this theoretical approach with respect to other evolutionary approaches to psychology is that it does not emphasize the continuity between humans and other animals, but rather the adaptive value of human behavior and mental processes.

Although the foundations of evolutionary psychology go back to Darwin's theory of natural selection, its most recent antecedents are to be found in the sociobiology of Edward O. Wilson. The publication of his book *Sociobiology: The new synthesis* in

1975 marked the beginning of a "resurgence" of interest in applying the evolutionary perspective to the study of human behavior. In this context, different approaches emerged within biology, anthropology and psychology that received different names: sociobiology or biosociology, human ethology, dual inheritance theory, cultural evolution, ecology of human behavior, evolutionary (or Darwinian) anthropology, and evolutionary (or Darwinian) psychology. Some of these names are synonymous, but others represent different approaches, with different emphases and methodologies, that were originally at odds with each other (e.g., human behavioral ecology and evolutionary psychology). In fact, these different evolutionary approaches to human behavior have much in common, since they coincide in the main adaptive problems that humans must solve to survive and reproduce and, therefore, in their research topics (e.g., obtaining food, avoiding danger, reproductive strategies, mate choice, childcare, task division, cooperation, etc.). They also agree on the potential of evolutionary theory to blur the boundaries between academic disciplines that study different aspects of human behavior (Desfilis 2009).

During the first decade of the twenty-first century, a great effort of integration was made to include the different approaches and methodologies in a common theoretical framework (Dunbar and Barrett 2007). This broad view of evolutionary psychology proposes that in order to understand human behavior and the human mind, it is necessary to consider functional issues (related to the adaptive value of a trait in the present or in the past), mechanisms (cognitive and neurobiological), and ontogeny (the complex interactions between genes and environment during development). In addition, it is essential to recognize the importance of culture and complex social relationships as factors responsible for our behavior (Desfilis 2009). To date, this process of convergence has not been completed, although many bridges have been built between different disciplines and approaches (Brown and Richerson 2014).

Despite its youth, evolutionary psychology has generated an enormous social interest that goes beyond the scientific field, giving rise to conflicting positions, philias, and phobias. Many scientific articles of original research have been published, but also theoretical and review articles, manuals for university teaching, popular science books, and journalistic articles. In addition, documentaries and television programs have been made on some of its research topics. Criticism of evolutionary psychology by scientists from different specialties has been numerous and diverse (Curry 2003; Neher 2006; Bolhuis et al. 2011). It has been criticized for assuming an extreme adaptationism, for the excessive specialization of the mental modules it proposes, for a conception of the environment of evolutionary adaptation that is too strict and too distant in the past, and for not adequately considering neural mechanisms, nor the complexity of the interactions between genes and environment during development. Many of these criticisms have been made by proponents of applying the evolutionary approach to the study of human behavior and mind; thus, they do not deny the interest of the approach, but criticize the more restrictive versions of evolutionary psychology. However, evolutionary psychology has also received amendments to the whole, especially from some sectors of the social sciences, which consider that culture is the only valid causal explanation for our behavior, and that biology has nothing to contribute. Feminist sociologist of science

Hilary Rose and neuroscientist Steven Rose are among the most radical critics. Their arguments are that evolutionary psychology is more a fashionable ideology (with political objectives) than a science, because it promotes simplistic, socially irresponsible and culturally pernicious explanations of human behavior that justify conservative and anti-feminist prejudices and political positions (Rose and Rose 2000; Curry 2003).

6.6 Darwin and Twenty-First Century Psychology

As we have seen throughout the chapter, since the publication of *Descent* the application of the evolutionary perspective to the human mind has generated and still generates a lot of rejection; most probably because it concerns our beliefs about our place in the world, our deep intuition that we are special. In fact, all human societies have some story about the origin of man, which includes the idea of our uniqueness; we are unique and exceptional, different from the rest of the beings that inhabit the planet. When psychology refers to the uniqueness of humans, it invokes qualities, capacities, and/or abilities that would be exclusively human and that would represent a clear discontinuity with other species. Psychologists have devoted much effort to investigating what human uniqueness consists of.

Darwinism in its more modern approaches has much to contribute to the twenty-first century psychology, and psychobiology is the discipline that bears the responsibility for incorporating this perspective, as it is the discipline that applies a biological approach to the understanding of behavior and mental processes. However, in a review of the history of the concept of psychobiology, Donald Dewsbury (1991) concludes that by the end of the twentieth century psychobiology had adopted an overly reductionist approach, in which the term biology is used as a synonym for physiology. In general, psychobiological disciplines interested in understanding the neural mechanisms of behavior, such as physiological psychology, psychopharmacology, neuropsychology, or psychophysiology, although they assume that the brain and neural mechanisms are the result of the evolutionary process, consider that to understand how these mechanisms work, the evolutionary pressures that have sculpted them are not relevant. Very few textbooks in these disciplines include a view on the ultimate causes or evolutionary function, i.e. on the adaptive value of psychological mechanisms (an interesting exception is Striedter 2016).

It is time to apply the broader conception of psychobiology, which was proposed by Dewsbury (1991) himself and has been subsequently elaborated by other authors (Colmenares 2015). Among other things, this broad conception incorporates the evolutionary perspective and pays attention to both proximate and ultimate causal explanations (Colmenares 2015). In this context, it is important for all psychology students to learn the basic concepts of evolutionary biology and behavioral ecology, so that they can adequately understand evolution and contribute to the future integration of evolutionary approaches into mainstream psychology (Burke 2014).

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