



Psychology: a Giant with Feet of Clay

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Abstract

The aim of the current study has been to highlight the theoretical precariousness of Psychology. The theoretical precariousness has been evidenced through a review of psychological “core-constructs” whose definitions were thoroughly searched in 11 popular introductory textbooks of psychology edited between 2012 and 2019 and in an APA dictionary of Psychology (VandeBos 2015). This analysis has shown unsatisfactory or discordant definitions of psychological “core-constructs”. A further epistemological comparison between psychology and three “harder” sciences (i.e., physics, chemistry and biology) seemed to support the “soft” nature of psychology: a minor consensus in its “core” and a minor capacity to accumulate knowledge when compared to the former “harder” sciences (Fanelli in *PLoS One*, 5, e10068, 2010; Fanelli and Glänzel in *PLoS One*, 8, e66938, 2013). This comparison also seemed to support the “pre-paradigmatic” condition of psychology, in which conflicts between rival schools of thought hamper the development of a real unified paradigm (Kuhn 1970). To enter a paradigmatic stage, we propose here evolutionary psychology as the most compelling approach, thanks to its empirical support and theoretical consistency. However, since the skepticism about “grand unifying theories” is well disposed (Badcock in *Review of General Psychology*, 16, 10–23, 2012), we suggest that evolutionary psychology must be intended as a pluralistic approach rather than a monolithic one, and that its main strength is its capacity to resolve the nature-nurture dialectics.

Keywords Theoretical psychology · Philosophy of science · Evolutionary psychology · Introductory textbooks · Theoretical definitions

“In psychology there are experimental methods and conceptual confusion...The existence of the experimental method makes us think we have the means of

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solving the problems that trouble us; though problem and method pass one another by”

Wittgenstein L. *Philosophical investigations*. Oxford: Blackwell, 1953, quot. in Wakefield 2014, p 38.

A Shaky Foundation: A Lacking Concept of “Mind”

Psychology is as an atypical science, as its main object of study is not clearly defined. Based on its etymology - ψυχή/psyché, soul and λογος/logos, science - it should be the “science of the soul” however, it is somewhat peculiar that the concept of “soul” is strongly rejected by scientists as a unit to be investigated. Psychologists and researchers usually limit their scientific focus to “mind and behavior” (see Appendix Table 1). The first signs of confusion may thus be related to the current use of the prefix “psych-” in all the main disciplines in this field, although its etymological meaning is typically refused. However, even if the term “soul” (and thus the “psych-” prefix) was regarded as an irrelevant historical legacy and the contemporary focus was only on the study of “mind and behavior”, things would not be better. In fact, the fundamental pillar of psychology, the concept of mind, is neither satisfactorily nor unanimously defined¹ (Appendix Table 1; Wallach and Wallach 2012). Remarkable efforts have been made in this respect, like the definition proposed by Siegel² (Siegel 2012, 2016). This formulation might solve the issue in the near future, however, it is still not shared by a sufficient proportion of the scientific community. Definitions of mind popular today are materialistic - mind interpreted exclusively as a brain activity (e.g. Cacioppo and Freberg 2013) or, more often, descriptive-set - mind intended as list of activities moving within it (see Appendix Table 1).

However, there are several critical aspects that hinder the *materialistic* definition (Porcelli 2009; Benovsky 2016). Among the most prominent is that there may be emergent properties, i.e. properties that a system shows which are not found in the single parts composing the system itself, and this might happen between mind and brain as well (Tononi et al. 1994; Edelman and Tononi 2000; Edelman 2003; Bedau and Humphreys 2008). Moreover, the brain and the body are directly affected by the mind itself, which operates as a “social organ” that converts relational experiences in the brain and somatic processes (e.g. Tomasello 1999, 2019; Danese et al. 2011; Lanius et al. 2010; Van der Kolk 2015). On the other hand, the descriptive-set definition, although more supported than the materialistic one, seems to lack conceptual consistency (Appendix Table 1). Activities (such as thinking and reasoning) and concepts (such as cognition and emotions) included to define the mind are themselves circularly defined by the formulation of mind itself, therefore resulting in a

¹ Behavior is a less debated term, but still it is not as easy-to-use as it first appears, since it can be intended as “overt” or “covert” or both (Appendix Table 1).

² “The mind is an embodied and relational process that regulates the flow of energy and information” (Siegel 2012, p.3)

vacuous recursion (Appendix Tables 1, 2, 3, 4, 5, and 6). For example, “mind” is often conceived as a list of activities that includes “thinking” or “thoughts” (Appendix Table 1), when, at the same time, the definition of “thinking” generally always refers to its “mental” nature as a characterizing feature (Appendix Table 5).

Most psychologists (more often implicated in practice rather than in theory).

consider the definition of mind as a matter of no significance, leaving it to the philosophers and therefore unconsciously adopting an ontological approach that could insidiously affect their own clinical or scientific activity.

An *unsteady* Building

This first fragile condition (that is a lacking concept of mind) is necessarily followed by many cumbersome consequences: most of the psychological constructs are not satisfactorily defined (see Appendix Tables 2, 3, 4, and 6). The cornerstones upon which psychological science is built seem to falter or fit only in the context in which they have been implemented (Staats 1999). The idea of “*language-game*” (Wittgenstein 1953) (i.e., the comprehension of a given word exclusively in the context in which it is used) could be called into question to depict this condition. Nevertheless, if the “*language-game*” theory works in semantics, it does not in the field of science, as it undermines many fundamental processes of the scientific enquiry, like replicability and intersubjectivity (Wilson 1999). **Cognition, consciousness, emotion, intelligence, mind and thinking**, are concepts usually used by psychologists and psychiatrists around the world. Nevertheless, *no one seems to agree on what they really are* (as reported from Appendix Tables 1, 2, 3, 4, 5, and 6). Several other terms might be less debated, presenting a larger degree of agreement (i.e., **attention, behavior, decision-making, language, learning, memory, motivation, reasoning, perception, problem-solving, and sensation**).

However, a real accordance is far from reached; more importantly, these concepts are often ambiguous, overlapping and circularly defined by the former concepts quoted above which, in our opinion, lack a satisfactory conceptualization (see Appendix Tables 1, 2, 3, 4, 5, and 6). All this results in *non-conclusive definitions*. The reasons that may account for such *theoretical chaos* may be attributed to the recent classification of Psychology as a science (Fernald 2007; Goldfried 2018) as well as the peculiar epistemological status of this discipline, dealing with subjectivity and objectivity at the same time (Jung 1947; Gaj 2016)³ or the degree of high complexity in which is involved (Staats 1999; Fernald 2007; Fanelli and Glänzel 2013).

The *clinical war*: Conflicts between “schools of thought”

Scientific and clinical psychology are controversially related to each other (Meehl 1954; Miller 2001; Gaj 2016). This contrast finds its reason in the peculiarity of the

³ The objective study of subjective experience (e.g. consciousness) presents *par definition* epistemological difficulties since it compares apparently irreducible entities (objective properties *measured* by the scientific enquiry) with inner and private mental states (sometimes referred to as *qualia*; states that cannot be measured and objectivised).

clinical context in which the nomothetic scientific approach conflicts with the necessary enhancement of the patient's idiographic perspective. Within this controversy, the theoretical chaos in the psychotherapeutic field is perhaps much wider (Melchert 2016; Goldfried 2018). Although conciliatory efforts do exist, most of the psychotherapeutic concepts are used in the specific context in which they were first formulated and are being ignored, even mocked, by other "schools of thought" (Krantz 1987; Tracy et al. 2005). The definition of psychotherapeutic constructs is just as confusing. The same phenomenon, substantially unmodified, is "discovered" and re-named several times (Goldfried 2018) [a phenomenon we propose here to label "*nominomania*", a neologism we have coined in this regard]. Furthermore, the term "school of thought", at least if taken literally, seems to be more appropriate in spiritual, political or ideological fields, not in scientific areas.

In this regard, often unification claims, that have a long and diverse history in psychology (e.g. Krantz 1987; Royce 1987; De Groot 1990; Kimble 1994; Anderson 1996, 2008; Staats 1999; Sternberg and Grigorenko 2001; Sternberg 2005; Henriques 2004, 2011; GlenbergM 2010; Gaj 2016; Melchert 2016) have been intended as a dangerous threat to scientific pluralism (e.g., Toulmin 1987; Gergen 1988; McNally 1992; Kukla 1992; Kirschner 2006). This happened, in our opinion, because the concept of scientific pluralism has been mistaken for the unrestrained proliferation of perspectives. As it has been recently proved, this uncontrolled proliferation risks being harmful to scientific integrity and progress (Baliotti et al. 2015).

The Current Study

The aim of our study has been to take a "picture" of the core-concepts of psychology and to consequently attest the way that they are commonly conceived and explained in introductory books, in order to attempt an "epistemological assessment" of the discipline.

This has been pursued through an examination of 11 popular introductory textbooks of psychology published between 2012 and 2019 and the APA dictionary of psychology (VandenBos 2015).⁴ Every concept's definition has been carefully researched along with the introductory textbooks and the dictionary, and it has been reported in Appendix Tables 1, 2, 3, 4, 5, and 6 along with the page it is presented upon, the authors and, when needed, the additional references made by the authors themselves.

The analysis of the introductory books has been chosen because, as written by Staats (1999, p.5) about controversies about a unifying theory, "(...) specialists in the various fields consulted and used only works in that specialty. The only books that treated the several fields of psychology were introductory psychology texts". In our opinion, this situation seems to be unchanged.

⁴ Someone could argue for the exclusion of influential sources, both due to their historical importance (e.g. William James, Wilhelm Wundt, John Watson...) or due to their specialization in specific psychological sub-disciplines (e.g. Noam Chomsky, Burrhus Skinner in language studies, Jaak Panksepp and Antonio Damasio in emotion studies). However, such criticism would not adequately consider the organizing rationale adopted here. Our interest lies in what is the "core - knowledge" of contemporary psychology operationalized in popular (and recent) introductory textbooks.

Furthermore, Fanelli (2010, p.2) explicitly states that “the core [of research] is (...) identifiable with the content of advanced university textbooks (...)”.

In the philosophy of science, the analysis of introductory textbooks has historically been an accessible tool used to roughly assess the state of a discipline (Cole 1983, 1996, 2001). This analysis is extraordinarily still used today by many psychologists with either epistemological, educational or political aims and focuses (e.g. Roeckelein 1996, 1997; Zechmeister and Zechmeister 2000; Habarth et al. 2011; Simonton 2004, 2006⁵; Costa and Shimp 2011; Kisse et al. 2014; Griggs and Christopher 2016; Whaley et al. 2017; Whitehead et al. 2017; Ferguson et al. 2018; Warne et al. 2018). The analysis of introductory books has also been implemented by scholars from other sciences, including informatics (McMaster et al. 2019), statistics (Ravinder and Misra 2016; Dunn et al. 2017), chemistry (Nelson et al. 2015), biology (Colosi 2000; Bednekoff 2005; Wright et al. 2017) and sociology (Manza and Van Schyndel 2000; Keith and Ender 2004; Shin 2014).

Method

Firstly, we examined the definitions of the following fundamental terms:

1. psychology
2. mind
3. behavior

The selection of further psychological core-constructs was based on the category of “*cognitive functions*”. “Cognitive functions” are, in fact, often the main objects of study of scientific psychology. However, since there is no clear definition of cognition (see Appendix Table 2), we failed to find a specific list of cognitive functions anywhere.⁶ We therefore adopted the wider meaning of cognition, “information processing in the brain” (Zimbardo, Johnson & McCann, p.190).

A list of cognitive functions is presented below. If their exclusive selection is no doubt somewhat arbitrary, all these terms are usually grouped under the umbrella-term “cognitive functions” (Newell 1994, p.15; Reisberg 2013, p.3–5; Ochsner and Kosslyn 2013, p.7–8).⁷

⁵ In Simonton’s studies, the analysis of introductory books is just one part of a wider procedure.

⁶ Even when they are classified in “higher” and “lower” [the latter being more automatic and reflex-type than the former, requesting an “effortful” process (Frith and Dolan 1996)], no clear list is presented.

⁷ “**Intelligence**” and “**language**” are two atypical concepts: they cover broader phenomena than those strictly grouped under the label “cognitive functions”. *Language* is sometimes conceived as a full-fledged cognitive function (e.g. Newell 1994, p. 441; Ochsner and Kosslyn 2013, p.7) and sometimes it is not, but is nevertheless considered as strongly related to cognitive functioning (e.g. Reisberg 2013, p.2). Intelligence is a wide concept, often assumed to underlie most cognitive process, or, more specifically, to be a sort of general “cognitive ability” (Bernstein et al. 2012, p.373), a varying potential of cognitive processing. Also, in this case, its close conceptual relatedness to the “cognitive functions” accounted for its inclusion in this list. For conceptual clarity and exhaustiveness, we included also the term “**cognition**” itself, even if of course it is not directly cited by these authors (because it is implicitly assumed to be the umbrella-term under which all these concepts are grouped).

1. attention
2. cognition
3. consciousness
4. decision-making
5. intelligence
6. language
7. learning
8. memory
9. perception
10. problem solving
11. reasoning
12. thinking

Though they are not usually considered “cognitive functions”, in the end we included the terms due to their importance in everyday psychology:

1. emotion
2. motivation
3. sensation

Problems arising in the analysis of the specific concepts (e.g. the subdivision of memory into working memory, long term memory and short-term memory) have been described table by table. All the tables are presented in [Appendix](#), while a summary is included in the results section.

Results

Below are the main definitions of core concepts in psychology highlighting the main elements shared by authors and the texts we selected (for all details, see [Appendix](#)).

Psychology is literally defined by most introductory books (7/12) as the “**scientific** study of **mind** and **behavior**”. The remaining definitions are substantially similar, despite the fact that “mind” is indicated through synonyms (e.g. “mental processes”, “thought”, “cognitive processes”) (3/12). Finally, in two definitions “mind” and “behavior” are listed along with the term “brain” or “brain processes”. As “mind” and “behavior” are transversely mentioned as the two pillars of scientific psychology, it follows that they must be the next elements to be analyzed.

Mind is not defined by *half* of the introductory books. Four sources define it as a list of **activities** (e.g. thinking, remembering, feeling...). Two bibliographic sources define it as “**brain** activity” or “brain and behavior”.

Behavior is not defined by half of the introductory books. The other sources define it globally as **something that can be directly observed**, but it is not clear whether it is intended as “overt” (external actions), “covert” (internal “actions”, such as an action potential), or in both the meanings. Then, our analysis focused on the so-called “cognitive functions”, presented here in alphabetical order.

(Selective) **attention**: its definitional core seems to converge on the concept of “**focus of (restricted) cognitive resources**”, but the definitions vary widely, often referring to “mental processes”, “conscience”, “awareness” or “perception”. Four sources do not define the phenomenon.

Consciousness, along with intelligence, is one of the most debated terms in psychology. Definitions largely vary, but ten out of the twelve sources *tautologically* define consciousness as “**awareness**”, one vaguely defines it as the “the brain process that creates our mental representation” and finally one source does not define it.

Cognition is so variously formulated that it is difficult to summarize its definitions. Broadly, cognition seems to be an “**umbrella-term**” under which all the activities traditionally considered to be “*cold cognition*” are grouped: e.g. **information processing, thinking, reasoning, problem solving, understanding, knowing**. Two sources consider the cognition as a mere *synonym* of “**thinking**” and three sources do not define it.

Decision-making is not defined by seven sources. The remaining five sources seem to converge on the process of “**selecting among different alternatives**”, but often referring to other phenomenon like “cognition”, “cognitive processes” or “evaluation”.

Intelligence is probably one of the most debated terms in the history of psychology. Definitions (10/12) are so rich and different that summarizing them is nearly impossible, but they almost all systemically refer to other psychological constructs (e.g. **reasoning, understanding, problem-solving...**) Two sources do not define the construct.

Language is variously defined, but almost all the definitions seem to converge on the manipulation of “**symbols**” (which are not defined) “**combined**” via a “**set of rules**” in order to “**communicate**” (“communication” is also scarcely defined). The content of the communication is indicated as “thoughts”, “feelings”, or “ideas”. One source does not define language.

Learning. All the definitions seem to converge on the “**modification**” of “**behavior**”, “**mental processes**” or “**information**” of an individual through “**experience**” (which is never defined).

Memory. Most of the definitions seem to converge on the “**ability**” (or “capacity”) to “**acquire information**”⁸, to “**retain**” it “**over time**” and to “**retrieve**” it if needed. Two sources do not define memory.

Perception: All its definitions seem to converge on the “**mental interpretation**” (which is never defined) of “**sensations**”.

Problem-solving is not defined by five sources. The remaining sources converge on the concept of “**goal**”, which can be achieved through different means including “**use of information**”, “**cognitive processes**”, “**thinking**”, “**behavior**”, “**reasoning**”, “**higher mental functions**” and “**active efforts**”.

Reasoning is not defined by six sources. The remaining definitions largely vary so that it is impossible to summarize them. What seems to emerge is a sort of “abstract” and “logical” process compared to problem-solving, which seems to be more pragmatic in its nature.

⁸ “information” is never defined in this case and in the following ones.

Thinking is a widely used term but in our opinion, is still vague. Five sources largely vary but converge on the concept of “(mental) **manipulation**” of “(mental) **representations**” (which are never defined). A lot of concepts are listed along with them, such “cognitive processes”, “information”, “inferences”, “conclusions”, “ideas”, “images” and “scripts”. One source defines it very roughly as “any mental activity or processing of information”. Five remaining sources do not define the phenomenon. One last one merely defines it as a synonym of “**cognition**”. Finally, we focused our analysis on three terms that are very important in everyday psychology: emotion, motivation and sensation.

Emotion is so variously defined that is very difficult to summarize. Some characteristics seem nevertheless to emerge (physical arousal, positive or negative experience, stimulus-related phenomenon, response behavior and cognitive appraisal), but they are so unequally considered from definition to definition that it is impossible to declare them as defining features.

Motivations are variously defined. Nevertheless, the definitions seem to converge on the concepts of “**drive**” (or “**influence**”, “**force**”, “**urge**”, “**factor**”, “**need**”, “**desire**”, “**disposition**”, “**impetus**” or “**cause**”) to direct “**behavior**” (or “**activities**” or “**actions**”) toward a “**goal**” (or “**purpose**”, “**needs**” or “**psychological wants**”). It is therefore not clear if motivations are based on “causes”, on “purposes” or on both, but this controversy is probably more philosophical than psychological.

Sensation. All its definitions seems to converge on the “**stimulation**” of the “**sense organ**” or “**sense receptors**”.

Discussion

As reported in all tables included in this work, the lack of consensus about the core-constructs of psychology is ubiquitous. Analogous considerations about the unsatisfactory nature of definitions of constructs have already been made in sociology (Wallace 1988). However, a coerced imposition of definitions would probably change nothing “unless the consensus on the meaning and significance of the concepts was real and natural” as written by Cole, again about sociology (1994, p.137). Cole’s claim probably stems from the fact that a consensus in formulating constructs cannot be reached if no paradigm is shared between the formulators (i.e. if they do not “filter” the world through the same “lenses”, resulting in a “real and natural” “consensus”). We think therefore, that a consensus could be reached by embracing a theoretical framework (Royce 1987). We do not share the ideas that unifying psychology is a more “disciplinary maneuver” than an “epistemological act” (Stam 2004), that it can be unified albeit in a “multi-paradigmatic” way (Sternberg and Grigorenko 2001); that it can be unified via “inter-field” and “inter-level” theories (Staats 1991) or that it is destined never to be unified (Koch 1993). In our opinion, the unification attempt might be successful as long as different scientists would *not disagree* on the “core” concepts main structures and functions.

In this regard, we believe that the most compelling candidate to try and fix this gap is *evolutionary psychology*: it may be designed to address the demands

reported above in the most comprehensive way.⁹ In fact, evolutionary psychology, in line with evolutionary biology, tries to answer Tinbergen's (1963) "four questions": 1) *mechanism*: "What is the structure of the trait; how does it work?" 2) *ontogeny*: "How does the trait develop in individuals?" (Nesse 2013, p.681) 3) *phylogeny*: "What is the system's history? How has it changed through evolution, and how does it differ between related species?" and 4) *adaptation*: "Why did the system evolve into its present form? What evolutionary advantages did it provide?" (Del Giudice 2018, p.42). The answers to the first two questions are usually labeled as *proximate* because they explain how an "organism works in present" (Del Giudice 2018, p.42). The answers to the third and fourth questions are labeled as *ultimate* because they explain how an organism reached its current biological functioning from a "historical" perspective.

Ultimate and *proximate* explanations are complementary; together, they can offer a satisfactory explanation about the whole functioning of psychological mechanisms. Nevertheless, the typical approach in medicine and psychology is to focus exclusively on the proximate ones (Del Giudice 2018). Evolutionary psychology could thus be the most complete approach because it is the only one that manages to integrate answers to all four questions. Furthermore, it dissolves the long-standing debate of nature vs nurture and it is a credible bridge between scientific and clinical psychology, which manages to connect in a continuum of *normal* vs *abnormal* functioning, offering a compelling explanation for many mental disorders (Nesse 2015; Brüne 2015; Del Giudice 2018). Some critical points must be addressed before this issue is analyzed more thoroughly.

First Critical Aspect: Is it any Different in the So-Called "harder" Sciences?

One could argue whether this conceptual vacuum is also present in other sciences. It is widely accepted that the scientific inquiry is a process of constant reviewing and redefining of its constructs (Kuhn 1970), so a similar situation could be evidenced in other branches of knowledge. However, there seem to be different degrees of "uncertainty" varying from one science to another. This has been defined by many as the contrast between "hard" and "soft" sciences.

What is meant by "hard" science? There is no univocal definition, though, the key idea is that hard sciences typically show a larger *consensus* in their "core" [the "core" is "the corpus of agreed upon theories and concepts that researchers need to know in order to contribute to the field" (Fanelli 2010, p.2)] (Zuckerman and Merton 1972; Cole 1983, 1994; Simonton 2006; Fanelli 2010; Fanelli and Glänzel 2013). Furthermore, hard sciences seem to prove a stronger capacity to accumulate knowledge, relying more "on the significance of new knowledge and the continuing relevance of old" (Fanelli and Glänzel 2013, p.1; Simonton 2002).

⁹ Henriques (2017) claimed that "every major perspective in psychology currently accepts evolutionary theory" (p.393), treating it as a simple theory and not as a meta-theory, which according to him is something different and can be represented in his "Tree of Knowledge" (Henriques 2003). We disagree with Henriques both in regard to the "acceptance" of evolutionary theory in the context of psychology and in regard to the consideration of evolutionary psychology as a theory, while we explicitly claim that it is a meta-theory.

By contrast, *soft* sciences seem to have less consensus in their core, a minor capacity to accumulate knowledge and a minor adherence to the data and theories, who “speak less from themselves” and are more likely to be influenced by non-cognitive factors, such as the academic prestige, political and ideological beliefs, and so on (Fanelli and Glänzel 2013). There is no qualitative difference, rather a “graduation” between these two “groups” (Fanelli and Glänzel 2013). This contrast, recently seen as “controversial, if not even offensive”, nevertheless seems “to capture an essential feature of science” (Fanelli and Glänzel 2013, p.1).

Psychology is both historically (Simonton 2004) and contemporarily (Fanelli 2010; Fanelli and Glänzel 2013) considered as “soft” when compared to “hard” sciences such as physics, biology or chemistry. These sciences are often compared to psychology theoretically and practically (Popper 1972; Lilienfeld et al. 2014); moreover, they are more frequently believed to be “stronger” than psychology both by lay people and by scholars (Janda et al. 1998). In order to assess if this difference in “hardness” is real, we conducted a comparison between the psychological science and these three sciences (physics, biology, chemistry).

Ideally, two considerations, respectively labeled synchronic and diachronic, must be addressed in order to draw the comparison. First, it must be examined whether, within a specific time interval (often the most recent), the degree of “hardness” in physics, biology and chemistry is meaningfully different than the one in psychology [synchronic]. Second, it must be examined whether, along with the scientific progress evolving over time, the “significance of new knowledge and the continuing relevance of old” is really different between psychology and these other three sciences [diachronic].

A Synchronic Point of View The first question seems to have been answered by empirical literature, which, by using sophisticated bibliometric and statistical methodologies, has empirically demonstrated what only used to be a conceptual speculation (Simonton 2002, 2004; Fanelli 2010; Fanelli and Glänzel 2013). Simonton’s first paper (2002) is an attempt to summarize a “systematic statistical comparison” (Simonton 2002, p.352) of all previous research conducted in the “epistemological assessment” of the hierarchy of sciences, in order not to “to address the substantive question piecemeal” but rather to get a global reliable index. For example, different studies previously conducted dealt with different disciplines. Also, the “various alternative rankings of the sciences” had “not [been] subjected to any rigorous statistical test of the degree to which they might be in agreement” (Simonton 2002, p.352). The disciplines considered in this study were physics, chemistry, psychology and sociology. With such a rigorous methodology, the parameters considered in this study have been:

1. **Theories-to-laws ratio.** “Roeckelein’s (1997) measure called “theories-to-laws ratio” (number of cited theories divided by number of cited laws in textbooks). (...) The ratio will be well-balanced, i.e., show low values, for the “natural” sciences (physics, chemistry, biology) and be poorly balanced, i.e., show high values, for the “social” sciences (anthropology, sociology)” (Roeckelein 1997, p. 131). The higher the ratio, the higher the “softness”.
2. **Consultation rate.** Suls and Fletcher (1983) index, based on Leon Festinger’s (1954) social comparison theory. In a nutshell, the consultation “with colleagues

before submitting a paper for publication in the discipline's journal (...), revealed in the acknowledgment sections of the published articles" (Simonton, p.351) is assumed to reflect the uncertainty about core topics of the discipline. "The specific measure was the number of persons acknowledged adjusted for the number of authors" (Simonton 2002, p.352). Similar to the previous index, the higher the ratio, the higher the "softness".

3. **Early impact rate.** All the remaining criteria came from Cole (1983). The first is the "proportion of scientists under 35 whose work received more than the mean number of citations for their field" (Cole 1983, p. 118; i.e., fields that incorporate most quickly the work of young scientists are assumed to rank higher in the hierarchy)" (Simonton 2002, p.354).
4. **Peer evaluation consensus I.** The fourth criterion is supposed to evaluate consensus, i.e. "the "consensus on evaluating scientists by field" (Cole 1983, p. 120), where 60 scientists per field were rated by colleagues in the same discipline (the consensus was gauged by the mean standard deviation of the ratings)".
5. **Peer evaluation consensus II.** The fifth criterion is supposed to evaluate the consensus as well, i.e. "the consensus gauged by asking scientists to mention those who "have contributed the most in past two decades" (Cole 1983, p. 120; the specific index is the percentage of "mentions received by 5 most mentioned names").
6. **Citation concentration.** The "concentration of citations to research articles" (Cole 1983, p. 122; using the Gini coefficient) (Simonton 2002, p.354). "If the citations are all concentrated in a single article, then the disciplinary consensus must be very high, whereas if it is more evenly distributed across articles, then the consensus must be minimal" (Simonton 2002, p.353).

The overall results (for further detail, see Simonton 2002) confirmed the "soft" status of psychology compared to physics and chemistry.

Simonton's second paper (2004) is aimed at replicating and expanding the former study. It deals specifically with physics, chemistry, biology, psychology and sociology. Two further primary criteria have been added to those mentioned above:

1. **The obsolescence rate** by McDowell (1982). "On the basis of the relative frequency of citations to older publications, McDowell (1982) determined the rate at which knowledge becomes obsolete for the disciplines (...) The specific measure used here was his calculation of the expected publication cost of interrupting a career for just 1 year. (...). For example, if their career is interrupted for a single year (e.g., by administrative work or parental or health leave), the output of physicists will be cut by about 17%, whereas the productivity of psychologists will be cut by about 10% (because physicists will have much more "catching up on the literature" to do before they can resuscitate their careers) (Simonton 2004, p.61).
2. **Graph prominence:** "Cleveland (1984) assessed the extent to which graphs appear in articles published in the professional journals, demonstrating that graphs are more extensively used in the "hard" disciplines (see also Smith et al., in press)."

The *peer evaluation consensus II* was removed due to methodological issues. Other “secondary measures” are considered, even if not essential for the main statistics because they are not completely objective but nevertheless they are “useful for validating the results obtained from the primary measures” (Simonton 2004, p. 62).¹⁰ The results demonstrated that Psychology is “softer” than the traditional “harder” sciences according to these parameters.

Fanelli’s first study (2010) focused on the “confirmatory bias”. In other words, “researchers in “softer” sciences should have fewer constraints to their conscious and unconscious biases, and therefore report more positive outcome” (Fanelli 2010, p.1). This study includes a broad range of sciences, including physics, chemistry, biology and psychology. The results are clear: “the odds of reporting a positive result were around 5 times higher among papers in the disciplines of Psychology and Psychiatry and Economics and Business compared to Space Science, 2.3 times higher in the domain of social sciences compared to the physical sciences, and 3.4 times higher in studies applying behavioral and social methodologies on people compared to physical and chemical studies on non-biological material”. For further methodological issues, see the original paper (Fanelli 2010).

Fanelli and Ganzel’s paper (2013) is more sophisticated. About 30, 000 papers from different disciplines (including physics, chemistry, biology and psychology) have been analyzed through nine indexes:

1. **Number of authors.** “Research teams are almost by definition built around a consensus on objectives and methods. Moreover, the ability to study a problem with greater accuracy and detail leads to a specialization of roles, making collaboration essential(...) The hardness of a field, therefore, should be manifest in the size of its research teams” (Fanelli and Glänzel 2013, p.4).
2. **Length of article.** “When consensus is lower, papers must put greater efforts in describing the background, justify their rationale and approach, back up their claims and extensively discuss their findings (...) Longer introductions, and generally longer papers, should therefore characterize softer research. We measured the total number of pages” (Fanelli and Glänzel 2013, p.5).
3. **Number of references.** “For reasons similar to those that make an article longer, references to previous literature should also be more numerous in low-consensus fields (...)”
4. **References to Monographs.** “Scholars in the humanities and social sciences still frequently choose to publish books rather than papers”
5. **Age of references.** “Having noted that some sciences “metabolize” the literature more rapidly, Price (1970) proposed an index, which measures the proportion of cited references published in the five years preceding the citing paper”. The faster the “metabolism”, the “harder” the science.
6. **Diversity of sources.** “When scholars agree on the relative importance of scientific problems, their efforts will concentrate in specific fields and their findings will be of more general interest, leading to a greater concentration of the relevant literature in few, high-ranking outlets” (Fanelli and Glänzel 2013, p.6).

¹⁰ *Lecture disfluency, Citation immediacy, Anticipation frequency, Age at receipt of Nobel Prize, rated disciplinary hardness* (for further details, see Simonton 2004).

7. **Relative title length.** “Linguistic analyses of scientific papers noted that the number of substantive words in titles tended to be longer and to correlate with an article’s total length in harder fields (...). We measured the total number of words, divided by total number of pages.”
8. **Use of first person.** “Scientists aim at making universal claims, and their style of writing tends to be as impersonal as possible. In the humanities, on the other hand, the emphasis tends to be on originality, individuality and argumentation, which makes the use of first person more common(...)”
9. **Sharing of references.** “Authors that cite a common literature almost by definition are exhibiting a common cognitive background. The sharing of references between papers, therefore, is perhaps the most direct expression of scholarly consensus. Of the various techniques available to analyse citation networks, the most likely to reflect this parameter is bibliographic coupling, in which a network link is drawn between two papers that cite the same reference(...)” (Fanelli and Glänzel 2013, p.6–7).

Once again, the hierarchy of sciences (with psychology/psychiatry as “soft” sciences) has been confirmed (for more detail, see Fanelli and Glänzel 2013). Psychology, often alongside psychiatry, really *seems to be “softer” than physics, chemistry and biology*. As we believe that the experimental method applied to philosophy is a valid tool to settle conceptual disputes (Griffiths and Stotz 2008; Sytsma and Buckwalter 2016), we have mainly based our considerations on this empirical data. Reasonably, it could be argued that this empirical data is not sufficient to exclusively resolve the issue. It could be said, for example, that even the fundamental concept of “life” - upon which biology is based (*βίος*/bios: life; *λόγος*/logos: science) - is indeed not unanimous, as said by Lilienfeld (2004) against Henriques (2004). In our opinion, this conceptual claim does not take into account the broader epistemological context of biology; the latter clearly seeming more “solid” than the context of psychology as demonstrated by the studies mentioned above. Similar considerations could be made on analogous controversies in physics and chemistry.

A Diachronic Point of View The second issue is about the historical discontinuity (“the significance of new knowledge and the continuing relevance of old”), or as Simonton (2002, p. 355) put it, the “*intra-disciplinary advancement*”. A historical analysis in psychology is inevitably preceded by many conceptual problems. First, does the word “paradigm(s)” fit the “schools of thought” in a proper sense? The answer is largely controversial, and some authors have fairly proposed to use the word “sub-discipline” instead (Friman et al. 1993), a suggestion that has been adopted by other studies in this field alongside the term “school” (Robins et al. 1999; Tracy et al. 2005; Norcross et al. 2005; Spear 2007). Here, we will use the word “approach”, “theory” or “trend” because the term “sub-discipline” or “school” might implicitly suggest that these views are completely incompatible with each other when they are not.

Consistent with the considerations about the experimental method applied to conceptual disputes, we based our commentary only on existing *empirical literature* on “historical trends” in psychology (Robins et al. 1999; Tracy et al. 2005; Norcross et al.

2005; Spear 2007).¹¹ These studies assessed the prominence of every theory thanks to particular bibliometric measures; assuming the more an approach is cited the more it is prominent, they estimate the “citation pattern” of every theory and compare one to each other in order to determine what “rises”, what “is in decline” and so on.

This stance obviously limited¹² (but also grounded) our conclusions in the period in which bibliometric analysis has been done, i.e., after the 1950’s. It has also restricted the analysis of just four approaches (psychoanalysis, cognitivism, behaviorism and neuroscience). Spear (2007) also considered the neuro-cognitive theory and Norcross et al. (2005), whose analysis was about clinics, also mentioned the humanistic and integrative/eclectic approaches. Cognitive-behavioral theory, gestalt theory, evolutionary psychology, alongside other important approaches and historical traditions – e.g. structuralism and functionalism - have been deliberately ignored, making our conclusions simpler (and perhaps more simplistic). Furthermore, the approaches have been considered in a “monolithic fashion”, while it is widely known, for example, that psychoanalysis is subdivided into many different approaches.

Despite all these limitations, since the intention was to have an overall idea about conflicts between different theories, we believe that such analysis may satisfactorily reach our aim. In summary, what emerges from these papers is that the neuro-cognitive approach is undoubtedly the most popular nowadays in psychology (Tracy et al. 2005; Spear 2007). On the other hand, in clinical psychology, cognitive and eclectic/integrative approaches appear to be the most implemented (Norcross et al. 2005). Although the cognitive approach is a very common and shared, it seems to be *far away from* being a real “paradigm”. (Tracy et al. 2005; Spear 2007).

A historical comparison with the other sciences is therefore unlikely to be made. No real paradigm seems to be identifiable in the “recent” history of psychology (post-1950). It is very likely that no real paradigm (in a *kuhnian* sense) existed either in “past” psychology (1879–1950) as many suggested (James 1894; Heidbreder 1933; Cronbach 1957). Since no real psychological paradigm (in a *kuhnian* sense) probably ever existed, it is very difficult to assess if the “intra-disciplinary advancement” is actually different between psychology and physics, chemistry and biology. One empirical study confirms this hypothesis (Simonton 2002, p.355). In this study, Simonton reanalyzed the theories-to-laws ratio collected by Roedkelein (1997) and showed how this ratio declines as the years pass in physics or chemistry, but rises in psychology, supporting its “softness”.

Finally, addressing the question that started this section, psychology appears to be different from the so-called “harder” sciences. It seems to still dwell in a pre-paradigmatic stage (Kuhn 1970), in which conflicts between rival schools hamper the development of an original research programme (Lakatos 1978). This condition has already been “assessed” by many (e.g. Kuhn 1970; Warren 1971; Briskman 1972; Balianetti et al. 2015; Melchert 2016; Goldfried 2018).

¹¹ Moreover, our focus has been exclusively on these studies because we wanted to avoid the systematic positive distortion of a researchers’ point of view towards his own theory (Tracy et al. 2005). This bias could potentially affect all qualitative historical analysis. Furthermore, empirical analysis appears to be a more intersubjective source than qualitative analysis (Simonton 1990, 2006).

¹² These bibliometric indicators have been harshly criticized (Pettit 2016; Burman 2018).

Second Critical Aspect: Is the Empirical Evidence Collected over One Hundred Years Not Enough to Declare Psychology as a Science?

The current work aimed at underlining the theoretical precariousness of psychology, not at undermining its scientific status or at denying its important discoveries and results. It is not our intention to question the validity, necessity or importance of this discipline. We are not discussing whether or not psychology is a science. Instead, our focus is on its epistemological status and on the way in which it could become a paradigmatic discipline and not a pre-paradigmatic one. As we have a great interest in the matter, we do hope that with a clearer theoretical framework, a lot of scientific issues could be tackled with more success.

Third Critical Aspect: Why Should Evolutionary Theory be more Complete than Others? How Would it be Adopted?

Evolutionary psychology has a lot of criticisms. Its major tenets have been questioned, including its testability, some of its fundamental cognitive assumptions like the massive modularity, the alleged inconsistency of the notion of EEA (environment of evolutionary adaptation), its potential methodological flaws (disjunction and grain problems), its alleged determinism, reductionism and the underestimation of the environmental influences, as well as the so-called “natural teleology” and the “spandrel” problem (Gould and Lewontin 1979; Davies et al. 1995; Panksepp and Panksepp 2000; Fodor 2001; Lloyd and Feldman 2002; Gannon 2002; Franks 2005; Buller 2006; Richardson 2007; Hamilton 2008; Machery 2008; Rose and Rose 2010; Bolhuis et al. 2011; Ward 2012; Peters 2013). However, many of these criticisms seem to be inconsistent due to theoretical misconceptions, as suggested by many evolutionary scholars (Buss et al. 1998; Carruthers 2003, 2006; Tooby et al. 2005; Barkow 2005; Daly and Wilson 2005; Hagen 2005, 2015; Hagen and Hammerstein 2005; Delton et al. 2006; Machery and Barrett 2006; Confer et al. 2010; Van Le et al. 2013; Klasios 2014; Ploeger and van der Hoort 2015).

Despite the considerable empirical support collected, which can be summarized in recently edited handbooks of evolutionary psychology (Barrett 2007; Buss 2015a, b, 2019) and despite the heartfelt claims of unification under its name (e.g. Cosmides et al. 1992; Tooby and Cosmides 1992; Buss 1995; Caporael 2001; Tooby and Cosmides 2007; Dunbar and Barrett 2007b, Duntley and Buss 2008; Badcock 2012; Carmen et al. 2013), this discipline is not *yet* a paradigm in the Kuhnian sense¹³ (Glass et al. 2012; Burke 2014).

We believe that evolutionary psychology may represent a compelling meta-theory. Nevertheless, it is more multifaceted than it is sometimes presented. This approach is indeed often mechanically identified with the “EP” or “Santa Barbara School” - led by John Tooby, Leda Cosmides, Steven Pinker, David Buss and Donald Symons - and with its own theories (Barrett et al. 2014). This trend is often referred to as the *narrow-sense evolutionary psychology* (Mameli 2007).

However, within evolutionary psychology, different theories have been proposed, aligned to a core-idea that however results in dramatically different assumptions and

¹³ i.e. an acknowledged and shared major theory and methodology around which minor sub-theories “orbit” (Kuhn 1970)

implications, a tendency that may be referred to as the *broad sense evolutionary psychology* (Mameli 2007). To testify this pluralism, it is worth noting that some leading evolutionary scholars question the computational postulation, the massive modularity hypothesis and the notion of EEA itself, concepts upon which the “Santa Barbara School” has been built (Dunbar and Barrett 2007a, b; Stephen 2014; Barrett et al. 2014; Barrett et al. 2015; Stulp et al. 2015). They firmly believe in the evolutionary framework, but they have a somewhat greater consideration of the environmental influences. For example, in a recent book, Tomasello (2019) suggested from an evolutionary perspective that what makes human *unique* is primarily related to *cultural* and *ontogenetic* processes. As regards for the computational criticisms, there is a growing interest in the e-cognition or distributed cognition (e.g. Barrett 2011).

Setting aside the specific controversies, what we want to highlight is that evolutionary psychology must not be identified as a monolithic school, rather as a core-idea (“our mind and behavior are significantly shaped by our phylogenetic history”) that can be variously addressed. What is fiercely debated concerns specific theories and methodologies: almost no-one would deny that we are animals biologically designed to survive and reproduce.¹⁴ Most of the critics of evolutionary psychology recognize that its core principle is credible (Hagen 2015).

However, “the contested nature of evolutionary psychology lies not in our status as evolved beings, but in the extent to which evolutionary ideas add value to studies of human behavior, and the rigor with which these ideas are tested” (Barrett et al. 2014, p. 1). Fodor (2001) advised in this regard that no scientific field, even if logically intriguing, could be valid a priori; the only legitimate criterion is the empirical evidence (a posteriori). He argues (Fodor 2001, p.83) that there is no pure logical reason constraining the mind and brain to follow the same evolutionary processes which designed the other organs of the body. Similarly, Fodor goes on, there is no necessary link between “lunar geography” and “cellular mitosis”, even if both can be claimed as scientific phenomenon. We find this argument logically consistent but pragmatically inconsistent. Adopting an “Occam’s razor” reasoning, we object that there seems to be a far greater “epistemological distance” between lunar geography¹⁵ and cellular mitosis than the one occurring between the mind-brain system and the rest of the body.

Despite its limitations, evolutionary psychology’s global theoretical consistency (which cannot determine its scientific success alone anyway) cannot be ignored (Wilson 1999). It is linked directly to biology, through which it can be connected to the other “hard” sciences. It is compatible with – and somewhat built on – neuro-cognitivism, and finally it is consistent with other psychological sub-disciplines (e.g. developmental, social, personality and psychopathology) and with other disciplines and sciences, like anthropology (Barrett 2007; Buss 2015a, b).

A great unresolved issue stands in our way to a theoretical and practical resolution. What about the other “schools of thought”? What about psychoanalysis, Gestalt, systemic, humanistic theory and positive psychology (just to note a few...)? Can they

¹⁴ Such statements must be interpreted with caution: the biological design does not imply a reductionistic view of the mind and the main evolutionary aim (reproduction) must be intended not in an overly intuitive manner (Pinker 1997).

¹⁵ Upon which soil no trace of life has been found

co-exist with evolutionary psychology? Can they maintain their identity? If evolutionary psychology proves itself as a meta-theory, will they be “cannibalized”¹⁶? The matter is the most important; here probably lies the very nature of the problem.

We explain below why evolutionary psychology seems to prove itself as the most all-encompassing approach. Historically, every psychological school posited a “drive” or a “aim” at the very heart of the whole psychological functioning. Melchert (2016, p. 488) labeled it as the “*first principle*”. For Freudian psychoanalysis, this has been the fulfilment of a “drive” (*Trieb*, in Deutsch), for Jung, it was the process of *individualization* – and similarly, every psychodynamic author has its own name and related theory. The same happens in other schools of thought as well: systemic theory, for example, posits that an individual cannot be separated from his familiar context, which is in turn seeking *homeostasis*. Rogers, often regarded as the “father” of humanistic theory, stated that every individual ultimately seeks *self-actualization*. This is a rough and simplistic summary, since is not our intention to make a list of all the different “*first principles*” by different schools. What we want to stress here is that every psychological school posits *universal* and *inborn* tendencies in every individual, which are obviously shaped by the environment in which they unfold. These *first principles* are *universal* and *inborn* tendencies, axioms through which all the theoretical and practical corollaries of the given school develop. Without the fulfilment of the drive, there would be no place in Freudian psychoanalysis for “higher” theories (e.g. dream interpretation, transference, psychosexual development, Oedipus complex, Eros and Thanatos etc.), or specific techniques (e.g. interpretation, confrontation, working through etc.) Similarly, in all the other schools, all theory and practice is eventually related to a *first principle(s)*, which is *universal* and *inborn*.

We claim that evolutionary psychology is precisely the most compelling theoretical and empirical effort to frame these *universal* and *inborn* tendencies (*nature*). It is also the most compelling approach to frame the environmental influences intervening in shaping these tendencies (*nurture*). In this regard, this approach could be based on two theoretical foundations, one nested in each other. The first foundation (*nature*) seems to clearly be the *process of natural selection itself*, which poses evolutionary psychology directly in connection with evolutionary biology. The natural selection chooses which components are part of human (and non-human) *innateness*. There are some controversies about the actual “unit” upon which natural selection acts, but one of the most popular and widely accepted theory today is the *gene-centered view of evolution*; commonly known as the “selfish gene” theory by Richard Dawkins (2016). According to Dawkins (and to many biologists that endorse this theory) the selection process does not act on individual organisms or species, rather, it acts on genes. The word “gene” is so important that it must be clearly defined. As explicitly stated by Dawkins, the word “gene” is used “in a special sense, tailored to evolution rather than embryology” (...) “A gene is defined as any portion of chromosomal material that potentially lasts for enough generations to serve as a unit of natural selection” (Dawkins 2016, p.754). Epigenetic variations are comprehended as well, because it is demonstrated that they are heritable and can be selected in the evolution process (e.g. Del Giudice 2018). Genes are expressed in phenotypes, but the latter are merely genes’ “vehicles”. To

¹⁶ Adopting a colorful metaphor by E.O Wilson, quoted in Buss (2019, p.39)

summarize, evolutionary speaking, it is almost all about genes trying to replicate themselves to become “immortal”.¹⁷ Complex phenomena like intra-genomic conflict and inclusive-fitness theory find their natural explanation in the Dawkins theory.¹⁸ Of course, the *gene-centered view of evolution* view has been criticized (e.g. Gould 1997). Furthermore, complementary and partially different explications have been proposed, like the *multilevel selection theory* (e.g. Nowak et al. 2010) which has been harshly criticized by a paper signed by 137 biologists (Abbot et al. 2011). Even if the controversies are far from dissolving, the consensus on the *gene-centered view of evolution* seems the mainstream theory in the contemporary evolutionary biology, so we will stick with it.

However, a *naive application* of the “selfish gene” theory to human mind and behavior to frame our “innateness” would lead us to unforgivable mistakes. Thanks to the “*seed bank paradox*”, we can easily grasp the *conceptual gap* between a naive application of the “selfish gene” theory in psychology and the actual evolutionary process that seems to be in play. For example, if the ultimate goal of an individual is to spread their genes, one could assume (*naive application*), that the males living in our contemporary society should feel the urge to donate their sperm to a seed bank in order to spread their genes at a dramatically higher rate than the one achievable through simple mating. Of course, this does not happen. The answer to this paradox, Steven Pinker (1997, p.44) wrote that “Sexual desire is *not* people’s strategy to propagate their genes. It’s people’s strategy to attain the pleasures of sex, and the pleasures of sex are the genes’ strategy to propagate themselves.” In other words, evolution selected the genes that code for sexual *lust*, that in turn was a “genes’ strategy to propagate themselves”. It is the lust, and not a cumbersome psychological mechanism such as the “urge to donate to seed bank”¹⁹ that human beings want to experience. A first important divisor must therefore be drawn between the behaviors’ “aim” and genes’ “aim”.²⁰ Behaviors are shaped by genes’ “perspective”,²¹ but they cannot completely be reduced to them. Here, the second foundation of evolutionary psychology is relevant; what makes our human mind and behavior *unique* (Tomasello 1999, 2019). What shaped the human specific psychology in our environment of evolutionary adaptation? The *social brain hypothesis*, popularized by the British scholar Robin Dunbar (1998, 2009) seems to successfully answer this question. Along with other fundamental adaptations (e.g. problems of survival, problems of sex and mating and problems of parenting and kinship), our *Homo sapiens* species seems to distinguish itself due to the importance that

¹⁷ Dawkins himself noted (2016, p.13) that “immortal gene” would had been probably a better title than “selfish gene”.

¹⁸ These complicated processes are here only mentioned for the sake of brevity. The reader may find further details elsewhere (e.g. Dawkins 2016)

¹⁹ The “seed bank” is a very recent cultural introduction and could not be targeted by the genes in so little evolutionary period to develop a psychological mechanism.

²⁰ The word “aim” is used in a deliberately metaphorically fashion, we do not imply teleology for genes.

²¹ It is absolutely necessary to stress the fact that we are adopting again metaphorical language. Genes actually do not “reason”, “plan” or “make strategies”, but we could easily grasp conceptually their “behavior” through these mentalistic metaphors.

the *social* environment has as a selective pressure to shape our psychological functioning (Dunbar 1998, 2009).²² We are, in Tomasello's words (2014), an "ultra-social" animal, the most socially competent species on the planet. We can co-operate in complex ways, "read" other "intentions" (what is often called as "theory of mind"), communicate through a public language, share our attention, etcetera (Tomasello 1999, 2019). What is crucial here is that our *social competence* is ultimately permitted by our biological functioning. In a nutshell, *we are naturally selected to be cultural*. At the same time, our cultural life has a biological impact on us; *we are culturally shaped in our nature*.

This evolutionary explanation seems to make sense to our extraordinary sensitivity to social signals and to our vulnerability to mental disorders, which characterize themselves very often as an impairment in "social participation" (APA 2013).

All that being said, evolutionary psychology *really* seems to prove itself as a compelling meta-theory. It fully accounts both for our innate and universal nature and for the crucial role of our social environment. It can explain both our universal nature and our personal individuality, because it accounts for our high plasticity to our environment, since we are biologically "wired" to collect environmental signals (which in turn can influence our biology). Eventually, it explains why we are so vulnerable to mental disorders. The study of the power of the gene-relatedness in our behavior is now largely attested (e.g. Buss 2019). More importantly, the "innateness" of evolutionary psychology is *biologically and empirically* based, it is not drawn from speculation or from clinical observations. At the same time, the social brain hypothesis is in harmony with the clinical observations made by systemic, Gestaltic, and intersubjective schools (just to note a few...). It furthermore explains, along with other complex psychological mechanisms (e.g. Del Giudice 2018) our abnormal functioning.²³ In another words, evolutionary psychology really seems to be the most complete and multifaceted approach to comprehend human (and non-human) psychological functioning.

Conclusion

An analysis of "core-concepts" in psychology (showing unsatisfactory and discordant definitions) and a comparison to "harder" sciences (physics, physics, chemistry and biology) appeared to demonstrate the "soft" nature of psychology and its pre-paradigmatic condition. Evolutionary psychology has been suggested to be the most compelling candidate to possibly overcome this epistemological impasse.

²² Of course mating, parenting and kinship are *social* processes themselves, but they are more common in the animal kingdom than the specific *Homo sapiens*' social competence, which seems to have being triggered by *group living*. It is likely that this competence has influenced the process of mating, parenting and kinship, according to a circular causality process.

²³ Finally, integrative attempts have been made with psychoanalysis as well (e.g. Nesse 1990; Walters 1994; Migone and Liotti 1998; Marcaggi and Guénolé 2018)

Obviously, there are many limitations to the considerations we proposed here. First, the empirical papers on which we have based our epistemological comparison are not numerous, and they should be replicated in more recent times (especially the papers about the “historical trends” in psychology, which also considered the schools in a “monolithic fashion”). Furthermore, someone could more generally question the empirical validity of these analyses from a methodological point of view. In addition, the selection of the sample of introductory books and the “core-constructs” could be questioned as somewhat arbitrary. Finally, the claim of unification under the name of evolutionary could be seen as ideological.

Nonetheless, we believe that our conclusions and main arguments remain robust. Even if the “empirical” papers about conceptual issues are not so numerous, we do believe that they are persuasive enough. This does by any means intend to devalue the theoretical reasoning *per se*, rather, rooting theory on an empirical ground. In other respects, despite its limitations, the analysis of introductory textbooks seems to capture an intuitive “picture” of the “core” of a science, and the constructs we have analyzed could be easily seen as “pillars” of psychology by many researchers. Furthermore, it would be impossible to conduct an analysis on an uncontroversial list of constructs, because, according to our knowledge, such a list simply does not exist. Finally, the motives we have brought into discussion to “elect” evolutionary psychology as the most compelling metatheory are reasonable, nor totaling or orthodox.

The theoretical chaos affecting psychology is not news (James 1894; Heidbreder 1933; Cronbach 1957; Miller 1985), however, most unification claims have been made in an argumentative fashion and have focused on methodological, philosophical and conceptual issues. On the other hand, many studies have been conducted to prove that psychology is more chaotic and “softer” than other sciences, or to assess the prominence of its “school of thoughts”. None of these studies, however, have directly made a claim in the unification issue. This article wants to be a bridge between these two respectful “traditions” to make a theoretical claim on an empirical ground.

Overcoming a pre-paradigmatic condition with the aid of evolutionary psychology is in our opinion, a reachable and desirable aim. An evolutionary psychological approach must not be intended as a monolithic theory but as a comprehensive and conciliatory approach, not excluding empirical findings of other theories. This would not mean an indiscriminate gathering of all the theories, rather a coherent yet comprehensive application of the evolutionary principles in psychology. Finally, we believe that theoretical coherence and consistency can be pursued without orthodox tendencies.

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Compliance with Ethical Standards

Conflict of Interest Andrea Zagaria declares that he has no conflict of interest. Agata Ando’ declares that she has no conflict of interest. Alessandro Zennaro declares that he has no conflict of interest.

Ethical Approval This article does not contain any studies with human participants or animals performed by any of the authors.

Appendix

Table 1 Definitions of psychology, mind & behavior

Authors	Psychology is the scientific study of	Mind is	Behavior is / refers to
Benstein et al. 2012 <i>Psychology, 9th edition</i>	Mind and behavior <i>p.4.</i>	X	X
Cacioppo and Freberg 2013 <i>Discovering psychology: The science of mind</i>	Mind and behavior <i>p.5</i>	The brain and its activities, including thought, emotion, and behaviour. <i>p.5</i>	any action that we can observe <i>p.5</i>
Ciccarelli and White 2018 <i>Psychology</i>	Mind and behavior <i>p.44</i>	all the internal, covert (hidden) activity such as thinking, feeling, and remembering <i>p.44</i>	all of our outward or overt actions and reactions, such as talking, facial expressions, and movement <i>p.44</i>
Feist and Rosenberg 2012 <i>Psychology: Perspectives and Connections.</i>	thought and behavior <i>p.5</i>	Brain and behaviour <i>p.5</i>	X
Grisson et al. 2017 <i>Psychology in your life</i>	Mind and behavior <i>p.5</i>	X	all of our actions that result from sensing and interpreting information <i>p.5</i>
Hockenbury et al. 2015 <i>Psychology</i> (7th ed.)	Mind and behavior and brain processes <i>p.2</i>	X	X
Lilienfeld et al. 2014 <i>Psychology: From inquiry to understanding</i> (3rd ed.)	mind, brain, and behavior <i>p.35</i>	X	X
Myers and DeWall 2015 <i>Psychology</i> (11th ed.)	Mental processes and behavior <i>p.5</i>	internal, subjective experiences we infer from behavior—sensations, perceptions, dreams, thoughts, beliefs, and feelings. <i>p.5</i>	anything an organism does—any action we can observe and record <i>p.5</i>
Schacter et al. 2014 <i>Psychology</i> (3rd ed.)	mind and behavior <i>p.2</i>	the private inner experience of perceptions, thoughts, memories, and feelings <i>p.2</i>	observable actions of human beings and nonhuman animals <i>p.2</i>

Table 1 (continued)

Authors	Psychology is the scientific study of	Mind is	Behavior is / refers to
VandenBos 2015 <i>APA dictionary of psychology, second edition</i>	the mind and behavior <i>p. 860</i>	broadly, all intellectual and psychological phenomena of an organism, encompassing motivational, affective, behavioral, perceptual, and cognitive systems; that is, the organized totality of an organism's mental and psychic processes and the structural and functional cognitive components on which they depend. (...) <i>p.654</i>	an organism's activities in response to external or internal stimuli <i>p.112</i>
Weiten 2013 <i>Psychology: Themes and variations, 9th edition</i>	behavior and the physiological and cognitive processes that underlie it <i>p.2</i>	X	X
Zimbardo et al. 2017 <i>Psychology: Core concepts</i> (8th ed.)	behavior and mental processes. <i>p.2</i>	X	X

Note:

1. sign **X** when the definition has been found missing
2. in some tables, definitions have logic inconsistency. These inconsistencies (i.e. tautologies or equivalences) are explained and highlighted
3. when the original formulators have been explicitly cited by the authors, they have been mentioned in the box and in the references
4. specific comments have been made in italics (e.g. subdivision of memory in long term memory and short-term memory, etc.)
5. the pages on which the definitions are presented are listed below the definitions.

Table 2 Definitions of attention, consciousness & cognition

Authors	(selective) Attention	Consciousness	Cognition
Bernstein et al. 2012 <i>Psychology, 9th edition</i>	The process of directing and focusing psychological resources to enhance perception, performance, and mental experience <i>p.184</i>	Tautological: Awareness of external stimuli and one's own mental activity. (Metzinger 2000 ; Zeman 2001) <i>p.331</i>	X
Cacioppo and Freberg 2013 <i>Discovering psychology: The science of mind</i>	X	Tautological: A state of awareness. <i>p.236</i>	Internal mental processes including information processing, thinking, reasoning, and problem solving. <i>p.454</i>
Ciccarelli and White 2018 <i>Psychology</i>	X	Tautological: a person's awareness of everything that is going on around him or her at any given time. (Farthing 1992) <i>p.178</i>	Considered as equal to thinking mental activity that goes on in the brain when a person is organizing and attempting to understand information and communicating information to others. <i>p.306</i>
Feist and Rosenberg 2012 <i>Psychology: Perspectives and Connections.</i>	the limited capacity to process information that is under conscious control. (Styles 2006) <i>p.230</i>	Tautological: an awareness of one's surroundings and of what's in one's mind at a given moment; includes aspects of being awake and aware. <i>p.226</i>	mental processes involved in acquiring, processing, and storing knowledge. <i>p.364</i>
Grisson et al. 2017 <i>Psychology in your life</i>	X	Tautological: The combination of a person's subjective experience of the external world and the person's mental activity; this combination results from brain activity. <i>p.79</i>	X
Hockenbury et al. 2015 <i>Psychology (7th ed.)</i>	the capacity to selectively focus senses and awareness on particular stimuli or aspects of the environment (Chun et al. 2011 ; Posner and Rothbart 2007) <i>p.135</i>	Tautological: Personal awareness of mental activities, internal sensations, and the external environment <i>p.135</i>	mental activities involved in acquiring, retaining, and using knowledge <i>p.273</i>
Lilienfeld et al. 2014 <i>Psychology: From inquiry to understanding (3rd ed.)</i>	X	Tautological: our subjective experience of the world, our bodies, and our mental perspectives <i>p.200</i>	Considered as equal to thinking the term psychologists use to describe the mental processes involved in different aspects of thinking <i>p.61</i>
Myers and DeWall 2015 <i>Psychology (11th ed.)</i>	the focusing of conscious awareness on a particular stimulus. <i>p.96</i>	X	all the mental activities associated with thinking, knowing, remembering, and communicating. <i>p.357</i>
Schacter et al. 2014	perceiving only what's currently relevant to you	Tautological:	X

Table 2 (continued)

Authors	(selective) Attention	Consciousness	Cognition
<i>Psychology (3rd ed.)</i>	<i>p.135</i>	A person's subjective experience of the world and the mind. <i>p.178</i>	
VandenBos 2015 <i>APA dictionary of psychology, second edition</i>	a state in which cognitive resources are focused on certain aspects of the environment rather than on others and the central nervous system is in a state of readiness to respond to stimuli. <i>p.87</i>	Tautological: 1. the state of being conscious 2. an organism's awareness of something either internal or external to itself. <i>p.236</i>	all forms of knowing and awareness, such as perceiving, conceiving, remembering, reasoning, judging, imagining, and problem solving. <i>p.201</i>
Weiten 2013 <i>Psychology: Themes and variations, 9th edition</i>	focusing awareness on a narrowed range of stimuli or events. <i>p.275</i>	Tautological: is the awareness of internal and external stimuli. <i>p.184</i>	refers to the mental processes involved in acquiring knowledge <i>p.14</i> // <i>p.314</i>
Zimbardo et al. 2017 <i>Psychology: Core concepts (8th ed.)</i>	a feature that makes one item stand out among others in consciousness <i>p.290</i>	The brain process that creates our mental representation of the world and our current thoughts. <i>p.289</i>	refers broadly to mental processes or thinking <i>p.190</i>

Note:

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3. when the original formulators have been explicitly cited by the authors, they have been mentioned in the box and in the references
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5. the pages on which the definitions are presented are listed below the definitions

Attention is as multifaceted construct rather than a single concept. Many components have been proposed: selective attention (subdivided in feature-based, object-based, space-based), sustained attention, executive attention... In order not to broaden uncontrollably, our analysis focused on the concept of selective attention alone

Table 3 Definitions of decision-making, intelligence & language

Authors	Decision-making	Intelligence	Language
Bernstein et al. 2012 <i>Psychology, 9th edition</i>	X	cognitive ability: the capacity to reason, remember, understand, solve problems, and make decisions <i>p.373</i> // Personal attributes that center around skill at information processing, problem solving, and adapting to new or changing environments <i>p.374</i>	Symbols and a set of rules for combining them that provide a vehicle for communication. <i>p.315</i>
Cacioppo and Freberg 2013 <i>Discovering psychology: The science of mind</i>	X	The ability to understand complex ideas, adapt effectively to the environment, learn from experience, engage in reasoning, and overcome obstacles (Neisser et al. 1996 , p. 77) <i>p.489</i>	A system for communicating thoughts and feelings using arbitrary signals. <i>p.478</i>
Ciccarelli and White 2018 <i>Psychology</i>	process of cognition that involves identifying, evaluating, and choosing among several alternatives. <i>p.311</i>	The ability to learn from one's experiences, acquire knowledge, and use resources effectively in adapting to new situations or solving problems (Sternberg and Kaufman 1998 ; Wechsler 1975) <i>p.311</i>	a system for combining symbols (such as words) so that an unlimited number of meaningful statements can be made for the purpose of communicating with others. <i>p.338</i>
Feist and Rosenberg 2012 <i>Psychology: Perspectives and Connections.</i>	X	a set of cognitive skills that includes abstract thinking, reasoning, problem solving, and the ability to acquire knowledge. <i>p.387</i>	a communication system specific to <i>Homo sapiens</i> ; it is open and symbolic, has rules of grammar, and allows its users to express abstract and distant ideas. (Bickerton 1995) <i>p.349</i>
Grisson et al. 2017 <i>Psychology in your life</i>	attempting to select the best alternative among several options. <i>p.278</i>	The ability to use knowledge to reason, make decisions, make sense of events, solve problems, understand complex ideas, learn quickly, and adapt to environmental challenges <i>p.287</i>	X
Hockenbury et al. 2015 <i>Psychology (7th ed.)</i>	X	the global capacity to think rationally, act purposefully, and deal effectively with the environment (Wechsler 1944, 1977) <i>p.290</i>	A system for combining arbitrary symbols to produce an infinite number of meaningful statements. <i>p.284</i>
Lilientfeld et al. 2014	the process of selecting among a set of possible alternatives	X	largely arbitrary system of communication that combines symbols (such as words and

Table 3 (continued)

Authors	Decision-making	Intelligence	Language
<i>Psychology: From inquiry to understanding</i> (3rd ed.)	<i>p. 325</i>		gestural signs) in rule-based ways to create meaning <i>p.330</i>
Myers and DeWall 2015 <i>Psychology</i> (11th ed.)	X	the mental potential to learn from experience, solve problems, and use knowledge to adapt to new situations. <i>p.386</i>	our spoken, written, or signed words and the ways we combine them to communicate meaning. <i>p.370</i>
Schacter et al. 2014 <i>Psychology</i> (3rd ed.)	X	the ability to direct one's thinking, adapt to one's circumstances, and learn from one's experiences (Gottfredson 1997) <i>p.396</i>	a system for communicating with others using signals that are combined according to rules of grammar and convey meaning. <i>p.352</i>
VandenBos 2015 <i>APA dictionary of psychology: second edition</i>	the cognitive process of choosing between two or more alternatives, ranging from the relatively clear cut (e.g., ordering a meal at a restaurant) to the complex (e.g., selecting a mate). <i>p.286</i>	the ability to derive information, learn from experience, adapt to the environment, understand, and correctly utilize thought and reason. <i>p.548</i>	system for expressing or communicating thoughts and feelings through speech sounds or written symbols. <i>p.585</i>
Weiten 2013 <i>Psychology: Themes and variations, 9th edition</i>	evaluating alternatives and making choices among them. <i>p.333</i>	X	consists of symbols that convey meaning, plus rules for combining those symbols, that can be used to generate an infinite variety of messages <i>p.314</i>
Zimbardo et al. 2017 <i>Psychology: Core concepts</i> (8th ed.)	X	is the mental capacity to acquire knowledge, reason, and solve problems effectively <i>p.207</i>	our ability to communicate through spoken and written words and gesture <i>p.245</i>

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5. the pages on which the definitions are presented are listed below the definitions

Table 4 Definitions of learning, memory & perception

Authors	Learning	Memory	Perception
Bernstein et al. 2012 <i>Psychology, 9th edition</i>	The modification through experience of preexisting behavior and understanding <i>p.197</i>	X	The process through which sensations are interpreted, using knowledge and understanding of the world, so that they become meaningful experiences. <i>p.157</i>
Cacioppo and Freberg 2013 <i>Discovering psychology: The science of mind</i>	A relatively permanent change in behavior or the capacity for behavior due to experience. <i>p.350</i>	The ability to retain knowledge. <i>p.399</i>	The process of interpreting sensory information. <i>p.181</i>
Ciccarelli and White 2018 <i>Psychology</i>	any relatively permanent change in behavior brought about by experience or practice. <i>p.218</i>	an active system that receives information from the senses, puts that information into a usable form, and organizes it as it stores it away, and then retrieves the information from storage. (adapted from Baddeley 1996, 2003). <i>p.264</i>	the method by which the sensations experienced at any given moment are interpreted and organized in some meaningful fashion. <i>p.160</i>
Feist and Rosenberg 2012 <i>Psychology: Perspectives and Connections.</i>	enduring changes in behavior that occur with experience. <i>p.306</i>	the ability to store and use information. <i>p.270</i>	the act of organizing and interpreting sensory experience <i>p.125</i>
Grisson et al. 2017 <i>Psychology in your life</i>	a change in behavior, resulting from experience. <i>p.197</i>	The nervous system's capacity to acquire and retain skills and knowledge for later retrieval. <i>p.233</i>	The processing, organization, and interpretation of sensory signals in the brain; these processes result in an internal neural representation of the physical stimulus.

Table 4 (continued)

Authors	Learning	Memory	Perception
Hockenbury et al. 2015 <i>Psychology (7th ed.)</i>	A process that produces a relatively enduring change in behavior or knowledge as a result of past experience. <i>p. 183</i>	refers to the mental processes that enable us to acquire, retain, and retrieve information. <i>p. 228</i>	<i>p. 157</i> The process of integrating, organizing, and interpreting sensations. <i>p. 86</i>
Lilienfeld et al. 2014 <i>Psychology: From inquiry to understanding (3rd ed.)</i>	change in an organism's behavior or thought as a result of experience <i>p. 236</i>	retention of information over time <i>p. 276</i>	The brain's interpretation of raw sensory inputs <i>p. 156</i>
Myers and DeWall 2015 <i>Psychology (11th ed.)</i>	the process of acquiring through experience new information or behaviors. <i>p. 280</i>	The persistence of learning over time through the encoding, storage, and retrieval of information. <i>p. 318</i>	the process of organizing and interpreting sensory information, enabling us to recognize meaningful objects and events. <i>p. 230</i>
Schacter et al. 2014 <i>Psychology (3rd ed.)</i>	involves the acquisition of new knowledge, skills, or responses from experience that results in a relatively permanent change in the state of the learner <i>p. 266</i>	The ability to store and retrieve information over time. <i>p. 222</i>	The organization, identification and interpretation of a sensation in order to form a mental representation. <i>p. 130</i>
VandenBos 2015 <i>APA dictionary of psychology, second edition</i>	the acquisition of novel information, behaviors, or abilities after practice, observation, or other experiences, as evidenced by change in behavior, knowledge, or brain function <i>p. 594</i>	the ability to retain information or a representation of past experience, based on the mental processes of learning or encoding, retention across some interval of time, and retrieval or reactivation of the memory. <i>p. 636</i>	the process or result of becoming aware of objects, relationships, and events by means of the senses, which includes such activities as recognizing, observing, and discriminating. These activities enable

Table 4 (continued)

Authors	Learning	Memory	Perception
Weiten 2013 <i>Psychology: Themes and variations, 9th edition</i>	is any relatively durable change in behavior or knowledge that is due to experience <i>p.230</i>	X	organisms to organize and interpret the stimuli received into meaningful knowledge and to act in a coordinated manner. <i>p.775</i>
Zimbardo et al. 2017 <i>Psychology: Core concepts (8th ed.)</i>	a process through which experience produces a lasting change in behavior or mental processes <i>p.118</i>	Human memory is an information processing system that works constructively to encode, store, and retrieve information. <i>p.154</i>	mental process that elaborates and assigns meaning to the incoming sensory patterns <i>p.76</i>

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 4. specific comments have been made below in italics (e.g. subdivision of memory in long term memory and short-term memory, etc.)
 5. the pages on which the definitions are presented are listed below the definitions
- Like attention, memory is a multifaceted phenomenon rather than a single concept. Sensorial memory, working memory, short-term memory, long term memory (divided in episodic, semantic, explicit or implicit memory), are all dimensions currently studied. In order not to broaden excessively our analysis our focus has been on the general definition of the term*

Table 5 Definitions of problem-solving, reasoning & sensation

Authors	Problem-solving	Reasoning	Thinking
Bernstein et al. 2012 <i>Psychology, 9th edition</i>	X	The process by which people generate and evaluate arguments and reach conclusions about them <i>p.295</i>	The manipulation of mental representations <i>p.287</i>
Cacioppo and Freberg 2013 <i>Discovering psychology: The science of mind</i>	The use of information to meet a specific goal. (Lovett 2002) <i>p.462</i>	X	X
Ciccarelli and White 2018 <i>Psychology</i>	process of cognition that occurs when a goal must be reached by thinking and behaving in certain ways. <i>p.311</i>	X	considered as equal to cognition mental activity that goes on in the brain when a person is organizing and attempting to understand information and communicating information to others. <i>p.306</i>
Feist and Rosenberg 2012 <i>Psychology: Perspectives and Connections.</i>	X	the process of drawing inferences or conclusions from principles and evidence. (Sternberg 2006) <i>p.368</i>	X
Grisson et al. 2017 <i>Psychology in your life</i>	Finding a way around an obstacle to reach a goal. <i>p.278</i>	Using information to determine if a conclusion is valid or reasonable. <i>p. 277</i>	The mental manipulation of representations of information we encounter in our environments <i>p.271</i>
Hockenbury et al. 2015 <i>Psychology (7th ed.)</i>	Thinking and behavior directed toward attaining a goal that is not readily available. (Novick and Bassok 2005)	X	The manipulation of mental representations of information in order to draw

Table 5 (continued)

Authors	Problem-solving	Reasoning	Thinking
Lilienfeld et al. 2014 <i>Psychology: From inquiry to understanding</i> (3rd ed.)	<i>p. 277</i> generating a cognitive strategy to accomplish a goal <i>p. 326</i>	X	inferences and conclusions. <i>p. 273</i> any mental activity or processing of information, including learning, remembering, perceiving, communicating, believing, and deciding <i>p. 320</i>
Myers and DeWall 2015 <i>Psychology</i> (11th ed.)	X	X	X
Schacter et al. 2014 <i>Psychology</i> (3rd ed.)	X	mental activity that consists of organizing information or beliefs into a series of steps in order to reach conclusions. <i>p. 388</i>	X
VandenBos 2015 <i>APA dictionary of psychology, second edition</i>	the process by which individuals attempt to overcome difficulties; achieve plans that move them from a starting situation to a desired goal, or reach conclusions through the use of higher mental functions, such as reasoning and creative thinking <i>p. 837, 838</i>	thinking in which logical processes of an inductive or deductive character are used to draw conclusions from facts or premises. <i>p. 886</i>	cognitive behavior in which ideas, images, mental representations, or other hypothetical elements of thought are experienced or manipulated. <i>p. 1084</i>
Weiten 2013 <i>Psychology: Themes and variations, 9th edition</i>	active efforts to discover what must be done to achieve a goal that is not readily attainable. <i>p. 324</i>	X	X

Table 5 (continued)

Authors	Problem-solving	Reasoning	Thinking
Zimbardo et al. 2017 <i>Psychology: Core concepts (8th ed.)</i>	X	the ability to compare and evaluate contradictory view- points (Baltes and Staudinger 1993; King and Kitchener 1994) <i>p.275</i>	Thinking is a cognitive process in which the brain uses information from the senses, emotions, and memory to create and manipulate mental representations, such as concepts, images, schemas, and scripts. <i>p.190</i>

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Table 6 Definitions of thinking, emotion & motivation

Authors	Emotion	Motivation	Sensation
Bernstein et al. 2012 <i>Psychology, 9th edition</i>	Transitory positive or negative experiences that are felt as happening to the self, are generated in part by cognitive appraisal of a situation, and are accompanied by both learned and innate physical responses. <i>p.446</i>	The factors that influence the initiation, direction, intensity, and persistence of behavior (Reeve 1996) <i>p.413</i>	Messages from the senses that make up the raw information that affects many kinds of behavior and mental processes <i>p.109</i>
Cacioppo and Freberg 2013 <i>Discovering psychology: The science of mind</i>	A combination of arousal, physical sensations, and subjective feelings that occurs spontaneously in response to environmental stimuli. <i>p.288</i>	A process that arouses, maintains, and guides behavior toward a goal. <i>p.289</i>	The process of detecting environmental stimuli or stimuli arising from the body. <i>p.181</i>
Ciccarelli and White 2018 <i>Psychology</i>	the “feeling” aspect of consciousness, characterized by a certain physical arousal, a certain behavior that reveals the emotion to the outside world, and an inner awareness of feelings. <i>p.413</i>	the process by which activities are started, directed, and continued so that physical or psychological needs or wants are met. (Petri 1996) <i>p.396</i>	the process that occurs when special receptors in the sense organs are activated, allowing various forms of outside stimuli to become neural signals in the brain. <i>p.134</i>
Feist and Rosenberg 2012 <i>Psychology: Perspectives and Connections.</i>	brief, acute changes in conscious experience and physiology that occur in response to a personally meaningful situation. <i>p.449</i>	the urge to move toward one's goals <i>p.426</i>	The stimulation of our sense organs by the outer world <i>p.124</i>
Grisson et al. 2017 <i>Psychology in your life</i>	Feelings that involve physical responses, changes in thoughts and in actions, and personal evaluation. <i>p.324</i>	Factors of differing strength that energize, direct, and sustain behavior. <i>p.309</i>	The sense organs' detection of external physical stimulus and the transmission of information about this stimulus to the brain. <i>p.157</i>
Hockenbury et al. 2015 <i>Psychology (7th ed.)</i>	A complex psychological state that involves a subjective experience, a		

Table 6 (continued)

Authors	Emotion	Motivation	Sensation
Lilienfeld et al. 2014 <i>Psychology: From inquiry to understanding</i> (3rd ed.)	physiological response, and a behavioral or expressive response. <i>p.330</i> mental state or feeling associated with our evaluation of our experiences <i>p.442</i>	The biological, emotional, cognitive, or social forces that activate and direct behavior. <i>p.314</i> psychological drives that propel us in a specific direction <i>p.465</i>	The process of detecting a physical stimulus, such as light, sound, heat, or pressure. <i>p.86</i> detection of physical energy by sense organs, which then send information to the brain <i>p.156</i>
Myers and DeWall 2015 <i>Psychology</i> (11th ed.)	a response of the whole organism, involving (1) physiological arousal, (2) expressive behaviors, and (3) conscious experience. <i>p.461</i>	a need or desire that energizes and directs behavior. <i>p.420</i>	the process by which our sensory receptors and nervous system receive and represent stimulus energies from our environment. <i>p.230</i>
Schacter et al. 2014 <i>Psychology</i> (3rd ed.)	positive or negative experience that is associated with a particular pattern of physiological activity. <i>p.316</i>	the purpose for or psychological cause of an action <i>p.330</i> <i>disposition, impetus, cause - purpose</i>	simple stimulation of a sense organ <i>p.130</i>
VandenBos 2015 <i>APA dictionary of psychology, second edition</i>	complex reaction pattern, involving experiential, behavioral, and physiological elements, by which an individual attempts to deal with a personally significant matter or event. <i>p.362</i>	the impetus that gives purpose or direction to behavior and operates in humans at a conscious or unconscious level <i>p.670</i>	the process or experience of perceiving through the senses. <i>p.962</i>
Weiten 2013 <i>Psychology: Themes and variations, 9th edition</i>	involves (1) a subjective conscious experience (the cognitive component) accompanied by (2) bodily arousal (the physiological component) and by (3) characteristic overt expressions (the behavioral component)	involves goal-directed behavior. <i>p.388</i>	the stimulation of sense organs <i>p. 130</i>

Table 6 (continued)

Authors	Emotion	Motivation	Sensation
Zimbardo et al. 2017 <i>Psychology: Core concepts (8th ed.)</i>	<i>p. 411</i> Emotion is a process involving four main components: physiological arousal, cognitive interpretation, subjective feelings, and behavioral expression (...) Emotions are a special class of motives that help us attend to and respond to important (usually external) situations and communicate our intentions to others <i>p.361</i>	Motives are internal dispositions to act in certain ways, although they can be influenced by multiple factors, both internal and external. <i>p.324</i>	process by which a stimulated receptor (such as the eyes or ears) creates a pattern of neural messages that represent the stimulus in the brain, giving rise to our initial experience of the stimulus. <i>p.765</i>

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