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Scientific Psychology, Origin Myths, and the Need for a New Psychology

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Abstract The present paper examines three origin myths in psychology (the Ontology myth, the Epistemology myth, and the Taxonomy myth) that have fostered mistaken and erroneous beliefs regarding the nature, investigation, and classification of psychological processes and have become institutionalized in the way we talk about and do psychology. These three origin myths have simultaneously created a scientific brand for modern psychology as well as lingering doubts about the scientific authenticity of psychology. The present paper debunks the three origin myths of psychology and proffers alternatively: 1) an emergent, stochastic, and integrative definition of psychology, 2) a unified and integrated science of psychology, and 3) a positive and supportive professional culture for the new psychology. In sum, a new psychology is recommended that is based upon a wide definition of the discipline of psychology and a strict, narrow definition of the science of psychology.

Keywords Scientific psychology, Origin myths, Emergent, Stochastic, Definition of psychology, Physics and psychology, New Psychology

1. Introduction

The problem with scientific psychology is in many ways straightforward and compelling. More than 140 years after Wundt's 1879 introduction of the first experimental psychology laboratory and the advent of scientific psychology (Wundt, 1909; Robinson, 2001), many people still doubt psychology is a science or relegate it to the soft sciences. Questioning the scientific authenticity of psychology can be traced back to the inception of scientific psychology and has continued to a greater or lesser extent across the five waves of psychology (Introspection, Gestalt, Psychoanalysis, Behaviorism, and Eclectic [Krupka, 2019]). There is to this day a clear credibility gap between what psychologists and non-psychologists consider the scientific authenticity of psychology.

That credibility gap is evident in how science is conceptualized differently by psychologists and non-psychologists. Most people would probably agree with the following statement describing science: The systematic study of the nature and behavior of the material and physical universe, based on observation, experiment, and measurement, and the formulation of laws to describe these facts in general terms (Collins Dictionary, 2019; Dictionary. Com, 2020; Merriam-Webster, 2020). In a very real sense, modern physics, with its demonstrable laws and robust mathematical models predictive of both the large and small scale, has become the face of science for the scientific community and the larger general public.

Psychologists, on the other hand, define their science differently. According to the American Psychological Association (APA, October 2019):

The science of psychology benefits society and enhances our lives. Psychologists examine the relationship between brain function and behavior, and the environment and behavior, applying what they learn to illuminate our understanding and improve the world around us ..... Using empirical methods, psychologists apply that universal curiosity to collect and interpret research data to better understand and solve some of society's most challenging problems ..... Psychologists employ the scientific method-stating the question, offering a theory, and then constructing rigorous laboratory or field experiments to test the hypothesis. Psychologists apply the understanding gleaned through research to create evidence-based strategies that solve problems and improve lives ..... The result is that psychological science unveils new and better ways for people to exist and thrive in a complex world.

As indicated above, APA mixes scientific method and marketing claims into the very definition of the science of psychology, thus forfeiting by default the customary neutral sounding definition of science. APA explicitly claims psychologists use empirical and scientific methods to

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improve the world around us (universal relevance). Yet despite all the professional claims-making, psychologists have failed to convince the larger scientific community and the general public of their scientific authenticity. Most people think science studies the natural world using the scientific methods of observation, experiment, and measurement in order to establish facts and to formulate laws. Most people think human mental processes and human behavior are qualitatively different from physical processes, and the scientific methods of psychologists and physicists are only remotely similar at best.

Much less apparent than the above credibility gap between psychologists and non-psychologists is how this credibility gap developed and persisted, despite literally tens of thousands of experimental and scientific studies across nearly a century and a half of modern psychology. The present paper contends there are three origin myths in psychology (widely held false beliefs concerning the nature, investigation, and classification of psychological processes) that can account for the "credibility gap" between what psychologists and non-psychologists consider the scientific authenticity of psychology. These three origin myths (the Ontology Myth, the Epistemology Myth, and the Taxonomy Myth) have had a profound and pervasive impact on all corridors of psychology. They have limited our understanding of the nature, investigation, and classification of psychological processes and human behavior. They have also, ironically, de-authenticated the science of psychology in the minds of the larger scientific community and the general public.

The purpose of the present paper, then, is to debunk the three origin myths of psychology and to proffer, alternatively, the following: First, a more ontologically accurate definition of human psychology and human psychological processes; Second, a new "Unified and Integrated Science of Psychology" for the 21st century: and, Third, a positive and supportive professional culture for the new psychology. This new psychology better reflects the full spectrum of psychological processes in the human species, how to describe, investigate, and explain that spectrum, and is more likely to advance the disciple of psychology and to be embraced by the larger scientific community and general public.

2. The Three Origin Myths in Psychology

The first origin myth associated with the advent of scientific psychology is the Ontology Myth. The Ontology Myth pertains to the very nature of psychological phenomena. It contends, explicitly and/or implicitly, that psychological phenomena are analogous to physical phenomena in the natural world. There is presumably lawfulness and universality governing both physical and psychological phenomena (see McLeod [2008] to appreciate how Wundt seeded the classical model of science in psychology). While there is in fact categorical empirical evidence of lawfulness and strong causality governing the physical universe, there is virtually no empirical evidence of lawfulness and strong causality governing human mental processes and human behavior (Kilbourne et al., 1988). Scientific and empirical based data in the social sciences are 100% stochastic, and we can only see evidence of weak causality across the full reach of the social sciences (Northrop in Heisenberg, 1958, pp.13-16; Kilbourne et al., 2014).

A stochastic process cannot be predicted precisely because it has a randomly determined pattern (having a random probability distribution) or a pattern that can be analyzed statistically. In a stochastic process there is indeterminacy, whereby movement to the next state or position only depends on the current state or position and is independent of prior states or positions. In a deterministic process, when the initial point is known, each subsequent step has a probability of 1 (complete certainty), which is not the case with a stochastic process. Stochastic models, due to families of randomness, are thus considerably more complex than deterministic models. For example, in a psychology experiment, the null hypothesis, which one never proves, indicates no significant difference between treatment and control conditions and is characterized by a random probability distribution. In a psychology experiment, the alternative hypothesis is supported when a *statistical analysis indicates a pattern of difference* occurring between the treatment and control condition with a probability in a normal distribution equal to or less than .05.

Stochastic data reported by psychologists are inherently different, ontologically and qualitatively, from the lawful data reported by physicists at both the classical and quantum levels of physics. A law in physics is a generalized rule, which implies a cause and effect relationship, and which always applies under the same conditions. For example, two objects of different mass dropped in free fall in a satellite were found to fall at a rate within two-trillionths of a percent of one another, thus confirming both Galileo and Einstein (Saplakoglu, 2020) and, therefore, the law of gravity (small differences in measurement may indicate current limits in calibration and/or the influence of other forces of nature, such as dark matter). There are no such laws in modern psychology (i.e., as per the generally accepted definition of lawfulness used by the scientific community) as there are in modern physics (e.g., as related to gravity, electromagnetism, the weak nuclear force, and the strong nuclear force, which all pertain to attraction and repulsion). There is no quantum state or complementarity in modern psychology as there is in quantum physics (e.g., the wave-particle duality*[1]). There is no precise individual prediction in psychology experiments as there is in physics experiments.

Psychologists, for example, cannot predict how a given individual in the treatment condition of a psychology experiment will or will not be affected by the independent variable or to what extent, nor can psychologists predict a given individual's exact or even approximate response on

any given item or scale in a standardized test (psychologists must rely instead on a constructed confidence interval after-the-fact to ascertain the "range" of the individual's response). Using statistics, then, psychologists cannot predict a priori an individual's exact or approximate response from group studies or standardized tests.

Similarly, physicists when using statistics cannot predict individual particle properties from ensemble averages. However, physicists, completely unlike psychologists, are also able to use the rules of mathematics, due to the ontological differences between physical processes and psychological processes, to ascertain a high degree of exactness or near exactness of certain physical phenomena, such as the orbit of a planet around its sun, the speed of light, the free fall of two objects of different mass, the high probability location of an electron, or to explain the experimental data in the field of quantum mechanics.

Moreover, probability itself is treated differently in physics and psychology. In psychology, probability (e.g., different degrees of variability or explained variance in psychology experiments) is an inherent characteristic of the entire spectrum of human psychological processes, whereas in physics probability is viewed and treated differently in classical physics versus quantum physics. In classical physics, probability (and hence uncertainty) is viewed as a characteristic of the method of investigation (statistics), not as a characteristic of the physical universe, and as a way, an epistemological choice, to investigate large bodies of information in a deterministic system,*[2] while ignoring some of the detailed information of that system (hence no uncertainty). In quantum physics, probability is mandated ontologically by the inherent and pervasive uncertainty at that level of nature itself, unlike the pattern of random and non-random probability of human psychological processes. In sum, physical phenomena in the natural world and psychological phenomena in the human world are ontologically and qualitatively different, and they are unquestionably characterized by different organizing principles.

The ontological difference between modern physics and modern psychology is perhaps best explained by John Barrow (1995). Barrow (1995) contends the laws of nature are simple due to symmetry principles, which apply to the physical universe and are, therefore, Platonic (mathematical). The outcomes of these laws, as, for example, in biology, are Aristotelian (teleological) and complex, with no symmetry principles or "broken symmetry." Such "emerging complexities" proceed from the simple laws of physics to complex outcomes in fields such as biology, psychology, sociology, anthropology, and economics. Emerging complexities in the human species appear to have ultimately evolved from the evolution of living organisms out of nonliving matter and to co-vary with the ongoing evolution of the universe. With the continued advance of science and technology, we should expect human engineers, in turn, to produce their own emerging complexities (i.e., planned stochastic outcomes) and to evolve the human species by transforming human biology, psychology, social systems, and physical environments.

In psychology, non-reducible emerging complexities are best evident in the following conundrum. On the one hand, all psychological processes are ultimately biological in nature because they only emerge in a species-specific, living, biological organism, the human being. On the other hand, most psychological studies of human beings across the spectrum of sub-disciplines, from early development, through maturity, and up to aging, cannot be reduced to specific biological mechanisms and none can be expressed in the form of mathematical and lawful equations. The majority of explained variance in empirical psychological studies is attributable to individual differences, context (physical and/or social), and culture. Similarly, sociology (the study of the development, structure, and functioning of society), anthropology (the study of human communities and culture), and economics (the study of production, consumption, and wealth, and the most mathematical and quantitative of the social sciences) are emerging complexities within human culture that cannot be reduced to psychology, biology, chemistry, or physics.

Therefore, because physical and psychological phenomena are ontologically and qualitatively different from one another (deterministic versus non-deterministic), psychologists are unable to construct a good dependent model of psychological reality in the same sense that physicists have constructed a good dependent model of physical reality (Hawking & Mlodinow, 2010). A good dependent model of reality is elegant, contains few arbitrary or adjustable elements, agrees with and explains all existing observations, and makes detailed predictions of future observations that can either disprove or falsify the model if they are not borne out.

The second origin myth associated with the advent of scientific psychology is the Epistemology Myth. The Epistemology Myth pertains to how psychological processes are investigated scientifically. Early scientific psychology embraced an arbitrary and erroneous application of experimental methodology to investigate psychological processes and behavior. More succinctly, Wundt (see McLeod, 2008) was determined to seed the classical model of science in psychology, and more than 140 years later that seed grew into a kudzu vine that smothered the discipline. A "classical model" of experimental methodology became reified in psychology and was characterized by nonprobability sampling of participants, small sample size experiments, and even smaller numbers of participants randomly assigned to each cell of a psychology experiment. In many respects, the Epistemology Myth follows directly from the Ontology Myth in psychology. If one believes psychological phenomena are universal and lawful, analogous to physical phenomena, then one can study any sample of participants (only limited by the minimum number of participants needed per cell to compute relevant statistical group comparisons) and expect to discover universal and, therefore, generalizable psychological phenomena across all

settings, cultures, and people.

By far most experimental studies cited in psychology textbooks published in the United States have in fact been conducted on white undergraduate college students, and a high percentage of those are female. Recent trends to extend nonprobability sampling (i.e., non-random sampling from an unknown population) to select participants from different cultures in small or large numbers does not alter the equation. Internal validity alone is not both a sufficient and necessary condition to achieve objectivity, reliability, and generalization in a psychology experiment. External validity alone is not both a sufficient and necessary condition to achieve objectivity, reliability, and generalization in a psychology experiment. Both internal and external validity are required, and both together constitute a sufficient and necessary condition to achieve objectivity, reliability, and generalization in a psychology experiment.

The random assignment of participants, who have been selected from a nonprobability sample of an unknown population (e.g., volunteer or convenience sampling), to different conditions in a psychology experiment does not allow generalization beyond a given psychology experiment, regardless of sample size, participant matching, and/or culture. How could it since one does not know the population of the sample, and, furthermore, the random assignment of participants from a nonprobability sample to different conditions in an experiment could in fact magnify bias by chance in one cell or another of an experiment. Thus, the nonprobability sampling of participants from an unknown population, not only compromises the ability to generalize beyond a given psychology experiment, it also compromises the internal validity of the psychology experiment since nonprobability sampling and random assignment are confounded with the independent variable(s) in unknown ways. A nonprobability sample is always a nonprobability sample and a biased data file is always a biased data file.

The facts speak for themselves. A quick perusal of any professional psychology journal or psychology textbook published in the United States indicates exceedingly small numbers of replication studies in general, most of which are based on nonprobability sampling and beset with the same nonprobability sampling problem as in the original experiment. More telling, planned replications in psychology are unquestionably difficult to obtain and some systematic attempts at replication have been found to occur less than chance (Open Science Collaboration, 2015; Rodgers & Shrout, 2017), and, unfortunately, there is no official source in psychology keeping a "scorecard" of successful and unsuccessful replications.

There is another serious problem associated with nonprobability sampling from an unknown population in traditional and contemporary psychology experiments. Inferential statistics in science building are primarily intended to be used with probability sampling from a known population (e.g., simple random sampling, stratified random sampling, cluster random sampling, etc., [Lin, 1976]) because that is the only way sampling error is predictable (Agresti & Agresti, 1989). Inferential statistics are not appropriate for and not intended to be used with non-probability sampling from an unknown population (e.g., quota sampling, volunteer sampling, convenience sampling, etc.) because sampling error is not predictable, regardless of the methodology (e.g., experimental design, quasi-experimental design and/or survey), and should only be used selectively with nonprobability sampling in the case of preliminary pilot studies (Agresti & Agresti, 1989). One cannot obtain a valid estimate of the risk of error with nonprobability sampling (Blalock, 1979). Additionally, non-sampling error, which involves errors of measurement, is unavoidable when using questionnaires and interviews. Total error is thus a function of two independent sources of error [*sampling and non-sampling error*] and cannot be subsequently reduced unless both types are simultaneously controlled (Blalock, 1979). Thus, the random assignment of participants from a nonprobability sample of an unknown population to different conditions of a psychology experiment does not minimize, equalize and/or rule out total error (i.e., sampling error and non-sampling error).

The third origin myth associated with the advent of scientific psychology is the Taxonomy Myth. The Taxonomy Myth pertains to how we categorize and classify psychological processes and has resulted in the ordering of psychological of processes into presumably independent and irreducible basic elements and/or functions (e.g., perception, cognition, memory, learning, emotion, attention, communication, development, social interaction, and self, etc.). The Taxonomy Myth follows directly from the Ontology Myth and the Epistemology Myth. It is as if psychological processes can be reduced to basic elements and/or functions in the human brain, analogous to the basic laws of the universe in physics, the basic chemical elements in the periodic table in chemistry, or the basic types of biological organisms in biology. To the contrary, psychological processes, such as sensation, perception, cognition, memory, attention, communication, social interaction, development, and self, etc., are each complex, interrelated, and integrated information processing systems, not distinct, independent, and irreducible basic elements and/or functions. They are always co-occurring and integrated to a greater or lesser extent with one another, and they cannot be directly observed (except, of course, for behavior), operationally separated from one another, or mathematically defined. When psychologists measure perception in a psychology experiment, for example, they cannot directly observe an individual's perception(s), and they cannot stop or "turn off" other psychological processes, such as sensation, cognition, memory, attention, emotion, behavior, or self, etc., while doing so. When clients sit in a doctor's office waiting for their appointments, they may be listening to background music, adjusting the backrest in their chairs, and reading a magazine, while periodically checking the time from a clock on the wall, or glancing at their cell phones. All information processing systems are on, and they do not stop to check if their sensory, perceptual, cognitive,

affective, and behavior systems are operating in coordination with one another, they just are, and they do so automatically, with or without awareness.

Furthermore, psychologists cannot directly measure a given psychological process in the present, in the actual here and now. The very act of measuring or recording a psychological process, especially when using questionnaires and interviews, occurs after the fact of the psychological process itself, or, in other words, the actual measurement is not occurring at the same time the actual psychological process is occurring. The hard psychology data (i.e., the electronic or physical data file of stochastic scaled responses [nominal, ordinal, ratio, and interval]) are essentially historical, archival, and reported data of past psychological processes. This is even the case with stochastic medical data, such as EKG, EEG, blood pressure and temperature, although the lag time is less apparent.

In sum, these three origin myths in psychology (i.e., Ontology, Epistemology, and Taxonomy) have operated together to promote widely held mistaken beliefs about the nature, investigation, and classification of human psychological processes and human behavior. They have literally become ***institutionalized*** in the way we talk about psychology and do psychology, in the laboratory, in the classroom, and in the community. Unintendedly and ironically, these three origin myths have resulted in simultaneously projecting a scientific brand for professional psychology as well as fostering a lingering doubt, within both the larger scientific community and the general public, regarding the scientific authenticity of psychology.

3. What is Psychology?

Psychology is, of course, many different things, and psychology is certainly different things to different people in different social/cultural contexts. A psychological process is never the exact same thing for a given person at different times, or the exact same thing for different people at the same time. A psychological process never occurs alone or in isolation from other psychological processes. Each psychological process is a complex, interrelated and integrated information processing system which is simultaneously and sequentially operating in unison, to a greater or lesser extent, with other psychological processes. Some of these psychological processes are apparent in other species (sensation, perception, memory, simple cognitive associations and emotions, consciousness),*[3] and some of these psychological processes are species-specific to human beings (higher-order cognition, diverse emotions, language, and complex symbolic and mathematical constructions).

Notwithstanding, there are four common denominators shared by all psychological processes in human beings. Each psychological process is inherently a stochastic process (i.e. indeterminate), an emerging complexity (i.e., a higher-order outcome), co-occurring with other psychological processes, and always experienced by the individual in the present. In other words, psychological processes are not determined, they are not reducible to basic elements and functions, they do not occur alone and in isolation from one another, and they do not exist or occur in the past or future. Psychological processes are always experienced in the present tense as sensing, perceiving, thinking, attending, remembering, behaving, relating, and communicating, with significant within and between individual variability. Psychological processes can be imagined, remembered, or reported in the present using past and future continuous tenses with significant within and between individual variability. Because each moment of human experience passes so quickly from one moment to the next, individuals often confuse the imperceptible change from one present to the next present to the next present and so on and so on, with the past and the future.*[4]

Psychologists rely on different methods, human activities, and human experiences (personal and interpersonal) to understand and learn about human psychology. One way that psychologists learn about human psychology is by using the scientific method. The scientific method is defined by systematic and objective observation, experiment, and measurement, and can provide a sturdy foundation for building the house of psychology. Psychologists also learn about human psychology by studying, participating in, and experiencing the arts (i.e., architecture, sculpture, painting, literature, music, performing, and film). The arts involve the direct creation and construction of symbolic representations by certain human beings (e.g., the artist) as well as the secondary, indirect experiencing of those symbolic representations by other human beings (e.g., the audience). And, of course, psychologists learn about human psychology through their own personal experiences and from the experiences that others share with them (i.e., anecdotes, stories, the media, psychotherapy, devotion, etc.).

In a very real sense, then, whether we are formally trained or untrained as psychologists, whether we prefer scientific or unscientific explanations, whether we rely on our own or other's interpretations of life experiences, we are all psychologists. Consciousness and all psychological processes are built into the genetic make-up and biology of the human species, and we all attempt, to various degrees, to be empirical when we evaluate people by what they say and what they do.

Yet, human beings experience reality differently (i.e., their own personal inner world as well as the outer world they share with others) and respond, in turn, to those internal and external representations differently. This variability in our internal and external realities, along with differences in how we receive and send information, is hard-wired into the human species, and gives rise to variability in constructing our everyday personal and shared realities. It allows human beings to understand the simple organizing principles of the physical universe (lawfulness), to adapt to and modify social and physical environments, and to understand, regulate, and transform their psychosocial and biological selves. The central and peripheral nervous systems of the human species work in concert to give rise to conscious experience, multiple

systems of information processing and directing, and the ability to shift focus while maintaining an awareness of ourselves and our environment.

The uniqueness, complexity, and abject inability to directly measure an individual's psychological experience is no better evident than in the study of human consciousness. Regardless of what theory one applies to explain human consciousness, Electromagnetic Field Theory (Pocket, 2012), Integrated Information Theory (Tononi et al., 2016), or Global Workspace Theory (Baars, 2005), all will agree that consciousness itself is not visible and, therefore, consciousness is not directly observable and measurable. Nonetheless, consciousness must be a necessary condition for all emergent, stochastic, and integrated psychological processes to be experienced, reported, and measured. Yet all we can say categorically about consciousness is that, *"Consciousness itself is an epiphenomenon associated with electrical and chemical reactions in the human brain, and those electrical and chemical reactions are seated in physical matter."*

It follows logically, then, that consciousness is an outcome (Barrow, 1995), unlawful and indeterminate, and is minimally a third-order emerging complexity that has progressed from the simple laws of physical matter (i.e., physical matter to chemical compounds to living biological organisms to consciousness).*[5] The subjective experience of consciousness in human beings involves degrees of awareness of our psychological processes (sensation, perception, cognition, memory, behavior, social interaction, self, etc.) and the environment (i.e., social and physical), and operationally presents itself as a complex display system by which human beings self-regulate and navigate the environment(s). Matter, on the other hand, is a material substance, a collection of atoms, that has mass and takes up space. It is distinct from consciousness, mind and/or spirit, and, most importantly in physics, from energy (in physics, everything is either matter or energy, and, of course, Einstein (1905) showed that the two are interchangeable via the most familiar equation in science, $E=mc^2$).

Psychologists unquestionably need a definition of psychology which reflects the emergent, stochastic, and integrated nature of psychological processes, and which encompasses the diverse ways human beings experience, understand, and express themselves psychologically. Not an arbitrary and de-limiting definition, such as the scientific study of human behavior or the scientific study of mental processes and human behavior, both of which only truncate and trivialize the full depth, range, and complexity of human psychological experiences, and which perpetuate, explicitly and/or implicitly, the erroneous belief that human psychology is lawful or law-like. An apt and succinct definition of psychology is indicated by the following:

Psychology is the scientific and non-scientific study and understanding of emergent, stochastic, and integrated mental processes, behavior, and complex, constructed action sequences in human beings across diverse socio-cultural and physical environments.

4. A Unified and Integrated Science of Psychology

While all dimensions and experiences of human psychology do not involve scientific investigation or scientific understanding, it behooves professional psychologists to develop a sound scientific foundation in order to advance our understanding of human psychology. In science, for instance, it is important to check one's work and to check one's work independent of oneself. But if everyone is making the same error, then everyone is not truly engaged in independent work, and error propagates systematically, sometimes in small, subtle ways, and sometimes exponentially. No one argues contemporaneously in psychology that their empirical findings obtained in laboratory experiments, field experiments, and/or investigations are lawful. However, psychologists continue to write and speak about their empirical findings in very general terms, as if their findings can be applied to people in general, even all people, when in fact they cannot. While psychology experiments in the United States generally employ the random assignment of participants to experimental conditions and increasingly sophisticated statistical analyses, they nonetheless over-rely on nonprobability sampling of participants (e.g., volunteer and convenience sampling) from unknown populations, small sample size investigations, and subjective measurement techniques (e.g., experimenter-specific paper and pencil tests using Likert-type scales), thus preventing valid and reliable general statements to be made about psychological processes in human beings.

What psychologists need is a unified and integrated science of psychology. A model of science capable of connecting the various independent investigations of psychological processes to one another ontologically, epistemologically, taxonomically, and pragmatically. Such a model of science begins with the explicit acknowledgement that psychological processes are not lawful, they cannot be assessed scientifically via nonprobability sampling, they are not directly measured, and they cannot be reduced to basic independent elements and/or functions. A model of science which mandates: 1) External validity (probability sampling from known populations of human beings, including the calculation of the required effect size for a given probability sample) and internal validity (measures what it claims to measure) in all scientific investigations, 2) Subjective and objective (calibrated) measurements of human psychological processes, 3) The cross-validation of psychological findings using multimethodological procedures, 4) Routine reporting of the limitations and qualifications of scientific results, 5) A systematic platform for scientific replications and non-replications, and 6) Standard ethical guidelines and research reviews.

A unified and integrated science of psychology requires including all human psychological processes, behavior, and complex, constructed human action sequences for study and investigation. Human psychological processes, behavior,

and complex, constructed action sequences need to be literally studied and investigated across all life situations, in the home, at work, at school, in church, at the mall, on the street corner, in the movies, in literature, at the art museum, at the music hall, at the political rally, on the battle field, and in every social system, culture and living space (on earth or in space).

A unified and integrated science of psychology requires connecting the different methodologies and investigations to one another in a systematic way. A unified and integrated science of psychology, therefore, should consist of ***linking systematically*** the following methodological components: 1) Scientific probability sampling of participants from known populations both within and between cultures; 2) Controlled laboratory and field experiments using random assignment of participants to conditions and double-blind procedures, 3) Longitudinal and cross-sectional studies, 4) Cohort and case control studies, 5) Structured interviews, and 6) Standardized assessments (i.e., testing and trainings). Each of the above components is immediately recognizable as an established methodology in and of itself. However, in a unified and integrated science of psychology, the above methodological components do not stand alone, they are intentionally and explicitly ***linked*** to one another in a systematic way. Each of the above methodological components requires linkage with other methodological components in the same psychological investigation in order to increase the likelihood of cross-validation and replication. Each of the above methodological components requires participants to be equipped with some form of objective calibration (e.g., a wear-on biometric device) as well as standardized and subjective measurement procedures. It is advisable, but not required, to supplement standard univariate and multivariate statistical analyses in psychology investigations with probabilistic mathematical and statistical techniques (e.g., Markov chains, Bayesian statistics, and/or Monte Carlo procedures [Bayes, 1763; Spielgelhauser & Rice, 2009; Markov Chains, np, July 1, 2013]).

Linked psychological investigations, or what we refer to herein as ***Conjunctive Psychological Investigations*** (CPI), meet all of the above requirements, and constitute a death knell for the single psychology experiment, nonprobability sampling (e.g., quota, volunteer, and/or convenience sampling, etc.), small sample size investigations, and solely subjective measurements of psychological processes, regardless of the methodology employed. CPI substantially raises the methodological bar in scientific psychology and is more demanding to do, in terms of time, effort, and financial cost, although the advantages should be self-evident. CPI increases the likelihood of obtaining external and internal validity in scientific investigations of psychological processes. CPI increases the ***ontological realism*** of psychological research (i.e., how human beings experience, express, and construct psychological processes, behavior, and complex action sequences in their everyday lives) and encourages ipso facto the assessment of different psychological processes (e.g., perception, cognition, memory, and social interactions, etc.) in the same psychological investigation. CPI increases confidence in psychological research findings by providing a platform to conduct and report replications and non-replications.

Regarding replications, it is apparent that replications in psychology are more difficult, for example, than in physics, because psychological data are inherently stochastic and unlawful. A replication of a given stochastic psychological process will never be exact or even approximate, and may not occur if the probability sample, methodology, and/or culture are substantially changed. A given stochastic psychological process will always express itself mathematically as a percentage of explained variance or as a probability. Nonetheless, replications of psychological findings are much more likely and convincing when researchers use CPI (i.e., Concurrently Linked Methodologies), and will increase confidence in statistically significant results across different probability samples, methodologies, and cultures.

Non-replication in psychology is a unique and formidable problem since we can never prove the null hypothesis, and, given current institutionalized methodology, non-replication cannot be explained *a priori*, only *post hoc*. Unlike physics, psychology does not enjoy the luxury of comparing a non-replication to an ontological baseline, that is, to a standard of lawfulness, a standard model, or even to specific predictions from specific mathematical equations. Also, institutionalized methodology in psychology does not offer an explicit platform by which to conduct and explain non-replications, nor reserve publication space in professional journals for such research failures.

On the other hand, CPI does in fact provide an explicit platform to systematically implement and explain non-replications *a priori* and under specified conditions, over and above researcher attempts to pit one hypothesis or theory against another in a single psychology experiment. Since psychological processes are ontologically stochastic processes, they will always vary naturally to a greater or lesser degree as a function of probability sample, methodology, and/or culture. CPI has the distinct advantage of being able to employ probability sampling from different known populations, multiple methodologies, and/or cultures as explicit independent variables, thus allowing a psychology researcher to hypothesize *a priori* a specific non-replication outcome as a function of a specific probability sample, specific methodology, and/or specific culture (see Kilbourne, 1989).

CPI can further enhance its replication platform by introducing and implementing a paired-control group procedure. In a paired-control group procedure, a second control group is paired to the standard control group. That second control group, the paired-control group, is conceptually and operationally identical to the standard control group except it receives some arbitrary and non-relevant information or activity (e.g., information on dental health, nutrition, healthy sleep habits, wind surfing, etc.) that is not delivered to participants in either the standard

control group or in the experimental treatment conditions. The amount of time engaged in some non-relevant information/activity for participants in the paired-control group is identical to the amount of time engaged in the independent variable for participants in the experimental treatment conditions. All participants across all conditions of the experiment respond to randomized objective and subjective dependent measures pertaining to both the treatment manipulations and the non-relevant information and/or activity in the paired-control group.

It should be emphasized here that when a non-replication occurs and when it was not hypothesized a priori due to the explicit manipulation of a specific probability sample, methodology, and/or culture, the paired-control group provides the researcher with a straightforward validity check on the experimental procedure. Only participants in the paired-control group receive the non-relevant information and/or activity, and, therefore, they alone should differ significantly from all other conditions of the experiment on measures of the non-relevant information and/or activity, independent of whether replication or non-replication occurs. More specifically, the inclusion of the paired-control group (no treatment and non-relevant information/activity) increases confidence in the soundness of a specific probability sample, specific methodology, and/or specific culture when an unexpected non-replication is obtained.

CPI can also increase confidence in psychology research by helping to identify, not eliminate, contamination effects in psychology experiments (i.e., demand characteristics, social desirability responding, the Hawthorne effect, and/or experimenter bias [Mayo, 1933; Roethlisberger & Dickson, 1939; Rosenthal, 1961, 1962; Orne, 2002]). The inclusion of a paired-control group allows the researcher to assess the extent that the added attention and/or active participation in a psychology experiment heightens participants awareness and may be confounded with the independent variable (s) in the experiment. Participants in the paired-control group should routinely differ on the non-relevant dependent measures from all other conditions of the experiment as well as differ on the treatment relevant dependent variables from participants in the treatment conditions of the experiment. If participants in the paired-control group do not differ from those in the treatment conditions on the treatment relevant dependent variables, while the standard control and treatment conditions do differ on the treatment relevant variables, then experiment contamination effects would be indicated. Thus, the combination of a double-blind procedure and a paired-control group in a psychology experiment simultaneously controls for contamination effects and allows for its assessment.

5. A Positive and Supportive Professional Culture

A unified and integrated science of psychology will not happen overnight, and it will not develop without considerable resistance. Old habits die hard, especially those entwined with professional identity, self-worth, prestige, job security, and monetary benefit. A unified and integrated science of psychology requires a positive and supportive professional culture. Notwithstanding, substantial advances in science and technology in the 21st Century, along with global industrial growth and the depletion of natural resources, rising expectations, the population explosion, extreme poverty, and climate change, are transforming the world as we know it, right before our eyes, and impacting the entire human population (Kilbourne et al., 2014). If the profession of psychology does not step up to the plate, a science of psychology could become irrelevant and the profession of psychology could be left behind.

A unified and integrated science of psychology requires a positive and supportive culture in order to maintain and perpetuate itself, and to evolve the profession of psychology. Specifically, what is needed is a professional culture where future generations of psychologists are educated and socialized in ways different from the present. The following considerations will help psychology to evolve professionally and to keep ahead of the curve in the 21st Century and beyond.

First, the origin myths of psychology (i.e., Ontology, Epistemology, and Taxonomy) are not likely to go quietly into the night. They have an attractive appeal, even if they are mistaken beliefs and false assumptions, and they are implicitly reinforced by prevailing cultural beliefs in the United States (e.g., individualism, pragmatism, innovation, and the belief in the absolute traits of God [Sampson, 1977, 1978]). The three origin myths need to be actively supplanted with education and training in physical science, technology, engineering and math (STEM) to ensure that future generations of psychologists do not lose sight of the ontological differences between physical science and psychological science. A basic education in STEM-related subjects, starting in high school and continuing throughout the undergraduate years of college, should be a pre-requisite for doctoral-level studies in psychology. Future generations of psychologists need programmed cross-training with different scientific disciplines and need to routinely embrace interdisciplinary collaborations to keep abreast of different scientific perspectives and technological advances.

Second, a healthy dose of cultural education and cultural humility is necessary to immunize future generations of American psychologists from the throes of ethnocentrism, racism, sexism, ageism, and classism. Psychology in general needs to move beyond a dialogue with American culture. Americans (i.e., citizens of the United States) are not a measure of all things to all people. Psychology needs to extend its disciplinary reach to include all human activities, situations, and cultures (Triandis & Brislin, 1984). Psychology can achieve this end by requiring all psychology students to become well versed in cultural anthropology, to learn a second and even a third language to read and speak fluently, and for all American psychologists to engage in routine cross-cultural trainings and interdisciplinary

collaborations and research. Psychology needs to "rainbow" future generations of psychologists, and to train them in STEM, CPI, cultural diversity, different languages, the arts, and ethics.

Third, and make no mistake about it, upgrading to CPI and to a unified and integrated science of psychology is a two-edged sword. Psychology will inevitably become more objective, valid, reliable, and generalizable. Without the artificial and arbitrary ontological, epistemological, and taxonomy blinders, psychology will become more meaningful and useful in the everyday lives of people in general. When psychology is studying and investigating all human psychological processes across all social and cultural contexts, it will become more culturally relevant, more situation-specific, more person-specific, and it will become more powerful. It will inevitably become, in turn, more desirable for some individuals and groups in society to solicit psychology to exploit, manipulate, and control human beings. *Therefore, ethics, specifically how psychologists investigate, report, and apply psychology, and how psychologists conduct themselves professionally, becomes as important as the knowledge generated by the science of psychology.* Any shade of Machiavellianism, exploitation, coercion (legal or illegal), restricted access, disinformation, or scientific fraud (Kilbourne & Teirumniks, 1983) is unacceptable. Students of psychology and professional psychologists alike need to continuously refresh their understanding of ethics and embrace a stringent professional code that scientific knowledge and professional ethics are inseparable partners, two sides of the same coin.

A unified and integrated science of psychology, moreover, draws into sharp relief the ethical implications of how the current brand of psychological science is promoted and marketed to the general public. Consider, for example, the present trend to promote and market evidence-based psychotherapies. Daniel, Cristea, and Hoffmann (2018) claim cognitive behavioral therapy (CBT) is the current *gold standard* of psychotherapy, "if gold standard is defined as best standard we have in the field at the moment." Daniel et al. (2018) contend that CBT has been tested with stringent criteria (e.g., randomized trials and active comparator), without ever mentioning external validity (e.g., scientific probability sampling from a known population, effective sample size, or the use of objective dependent measures to reduce non-sampling error) in their so-called stringent criteria. However, sound science requires both external validity and internal validity in a psychology experiment as well as explicit *a priori* research plans to balance sampling and non-sampling errors. Since most CBT studies over-rely on non-probability sampling, small sample sizes, and subjective dependent measures it is near impossible to know with any certainty the population these studies generalize to nor the risk of sampling error. A clinician cannot automatically assume such studies generalize to his or her caseload and must, alternatively, first assess whether evidence-based psychotherapies do in fact generalize to his or her own caseload, by individual client and diagnostic group. The problem is not evidence-based data. The problem is what we call evidence-based data and how we collect that data.

6. Conclusions

Could the present critical analysis of contemporary scientific psychology be wrong? Yes, of course it could be wrong, but probably not. There are no laws of psychology analogous to the laws of physics. Reliable group predictions in psychology are problematic since they are neither exact nor approximate. Group predictions occur within a range, a confidence interval, and vary from one experiment to the next. Exact or even approximate individual predictions in psychology do not exist, in or out of the laboratory. The overall science of psychology in the United States is based on an incredibly small slice of human experience and cannot be generalized to most people in the United States, let alone to all human beings. Replications are far and few between, and they are typically reported by researchers of the same inkling who use similar nonprobability sampling of participants and similar methodology. Non-replications rarely appear in professional journals because they are uninterpretable in general and *post hoc*, and because there is no extant platform by which to report non-replications in psychology. Without an explicit platform to report replications and non-replications, it is extremely difficult to make *a priori* predictions to prove or disprove a theory or model (Hawking & Mlodinow, 2010) or to search for anomalies.

One might ask rhetorically, then, "Well, how can we account for the large body of statistically significant experimental findings in the psychology literature?" Which begs the question: who knows? It could be due to a variety of factors, such as experiment specific subjective ratings of presumed psychological processes, nonprobability sampling error, non-sampling error, small sample size investigations, unrecognized confounding, chance, experimenter bias, participant contamination effects, scientific fraud (Kilbourne & Teirumniks, 1983), or some combination therein. *What we do know is that multiple generations of psychologists have outright ignored some basic scientific principles in their pursuit of a science of psychology.* Scientifically oriented psychologists cannot hope to be credible scientists if they arbitrarily pick and choose what is considered scientific in psychology, redefine concepts and terms of science to their own liking, fail to distinguish psychological science from physical science, and/or claim scientific credentials and marketing benefits in the same breath.

Both external and internal validity are required in a psychology experiment (Campbell and Stanley, 1963). Inferential statistics are primarily intended to be used with probability sampling from a known population (Blalock, 1979; Agresti & Agresti, 1989), not as a routine way to compare differences between independent groups, when using nonprobability sampling, small sample sizes, and subjective dependent measures. Psychological science and

physical science are ontologically and qualitatively different from one another (Heisenberg, 1958; Kilbourne et al., 1988; Kilbourne et al., 2014) and, therefore, classical science is not a good model for psychology to emulate. Neutrality is the sine qua non of science, even if we just consider it to be an ideal, and can be safeguarded by separating method from promotion in the definition of science, avoiding and/or disclosing conflicts of interest, recognizing value-based decisions, and taking responsibility for how science is used by non-scientists.

Psychology cannot afford to stand frozen in a tradition of misdirected and mistaken origin myths. Just as tradition is not the same as law, so, too, tradition is not the same as truth and/or fact. The extant status quo in psychology, entrenched in a legacy system dating back to the 19th Century, can neither advance the discipline of psychology beyond the present nor enhance the scientific authenticity of psychology. Psychology needs to evolve. The discipline of psychology needs to acknowledge the glaring discrepancy between its self-perception and the public perception of psychology, implement necessary corrections, and strive to achieve its full potential. That glaring perceptual discrepancy will certainly widen as future generations of young Americans continue to embrace STEM disciplines and high technology professions and lifestyles, and as American society continues to racially and culturally diversify. From an international perspective, due to the rise of China abroad, Nativism at home, and the forfeiture of American leadership regarding global geo-political issues (e.g., climate change and the coronavirus pandemic), the role of American psychology will inevitably diminish concurrently with the delegitimizing and decentering of the United States in the global economy and in the new emerging world order.

Psychology cannot claim to be something it is not, and psychology should not try to seek shelter in tradition, polemics, self-serving marketing strategies, elitism and/or protectionism. *Psychologists should embrace the reality that people are not the same as non-living matter and forces in nature, and people cannot be scientifically described, investigated and explained in the same way as non-living matter and forces in nature.* Psychologists should celebrate the inherent differences between psychological processes and physical processes.

Simply put, we need a new psychology, one which consists of redefining the discipline and science of psychology. The discipline of psychology needs a wide definition and the science of psychology needs a strict, narrow definition. The discipline of psychology needs a wide definition that includes all people, activities, situations, and cultures, scientific (objective and quantitative) and non-scientific (subjective and qualitative) explanations, species specific and species nonspecific investigations, and not just a truncated, simplified, and homogenized version of psychology that intentionally or unintentionally perpetuates American ethnocentricity, white superiority, racism, male dominance, and elitism (Gergen, 1973; Sampson, 1977, 1978). The science of psychology, however, needs to be more strictly and narrowly defined, crafted specifically to the emergent, stochastic, and integrative nature of psychological processes, behavior, and complex, constructed action sequences, and not to physical processes. Psychology is a science of probabilities, not a science of laws. When psychology models itself erroneously after classical physics it is simply unable to make strong causal statements or even consistent testable predictions.

A unified and integrated science of psychology does not throw the baby out with the bathwater. To use another metaphor, a unified and integrated science of psychology just rearranges the pieces of the puzzle to form a new and different picture. This new picture of the science of psychology is internally and externally consistent, as per ontology, epistemology, taxonomy, and practicality, with the psychological experiences of human beings and with the psychological data psychologists collect and report. What emerges is a science of probabilities that is based on an appropriate scientific methodology (e.g., Conjunctive Psychological Investigations). Such a unified and integrated science of psychology will uplift the standing of psychology in the larger scientific community and in the minds of the general public, and very likely breathe new life into the Scientist-Practitioner Model of Mental Health Care (Baker & Benjamin, 2000).

A good start to achieve the above would be to create a national website and national data base (e.g., the National Psychology Data Base) where all participants and researchers would be assigned an encrypted personal password and profile. The first tier would consist of two components: 1) Selecting participants from probability samples of known populations (e.g., census data, voter files, student enrollments, hospital admissions, state and national unemployment records, etc.) to conduct a *survey* for the purpose of collecting psychological data using subjective, standardized and calibrated measures (e.g. downloadable biomedical apps), and 2) Selecting participants from probability samples of known populations (see above) to conduct an *experiment* for the purpose of formulating *a priori* hypotheses and collecting psychological data using subjective, standardized and calibrated measures (see above). The second tire would consist of a *spectrum of in situ* investigations, which follow directly from the first tier, and which would allow the investigation of specific hypotheses using diverse methodologies and diverse natural settings.

However, only a wide definition of the discipline of psychology, the art and science of psychology, will truly advance our understanding of all psychological processes in the human species. To achieve such a wide definition of psychology, psychology needs a huge international effort, analogous to the huge international effort ongoing in the physical sciences.

Footnotes

1. Some authors (Stapp, 1993; Wang & Busemeyer, 2015; Popova, 2018) have mistakenly argued that William

James (1890) and Niels Bohr (1928) used the concept of complementarity similarly. In fact, James and Bohr used the same concept differently. James used the concept of complementarity ***descriptively and subjectively*** to reconcile how total consciousness in human beings can seemingly: (1) "split into parts which coexist and mutually ignore one another" (p.204), (2) be opposite but complementary ("How to regard them is the question-for they are so discontinuous with ordinary consciousness ….. It is as if the opposites of the world, whose contradictions and conflict make all our difficulties and troubles, were melted into unity" [cited in Popova, 2018]) and (3) vary in a matter of degrees (After experimenting with nitrous oxide and concluding "a group of states of consciousness peculiar enough to deserve a special name and to call for careful study" [cited in Popova, 2018]). Bohr, however, used the concept of complementarity ***ontologically and empirically*** to reconcile the wave-particle duality of nature at the quantum level, a state of being which does not exist in human experience, and to describe two states of a duality which differ absolutely from one another, not in a matter of degrees. For example, Bohr emphasized that light is neither a particle nor a wave. It is something our language cannot describe. It is a superposition of these two states of being, particle and wave, until physicists make a measurement, whereupon the wavefunction describing light collapses into one or the other depending on the type of measurement one makes (e.g., a particle when doing a photoelectric experiment and a wave when doing an interference experiment). However, the act of measurement does not literally create either of these two states of being at the quantum level of nature, rather the act of measurement at the classical level of nature can only reflect one state of superposition at a time.

2. In classical physics, statistics are used as a matter of computational convenience, which, of course, does not affect the ontological and qualitative difference between physical processes and psychological processes. For example, there are so many molecules in a sample of gas that, even though in principle they each obey Newton's laws, there is no way to follow each one of them using these laws (even using a super, super, supercomputer), so physicists "opt out" in favor of a statistical description of the ensemble of particles, content with information on only the ensemble average. This is simply because there are too many particles, some moving slow, some slower, some fast, some faster, etc., to follow individually. But, in fact, because there are so many particles (unlike in psychology experiments that are sample limited, e.g., 100 participants or less, and unlikely to apply to the population as a whole), physicists obtain meaningful, predictable, and accurate statistical information.

3. The importance of comparative psychology cannot be overemphasized in order to facilitate our understanding of human development and cohabitation with other species (Liebal & Haun, 2012), and to facilitate protections for the natural environment and all living organisms (Mainstrom, 2010).

4. This psychological illusion, confusing past, present, and future, while only actually physically experiencing the world in the present, can be better appreciated at the individual subjective level with exercises in mindfulness and meditation (Hanh, 1987).

5. Barrow's (1995) notion of emerging complexities should not be confused with the Gestalt notion first introduced by Kurt Koffka, "The whole is other than the sum of the parts" (Heider, 1977). Using Barrow's reasoning, the whole is not something other than the sum of its parts, because simple laws and complex emergent outcomes are different parts of the same universe, and there is no "other than" the universe itself. Moreover, emerging complexities have both physical and non-physical manifestations.

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