(When) Should Psychology Be a Science?

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Abstract

Since its emergence in the 19th century, academic psychology has striven to become accepted as a scientific discipline. This emphasis on "science" has led to many unprecedented advancements in the understanding of human behavior. However, the view that psychology must be approached as a science has become ingrained in the field over time, and critically discussing the implications of this notion has turned into a taboo. In this article, I examine the benefits and limitations of applying the scientific paradigm to psychology, and I propose when it is not optimal to approach psychology as a science if the field is to maximize its potential. Importantly, I do not imply that practicing psychology as a "non-science" means practicing it as a pseudoscience. Quite to the contrary, I argue that not always enforcing the scientific viewpoint can prevent pseudoscientific practices and make the field more scientific in the long run.

Keywords: Science, method, knowledge, pseudoscience, metapsychology

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It has been frequently debated and discussed to what degree psychology is a science and how to make its practices more scientific (Cesario, 2014; Feynman, 1974; Ketelaar & Ellis, 2000; Kuhn, 1962; Skinner, 1990). However, it is generally implied that psychology should strive to be a science, and this view is rarely critically examined (Abra, 1998; Barbalet, 2004; Belk & Ruse, 2000; Gardner, 1992; Holtz & Monnerjahn, 2017; Mixon, 1990). In this article, I first define what it means to approach psychology as a science and discuss when this approach advances the discipline and when it negatively affects it. I then offer practical guidelines that can help identify psychological topics that currently do not lend themselves to scientific investigation, and I propose a method of non-empirical theorizing that can be used to conceptually develop these topics and elevate them to the stage where the scientific approach is optimal.

1. What Does it Mean to Approach Psychology from a Scientific Perspective?

To approach psychology as a science means to investigate psychological phenomena (i.e., mental states and behaviors) by employing scientific method (e.g., Ayala, 2009; Krpan, 2020; Haig, 2005; Rosnow & Rosenthal, 1989). In other words, to accept theories about behaviors and mental states as knowledge, it is necessary that a) these behaviors and mental states can be measured, and b) it can be convincingly demonstrated that the occurrence of these phenomena as proposed by the theories is not just a chance and can be reliably observed in the physical world (Krpan, 2020; see also Feynman, 1974). For example, if a researcher proposes that Mozart's music improves intelligence, it should be possible to measure intelligence as a construct and demonstrate that it changes in the presence of his music. If these conditions cannot be satisfied, there is no scientific basis to believe that Mozart's music improves intelligence (Steele, Bass, & Crook, 1999; Steele et al., 1999).

Notwithstanding these general characteristics of scientific method, it is important to emphasize that there is no one scientific method (e.g., Feyerabend, 1975). This method can be described as a sum of various methodological and statistical approaches that have evolved over time and that constantly compete with and supplement each other (Feyerabend, 1975; Krpan, 2020). Applying this statement in the context of psychology indicates that there is no consensus regarding how to best measure behaviors and mental states or convincingly demonstrate that their occurrence is not just chance or imagination. This is evident in numerous debates that psychologists have had regarding their preferences for and criticisms of various research designs and techniques (e.g., Amrhein, Trafimow, & Greenland, 2019; Benjamin et al., 2018; Koffka, 1924; Rosnow & Rosenthal, 1989; Trafimow, 2014). If we return to the example of Mozart's music, a quantitative researcher may demand that understanding whether his music improves intelligence requires quantifying intelligence and assessing whether listening to this music increases its quantity, whereas a qualitative researcher may demand that people describe their experiences while doing so to understand their mental processes (Madill & Gough, 2008; Rennie, 2012).[1] Moreover, a frequentist quantitative researcher may require that frequentist statistics be used to evaluate the influence of music on intelligence, whereas a Bayesian researcher may require that Bayesian statistics be used (van Zyl, 2018). Overall, different methods can be indefinitely contrasted and complemented regarding any psychological phenomena using this logic. What unites these approaches into scientific method is not that they are necessarily compatible or agree, but that they require measuring or accessing different psychological phenomena in some way and demonstrating that these phenomena are not just imagination.

[1] By contrasting qualitative and quantitative methods in this example, I wanted to indicate that scientific method is not the same as "quantitative" or "nomothetic" and can also involve "qualitative" or "idiographic" approaches.

In addition to defining psychological science, this conceptualization of scientific method can be used to distinguish between approaching an idea or theory as a "non-science" versus pseudoscience. In some cases, phenomena that a theory tackles cannot be measured either because technology and measurement devices have not yet sufficiently advanced or for some other practical reason. For example, before the advancement of modern brain imaging techniques (Raichle, 2009), one could theorize about the brain and its relationship to cognition, but it was either impossible or extremely difficult to test such theories. Even today, theories or principles of brain functioning that cannot yet be directly verified because of technological limitations are being proposed. For example, Friston's (2010) highly influential free-energy model outlines fundamental principles of how the brain operates, some of which cannot yet be scientifically examined because they are more advanced than the existing brain imaging techniques.

In line with this logic, to approach psychology as a non-science means to develop logically rigorous theories or ideas that cannot yet be tested for practical reasons but may become testable in the future as scientific methodology advances and thus generate new knowledge about human mind and behavior. Importantly, an intellectual who proposes an idea that is currently non-science does so in the hope that it will enrich scientific understanding of the world in the future when it becomes testable, but they do not falsely claim that this idea constitutes scientific knowledge at present (Feynman, 1974). There are several examples of theories from harder sciences such as physics that were rigorously tested only years after being proposed as the technology advanced, including Einstein's theory of relativity (Will, 1990). In Contrast, pseudoscience means falsely claiming that an idea or theory is convincingly supported by evidence when in fact this is not the case either because its postulates cannot yet be measured and tested or because its empirical tests failed. An example of pseudoscience is phrenology, which claimed that the shape of the skull can predict people's psychological characteristics and that this premise is supported by evidence (Davies, 1955).

To further understand the distinction between non-science, science, and pseudoscience, it is essential to additionally discuss the concept of theory testability. Theories generally comprise constructs that are not directly observable, and testing the theories therefore relies on a certain set of premises that need to be met to link these constructs to the observable world (Trafimow & Rice, 2009; Trafimow & Uhalt, 2015). Trafimow (2009, 2012, 2017) refers to these premises as auxiliary assumptions. For example, two key constructs of construal level theory (CLT; Trope & Liberman, 2010) are psychological distance (i.e., the extent to which some stimulus is distant from a person in terms of time, space, social connection, and probability) and construal level (i.e., whether a person mentally represents the world in abstract or concrete terms). However, these constructs cannot be directly accessed, and measuring them to test theoretical postulates of CLT requires relying on various assumptions, such as that it is possible to report perceived psychological distance between oneself and a stimulus using a paper and pencil survey, or that finding an abstract description of an activity more representative of this activity than a concrete description is indicative of high construal level.

The notion of auxiliary assumptions (Trafimow, 2009, 2012, 2017) has several implications for theory testability. First, whether a theory is testable or not (i.e., whether it is possible to attempt to falsify it) depends both on the theory itself and on its auxiliary assumptions. For this reason, it is almost impossible to proclaim with certainty that a theory is not testable, given that one can never argue with confidence that auxiliary assumptions which would deem it testable do not exist and will not one day be discovered. For example, Freud's psychoanalytic theory (Freud & Strachey, 1964) has been perceived as untestable, but researchers have eventually found ways to test it (Trafimow, 2009). Second, it is important to distinguish between a theory being testable now versus in the future. For a theory to be testable now, both the auxiliary assumptions and the methodological tools that allow assessing its theoretical postulates in line with these assumptions need to be in place. For example, one auxiliary assumption regarding Einstein's (1961) relativity was that the theory can be tested by capturing light deflection during solar eclipse (Dyson, Eddington, & Davidson, 1920); without the sophisticated photography equipment, this would not be possible. In contrast, a theory is testable in the future either if the necessary auxiliary assumptions do not exist, or if they do exist but the corresponding methodological tools are yet to be devised. Janson and Marsden (2017) proposed a conceptual model of a cognitive system that comprises precise mathematical formulations of neurons that could be easily tested if the equipment that accurately measures the workings of each neuron existed. This is, however, not the case. I on purpose do not make a strong distinction between the absence of auxiliary assumptions and/or methodological tools as the reasons behind a theory not being testable now. I assume that, for each theory, both the assumptions and tools can be conceived in the future, because arguing to the contrary would require exhausting infinite possibilities (Trafimow, 2012). Therefore, I posit it is impossible to proclaim theory as testable versus not testable; it can only be proclaimed as testable now versus in the future.

Now that I have discussed the concept of theory testability, I can further clarify the distinction between science and non-science. By saying that "to approach psychology as a non-science means to develop logically rigorous theories or ideas that cannot yet be tested for practical reasons but may become testable in the future", I mean that non-science involves any theory or idea that is not testable at present, either because the appropriate auxiliary assumptions or methodological tools are not yet developed, whereas science refers to theories or ideas testable at present.[2] In line with this rationale, pseudoscience does not directly concern whether a theory is testable now or not, but whether it is falsely claimed that it has not yet been falsified (for an additional discussion of this issue, see Cioffi, 1985). For example, if the key postulates of a theory have been empirically tested and falsified numerous times, but this evidence has been dismissed or skewed, and only the positive evidence has been retained, this theory would correspond to pseudoscience. That, however, does not mean the status of pseudoscience is irreversible. There always remains a possibility that someone will discover more sophisticated auxiliary assumptions and/or methodological tools which will eventually demonstrate that the initial evidence that falsified the theory was flawed because it relied on inappropriate auxiliary assumptions (see Trafimow, 2009, 2012, 2017).

2. Benefits of Approaching Psychology as a Science

The benefits of approaching psychology as a science are numerous and covering them in depth would require writing a book. Here, I briefly discuss three of them that I see as key: advancement of psychological knowledge, practical impact of psychology on the world, and increasing the field's reputation.

Psychological knowledge can be defined as "a reduction of uncertainty regarding the occurrence of phenomena of interest to psychology: mental states and behaviors" (Krpan, 2020, p. 1043; see also Fanelli, 2019; Koch, 1981). In other words, for any explanations about how human mind and behavior function and what kind of circumstances give rise to different behaviors and mental states, it is necessary to show that they match the physical reality to count them as knowledge. Whereas philosophers such as Aristotle (Robinson, 1989) or early psychologists such as William James (1890) had many profound ideas about psychological phenomena, their ideas were speculations because for most of them it was

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[2] Although scientists typically do not explicitly make a distinction between science and non-science, I formulated this distinction to conceptualize a general sentiment that even highly rigorous theories tend to not be seen as science if they are not testable at present and have not been empirically validated (e.g., Ellis & Silk, 2014).

unfeasible at the time to provide reliable evidence that would turn them into knowledge. As the emphasis on science led to the development of many statistical and methodological tools during the 20^{th} and 21^{st} centuries, it became possible to test numerous theories and build a body of psychological knowledge (Koch, 1959; Leahey, 1987, 1994; Nosek, Ebersole, DeHaven, & Mellor, 2018; Robinson, 1995). For example, one of the greatest advancements in this regard is the prospect theory (Kahneman & Tversky, 1979; Tversky & Kahneman, 1974), which uncovered the key principles that govern people's decision-making under uncertainty and has so far passed many rigorous replication tests (Ruggeri et al., 2020).

Whereas increasing psychological knowledge is important to scholars who work in the field, the public may care little about this knowledge if it cannot be practically applied. Approaching psychology as a science has led to many significant practical uses of psychological knowledge because it has made it possible to clearly demonstrate how psychological ideas and theories can produce concrete outcomes of interest to the public. For example, in recent years, psychology has become widely adopted by policy makers and used to help people save for their retirement, enhance energy conservation and other sustainable behaviors, improve tax compliance, increase vaccination uptake, etc. (Benartzi et al., 2017; Halpern, 2015; Oliver, 2013; Steg & Vlek, 2009; Van der Linden, Maibach, & Leiserowitz, 2015). As another example, scientifically testing the effectiveness of various therapies aimed at helping people dealing with issues such as anxiety or depression allowed identifying those that can reliably achieve positive results (e.g., Cuijpers et al., 2013; Jauhar et al., 2014; Telch, York, Lancaster, & Monfils, 2017; Watkins, Sprang, & Rothbaum, 2018). Other domains where psychological science has been practically applied include work (e.g., Deci, Olafsen, & Ryan, 2017; Kozlowski & Ilgen, 2006) and education (e.g., Hadden, Easterbrook, Nieuwenhuis, Fox, & Dolan, 2020; Karpicke & Blunt, 2011), to name but a few.

Finally, it can be argued that approaching psychology as a science is important for its reputation and can make it more credible in the eyes of the public and various funding bodies (Adair, 1980; Arnett, 2016; Ferguson, 2015; Kiesler, 1977; Lilienfeld, 2012; Lowman & Stapp, 1981). Although psychology's reputation does not in itself directly advance the field's practical applications or knowledge, it can lead to more funding and other benefits that can eventually result in more research projects and thus in more theoretical and practical insights about human mind and behavior.

3. Limitations of Approaching Psychology as a Science

Despite the many benefits, approaching psychology from a scientific perspective can also have serious limitations. I argue that the most significant limitation of this approach is that it can discourage intellectual exploration of topics that cannot at present be investigated from a scientific perspective for various practical reasons (e.g., because the necessary technology or methodology is not yet available, because undertaking the research would require substantial resources that are unattainable, etc.).

An early example that supports this premise is behaviorism, which was a dominant paradigm in the field between 1920s-1950s (Liu & Liu, 1997). Although this movement to some degree established psychology as a science due to its rigorous emphasis on the scientific method, its agenda to investigate only behavior because it can be reliably measured hampered the development of new ideas about other psychological phenomena such as cognition or emotions (Liu & Liu, 1997; Miller, 2003; Sperry, 1993). It was only after behaviorism gradually lost its dominance that ideas and research about these topics flourished and scientific methodology to study them advanced (Levenson, 2019; Miller, 2003; Robins, Gosling, & Craik, 1999; Chomsky, 1959).

Although contemporary psychology is not dominated by paradigms such as behaviorism, many topics currently exist that cannot be easily investigated from a scientific perspective and have thus been neglected. For example, one of these topics comprises rare and exceptional psychological events that have had a profound impact on humankind, such as the invention of a highly original theory that fundamentally changes people's view of the world or the creation of transformative works of literature or art. Another neglected topic involves the limits of human possibilities. For example, what drives most extreme behavioral changes (e.g., when a person is addicted to a materialist lifestyle and then adopts a completely opposite lifestyle of voluntary simplicity), or what are the most profound and transformative states of mind a human being can reach and how? Considering that reducing the rate of climate change to the levels where we can prevent a full-blown ecological catastrophe likely requires an extreme behavioral change on a global scale (Hoegh-Guldberg et al., 2019; Kallis et al., 2018), understanding the limits of human possibilities is more important than ever. Beyond these illustrations, I am sure that every psychologist has their own examples of themes that are interesting to them, but they feel discouraged from tackling these themes because it is highly difficult or impossible to approach them scientifically.

Why would psychologists avoid working on topics that do not lend themselves to scientific investigation? There are various reasons. Most importantly, to get tenure and keep their academic position, which eventually allows them to pay the bills and meet their basic needs, they need to publish, preferably in top journals (Csiszar et al., 2020; De Rond & Miller, 2005; Heckman & Moktan, 2020; McKiernan et al., 2019; Moher et al., 2018; Niles, Schimanski, McKiernan, & Alperin, 2020; Nosek, Spies, & Motyl, 2012; Schimanski & Alperin, 2018). These journals, and most other serious journals as a matter of fact, are empirical and require them to provide research evidence in support of their ideas (Adair & Vohra, 2003; Sigal & Pettit, 2012; Safer & Tang, 2009). Even theoretical journals require psychologists to form ideas and theories by heavily relying on previous research, and hence theorizing about something that is under-investigated or highly difficult to investigate is less likely to be accepted for publication (Adair & Vohra, 2003; Holyoak, 2016; Safer & Tang, 2009; Trafimow & Rice, 2009). Therefore, if one decides to work on a topic that is largely outside the realm of science, having any reasonable chance to publish this work in a psychology journal typically requires limiting oneself and focusing on its most superficial aspects that can be currently measured and studied.

However, to reach a stage where topics that currently do not lend themselves to scientific investigation can be studied scientifically in their full richness, it is important to conceptually develop them. This is because improved conceptual understanding both makes it easier to realize how to eventually measure the phenomena in question and propels methodological developments that are necessary to study them scientifically (e.g., Mixon, 1990). An example that supports this proposition comes from one of the core natural sciences—physics. This discipline is divided into theoretical physics, which deals with forming theories of various natural phenomena by using mathematics and logical abstractions of physical objects, and experimental physics, which relies on experiments to test these theories (Feshbach, Morse & Michio, 2019; James, 2006). Importantly, some of the most influential theories in physics are highly abstract mathematical formulations that deal with levels of reality that are unmeasurable at present. For example, the string theory proposes a fundamental model of the universe that is based on rudimentary constituent components referred to as strings (Becker, Becker, & Schwarz, 2006). These components are so small that it is currently impossible to directly measure them. However, string theorists have been driven by the assumption that clearly formulating how these strings may operate using a mathematical language will eventually make it easier to study them experimentally. In fact, such theoretical developments go hand in hand with methodological developments in physics, because new methodologies are constantly being developed to enable studying the most influential theories. For example, the Large Hadron Collider at CERN was developed to enable testing various predictions from particle physics and is currently also used to examine some predictions of the string theory (Brianti, 2004; Datta, Mukhopadhyaya, & Raychaudhuri, 2010; Evans, 2012; Hewett, Lillie, & Rizzo, 2005; Nath et al., 2010).

Therefore, if psychology truly strives to be a science, then it should, in line with other hard sciences such as physics, allow the separation of theory and experimentation to a similar degree. This would allow psychologists to conceptually develop phenomena that are currently outside the realm of science and thus influence the required psychological methods and auxiliary assumptions to evolve sufficiently for such phenomena to be studied. One current obstacle to separating psychological theory from experimentation is that the discipline deals with more complex phenomena than physics, but it does not have a highly evolved system of logical and symbolic language that would allow theorizing about such phenomena. However, if psychology wants to reach the next stage of development where it can start tackling various highly important topics that are currently beyond its level of scientific development, creating such a language needs to become one of its main goals.

The second important limitation of approaching psychology as a science is that requiring ideas and theories to be stringently defended by evidence can push researchers to apply scientific method to psychological topics that are not ripe for this (e.g., they lack the appropriate auxiliary assumptions) or to falsely generate evidence in their defense, thus turning them into pseudoscience. An example of this is research on precognition, which refers to one’s ability to predict future events (Greenaway, Louis, & Hornsey, 2013). Regardless of one’s opinion about precognition, it is possible to generally state that this is a highly subtle and interesting phenomenon whose plausibility needs to be conceptually examined on the level of physics if one is to understand it sufficiently to research it. For example, before studying precognition experimentally, it would be useful to critically appraise whether predicting future events is physically possible and create a conceptual model that would explain how it operates in relation to relevant constructs from physics. Then, one would need to build experiments informed by the model that could somehow capture the physical mechanisms that support the existence of this phenomenon to understand more clearly what type of future information and events can be predicted, if any.

Forcing experimentation before a compelling explanation of precognition that can guide research is developed would be fruitless because a) there would be no good reason to believe that the phenomenon exists in the first place and b) it would not be possible to select or develop the appropriate methodological tools that can detect the phenomenon. Metaphorically speaking, it would be like trying to test the string theory by using binoculars. And yet this is exactly what happened to precognition. To my knowledge, rigorous and compelling theoretical models of the phenomenon have not been developed, although several improvements in this regard have recently been achieved (Millar, 2015), but that did not prevent researchers from conducting numerous experiments to test precognition using classical psychological methodology, such as random presentation of stimuli whose sequence needs to be predicted (e.g., Bem, 2011). Many of these studies were subsequently criticized for being false positives and not replicating (e.g., Galak, LeBoeuf, Nelson, & Simmons, 2012; Lakens, 2015; Maier et al., 2020; Rabeyron, 2020; Romero, 2017; Schimmack, 2012; Wagenmakers, Wetzels, Borsboom, & van der Maas, 2011; Wagenmakers, Wetzels, Borsboom, Kievit, & van der Maas, 2015; Wagenmakers et al., 2015), which negatively impacted the credibility of this research field, and debates about the existence of precognition are still ongoing (Bem, Tressoldi, Rabeyron, & Duggan, 2015; Mossbridge & Radin, 2018). Had precognition been a purely theoretical discipline that first aimed to build strong and compelling theoretical models as well as the auxiliary assumptions, this could have been avoided because either the phenomenon would have been tested using more appropriate methodology, or it would have not been tested at all if it were deemed theoretically impossible.

It is important to understand that my aim here is not to discredit or criticize precognition, but to show how overemphasis on approaching psychology from a scientific perspective can hamper potentially interesting research topics that could have been addressed more rigorously via comprehensive theorizing instead of being prematurely pushed into pseudoscientific practices to justify their existence.

4. When Should Psychology (Not) Be a Science?

Based on the limitations I have examined, a simple answer to when it is suboptimal to approach psychology from a scientific perspective is—whenever a topic of interest does not currently lend itself to empirical investigation for some reason (e.g., because of the lack of appropriate auxiliary assumptions and/or methods). However, this answer requires a more concrete and nuanced elaboration. In Table 1, I offer a set of guidelines that can help identify topics that may profit from being tackled as non-science. Whereas some of these topics are straightforward and have already been discussed (e.g., topics dealing with rare, exceptional phenomena or events: Guideline 1, Table 1), some would benefit from further clarification.

Guideline 2 (Table 1) concerns topics that deal with levels of reality not easily observable. This includes several phenomena from paranormal psychology, such as precognition, because potential mechanisms driving them (assuming these phenomena "exist") likely operate on very low scales of matter that are in the domain of physics, even if the consequences of these phenomena (e.g., whether someone can predict a future event) can be observed on the human scale. As another example under Guideline 2 (Table 1), there have been rare cases where scholars attempted to stringently model cognition using mathematical theories, such as dynamical systems theory (Janson & Marsden, 2017). These models are so precise that they account for each neuron using mathematical language and it is not possible to investigate them using currently available technology.

Table 1

When It Is Optimal to Approach a Psychological Topic as Non-science

	Guidelines	Examples
1)	Topic deals with rare, exceptional phenomena or events.	Great intellectual inventions; extreme personal transformations or behavioral changes not caused by biological factors.
2)	Topic deals with a level of reality that cannot be easily observed.	Precognition; telepathy; clairvoyance; mathematical modelling of brain and cognition in the sphere of physics that cannot be captured by modern brain imaging techniques.
3)	Topic deals with phenomena that may be important but unethical to research.	Long-term sensory deprivation; human mind under extreme circumstances (e.g., after long periods of food deprivation or after pushing other bodily limits).
4)	Topic deals with cognition or behavior under circumstances that cannot currently be encountered on earth or in society.	Cognition or behavior in novel political or economic systems that are currently not practiced by any country or society, or in unusual physical surroundings (e.g., architectural designs or artificially created environments) that do not yet exist.

Under Guideline 3 (Table 1), there are several topics that are unethical to research but may be important to understand for various reasons. For example, long-term sensory deprivation cannot be ethically studied except for rare circumstances where it naturally occurs (e.g., solitary confinement in prisons, or space missions). However, in some cases the general population may greatly benefit from knowledge about them, such as during COVID-19 lockdowns when many people were forced to live under restricted sensory circumstances. Finally, Guideline 4 comprises cognition or behavior under conditions that cannot be currently encountered on earth, such as novel political or economic systems. Tackling such themes is highly valuable because it could lead to increased understanding of situations in which human beings may flourish and thus in the future allow the development of better societies.

Whereas the guidelines proposed clarify which psychological topics should be approached as a non-science, they do not explain how to actually apply this approach and develop the topics, on a conceptual and methodological level, so they can eventually be studied from a scientific perspective. To address this issue, I propose the concept of *non-empirical theorizing*, inspired by hard sciences such as physics where theoretical models do not always need to have strong empirical basis (e.g., Becker et al, 2006). I therefore define non-empirical theories as those that either do not draw on empirical evidence at all because it is not available or that draw on few existing empirical studies but are largely speculation. In Table 2, I outline the main principles of this type of theorizing that could be employed by any scholars interested in approaching a psychological topic as non-science. The principles are explained using the example of precognition. My hope is that these principles can allow psychologists to make rigorous non-empirical theories despite the absence of mathematical language and symbolic abstractions that have been developed in hard sciences over centuries.

Table 2

Main Principles of Non-empirical Theorizing Applied to Precognition as an Example

	Principle	Examples
1)	Define key concepts that are important for understanding the topic.	Key concepts may include: prediction of a future event (*P*); temporal distance of the future event (D_t); physical distance of the future event (D_l); information that allows the prediction (*I*); complexity of the future event (*C*); computational capacity needed for the prediction (C_p); and computational capacity of the brain (C_b).
2)	Operationalize the key concepts in empirical terms, even if they cannot be measured at present.	Prediction of a future event (*P*): On the level of human perception, this concept refers to whether a person accurately or inaccurately stated, before an event has occurred, how exactly this event would unfold (e.g., the

	exact pattern of die rolls). On the level of physics, predicting the future involves predicting the movement of particles that constitute an event (e.g., die rolls). Temporal distance of the future event (D_t): Objective distance, measured in some unit of time, between the prediction was made and the occurrence of the predicted event. Physical distance of the future event (D_l): Objective distance, measured in some unit of length, between the place where the prediction was made and the place where the predicted event is expected to occur. Information that allows the prediction (*I*): The information that could be extracted from some level of physical environment (e.g., from the movement of particles that constitute matter) and used to accurately predict the event. Complexity of the event (*C*): The degree to which the predicted event is simple (e.g., an outcome of one die roll) versus complex (e.g., an outcome of thousand die rolls or a very accurate description of a machine that is yet to be invented). Computational capacity needed for the prediction (C_p): Computing power that would be necessary to infer, based on the available information and complexity of the expected event, the occurrence of this event. Computational capacity of the brain (C_b): The brain's capability to process information from the environment to make inferences about this environment.
3) Outline a preliminary model of how the key concepts are linked and may operate in relation to each other.	Prediction of a future event (*P*) is a function of temporal (D_t) and physical distance (D_l) of this event and its complexity (*C*), as well as the information that allows the prediction (*I*), and both the computational capacity required for the prediction (C_p) and the capacity of the brain (C_b). More specifically, a future event can be predicted if the computational capacity needed for the prediction does not exceed the brain's computational capacity. Computational capacity needed for the prediction is further dependent on the complexity of the event,

	its temporal distance, and the availability of the information that allows the prediction, which may be dependent on physical distance of the event (given that it is more difficult to directly access information about something that occurs far away). In other words, computational capacity needed for the prediction is higher if the event is more complex, if it is temporally more distant, and if it is physically more distant. Using a simple symbolic language, this model could be conceptualized as follows. $C_b \geq C_p \Rightarrow P \mapsto f(C_p) = f(C + D_t + I) = f(C + D_t + D_l)$ $C_b < C_p \Rightarrow \mathrm{P} = 0$
4) Search for examples that either support or counter the model and continuously adjust the model based on these examples. Search for examples in diverse areas: in psychology and scholarly disciplines beyond psychology, in personal life and observations, etc.	This principle indicates that any possible examples or evidence that can inform the model need to be very carefully explored in any available scholarly disciplines, other intellectual areas, and in personal life or through personal or other kinds of observations. For example, is there any information in physics and mathematics that can help understand how to determine computational power necessary for inferring an event and compare it to the computational power of the brain; is there any information in other sciences that would support the relations between the key concepts as specified by the model (or fail to support them); has someone else documented that future events have been successfully predicted as proposed by the model, etc.?
5) Use skepticism to appraise, via rational reasoning, whether the examples that have informed the model may be generalizable or are just rare occurrences.	This principle indicates that any examples identified under Principle 4 need to be further critically examined using rational reasoning. For example, if certain approaches to identify computational power have been determined, can they be applied to the human brain or the events in question, or they are specific to other physical entities? Moreover, if certain information in other sciences that would support the relations between the key concepts as specified by the model has been identified, on what grounds is one to believe that this information is not an anomaly?

6) Once the model has been fully developed, if possible, evaluate whether it is consistent with other relevant theoretical models across different scientific disciplines (e.g., physics, biology, etc.) that have withstood extensive empirical testing.	The aim of this principle is to undertake a final evaluation of whether the theoretical model developed is consistent with relevant scientific theories that have undergone comprehensive empirical testing. For example, given that the model of precognition proposes how information extracted from some level of physical environment can be used to accurately predict an event, one may examine whether the model is consistent with the second law of thermodynamics, which has important implications for information transfer (e.g., Parrondo, Horowitz, & Sagawa, 2015). This principle will ensure that the model is not incompatible with the knowledge previously obtained via empirical testing. In case the inconsistency does exist, one should evaluate whether the model should be updated or discredited, or it potentially taps into new spheres not captured by previous theories.
7) Propose what kind of conceptual or technological methodological tools would need to be built to make the empirical investigation of the model possible.	Finally, when the conceptual development of the topic of interest has reached a high level because the key concepts have been clearly defined and operationalized, and the model that links these concepts has been rigorously developed in line with Principles 4-6, it is necessary to try to think of tools that would need to be created to test the model, because this is the key step for turning the topic into science. For example, to comprehensively test the model of precognition, it would be necessary to develop a procedure that can be used to calculate complexity of any event, and a procedure that can calculate computational capacity of the event and compare it to the available capacity of the brain. Moreover, it would be necessary to create a tool that can quantify the information used to make the prediction (e.g., velocities of matter whose movement precedes the event), etc.

Overall, it is important to point out that the example covered in Table 2 to illustrate the principles is an oversimplification, and in reality it would probably take hundreds or thousands of pages and years of work to address each principle. However, I find the example to be a useful illustration of how a psychological topic that is not ripe for scientific investigation could be conceptually developed through non-empirical theorizing to reach a stage where it can be studied scientifically. Moreover, I hope that the principles outlined will be a useful foundation from which psychological scientists will develop more rigorous principles in a joint effort, as they try to use non-empirical theorizing in their work and practically experience its strengths and limitations. However, allowing psychology to flourish by studying certain topics from a non-scientific perspective to elevate them to the level of science will largely be dependent on journals and their willingness to integrate the proposed approach into their publishing objectives.

5. Conclusion

Although approaching psychology from a scientific perspective has led to many benefits, including the advancement of psychological science and its practical applications, it can also have significant limitations. For example, it can discourage intellectual exploration of topics that at present cannot be investigated scientifically for various methodological reasons, and thus hamper the discipline's potential to generate knowledge about psychological phenomena. However, tackling such topics as "non-science", by applying non-empirical theorizing, can elevate them to the stage where they can be explored scientifically, and thus advance psychological science.

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