

# Changing Minds: A Psychodynamic Interpretation of Kuhnian Paradigm Change

Julia Elad-Strenger  
Ben Gurion University of the Negev, Beer-Sheva, Israel

Thomas Kuhn's model of the structure of scientific revolutions is, to this day, one of the most influential attempts to understand central processes in the history of science. While Kuhn coached his theory in historical and sociological terms, this article argues that modern existential psychology can be used to add a psychodynamic dimension to Kuhn's model. Specifically, while Kuhn famously claimed that scientific paradigms are worldviews held by scientists and described their pattern of change, terror management theory (TMT) emphasizes the existential importance of worldviews and specifies the conditions under which individuals will either radicalize or abandon their worldviews when they are faced with threat or negative evidence. This article shows that the stages Kuhn describes in the history of science can fruitfully be elucidated by central TMT concepts, and exemplifies their applicability through two examples in the history of psychology. The resulting psychological interpretation of scientists' existential attachment to their worldview might prove fruitful in understanding crucial dynamics in the history of science.

*Keywords:* terror management theory, Thomas Kuhn, worldview threat, psychoanalysis, behaviorism

Social psychology has made a crucial transition in recent decades. While great existential questions were once taken to be the exclusive domain of philosophical thought, it now emerges that psychology is able to address these questions, both conceptually and empirically (Greenberg, Koole, & Pyszczynski, 2004). Specifically, since the mid-1980s, experimentally oriented psychologists have shown renewed interest in the study of existential themes. As a result, existential experimental psychology has evolved into an empirical research paradigm that tackles large-scale questions such as: What is freedom of will? How do humans deal with mortality? How do we imbue our lives with meaning and value? A major impetus for this development was terror management theory (TMT; Greenberg, Pyszczynski, & Solomon, 1986), a theoretical perspective inspired by existentialism, most notably the work of cultural anthropologist Ernest Becker.

TMT was initially developed to explain why people need meaning and self-esteem and why encounters with members of different cultures and ethnicities are so often fraught with prejudice and conflict (Greenberg et al., 1986). One of TMT's key contributions to social psychology was its emphasis on the importance of culture as a defining human characteristic (Greenberg et al., 2004). Using experimental methods, TMT has produced in-depth investigations of the existential importance of cultural worldviews, their anxiety-buffering function, and the dynamics by which they are bolstered and protected against threat. Specifically, countless experiments conducted within the framework of terror management theory

suggest that under conditions of existential anxiety, people will become less tolerant toward out-group members and cling more closely to their cultural worldviews (for a review, see Greenberg et al., 2004).

While most of the existing research linking existential concerns to cultural worldviews has focused on ideological polarization, it has also contributed greatly to the understanding of other, more profound forms of worldview change. Specifically, some TMT-inspired research projects investigate the specific conditions under which people are apt to repudiate their cultural worldviews or, in response to extreme trauma, abandon them entirely. Obviously such profound worldview changes are less common than the many instances in which we defend our worldviews in our lives: by and large, maintaining faith in, or connection with, our worldview, helps us preserve psychological equanimity (Greenberg et al., 2004).

Nevertheless, as our personal experience and collective history shows, such profound worldview changes do occur. Individuals experience religious conversions and political worldview changes, and history has witnessed the disappearance and appearance of political and ideological movements time and again. During the 19th and 20th century, for example, whole countries moved from one form of political organization (monarchy, dictatorship) to others (democracy, communism; Hobsbawm, 1994).

This raises the question, under what conditions do human beings continue to defend their worldviews, and when do they decide to change them? One very well-established model for processes that includes both the reinterpretation and the revision of worldviews in the face of threat has been presented by Thomas Kuhn. In his seminal model of the structure of scientific revolutions (1962), to this day one of the best-known models in the history and philosophy of science, Kuhn shows that scientific progress is not linear and cumulative, but rather an evolving, multiphased process. According to Kuhn, science evolves in a series of paradigms that are,

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Correspondence concerning this article should be addressed to Julia Elad-Strenger, Self & Health Lab (SEALTH), Department of Psychology, Ben-Gurion University of the Negev, Beer-Sheva 84105, Israel. E-mail: [juliastrenger@gmail.com](mailto:juliastrenger@gmail.com)

most of the time, assumed to be valid, even if there is evidence to the contrary. In other words, during the course of what he calls “normal science,” evidence contradicting the dominant paradigm is explained away as anomalous. Only when such evidence becomes overwhelming does part of the scientific community conclude that the existing paradigm needs to be replaced. During such times of “scientific crisis,” scientific revolutions become possible, even though a sizable fraction of the scientific community never changes its adherence to the old paradigm.

One could of course ask whether Kuhn’s model can be applied to worldviews in general. The guiding working hypothesis of this article is that this is possible for a simple reason: one of Kuhn’s greatest contributions to our understanding of science is precisely that he showed the scientific enterprise to be not just a practical and intellectual undertaking. Kuhn’s famed concept of scientific paradigms shows that, for its practitioners, science is far more than a theory about a particular domain: it is a way of looking at the world. It guides us in interpreting reality, in differentiating true from false, in deciding which questions are legitimate and which do not count as science. Kuhn famously went so far as to say that scientists holding different paradigms live in different worlds, and hence cannot really communicate with each other (Kuhn, 1962). In other words, scientific paradigms can be seen as cultural worldviews (Mendelsohn & Elkana, 1981).

If so, the psychological mechanisms studied by TMT should be applicable to the Kuhnian dynamics of paradigm change. The main aim of this article is therefore to explore the possibility that TMT could add a psychodynamic tier to Kuhn’s model of paradigm change. While Kuhn’s attempt to explain the pattern of scientific change in sociological terms has certainly been very fruitful, this article will show that empirical research in existential psychology could add to our understanding of the dynamics of such developments. I will start by describing Kuhn’s model of paradigm change. I will then review some of the main studies on cultural worldview change conducted within the framework of TMT. Finally, I will show how TMT research can provide a psychological explanation of each stage in the Kuhnian dynamics.

### Scientific Paradigms as Worldviews

The concept of scientific paradigms is at the center of Thomas Kuhn’s (1962) seminal book, *The Structure of Scientific Revolution*, in which he provides a detailed description of the multiphased process leading to scientific revolutions. Kuhn defines scientific paradigms as the worldviews in which we scientists live and through which our observations make sense. Such paradigms are not merely sets of beliefs of values, and may in fact “be prior to, more binding and more complete than any set of rules for research that could be unequivocally abstracted from them” (p. 46). The underlying beliefs of the current or dominant paradigm form the epistemological foundation of professional education, and once adopted, exert such a deep hold on students’ minds, that they eventually become part of their professional (and often personal) identity. These paradigms determine how we researchers view reality and guide the questions, solutions, and goals of our practice. In this sense, the term “paradigm” is equivalent to the term “worldviews” as it is used in social sciences; it is a term that encompasses all kinds of worldviews, be they scientific, religious, cultural, or political. Although the term “worldview” has been

used quite pluralistically in the scientific literature, it is generally defined as “a way of describing the universe and life within it, both in terms of what is and what ought to be. A given worldview is a set of beliefs that includes limiting statements and assumptions regarding what exists and what does not (either in actuality, or in principle), what objects or experiences are good or bad, and what objectives, behaviors, and relationships are desirable or undesirable” (Koltko-Rivera, 2000, p. 2). As this definition shows, these terms are parallel both in their centrality to the individual’s identity, and in their function as sources of meaning.

The main characteristic of a paradigm, Kuhn argued, is that it has its own set of rules and illuminates its own set of facts. Because it is self-validating, it tends to be highly resistant to change. Hence, in what he calls “periods of normal science,” the primary task of scientists is to bring the accepted theory and fact into closer agreement. As a consequence, scientists tend to solve puzzles within the context of the dominant paradigm and to ignore research findings that might threaten the existing paradigm and trigger the development of a new and competing paradigm. Kuhn argues that normal science is characterized by solving puzzles within the confines of a given paradigm.

In his view of “normal science,” however, Kuhn does not claim that scientists do not strive to solve scientific mysteries and find new solutions to scientific questions. In fact, in his distinction between normal science and revolutionary science, Kuhn does not wish to distinguish stagnation from innovation, but rather to distinguish new discoveries that confirm the theories of normal science from anomalous discoveries that challenge them. While the former are the mainstay of scientific endeavor, the latter are usually ignored and seldom welcomed by the scientific community. Indeed, Kuhn acknowledges the essential tension between innovation and tradition, and even deems it necessary in order for normal science to succeed in making progress. While innovation and flexibility have been prominent features of the self-image of science, Kuhn chose to stress the opposite factor, namely the need for tradition and the positive role of unquestioned metaphysical and methodological assumptions in research. The paradigm itself, according to Kuhn, transforms seemingly insoluble problems into puzzles that can then be solved by the practitioner’s ingenuity and skill (Marcum, 2005). Moreover, Kuhn (1977) states that the commitment to the existing paradigm is essential particularly *because* it allows for true scientific revolutions:

The scientist requires a thoroughgoing commitment to the tradition with which, if he is fully successful, he will break. In part this commitment is demanded by the nature of the problems the scientist normally undertakes . . . problems of this sort are undertaken only by men assured that there is a solution that ingenuity can disclose, and only current theory could possibly provide assurance of that sort. (p. 235)

So when do scientists challenge scientific consensus and make revolutionary innovations that result in paradigm shifts? While in periods of normal science, scientists interpret evidence contradicting the paradigm as anomalies and continue to work within the dominant paradigm, over time, anomalies may accumulate that are difficult to explain within the context of the existing paradigm. While usually these anomalies are resolved, in some cases they may accumulate to the point where old paradigms seem too incomplete or imperfect to account for these data. This creates a

paradigmatic crisis that is not resolved immediately. Only after a long period of crisis in a tradition-bound normal science, Kuhn argues, can a scientific revolution occur, which reexamines the underlying assumptions of the field and establishes a new paradigm. After the new paradigm's dominance is established, scientists return to normal science, solving puzzles within the new paradigm.

In conclusion, Kuhn describes a complex process that includes three stages: During the paradigmatic stage, or "normal science," reality is interpreted so that it fits the existing paradigm. In the second stage, or the stage of crisis, a growing number of scientists acknowledge that the paradigm cannot handle anomalies. In the third and final stage, a growing number of scientists actively test the alternatives and finally settle into a new or revised paradigm.

But can such processes of reinterpretation, crisis, and revision be seen in nonscientific worldviews? A huge body of empirical research in existential psychology suggests a positive answer. Along with Kuhn, terror management theorists posit that cultural worldviews are essentially immunized or protected from challenge or falsification despite, or in the face of, countervailing or anomalous facts (Greenberg et al., 2004). More profound cultural worldview changes, on the other hand, are rarer and are usually the result of extreme trauma, in which one's worldview is challenged to the point that the belief in it no longer provides existential protection (Pyszczynski & Kesebir, 2011). However, while Kuhn's contribution to the understanding of such processes was mainly their sociological description, terror management theory focuses on the understanding of these worldview changes in psychodynamic terms.

In the next section, I will review some of the research conducted within the framework of terror management theory, suggesting a deep existential motivation for cultural worldview changes in the face of threat. Next, I will demonstrate how it may contribute to our understanding of the psychological dynamics underlying the processes of worldview change described by Kuhn.

### The Existential Basis of Paradigm Change

TMT, inspired by anthropologist and existentialist Ernest Becker (1973), was originally developed to provide an account of the psychological function of self-esteem and cultural worldviews. The theory asserts that the juxtaposition of an inclination toward self-preservation with the highly developed intellectual abilities that make humans aware of their vulnerabilities and inevitable death creates the potential for paralyzing terror. Cultural worldviews allow the psyche to manage the terror of death through the belief that one is a valuable contributor to a meaningful universe. Effective terror management consequently requires faith in a meaningful conception of reality, or a cultural worldview, and a belief that one is meeting the standards of value prescribed by that worldview (Rosenblatt, Greenberg, Solomon, Pyszczynski, & Lyon, 1989).

The mortality salience (MS) hypothesis was developed to provide empirical support for the central tenet of TMT, that cultural worldviews serve a death-denying function. Specifically, to the extent that beliefs about reality serve to mitigate death-anxiety, when people are made aware of their mortality (i.e., when mortality is salient) they feel the need to uphold, strengthen, and defend their cultural worldview (Rosenblatt et al., 1989). In sup-

port of this proposition, numerous studies have found that reminders of death increase humans' preference for their own religion, nation, country, and related symbols (e.g., Castano, Yzerbyt, Paladino, & Sacchi, 2002; Jonas, Fritzsche, & Greenberg, 2005).

Further support for the role of worldviews as death-anxiety buffers is provided by studies indicating that having people ponder their own mortality should increase affection for people and ideas consistent with existing beliefs, and increase hostility and disdain for people and ideas in opposition to them. Specifically, studies have shown that reminders of death lead to more positive evaluation of those who praise one's culture, nation, and religion, and increase negative evaluations of those who criticize them (e.g., Castano, 2004; Jonas, Schimel, Greenberg, & Pyszczynski, 2002). Studies have also shown that MS increases the discomfort people experience when using religious, cultural, or national symbols inappropriately (e.g., Greenberg, Simon, Porteus, Pyszczynski, & Solomon, 1995). Similarly, challenges to religious beliefs, in the form of information about inconsistencies in the Bible or arguments supporting evolutionary theory, were found to increase death-related but not other types of negative thoughts among religiously devout persons (Friedman & Rholes, 2007; Schimel, Hayes, Williams, & Jahrig, 2007). Essentially, these studies show that when alternative worldviews or assessments of one's value are encountered, they are viewed as challenges to the established death-denying belief systems. According to TMT, this is why people are generally uncomfortable around, and often hostile toward, those who do not share their cherished religious and political values.

More relevant to the study of worldview changes, the logic of TMT implies that people respond to threats to their existential security by moving toward whatever element of their worldview provides the quickest, most efficient, and most secure buffer against the potential for anxiety. In the context of religious worldviews, people who believe in an afterlife become more confident in its existence after being reminded of death (e.g., Schoenrade, 1989). Death reminders also increase faith in supernatural agents among those who believe in God, but not among nonbelievers (Norenzayan & Hansen, 2006).

In the context of political worldviews, terror management research has found that clinging to extreme ideologies, whether left-wing or right-wing, helps manage existential threat (Jonas & Greenberg, 2004). In support of this proposition, Pyszczynski, Greenberg, Solomon, and Maxfield (2006) found that MS led political conservatives, but not political liberals, to increase their support for the use of extreme military force against terrorists. Similarly, Hirschberger and Ein-dor (2006) found that MS increased agreement for use of military force against the Palestinians only among Israelis who held right-wing ideologies. In another study, Jonas and Greenberg (2004) found that when reminded of their own death, people who support German reunification showed a more favorable evaluation of a positive essay about the fall of the Berlin wall and a more negative reaction to a critical essay than participants in the control condition. A similar pattern was found in a study conducted by Greenberg, Simon, Pyszczynski, Solomon, and Chatel (1992), who found that MS increased American conservatives' negative evaluations of out-group members, while increasing American liberals' positive evaluations of out-group members. In a recent study (Kosloff, Greenberg, Weise, & Solomon, 2010), MS caused increases in the preference of self-labeled

conservatives for conservative political leaders, and increased preference for liberal political leaders in self-labeled liberals. A similar pattern was found in a study examining the long-term consequences of real-life death reminders on political attitudes. In a recent study, [Chatard, Arndt, and Pyszczynski \(2010\)](#) have found that real-life personal loss (i.e., the death of a family member) was significantly associated with increased conservatism among relatively conservative participants, but nonsignificantly associated with decreased conservatism among relatively liberal participants. The authors conclude that loss seems to elicit a pattern of responses consistent with a polarization of preexisting worldviews, thus lending support to the terror management model of radicalization.

To date, in most studies on the existential underpinnings of worldview change, threat was elicited by using death reminders (for a review, see [Greenberg, Solomon, & Arndt, 2008](#)). However, because cultural worldviews serve an anxiety buffering purpose, threatening them directly is hypothesized to trigger worldview defenses similar to the ones induced by death reminders. In support of this proposition, recent research has shown that various kinds of threats to people's cultural, religious, or nationalistic worldviews can increase death-thought accessibility (DTA) in the absence of any explicit reminders of death, unless defensive beliefs have been activated preemptively or immediately in response to the threat (e.g., [Friedman & Rholes, 2007](#); [Hayes, Schimel, Arndt, & Faucher, 2010](#)). Other studies have shown that because worldview threats lead to a momentary breakdown in the anxiety buffer, worldview defenses will ensue in much the same way as when DTA is aroused by other means. For example, threats to one's sense of meaning and certainty (e.g., [van den Bos & Miedema, 2000](#)) have also been shown to produce effects similar to MS.

In conclusion, terror management advocates suggest that when death is salient the need for security and stability increases the tendency to cling to familiar worldviews. Most important, recent studies suggest that worldview threats often elicit similar protective responses; namely, strengthening one's belief in one's worldview. Hence, according to TMT, a worldview threat is in essence an existential threat that requires worldview protection or, in the context of religious and political worldviews, ideological radicalization.

However, TMT does not rule out the fact that other, more profound worldview changes may also be rooted in existential concerns, and it thus expands existential research to include worldview changes that do not follow a polarization pattern. Although terror management literature has so far mainly supported the claim that change is existentially threatening, and that MS typically increases resistance to change, studies suggest that some individuals find worldview changes more existentially threatening than others ([Anson, Pyszczynski, Solomon, & Greenberg, 2009](#)). Furthermore, some researchers point to numerous instances in which death reminders may promote cognitions and behaviors that increase uncertainty rather than reducing it. Similarly, studies show that when change does not bolster cultural worldviews, and when it entails more losses than gains, it is likely to be experienced as existentially threatening and will elicit greater resistance ([Hirschberger & Shaham, 2012](#)).

In fact, in the original theoretical statement of TMT, [Solomon, Greenberg, and Pyszczynski \(1991\)](#) wrote:

There may be circumstances under which individuals cannot maintain the cultural anxiety buffer, either because they cannot maintain a sense of value within the cultural drama, or because they can no longer sustain faith in the cultural drama itself. One possibility for such people is to find an alternative shared cultural worldview that is more compelling and better enables them to obtain self-esteem. Dramatic examples of this are individuals who experience religious conversions, join "cults," or emigrate to other cultures. (p. 133)

Consequently, several TMT-inspired research projects have set out to investigate the conditions under which people are apt to repudiate, rather than radicalize their cultural worldviews. Specifically, [Arndt, Greenberg, Schimel, Pyszczynski, and Solomon \(2002\)](#) have shown that when an in-group is framed negatively, MS leads in-group members to devalue, reject, or distance themselves from the group or its worldview. From the perspective of TMT, group identification serves an anxiety-buffering function, because it provides a sense that one is a significance contributor to a meaningful reality. When one's group is negatively valued, however, MS would reduce one's tendency to identify with the group, because it no longer provides a sense of self-esteem and existential security.

Major worldview changes, however, may not only result from negative framing of one's in-group. TMT also shows that severe trauma may lead to radical worldview changes. Specifically, [Pyszczynski and Kesebir \(2011\)](#) have shown that highly traumatic events, such as natural disasters, shatter survivors' core assumptions regarding the secure continuity of their existence and thus disrupt their anxiety-buffering mechanisms. According to the authors, while mild to moderate experiences of trauma typically threaten these meaning structures and therefore lead to more extreme attempts to defend them, more severe traumatic experiences sometimes lead to a more complete breakdown of these mechanisms. Because these views about the world serve an anxiety-buffering function, survivors of such trauma become vulnerable to recurrent bouts of anxiety, which leads to the onset of posttraumatic stress disorder (PTSD). This anxiety buffer disruption theory, proposed by [Pyszczynski and Kesebir \(2011\)](#), is largely based on [Janoff-Bulman's \(1992\)](#) theory of shattered assumptions: when a traumatic experience cannot be easily assimilated into existing meaning structures, an intense psychological crisis ensues, and trauma survivors are forced to adopt a modified view of the world.

Similarly, [Salzman \(2001\)](#) demonstrates how entire cultures' belief in their worldview may be shattered as a result of what he calls "cultural trauma." Specifically, when minorities or colonized cultures become marginalized, their culture is incapable of maintaining its anxiety-buffering properties. Under these circumstances, no anxiety-buffering self-esteem could be derived from meeting the standards prescribed by the devaluated cultural worldview. Unless culture members recover from this trauma by engaging in its collective reconstruction, the original trauma is transmitted across generations with compounding effects.

As this review shows, TMT emphasizes the existential importance of worldviews by suggesting that people will only rarely abandon them. According to this view, people rely so heavily on relational structures to understand events in their lives as to indicate that breakdowns of these structures are existentially threatening. Consequently, people will usually react to threat with attempts

to defend their worldview, but may choose, or be forced to abandon their worldview altogether when it fails to fulfill its protective function as an anxiety buffer.

Unfortunately, the cultural anxiety buffer requires continual bolstering and defense against threat. We are heavily dependent on other people for the maintenance of our own conceptions of self and world: we need them to validate us and believe the world is really as we perceive it to be, for us to maintain faith that they are as we perceive them. Thus, to strengthen the protective value of our worldview—we strive to convince others that our worldview is right and valid (Rosenblatt et al., 1989).

According to the existential perspective, however, protection from anxiety requires not only that one believes in the validity of a cultural worldview and the standards and values associated with it, but also that it meets or exceeds those standards and values. Becker (1973) argues that humans must feel that their acts are heroic, in that they are timelessly meaningful. Hence, the cultural worldview provides a context within which individuals can perceive themselves as valuable participants in a meaningful world. Moreover, the culture promises symbolic immortality to those who uphold its standards of value (Greenberg et al., 1990). The group remembers its heroes; symbolically, they will live forever in the group's collective memory (Kruglanski, Chen, Dechesne, Fishman, & Orehek, 2009).

According to terror management theorists, trying to achieve fame and social recognition, or seeking to connect the self to the famous, are manifestations of the human need to achieve symbolic immortality. In a recent study, Greenberg, Kosloff, Solomon, Cohen, and Landau (2010) found that MS led to increased self-reported desire for fame, interest in having a star named for oneself, and liking for an artwork created by a famous celebrity rather than an unknown artist. Similarly, McCabe, Arndt, Vail, and Goldenberg (2011) found that MS increased participants' preference for bottled water if advocated by Jennifer Aniston rather than a doctor.

Similarly, research has shown that engaging in risky behaviors would also entail the benefits of social status and social recognition, especially but not only when thoughts of death are made salient (e.g., Greenberg, Pyszczynski, & Solomon, 1997). Dangerous activities ranging from skydiving to substance abuse may offer individuals an opportunity to demonstrate mastery and courage (Hirschberger, Florian, Mikulincer, Goldenberg, & Pyszczynski, 2002). This is particularly true when such risky behaviors are likely to lead to heightened self-esteem. In a study by Taubman Ben-Ari, Florian, and Mikulincer (1999), reckless driving increased significantly when participants were reminded of their own mortality if driving was relevant to the participant's self-esteem.

Fame seeking or risk taking, however, will provide no symbolic immortality unless valued by one's culture or group. Celebrities are regarded as objects of primary value by virtue of their placement in the cultural system. In other words, according to terror management theory, heroes validate the cultural worldview by upholding cherished values, not by violating them (Rosenblatt et al., 1989).

In sum, TMT has contributed a great deal to the understanding of the psychological mechanisms underlying different forms of worldview change. Kuhn, on the other hand, has proposed a long-term perspective on paradigm change by describing multi-

phased, nonlinear developmental processes that may include the use of many different coping strategies. While terror management theorists have generally depicted the process of coping with ruptures in mental representations of reality as a choice between variations on the Kuhnian strategies of reinterpretation and revision, Kuhn raises the possibility that profound paradigm change is also a function of the persistence of the threat over time.

Can we therefore use existential terms to explain the psychodynamic mechanisms underlying such multiphased processes, such as the ones described by Kuhn? In the next section I will offer an existential interpretation of Kuhnian paradigm changes by analyzing two such large-scale worldview change processes.

### A Psychodynamic Interpretation of Kuhnian Paradigm Change

Both Kuhn and terror management theorists emphasize the central role played by worldviews, or paradigms, in defining individual identity. Consequently, both models posit that individuals will for the most part avoid revising their worldview to fit evidence that contradicts them, or threatens their absolute validity. According to Kuhn, this dynamic is characteristic of normal science, in which scientists operate within the confines of a given paradigm. Terror management theorists explain this dynamic by emphasizing the role of cultural worldviews as buffers against our deepest existential fears, and hence as a key source of meaning. Any threat to such sources of meaning and protection, according to this model, will thus be perceived as an extreme one. In this respect, the resistance to paradigm change in Kuhn's theory is akin to the process of radicalization described by terror management research: when our worldview is threatened, we will cling more closely to it in order to maintain its protective function. In existential terms, proving that the paradigm can be successfully utilized to explain a wide range of phenomena is a means to bolster it and reaffirm its absolute validity.

Worldviews, however, are considered by both models to be quite fragile constructions. According to Kuhn, when the accumulation of anomalous research findings can no longer be assimilated to existing paradigms, part of the scientific community comes to the conclusion that the current paradigm is in crisis and begins to look for alternatives. This is the time when scientific revolutions can occur.

In terror-management terms, a worldview ceases to provide a sense of self-esteem and existential security when it becomes clear that it no longer fulfills its essential function: it no longer explains empirical reality because it is contradicted by too many data. There comes a point where at least part of a scientific community no longer sees the attempt to explain away these contradictory data as anomalous, and therefore comes to the conclusion that the paradigm needs to be abandoned. Both Kuhn and TMT, thus, consider profound worldview changes as adaptive only when immunization of an existing paradigm or worldview no longer works.

From an existential perspective, however, scientists gravitate toward new paradigms not only because old ones can no longer provide existential security, but also because developing new ones provides the most valued routes to symbolic immortality. In the modern era, it seems that there is a high premium on being able to do "revolutionary" science. It seems that modern scientists achieve

the high standards for symbolic immortality in contemporary society by constantly generating innovation.

But if great innovation indeed promises symbolic immortality, was Kuhn wrong in his claim that solving puzzles within the existing paradigm is generally the norm? To answer this question, we must first define what counts as “revolutionary” or “normal” science. It has been claimed that most of today’s scientific production, particularly in the “hard” sciences, can be categorized as normal science, as it is mostly based on checking, trial-and-error improvement and incremental extrapolation of existing paradigms, rather than making new theories, discoveries or technologies. Supposedly, normal science now overwhelms revolutionary science in terms of quantity, as the standard scientometric research output (such as number of publications and citations) does not detect and measure the much rarer examples of paradigm-transforming research (Charlton, 2007).

Scientists working in modern-day universities are required to publish in peer-reviewed journals, or perish. Critics of this peer-review system claim that because reviewers are members of the same scientific communities as the researchers submitting the articles, modern science in fact promotes homogeneity in terms of what is recognized as scientific knowledge. The publish-or-perish system would seem to promote normal rather than revolutionary science (Borsen Hansen, 2006).

The distinction between “revolutionary” and “normal” science seems, however, a bit clearer in the social sciences. While social scientists are for the most part encouraged to advance ostensibly new theories, they are expected to test them using proven, primarily quantitative methods (Morgan, 2007). Social science seems to encourage “revolutionary” theory tested with “normal” methods if they wish to get published, be awarded grants, and receive research appointments. From a strict Kuhnian perspective, sticking to classic psychological methods to test new theories would not count as revolutionary science. Although scientists may imagine that they are doing revolutionary science in order to attain a sense of symbolic immortality, for science to count as revolutionary in Kuhnian terms, methodological innovation would be necessary.

This dynamic can be readily explained in existential terms. According to existential theory, human actions will only grant symbolic immortality if they are valued, or at least acknowledged, by the community in which the actor operates. Cultural heroes are those who live up to cultural norms and values, not those who violate them. Thus, revolutionary discoveries that challenge the very standards and values prescribed by a cultural worldview will provide no symbolic immortality, unless the scientific community is willing to consider the challenge as legitimate. This, according to Kuhn, will only be the case if the scientific community acknowledges that a crisis exists, thus loosening theoretical stereotypes. Although revolutionary science, or extraordinary innovation, is the ultimate pathway to symbolic immortality, the scale of scientific innovation is determined, according to existential theory, by the acceptance range of the scientific community.

Although “revolutionary” science may be seen as a clear pathway to symbolic immortality, it is also a risky one, as it cannot challenge “normal” models to too great an extent without running the risk of alienating the scientist. As a consequence, many scientists constantly seek a balance between the “revolutionary” and the “normal” in order to maintain their sense of symbolic immortality. From an existential perspective, thus, it seems that during periods

of paradigm change, scientists often attempt to satisfy what Becker (1973) referred to as the “twin ontological motives,” a paradox that is a necessary part of human existence. On the one hand, the fear of isolation and the need to expand one’s self-feeling impels individuals to merge themselves in a greater whole. At the same time, they strive to develop themselves as individuals by being unique and standing out as different or heroic. To achieve a guarantee of immortality, individuals seek a balance between personal fame and self-distinction on the one hand, and integration into a collective meaning system on the other.

As Kuhn notes, however, some parts of a scientific community may never give up their old paradigm. It seems that some scientists may never be able to live without the protective function and the identity-preserving structure of the paradigm they have been educated to believe in. As Max Planck quipped, “A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die, and a new generation grows up that is familiar with it” (Kuhn, 1970, p. 150). This dynamic corresponds to phenomena TMT has studied in depth: as terror management research suggests, worldview change will only occur during a deep crisis stemming from a protracted clash between the worldview and reality. The desire to sustain the belief in one’s worldview is the stronger force that will prevail as long as people can maintain it. In other words, both TMT and Kuhn view worldview immunization as the first line of defense against threat.

How can this psychodynamic interpretation of worldview changes be used to explain the processes described in Kuhn’s theory of scientific paradigm change? As a physicist, Kuhn focused on scientific paradigm changes in his fields of expertise. One of his most famous examples is the transition from classical mechanics to quantum mechanics and relativity at the end of the 19th and beginning of the 20th centuries. Relativity and quantum theory showed that the basic intuitions behind Newton’s universe were invalid. For a long while, this new theory met with strong opposition among physicists and, in Kuhn’s terms, scientists reacted by immunizing their existing worldview against this threat. In TMT terms, it seems that scientists chose to cling rigidly to their worldview to maintain its protective function in light of the threat on their meaning system. Over time, however, while some scientists remained loyal to the dominant paradigm, others, particularly young physicists like Bohm and Schrödinger, developed new paradigms to replace them (Kragh, 1999). How did this happen? Consistent with TMT research, when the old worldview no longer fulfilled its protective function, the new worldview had to be adopted. This revision of the existing paradigm was the result of a profound existential threat, as the old paradigms could no longer fulfill their protective function. In Kuhn’s terms, when the anomalies started to mount, scientists could no longer subscribe to the old paradigms; a scientific crisis occurred and eventually led to paradigm change.

### Paradigm Changes in Psychology

Here the following question arises: can we apply this Kuhnian-existential interpretation to paradigm changes outside the realm of so-called “hard” sciences? If we choose scientific disciplines as our units of analysis, using Kuhn’s terms may seem problematic. As opposed to physical science, which was at the focus of Kuhn’s

work, many other disciplines operate with more than one paradigm at any given time. In most social sciences, a single paradigm may not rise to complete dominance, and may not replace alternatives. The most widely used example in this context is the field of psychology, which many have claimed not to be a unified discipline, but rather a preparadigmatic field in which numerous schools and paradigms exist simultaneously (Staats, 1981). In the words of T. A. Leahey (1987), “There has never been a paradigm in psychology” (p. xiii). If indeed there was never a dominant paradigm in psychology, it follows that psychology never had a period of normal science in Kuhnian terms. However, paradigms clearly exist in the social sciences and humanities: think of behaviorism and the cognitive approach in psychology, the neoliberal model in economics, structuralism and functionalism in anthropology, analytic philosophy, or psychoanalysis. If we accept Kuhn’s model as a model of cultural worldview changes, we may still use his ideas to illuminate how paradigms develop and change in various contexts. Staying in the realm of science, we may use a different unit of analysis to describe worldview change processes. Specifically, we may examine paradigm change processes within the group holding a paradigm, regardless of how this paradigm measures up to others in a given discipline, or whether it is the dominant one or not. The unanimity requisite for possession of a paradigm is not problematic, according to Kuhn, if the unit of the analysis for paradigm attribution is taken to be the relevant scientific research community involved (Weimer & Palermo, 1973).

As opposed to many scientific disciplines, scientific communities, or schools of thought are essentially defined by a common or accepted paradigm (Hergenhahn, 2009). According to Kuhn’s original definition, a paradigm suggests that experiments are primary and which secondary to the advancement of knowledge, and enables practitioners to conduct research without establishing it anew with every experiment. Fifteen years after publishing *The Structure of Scientific Revolutions*, however, Kuhn wished to replace the term “paradigm” in the very broad sense he had originally intended, with a more explicit term, disciplinary matrix: “‘disciplinary’ because it is the common possession of the practitioners of a professional discipline and ‘matrix’ because it is composed of ordered elements of various sorts, each requiring further specification” (1977, p. 297). More accurately, Kuhn would rather the word paradigm refer to a narrower part of the disciplinary matrix, that of exemplars or puzzles, which are concrete problems solved by the forms provided (Spruiell, 1982). Thus, the interest of science is finding a solution to a problem, along pathways shared by the community, for which there is a solution. Even according to the narrower definition of a paradigm, most psychological schools resemble the scientific disciplines described by Kuhn in that they try to solve puzzles with the aid of shared rules, theoretical concepts and symbolic generalizations (Hergenhahn, 2009). Like disciplinary communities, most psychological schools share preferred metaphors or models for their structure and operations, and establish departments and professional societies that preserve the community and provide a setting for establishing or renewing their basic precepts (Schultz & Schultz, 2011).

According to this view, psychological schools indeed go through periods of normal science. According to Kuhn, the term “normal science” describes a period in which research is firmly based on a paradigm that supplies the foundations for further

practice. Normal science, according to Kuhn, is very selective in that it only accepts problems that tradition claims can be turned into solvable (Kuhn, 1962). Although there are many debates around the question whether such periods ever existed in psychology as a discipline, it adequately describes the state of mind of specific schools of thought in most contexts and periods of time.

## The Cognitive Revolution

A well-documented example is that of the shift from behaviorism to cognitivism in the mid-20th century in North America (Gardner, 1987). Although there is no consensus among psychologists as to whether behaviorism was or was not the dominant paradigm in psychology at that time (Baars, 1986; Hobbs & Burman, 2009), the behaviorist school of thought conforms to the stages of paradigmatic development described by Kuhn. Hence, we will focus on the school as the unit of analysis, and ask what happened to the behaviorists themselves when new evidence challenging their behaviorist worldview started to surface. There can be little doubt that behaviorism was a worldview: B.F. Skinner, one of behaviorism’s leading theorists and researchers, wrote two famed (or, depending on the perspective, notorious) books in which he expounded this view of nature, its philosophical underpinnings, and its social and political implications (Skinner, 1971, 1976).

From the 1920s onward, the behaviorist school flourished. It offered an agenda (behavior can be accounted for by behavioral laws), an epistemology (only observable behavior must be part of the theory) and a variety of techniques (classical and operant conditioning). After its initial success, however, problems emerged that were beyond the reach of behaviorist explanations, such as language and rational planning (Bechtel, 1988). In particular, Chomsky’s (1959) landmark article showed conclusively that behaviorism could not account for the most rudimentary processes of language acquisition (Giere, 1992). In the 1960s and 1970s, behaviorist models were under massive attack by scientists who tried to experimentally prove the detrimental effects of behavioral techniques, particularly the ones derived from reinforcement theory. Nevertheless, most behaviorists were initially reluctant to adopt cognitive theories and refused to abandon their behaviorist models and techniques, and in Kuhn’s terms, tried to immunize their worldview by avoiding any reference to mental states and processes. But as the evidence started to mount, the school went into a period of crisis, and many behaviorists started to consider alternatives that provided more convincing explanations to these questions.

Gradually, a new paradigm began to develop, which seemed an interesting alternative for many behaviorists. At this point, the school entered the period of revolutionary science, characterized by an ongoing struggle between defenders of the old paradigm and proponents of the new one. In the late 1950s and through the 1960s, there were heated debates between behaviorists and those advocating the new cognitivist approach about the legitimacy of positing mental states and using them as explanations (Bechtel, 1988). Over time, most of them replaced their behaviorist worldview with a cognitivist one, and made cognitive processes and mental events the focus of their work (Cameron & Pierce, 2002).

The exact nature of the change behaviorists went through is still in dispute. For example, Greenwood (1999) concluded that the

behaviorist descriptions were replaced by hypothetical constructs, or cognitive causes. Mandler (2002), on the other hand, suggested that behaviorists actually returned to prebehaviorist models and theories. Regardless of the exact nature of this change, however, it is clear that many behaviorists abandoned their worldview following their consistent exposure to evidence contradicting it, and most adopted a specific paradigm instead: the cognitive one. In this sense, at the final stage of the process, the new paradigm was adopted—regardless of whether it was adopted by psychologists at large, it is agreed that it was adopted by most behaviorists (Bechtel, 1988). This description is consistent with Kuhn's view of the process of paradigm change: while at first behaviorists tried to discard the evidence challenging their paradigm as anomalous, they eventually had no choice but to examine the popular alternative and abandon the older one.

However, some behaviorists persisted in their refusal to accept the new paradigm as an alternative to behaviorism. While on the one hand Chomsky is now taken to have already refuted behaviorism in 1957 (Giere, 1992), the number of articles published by behaviorist psychologists, specifically operant psychologists, actually increased. Operant psychology, which is seen as a radical form of behaviorism, was emerging, and prospers to this day (Smith, 1994). Kuhn does not rule out such an outcome, and acknowledges the possibility that some scientists may resist indefinitely. In fact, Kuhn argues that the assurance that “the older paradigm will ultimately solve all its problems, that nature can be shoved into the box the paradigm provides” (1962, pp. 151–152) is what makes normal science possible.

What we see here is a paradigm change within the school of behaviorists in North America. That there were other approaches that existed alongside the behaviorist approach is relevant only if one takes an exclusionary scientific perspective in the Kuhnian sense—looking at sciences rather than communities within a given science. Hence, while the term “cognitive revolution” may be inappropriate in describing a global phenomenon, it can be usefully applied to a certain community at a certain point in time.

### An Existential Analysis of the Cognitive Revolution

How can we use TMT to elucidate this process in psychodynamic terms? Evidence threatening the validity of the behaviorist approach as an explanation for human behavior was clearly perceived by behaviorists as a threat to the community as well as to its dominant worldview. In TMT terms, such consistent and profound threats to one's meaning system motivate worldview defense responses aimed at restoring its protective function. Therefore, consistent with TMT predictions, these threats were met with strong opposition—initially, scientists refused to acknowledge data contradicting their worldview in an attempt to maintain its anxiety-buffering function. It is interesting to note that some behaviorists never abandoned their cherished worldview and, at least at the group level, more radical forms of behaviorism were gaining popularity within the behaviorist community. As TMT researchers have demonstrated in a variety of cultural, religious and political contexts, when people are committed to a belief and a course of action, clear disconfirming evidence may indeed result in deepened conviction.

If so, why did so many behaviorists end up adopting cognitivism as an alternative framework? According to TMT, worldview

change can result from the failure of radicalization to provide the necessary protection following robust and persistent disconfirmation of one's belief. Consistent with this proposition, it seems that the disconfirming evidence had mounted sufficiently to cause the behaviorists' worldview to be rejected, as it no longer provided a buffer against existential anxiety and a sense of psychological security.

What specific factors made some scientists abandon the behaviorist worldview as a viable anxiety buffer or vehicle for symbolic immortality, whereas for others, it maintained these functions? According to existential theory, this depended on the extent to which the behaviorist worldview and community were able to provide the scientists with a sense of self-esteem and symbolic immortality. Moreover, adopting this new paradigm may have also entailed some rewards or benefits, particularly from an existential perspective.

What was specifically psychologically attractive about the new cognitive paradigm to which these researchers gravitated? How did they become endowed with a superior capacity for providing symbolic immortality? During the 1960s, the cognitive paradigm was rapidly becoming a trendy and prestigious field of study in the psychological community in North America. Joining this new community promised scientists an opportunity to make history by taking part in cutting-edge psychological research, that is, to gain symbolic immortality by being “revolutionary.”

The year 1956 is generally seen as critical for the development of cognitive psychology, and it was a year filled with relevant events, articles, and books. From the Special Group on Information Theory of the Institute of Electrical and Electronics Engineers at MIT to the RAND summer seminar on computer simulation, numerous prestigious institutes held highly publicized conferences in the field of cognitive science. Many of these were organized by the young generation of reformed behaviorists who later became leaders of the field, such as George Miller (Mandler, 2007). During the 1960s, two very influential research centers were established, the Center for Cognitive Studies at Harvard University and the Center for Human Information Processing at UCSD, which quickly became well known among psychological researchers. In the 1960s, cognitive science books written by young and upcoming scholars, such as Ulric Neisser's *Cognitive Psychology* and Koch's *Psychology: A Study of a Science*, were becoming tremendously influential, followed by the appearance of new and prestigious journals in the early 1970s, such as *Cognitive Psychology*, *Cognition and Memory*, and *Cognition* (Henriques, 2011; Tracy, Robins, & Gosling, 2003).

While some young scholars, like George Miller and Sigmund Koch, became disenchanted with behaviorism (Baars, 1986; Miller, 2003), there were more established behavioral scholars like B. F. Skinner, one of the founding fathers of classical behaviorism, were obviously reluctant to renounce their life's work by adopting the new paradigm and strongly resisted the trend. Of all major figures in classical behaviorism, Skinner was the most criticized behaviorist and consequently the most outspoken critic of the new paradigm, most famously in his 1977 article “Why I am not a cognitive psychologist,” published in the leading journal of his field, *Behaviorism*. In fact, his reluctance to accept any deviation from classical behaviorism is also evident in his reaction to the failure of Hullian theory, which he considered to be a result of “too much theory” (Baars, 1986). While this criticism labeled him



radical outside classical behaviorism, his star among his followers continued to rise, and his approach was ever more persistently applied within these circles.

It is important to note, however, that not all leaders of the cognitive revolution were young scholars at the onset of the revolution. Rather, some of the more influential figures who played a central role in sparking this revolution, such as Edward C. Tolman and Donald O. Hebb, were by then highly established scholars. Both, however, had recognized the importance of cognitive variables in behavioral research back in the 1930s, long before the formal revolution had started (Baars, 1986).

In short, at a time of massive threats to their scientific paradigm, behaviorists chose different paths to maintain their sense of meaning: while some chose to adopt the cognitive worldview in the hope of gaining symbolic immortality, some chose to protect their source of significance and self-esteem by strengthening their commitment to their worldview and community and resisting change.

### Paradigm Change in Psychoanalysis

A related example may be found in psychoanalysis. Whether psychoanalysis is or is not a science has been contentious from its earliest beginnings. Some of its critics, like Popper, thought that it could not be a science, because it could not be falsified (Popper, 1963). Others thought that central theoretical tenets of psychoanalysis could be tested in principle, but not with the clinical tools of psychoanalysis: systematic experimental, etiological, and developmental studies were needed to corroborate or falsify them (Grünbaum, 1984). Neither the champions nor the detractors of psychoanalysis would have denied that it is a worldview. W.H. Auden, in his poetic obituary for Freud written in 1939, spoke of psychoanalysis as a “climate of opinion.” It became the language in which Western educated middle classes understood their lives for the better part of the 20th century. Moreover, it became the dominant paradigm of American psychiatry after World War II (Hale, 1995).

Adolf Grünbaum was one of the philosophers of science who had delved deeply into psychoanalysis. One of his major claims (Grünbaum, 1984) was that psychoanalysis was based on Freud’s claim that only the resolution of unconscious conflicts and the lifting of central repressions could cure neurotic symptoms. This thesis was decisively rejected when, from the midcentury onward, a number of competing therapeutic methods like client-centered psychotherapy and behavior therapy were proven to be effective in bringing symptomatic relief.

In theory, the emergence of other forms of psychotherapy no less or even more effective than psychoanalysis could have been taken as a falsification of the whole psychoanalytic edifice. But, as Kuhn would have predicted, psychoanalysts by no means hurried to drop their paradigm. Psychoanalysis continued to thrive; psychoanalytic institutes trained thousands of practitioners; psychoanalytic journals continued to flourish, and psychoanalytic conferences were held around the world.

The older generation of psychoanalysts mostly clung to the Freudian paradigm, in line with Max Planck’s dictum quoted above, that most classical physicists never converted to relativity and quantum theory. This led critics like Ernest Gellner (1985) to claim that psychoanalysis was much more akin to religion than to science. However, some changed radically and adopted alternative theoretical frameworks, in line with Kuhn’s prediction: Heinz

Kohut, who had been president of the International Psychoanalytic Association, created Self Psychology, an approach akin to American humanistic psychology, that emphasized the self’s striving for coherence and self-expression (Kohut, 1971, 1977, 1984). He also claimed that psychoanalysis had an epistemology of its own, totally different from the natural sciences, based on introspection and empathy, a position opposed to Freud’s view that psychoanalysis was part and parcel of science as a whole (Freud, 1966).

Kohut’s biography shows the existential dynamic of paradigm change in very interesting ways. *Prima facie*, Kohut should not have challenged the existing psychoanalytic paradigm, as he was a highly regarded member of its community and became president of the International Psychoanalytic Association. But, as Strozier (2004) has amply documented, Kohut felt that classical Freudian theory created a personal problem for him; his first analyst had kept interpreting his psychological structure as an infantile defense against his oedipal strivings, and made Kohut feel inadequate and morally judged. Kohut’s reformulation of the theory of narcissism claimed that people like him were not fixated on early desires they did not want to abandon, but the victims of inadequate parental care. This resolved Kohut’s own conundrum: as Strozier shows, one of his most famous articles, “The Two Analyses of Mr. Z” is really a veiled retelling of Kohut’s own biography, showing that his new theory was far more capable of explaining his own character traits than classical psychoanalytic theory.

Kohut exemplifies the existential mechanisms discussed here in other ways as well. In his first two books, *The Analysis of the Self* (1971) and *The Restoration of the Self* (1977), he still coached his theory within the language of classical psychoanalytic theory. He even sent *The Analysis of the Self* to Heinz Hartmann, one of the dominant figures of classical psychoanalytic theory, for approval before publishing it. But in the late 1970s, Kohut came to know that he was terminally ill with leukemia. He set out to write what would be his last, posthumously published book, *How Does Analysis Cure* (Kohut, 1984), in which he completely abandoned classical psychoanalytic language and finally established his own self-psychology as an alternative paradigm. This powerfully corroborates existential theory: in the face of death, Kohut was less inhibited by social concerns and tried to achieve symbolic immortality as the founder of self-psychology as a new psychoanalytic paradigm.

Others were less inhibited to begin with: at the NYU postdoctoral program, a younger generation, mostly born after World War II, developed a new paradigm, relational psychoanalysis (Aron, 1996) from the 1980s onward. It was inspired by the surge of research in attachment theory and by the discovery that mother-child interaction was much more mutual than classical psychoanalytic theory had thought. The new paradigm largely focused on the development of intersubjectivity, and constituted a sharp break with classical Freudian psychoanalysis, as one of relational psychoanalysis’ major proponents argued (Mitchell, 1993). The willingness of these proponents to break with established psychoanalytic theory was partially because they were psychologists who, unlike psychiatrists, were only accepted into psychoanalytic training in the 1980s and were therefore less committed to the older psychiatric-psychoanalytic establishment (Hale, 1995).

But of course there were large groups in American psychoanalysis who continued to adhere to the classical psychoanalytic model. Many of their leading figures, like Kurt Eissler and Heinz

Hartmann, had immigrated to the United States before World War II and had built their whole lives on establishing psychoanalysis in the United States (Hale, 1995). Others, who proffered to stay in conservative institutions like the New York Institute of Psychoanalysis, felt that the long-standing Freudian paradigm provided them with existential safety, institutional belonging, and an integrated worldview that they did not want to abandon, and refused even to consider evidence detrimental to psychoanalysis (Gellner, 1985).

### **An Existential Analysis of Paradigm Change in Psychoanalysis**

The Kuhnian-existential perspective is well suited to interpret this dynamic. Psychoanalytic training requires a huge investment of time and money; it truly becomes the worldview of its theorists and practitioners, through which they view all facets of life. TMT would predict that worldviews as identity-defining as psychoanalysis will be protected strongly. To drop a worldview that has provided its practitioners and theorists with meaning and identity carries too high a psychological price (in addition to concrete financial interests). However, when new therapeutic frameworks and methods challenging the effectiveness of the classical Freudian paradigm began to emerge and gain popularity within the psychoanalytic community, many psychoanalysts chose to adopt these alternatives. In TMT terms, individuals' levels of investment in and identification with cultural worldviews depend upon the extent to which they provide them with meaning and self-worth. Hence, when the worldview threat undermines the basis from which that high self-esteem is derived, individuals may distance themselves from this worldview (Arndt et al., 2002). In this case, exposure to negative attacks on the classical Freudian paradigm may have led many psychoanalysts to seek an alternative meaning-providing worldview. As such alternative frameworks started to emerge, the Freudian paradigm ceased to be the dominant theoretical and practical framework within the psychoanalytic community, and was replaced by new, more lucrative and seemingly more effective paradigms.

One could also ask why models like self-psychology and relational psychoanalysis still place themselves within the psychoanalytic tradition at all, given that they have very few theoretical assumptions in common with Freud (Mitchell & Black, 1995). TMT has an interesting answer to this: one of the crucial psychological functions of worldviews is to provide symbolic immortality. The longer a culture and its worldview can claim to exist, the more its holders feel that they are guaranteed symbolic immortality. This might explain why today's psychoanalytic paradigms are interested in belonging to psychoanalysis, one of modern psychology's longest-surviving worldviews, rather than claiming that they have founded a completely new paradigm. While many of them disidentified with a specific theoretical group representing the Freudian paradigm, they did not disidentify with the larger community of psychoanalysts.

Here we can once again return to Becker's notion of the "twin ontological motives." The fact that many psychologists have kept one foot in the ideas of psychoanalysis despite the fact that this paradigm has been generally discredited may partially be attributed to the deep need to balance between the two seemingly contradicting motives of uniqueness and codependency. Staying

attached to some aspects of a prior paradigm, while also inventing elements of a new paradigm, may have allowed them to build a strong anxiety buffer guaranteeing both their collective recognition by their peers and their own sense of personal immortality.

This phenomenon is also consistent with Kuhn's model of paradigm shifts in science: by adopting new theoretical and methodological paradigms, scientists do not necessarily disidentify with the scientific community. In fact, for Kuhn, the very reason scientists resist paradigm changes so strongly is to preserve their professional identity. In Kuhn's (1963) words, "... can we be surprised that scientists resist paradigm change? What they are defending is, after all, neither more nor less than the basis of their professional way of life" (p. 363). Hence, founding or adopting a new paradigm within the same professional or academic community is consistent with the need to preserve one's professional identity and way of life.

### **Suggestions for Future Research: Scientists and Their Paradigms**

As the examples used in this article show, a Kuhnian-existential interpretation of worldview changes in science and scientific or professional communities may deepen our understanding of such processes. Specifically, existential theory and the above examples suggest some existential variables that may be considered when making predictions about individual scientists' choices between remaining committed to their preexisting paradigm and moving toward a paradigm shift.

(1) Individual scientists may be predisposed to embrace or reject paradigm change by the amount of anomalous evidence questioning the paradigm. As argued by both Kuhn and TMT researchers, the more extreme the degree of anxiety-buffer disruption following a threat to the scientific worldview, the more the scientist is willing to abandon the existing paradigm in favor of an alternative.

(2) The predisposition of scientists to change their paradigms may also depend on the extent to which the existing scientific worldview and community are able to provide them with a sense of self-esteem and symbolic immortality. Hence, another existential factor in predicting paradigm change may be the extent to which the scientist's self-esteem is currently invested in the existing paradigm. If a scientist's career and reputation were largely based on her work within the existing paradigm, abandoning it would entail the risk of losing her main source of meaning and self-esteem. If, on the other hand, a scientist had not yet built a reputation in this field, starting anew within an alternative paradigm would seem to be less risky in existential terms.

(3) A scientist's willingness to embrace paradigm change could be influenced by the extent to which she has access to other sources of meaning and immortality outside of her career. If an individual's career as a scientist is considered central to her identity or is experienced as a primary source of self-esteem, be it close relationships, religion or alternative scientific worldviews, she may be more likely to reject paradigm change. Alternatively, when a scientist has alternative sources of self-esteem and meaning from which she can derive a sense of symbolic immortality, she may resort to them when her scientific worldview is under threat, whether permanently or temporarily, until she can find a satisfying alternative.

(4) Another relevant factor is the scientist's age. In a scientist's later career changes, her existential investment in the scientific paradigm is much higher, and thus may predict a reluctance to abandon it. In addition, the very closeness of death may in itself affect the scientist's openness to paradigm change. As TMT research has shown time and again, when death is made salient, the tendency to cling to familiar worldviews increases (for a review, see Greenberg et al., 2008).

(5) The extent to which a scientist is invested in individual versus group-based immortality striving might impact his or her propensity to staying within a paradigm. As noted before, scientists will usually strive to balance between the need for personal fame and being a significant part of a larger whole. However, some people may be more inclined toward one or the other. If a person is mostly invested in promoting her personal fame and recognition, losing her group-based support may seem less threatening, as her sense of meaning and immortality is less derived from her group affiliation. Moreover, in such cases, standing out in a group of scientists by rebelling against the dominant paradigm may even be rewarding in and of itself, as it entails the potential of gaining a heroic status within a community supporting an alternative paradigm.

(6) An alternative worldview will not, however, provide a sense of symbolic immortality unless it has gained sufficient support within the scientific community. In other words, the symbolic immortality potential of the new paradigm is highly dependent upon the amount of enthusiasm for and evidence supporting it.

Although this list of hypothetical factors is inevitably speculative, it may potentially help advance research both on philosophy of science issues and within experimental existential psychology. Thus, future research is encouraged to empirically examine the role of these factors in predicting paradigm change in science, and particularly in psychology.

Such expansion of Kuhn's model to psychology should, however, be executed with caution. Although, like TMT theorists, Kuhn considers paradigm shifts to be infrequent, dramatic developments, he argues that most scientific disciplines like physics, chemistry and biology have gone through such change cycles repeatedly. In fact, Kuhn describes successive paradigm changes as the typical developmental pattern of scientific progress or as a natural result of continuous worldview disconfirmations by reality.

Does the same happen in psychology? Clearly, paradigm changes in psychology or any other science do not always follow a multiphased change pattern similar to the ones described by Kuhn. Thus, along with Kuhn, it is important to note that this article does not intend to predict the occurrence of such changes nor does it claim that the commutation of scientific evidence contradicting dominant paradigms will always lead to paradigm change. Rather, along with Kuhn, it proposes that we may be able to explain such complex processes in retrospect, once we acknowledge that they may indeed occur.

### Conclusion

Complex social processes are of necessity multitiered, and it is therefore essential to elucidate them with interdisciplinary tools. Thomas Kuhn's seminal model of scientific paradigm change originally showed that philosophical models of science needed to be supplemented by data from the history of science, and that

sociological tools were required to understand the complex dynamics behind the evolution of science. Existential psychology has developed concepts and theories that shed light on these processes from a different and extremely important vantage point. Specifically, terror management research emphasizes the existential importance of worldviews and specifies the conditions under which individuals will radicalize, or even abandon their worldviews when they are faced with existential threat. This article hopes to demonstrate that Kuhn's stages of scientific paradigm change acquire psychological depth when seen from the paradigm of existential psychology. Kuhn's model of paradigm change proposes a long-term, multiphased perspective that could also be applied to worldview changes in communities that are not strictly scientific.

Future research may show that integrating a Kuhn-based model of cultural worldview change with existential thought might allow us to further expand our understanding of worldview changes in various contexts.

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