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# Step by Step: Finding Compensatory Order in Science

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## Abstract

People are motivated to maintain the belief that they live in an orderly world in which things are under control. Previous research has shown that perceptions of order can be maintained via two routes: affirming personal control over one's life and future outcomes, and bolstering one's belief in external systems or agents that exert control over the world. Both religion and sociopolitical institutions can provide subjective and socially sanctioned security in the context of low personal control or disorder in one's environment. In this article, we argue that belief in science and progress could serve a similar function. Science is not only assumed to simplify people's lives; it also creates a sense of order and predictability. We show that perceiving order (regardless of external agency) can be sufficient to combat lack of control, and that perceptions of order can be derived from science and from more general beliefs about progress. We also discuss findings from our research addressing the processes underlying these effects and the functionality of compensatory beliefs and perceptions. We conclude that endorsing scientific theories and beliefs in societal and scientific progress helps people regulate threats to order and control, as long as these theories and beliefs suggest that the world is (or will be) an orderly place.

## Keywords

compensatory control, randomness perceptions, scientific theories, belief in progress, religious belief

Disorder is our worst enemy.

—Hesiod, c. 700 BC

Given that control is considered to be a fundamental human motivation (Heckhausen & Schulz, 1995; Skinner, 1996), a rapidly increasing amount of research has aimed to explain how people deal with fluctuating levels of personal control. A recent influential perspective is the compensatory control model (CCM; Kay, Gaucher, Napier, Callan, & Laurin, 2008; Kay, Whitson, Gaucher, & Galinsky, 2009), which, in accordance with seminal work by Rothbaum, Weisz, and Snyder (1982), distinguishes between primary, or personal, control (the ability to influence the environment in response to personal needs) and secondary, or compensatory, control (the ability to adapt the self in response to the environment<sup>1</sup>). The CCM posits that striving for personal control is part of people's more inclusive motivation to perceive order in the world (see also Janoff-Bulman, 1992; Krantz, 1998; Kruglanski & Webster, 1996; Lerner, 1980; Pittman, 1998, for the idea that

perceiving the world as orderly and predictable is pivotal to human functioning).

Being in control over outcomes (personal control) and perceiving external systems to be in control (compensatory control) serve the same function and therefore are psychologically substitutable sources of order. Thus, maintaining perceptions of order in the world and preventing aversive cognitions related to randomness can be achieved through both personal control and compensatory control. Moreover, when personal control is low, the need to bolster compensatory control increases, and when personal control is high, the need to bolster compensatory control decreases.

Kay et al. (2008) showed that threats to personal control enhance belief in the existence of a controlling God and increase the tendency to defend and justify the

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sociopolitical system. Research findings have suggested that there is a *hydraulic*, or intersubstitutable, relationship between personal and external control: Not only do randomness primes (e.g., the world is not orderly) tend to increase belief in a controlling God (Kay, Moscovitch, & Laurin, 2010), but challenging an external source of control (e.g., the government) also motivates people to increase their belief in an alternative source of control, either by exaggerating their personal control or by bolstering their perceptions of external control (e.g., God; Kay, Gaucher, McGregor, & Nash, 2010; Kay, Shepherd, Blatz, Chua, & Galinsky, 2010). The latter finding thus helps explain not only how people deal with fluctuating levels of personal control, but also how they may cope with fluctuating levels of external control (e.g., governmental instability).

### Compensatory Order Without External Control

Spilka, Shaver, and Kirkpatrick (1985) and Rothbaum et al. (1982) argued that an important function of belief in God is that it fulfills the need for (secondary) control. Research based on system-justification theory (Jost, Banaji, & Nosek, 2004) has also shown that defense of one's sociopolitical system is a potent source of compensatory control.<sup>2</sup> However, in this article, we venture beyond the realm of external control and focus on *science* as a source of perceived order in the world. Drawing on the importance of perceptions of order and on the CCM's assertion that perceiving order is the driving force behind the effects of threats to control (hereafter referred to as *control-threat*), we propose two related ideas. First, in the process of coping with threats to control, an external agent or system can be sufficient but is not essential for threat compensation—affirmations of order that do not involve external control should also suffice (see also Whitson & Galinsky, 2008). Following from this idea, we expect that affirmations of order can be provided by more future-oriented belief systems than those mentioned in the literature thus far. This provides a wider perspective than the prevailing emphasis on more conservative (i.e., maintaining the status quo) or defensive belief systems as a way to compensate for psychological threat.<sup>3</sup> The research we describe here focuses on scientific theories that impose order on reality and on more general beliefs about scientific and societal progress.

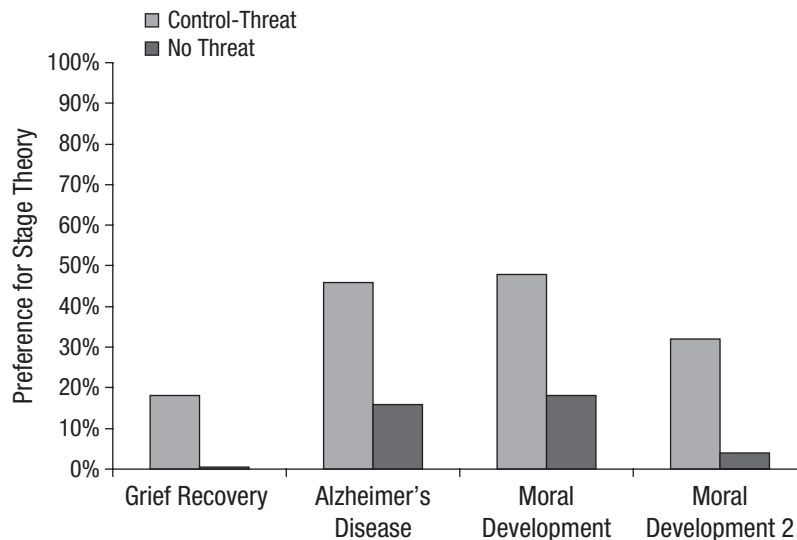
### Finding order in scientific theories

In an initial study (Rutjens, van der Pligt, & van Harreveld, 2010), we addressed whether order without external control is sufficient (i.e., whether or not people necessarily prefer external control over non-agentic alternatives) and

whether order can be conferred from both religious and scientific views on the origin of life. More specifically, we compared participants' preference for intelligent design (a worldview describing order provided by an agent), Darwin's theory of evolution (a theory that specifies no agent and allows for randomness), or an orderly perspective on evolution (a theory that offers a more "orderly" view than Darwin's classic view on evolution but that still involves no agent; Conway-Morris, 2005) as a function of control-threat. As expected, control-threat enhanced participants' preference for intelligent design only when the alternative was Darwin's theory of evolution. A threat to control also caused an increase in preference for the orderly perspective on evolution over the less orderly perspective, but threat had no effect when participants were asked to choose between the orderly theory of evolution and intelligent design.

This finding was extended by a second line of research (Rutjens, van Harreveld, van der Pligt, Kreemers, & Noordewier, in press) that focused on the effects of threats to control and order on preference for scientific theories—more specifically, preference for stage theories versus continuum theories. Whereas stage theories explain a certain process (e.g., moral development; Kohlberg, 1958) in terms of an orderly and predictable series of discontinuous steps, continuum theories describe phenomena as gradual transitions without clear disruptions or steps. Building on the idea that stage theories might be psychologically appealing because they help people to impose order on reality (by molding complex behavioral and environmental variables into an orderly sequence of stages) and to understand and predict current and future outcomes (Shermer, 2008), we sought evidence for a compensatory function of stage theories in science.

Results from five experimental studies (see Fig. 1) showed that threatening participants' feelings of personal control, as well as priming randomness-related concepts, significantly increased participants' preferences for stage theories over continuum theories. We observed this effect for a variety of theories (having to do with, e.g., grief recovery and moral development). Moreover, we showed that people rate stage theories as providing more order and predictability than continuum theories. Additional analyses provided evidence in support of our hypothesis that illusory pattern perception (i.e., the tendency to infer patterns where none exist; see Whitson & Galinsky, 2008) mediates the effects of control-threat on theory preference, indicating a motivated search for order. In summary, threat triggered the motivation to impose order on chaos, and this increased preferences for order-providing theories. Finally, one of these studies provided an important additional insight into the process of order compensation: The motivation to regulate threats to control and



**Fig. 1.** Percentage of participants preferring stage theories of grief recovery, Alzheimer's disease, and moral development over continuum theories of the same processes as a function of threats to order and control (Rutjens, van Harreveld, van der Pligt, Kreemers, & Noordewier, in press). Note that in the study involving theories about dementia, threat was manipulated by assigning participants to either a randomness prime (threat to order) or a negativity prime (no threat to order).

order seemed powerful enough to override people's preference for positively valenced outcomes.<sup>4</sup>

### ***Order-providing beliefs in scientific progress***

This proposal of the primacy of perceptions of order, rather than external control per se, paves the way for exploring other beliefs and views on the world that might harbor a compensatory-order function. Theoretical observations from philosophy and historiography inspired us to investigate the idea that belief in scientific and societal progress might also harbor a compensatory-control function. Indeed, belief in progress—in other words, faith in the notion that the course of scientific endeavors and human history is not cyclical but rather follows an upward trend—can be associated with a view of the world as orderly and under control (see Gray, 2004; Russell, 1929), as well as with a view of the course of human history as predictable (because it is gradually progressing according to logical laws of cause and effect; Bury, 1920/1955).

In two different lines of research, we and our colleagues investigated the hypotheses that a threat to control enhances belief in progress and that affirming belief in progress helps to restore perceptions of order (i.e., it has functional value). In the first set of studies (Rutjens, van Harreveld, & van der Pligt, 2010), we observed that lowering people's personal control indeed increased their tendency to defend the idea of

human progress and increased faith in scientific and societal progress. Moreover, we found that threats to control specifically enhanced willingness to invest in future-oriented research and development (e.g., stem-cell research and nanotechnology).

A second line of research (Meijers & Rutjens, 2012) provided evidence for the functional value of belief in progress by systematically exploring the effects of affirming belief in scientific progress as an external source of order (rather than measuring it as a dependent variable). In one study, participants who had read an article that affirmed the reality of scientific progress (i.e., it described science as progressing at a fast rate and enabling society to control problems related to the natural environment and human health in the not-too-distant future) reported higher perceptions of order in life and in the world than did participants who had read an article that questioned scientific progress. Moreover, this line of research yielded evidence for a surprising benefit of threats to order. On the basis of the CCM's view on the substitutability of sources of order (Kay, Shepherd, et al., 2010), we found that priming randomness (vs. order) increased people's intentions to engage in environmentally sustainable behavior. A subsequent study showed that engaging in such behavior can boost perceptions of personal control when order is threatened.<sup>5</sup> A final experiment showed that affirming scientific progress decreased people's intentions to engage in environmentally sustainable actions, and that this inertia effect was mediated by

enhanced perceptions of order in life and in the world (see Fig. 2 for a graphic summary of the results).

Thus, this set of studies provided direct evidence for the functional value of compensatory belief systems. Moreover, in line with the idea of hydraulic sources of order, the beneficial consequences of threats to order described here of course also imply a potentially detrimental consequence of external-order *affirmation*: behavioral inertia. It may very well be the case that similar inertia effects occur in other domains. For example, an exaggerated faith in medical advances might have detrimental effects on health behaviors, and similar processes might also occur in the domains of religious and sociopolitical beliefs (e.g., perceiving God or the government as strongly exerting control may lead to inertia; see also Laurin, Kay, & Fitzsimons, 2012).

## Conclusion and Future Directions

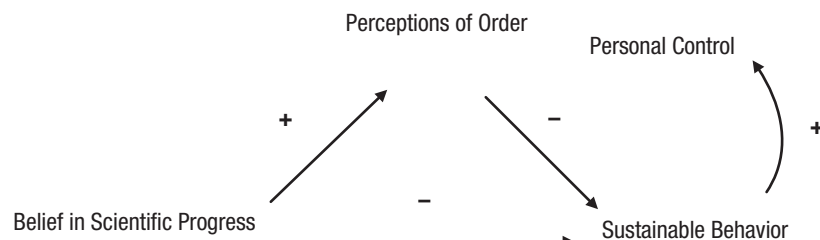
The research we have summarized in this article shows that people are quite flexible and adaptive in finding compensation for threats to control and order. Compensation can be achieved not only by affirming beliefs in controlling external agents and systems but also by endorsing order-providing scientific theories and ideas about scientific and societal progress. These findings are important because life in modern society can be replete with reminders of uncontrollability and randomness. Large-scale events (e.g., natural disasters, economic crises, wars, or terrorism), but also more personal events and incidents (e.g., sudden illness or loss of one's job), can threaten perceptions of personal control as well as beliefs in an orderly and predictable world.

Given that the way people compensate for such events often seems to entail the motivated support for particular belief systems, and that threat compensation as such often translates to a defensive bolstering of systems and institutions (i.e., system justification; Kay & Friesen, 2011; see also Rutjens, van der Pligt, & van Harreveld, 2012), it is important to recognize that threat compensation can also be facilitated without such a reliance on external systems (and without having to resort to other, arguably

less rational, nonagentic sources of compensation—e.g., magical thinking or endorsement of conspiracies; e.g., Whitson & Galinsky, 2008). Compensatory order can even be found in future-oriented and socially engaged ways of thinking (“Yes we can”; Rutjens, van Harreveld, & van der Pligt, 2010), as has been shown by our studies on belief in progress. Moreover, threats to order and control not only enhance such belief in progress but can even induce behaviors that are needed to actually facilitate progress.

The research reported in this article shows that we are not restricted to God or country in our search for compensatory order. Scientific theories and worldviews can help, too. This is important for public perceptions about the role of science in society; understanding how science can fulfill the fundamental need for order can advance knowledge on how to positively affect these perceptions. Whether people will rely on belief in God or country, on magical thinking, or on belief in science and progress is not easy to predict and is likely influenced both by pre-existing beliefs and by folk intuitions about science (e.g., Keil, 2012). However, science might have an edge here because it is arguably perceived as generally providing order, whereas religious and sociopolitical beliefs differ in the extent to which they provide order (Kay et al., 2008). Finally, the extent to which people engage in defensive or socio-politically conservative compensation or endorse future-oriented progress-related beliefs may also be influenced by the regulatory needs associated with their current motivational state (promotion or prevention; Higgins, 2000), as well as by cultural differences (e.g., Heine & Lehman, 1995).

In this article, we have also provided insight into the mechanism underlying threat compensation as well as the functional value of compensatory beliefs and preferences. Moreover, our research on stage theories has indicated that order is sometimes preferred regardless of whether outcomes are positive or negative. There are many exciting avenues future research might take, of which we think advancing insight into the flexibility, process, and functional value of threat compensation is most important. Given the substitutability of external sources



**Fig. 2.** A model showing the effects of affirming belief in scientific progress on perceptions of order and engagement in action associated with personal control over outcomes (sustainable behavior).

of control (i.e., God and government; Kay, Shepherd, et al., 2010), it would be fascinating to explore to what extent the flexible employment of these hydraulic sources also holds for scientific versus religious worldviews (Preston & Epley, 2009; Rutjens, van der Pligt, & van Harreveld, 2010).

Gaining more insight into the process underlying threat compensation poses another challenge for future research. More specifically, it remains to be seen whether compensatory beliefs and preferences primarily provide *compensation* (so that the threat remains but the person is better equipped to psychologically cope with it or is inoculated against it) or actually *regulate* the threat (so that the threat is effectively removed). We hope that future research will further advance understanding of the diverse ways in which people cope with threats to control and order.

### Recommended Reading

- Kay, A. C., Gaucher, D., Napier, J. L., Callan, M. J., & Laurin, K. (2008). (See References). A report of empirical research systematically investigating belief in God and government as compensatory control mechanisms.
- Rothbaum, F., Weisz, J. R., & Snyder, S. S. (1982). (See References). A seminal article on primary and secondary control constructs.
- Rutjens, B. T., van Harreveld, F., van der Pligt, J., Kreemers, L. M., & Noordewier, M. K. (See References). An empirical article showing that stage theories in science provide compensatory order and increase in attractiveness when personal control and perceptions of order are threatened.

### Declaration of Conflicting Interests

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

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### Notes

1. Compensatory control is a form of secondary control that is somewhat related to what Rothbaum, Weisz, and Snyder (1982) called *vicarious control*. However, vicarious control refers to aligning oneself with a powerful agent to share in that agent's power (e.g., praying to God in order to obtain certain outcomes), thus providing what could be called indirect personal control. Compensatory control merely refers to endorsing faith in a powerful other in order to assure oneself that "things are under control."
2. Although religion seems to offer an especially powerful compensatory control mechanism, given that belief in God is arguably less prone to fluctuations in the perceived stability of the agent's ability to control outcomes (compared to, e.g., governmental control).

3. This emphasis is prevalent in the general threat-compensation literature—see, for example, research focusing on uncertainty (e.g., McGregor, Haji, Nash, & Tepe, 2008), meaning-threat (Proulx, Heine, & Vohs, 2010), and existential anxiety (Greenberg, Solomon, & Arndt, 2008; but see Vail et al., 2012).
4. In this study, we presented participants with two theories on Alzheimer's disease, one of which was a stage theory describing clearly discernible stages in a predictable process of decline (from mild to severe cognitive deterioration). The alternative continuum theory described a less set process and explicitly mentioned the possibility of living in relative health for a considerable amount of time after being diagnosed. Interestingly enough, threatened participants showed a significant preference shift in favor of the stage theory characterized by negative predictability, whereas the majority of the nonthreatened participants clearly preferred the continuum theory, which was both more uncertain and more hopeful.
5. Kay, Shepherd, Blatz, Chua, and Galinsky (2010) reported a study in which they showed that affirming the government's ability to provide control reduced belief in an alternative source of external control (God). In our research, we investigated whether the desire to exert personal control was also reduced when perceptions of order were affirmed, in a domain in which such an enhanced incentive to act could be considered desirable. Given the themes that formed the context of these studies (scientific progress and environmental problems), we focused on sustainable behavior as a means to exert personal control over outcomes.

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