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Start making sense: Compensatory responses to control- and meaning threats

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Chapter 4

Questioning science fosters sustainable behavior

This chapter is based on Meijers, M. H. C., & Rutjens, B. T. Questioning science fosters sustainable behavior. *Manuscript under review.*

Floating cities, solar powered cars, and self-supporting buildings. The climate is changing, but judging from the media it often seems that science is always one step ahead (e.g., Miller, Tegen, & Perlwitz, 2004; Rosenfeld et al., 2008). Might this optimistic view on science contribute to the fact that people have a hard time to behave sustainably (Dunlap, Gallup, & Gallup, 1993)? Lay people's knowledge about science is often based on popular media coverage of science (e.g., Caulfield, 2004; McInerney, Bird, & Nucci, 2004). Research has however shown that popular media often overstate the progress of science and its ability to provide solutions to pressing problems such as climate change and diseases (e.g., Corbett & Durfee, 2004; Stewart, Dickerson, & Hotchkiss, 2009; Weaver, Lively, & Bimber, 2009). For example, diseases like cancer and HIV are still difficult to combat, but are often portrayed as nearly 'solved' problems (Donovan, Carter, & Byrne, 2006). We argue that such communication instills a view on the environment and the world as being under control and manageable. Based on recent research demonstrating the substitutability of external sources and personal actions in meeting the fundamental motivation to perceive order (Kay, Gaucher, Napier, Callan, & Laurin, 2008), we contend that affirming belief in science will lead people to engage less in sustainable behavior because they feel that personal actions are unnecessary.

Disorder, Order, and Control

People are motivated to perceive the world as orderly and structured (e.g., Kay et al., 2008; Kruglanski & Webster, 1996; Whitson & Galinsky, 2008). When they perceive their lives to be less orderly than desired, people try to counteract these feelings of disorder. One of the antidotes to these unsatisfactory feelings is affirming the feeling of being in control. When

people experience a sense of personal control, they feel that they are able to predict and influence their environment, which bolsters the belief that they are in fact leading an orderly life in a sense-making world (Kay et al., 2008).

Additionally, research has shown that unsatisfactory feelings of disorder may not only be countered by affirming a sense of *personal* control, but also by affirming a belief in *external* sources of control. Personal control and external agents that control outcomes complement each other so as to create an optimal level of order and to thwart perceptions of disorder (Kay, Shepherd, Blatz, Chua, & Galinsky, 2010). For example, when people perceive the world to be chaotic as a consequence of low personal control they may affirm their belief in an intervening God, since this external agent provides compensatory control and thus imbues the world with order.

Recently, research has shown that another provider of compensatory control is belief in the progress of science (Rutjens, van Harreveld, & van der Pligt, 2010). Scientific progress indicates that humanity possesses an increasing ability to exert control over the world, thus providing compensatory control similar to, for example, religious belief -- but without relying on a supernatural agent. This suggests that affirming people's belief in science helps reducing feelings of disorder. Based on the idea that personal and external feelings of control are compensatory (Kay et al., 2010), we assume that when people strongly believe in scientific progress (i.e., an external source) the need to exert personal control becomes redundant, as the world already is perceived to be an orderly place. However, when belief in science is lacking exerting personal control can function as a means to restore order. We posit that engaging in sustainable behavior is one way to restore order, because people experience personal control when aiming to influence a certain

outcome (similar to previous findings showing that behaving in a pro-social manner restores order; Banfield, Nadolny, & Kay, 2011). This suggests that engaging in sustainable behavior (personal control) and a strong belief in science (external control) are compensatory sources of order.

In other words, we hypothesize that affirming one's belief in scientific progress leads to a decrease in sustainable intentions and behavior, since desired levels of order are already met through the external agent (i.e., science), rendering the effectuation of personal control (i.e., behaving sustainably) superfluous. As such, communicating about science in a way that it seems infallible and rapidly progressing may actually cause passivity and lessen personal actions like sustainable behavior. In contrast, questioning scientific progress should foster sustainable behavior since optimal levels of order are not provided by an external source, resulting in an elevated motivation to effectuate personal control. We will test these hypotheses in four studies. We start by investigating whether tempering belief in science indeed increases feelings of disorder, compared to affirming belief in science (Study 4.1). In Study 4.2 we investigate whether a disorder prime encourages sustainability intentions to a higher extent than an order prime. In Study 4.3 we test the full model, in which we hypothesize that affirming scientific progress diminishes feelings of disorder (compared to a tempered belief in scientific progress) and as such lowers sustainability attitudes and intentions. In contrast, questioning scientific progress is expected to heighten feelings of disorder and thus enhance sustainability attitudes and intentions. In the fourth and final study, we more directly test whether expressing sustainability attitudes and making sustainable choices can indeed be understood as a way to regain personal control (and as such help meeting the primary need to

restore perceptions of order). We expect that tempering belief in scientific progress leads people to make more sustainable choices, but that this effect disappears when they engage in a personal control affirmation task first.

Study 4.1

Method

Participants and Design. One hundred and two participants ($M_{age} = 19.54$, $SD_{age} = 3.04$, 79.4% female) participated voluntarily in the study. They were randomly assigned to one of two conditions (belief in scientific progress: affirming, tempering) of a between-subjects design.

Procedure. Participants came to the lab and received a paper-and-pencil questionnaire that ostensibly consisted of several unrelated questionnaires. They were asked to read all the instructions carefully and to ask for help if they had any questions. Participants first read a newspaper article about the progress of science, next they were asked to complete a sustainability questionnaire.

Belief in scientific progress manipulation. We created two counterfeit newspaper articles to manipulate belief in scientific progress. These articles were identical in length (420 words). Moreover, the lay-out and writing style were modeled after articles of a popular Dutch news website. In the *affirming belief* condition we stressed that science progresses rapidly. The article described how diseases that used to have disastrous consequences, like tuberculosis, are now more easily combated. Furthermore, it described how the treatments for potential deadly diseases like HIV and cancer are improving, and how science provides solutions for problems like climate change by inventions such as electric cars and floating cities. In the *tempering belief* condition we stressed that while scientific progress does occur, its pace

is oftentimes insufficient to provide solutions to urgent problems. The article described how diseases that used to have disastrous consequences, like tuberculosis, are now more easily combated, just like in the affirming belief condition. However, the article stressed that although the treatments for potential deadly diseases like HIV and cancer are improving, these diseases are still hard to combat. Moreover, it posited that although science is starting to provide initial solutions for climate change issues, these solutions do not yet suffice. For example, electric cars still need energy, and as such still contribute to climate change.

Dependent measures. Participants completed a questionnaire that measured perceptions of disorder; *the events in my life are largely coincidental and our lives are being ruled by randomness*, $r = .56$, $p < .001$. The other items were manipulation checks. The first was to verify that our manipulation of a tempered versus affirmed belief in scientific progress was effective; *to what extent do you think science is capable of solving climate-related problems?* The other two items aimed to ensure that our manipulations did not alter personal feelings of control; *to what extent do you feel you can influence your environment*, and *to what extent do you experience control over your life in general*, $r = .21$, $p = .031$. The latter is important since we wanted to check that our manipulations did not affect people's (perceived) ability to act in the tempered belief condition, but only people's implicit motivation to act. After completing the questionnaires, that were all measured on a scale from 1 (*completely disagree*) to 7 (*completely agree*), participants were thanked for their participation and debriefed.

Results and discussion

Results of a one-way ANOVA showed that we successfully manipulated belief in scientific progress; affirmed belief participants believed more strongly in the ability of science to solve climate-related problems ($M = 5.24$, $SD = 1.06$) than tempered belief participants ($M = 4.85$, $SD = 0.89$), $F(1, 100) = 4.12$, $p = .045$, $\eta_p^2 = .04$. Next, we averaged the personal feeling of control items into an index and checked whether our manipulations altered personal feelings of control. As expected, this was not the case: both items $F < 1$. Then, we averaged the scores on the disorder items into an index and used this as the dependent variable in an ANOVA, which yielded a significant effect, $F(1, 100) = 6.88$, $p = .010$, $\eta_p^2 = .06$. As expected, affirmed belief participants experienced lower feelings of disorder ($M = 3.49$, $SD = 1.04$) than tempered belief participants ($M = 4.01$, $SD = 0.96$). Study 4.1 thus supports our hypothesis that an affirmed belief in scientific progress arms against feelings of disorder.

Study 4.2

In a second study we built on the results of Study 4.1 and investigated whether priming feelings of disorder enhances sustainability intentions, whereas priming feelings of order decreases the motivation to engage in sustainable behavior.

Method

Participants and Design. One hundred and six participants ($M_{age} = 19.88$, $SD_{age} = 1.74$, 73.6% female) participated voluntarily in the study. They were randomly assigned to one of two conditions (prime: disorder, order) of a between-subjects design.

Procedure. Participants came into the lab for a series of unrelated experiments and completed our questionnaire on a personal computer.

Priming disorder versus order. Participants first completed a scrambled sentence task (Srull & Wyer, 1979) that either primed disorder or order (Kay et al., 2010). Participants unscrambled sixteen word sets, of which eight were either related to disorder or to order. In the disorder condition, participants unscrambled word sets such as *the chaotically door meeting proceeds (the meeting proceeds chaotically)*, whereas in the order condition these were sets such as *the orderly door meeting proceeds (the meeting proceeds orderly)*.

Dependent measures. Next, participants read that a research institute affiliated with their university was interested in students' opinions regarding sustainability issues. In fact this was the dependent measure in which we measured their sustainability attitudes (e.g., *we have to take the greenhouse effect seriously*) and intentions (e.g., *the next time it is cold outside, I will not put on a sweater but I will turn up the thermostat*) consisting of a total of twelve items on a seven point-scale (*completely disagree – completely agree*), $\alpha = .80$.

Results and discussion

We averaged the scores on the attitudes and intentions items into an index and used this as the dependent variable in an ANOVA. As expected, disorder condition participants displayed more positive sustainability attitudes and intentions ($M = 5.35$, $SD = 0.76$) than order condition participants ($M = 4.97$, $SD = 0.87$), $F(1, 104) = 5.78$, $p = .018$, $\eta_p^2 = .05$. Study 4.2 thus supports our hypothesis that (primed) feelings of disorder enhance the likelihood of engaging in sustainable behavior compared to (primed) feelings of order.

Study 4.3

In Study 4.3 we investigated the full model and tested whether affirming scientific progress attenuates feelings of disorder and as a consequence lowers the likelihood of behaving sustainably, whereas questioning scientific progress enhances feelings of disorder and as a consequence heightens the likelihood of behaving sustainably.

Method

Participants and Design. Forty-one students ($M_{age} = 24.68$, $SD_{age} = 6.91$, 70.7% female) participated voluntarily in the study. They were randomly assigned to one of the conditions of a (belief in scientific progress: affirmed, tempered) between-subjects design.

Procedure. Participants came to the lab and received a paper-and-pencil questionnaire that ostensibly consisted of several unrelated questionnaires. Participants first read one out of two counterfeit newspaper articles about the progress of science (similar to the articles used in Study 4.1).

Next, participants were asked to complete a questionnaire that measured perceptions of disorder with the item *our lives are being ruled by randomness* and measured feelings of personal control with the item *to what extent do you experience control over your life in general*, on a 7-point scale from 1 (*completely disagree*) to 7 (*completely agree*).

Hereafter, participants expressed their sustainability attitudes and intentions using six items (e.g., *I understand that people worry about the environment*) that were measured on a 7-point scale (*completely disagree* – *completely agree*), $\alpha = .79$. Finally, participants completed a sustainability behavior task measuring the extent to which they made sustainable choices by having them choose between food items. Participants imagined doing groceries and were asked to look at six product categories (e.g., pasta). For

each category, they were instructed to choose one product out of three available options. One of the options was always organic. In the Netherlands (where this study was conducted) organic products are primarily perceived to be better for the environment rather than being of better quality or better for one's health (Tacken, de Winter, & Wertheim-Heck, 2007). Lastly, participants were thanked and debriefed

Results and Discussion

Disorder. An ANOVA showed that participants in the affirmed belief condition experienced lower feelings of disorder ($M = 3.14$, $SD = 0.73$) than participants in the tempered belief condition ($M = 4.10$, $SD = 1.17$), $F(1, 39) = 10.06$, $p = .003$, $\eta_p^2 = .21$. As expected, the manipulation check showed that our manipulation did not alter personal feelings of control, $F < 1$.

Attitudes and intentions. Next, we averaged the scores on the attitudes and intentions items into an index and used this as the dependent variable in an ANOVA, which yielded a significant effect, $F(1, 39) = 9.72$, $p = .003$, $\eta_p^2 = .20$. As expected, affirmed belief participants displayed less positive sustainability attitudes and intentions ($M = 5.15$, $SD = 0.91$) than tempered belief participants ($M = 5.95$, $SD = 0.72$). We expected that an affirmed belief in scientific progress leads to less sustainability attitudes and intentions because it attenuates perceptions of disorder. Therefore, we assessed whether feelings of disorder mediate the effect of belief in scientific progress on sustainability attitudes and intentions. We performed a mediation analysis and computed three regression equations (see Figure 4.1). A bootstrapping analyses with 5000 samples (see Preacher & Hayes, 2004) confirmed mediation through feelings of disorder (indirect effect = .26, $SE = .14$, 95% confidence interval = .039 to .624).

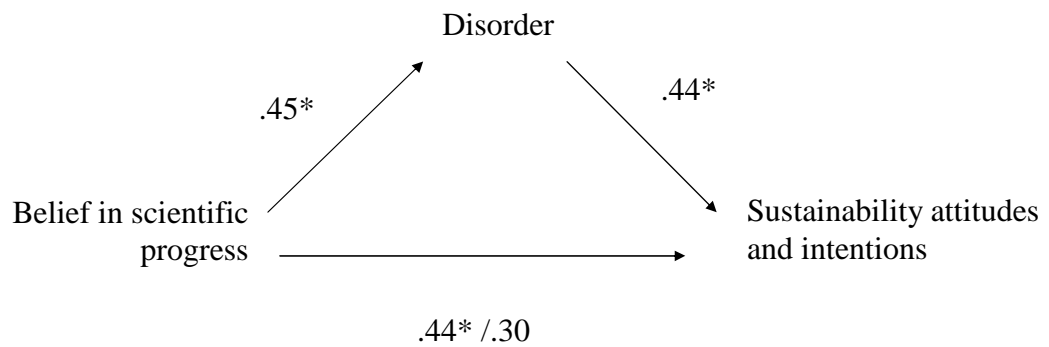


Figure 4.1. Standardized regression coefficients for the relationship between belief in scientific progress (manipulated) and sustainability attitudes and intentions, mediated by feelings of disorder (Study 4.3), * $p < .05$.

Sustainable behavior. We added the number of organic products that participants chose in the grocery shopping task and used this as a dependent variable in ANOVA, which revealed a marginally significant effect, $F(1, 39) = 3.91, p = .055, \eta_p^2 = .09$. Affirmed belief participants chose less sustainable products ($M = 1.95, SD = 1.63$) than tempered belief participants ($M = 3.10, SD = 2.07$). The amount of sustainable products that participants chose correlated significantly with participants' sustainability attitudes and intentions, $\beta = .31, p = .048$.

Study 4.4

Study 4.4 was designed to test whether engaging in sustainable behavior can indeed be understood as way to regain personal control. Specifically, we tested whether the positive effect of a tempered belief in science on enhancing sustainable behaviors disappears when participants have the opportunity to affirm feelings of personal control before having the chance to make sustainable choices.

Participants and Design

Eighty-four participants ($M_{age} = 19.42$, $SD_{age} = 1.59$, 70 females) participated voluntarily in the study. They were randomly assigned to one of the conditions of a 2 (belief in scientific progress: affirmed belief, tempered belief) x 2 (control affirmation: yes, no) between-subjects design.

Procedure

Participants came to the lab and first read one of the two newspaper articles used in Studies 4.1 and 4.3. Subsequently, half of the participants completed a control affirmation task in which they were asked to recall an event in the recent past over which they experienced full control. After this, they were asked to complete a questionnaire about sustainability attitudes and intentions using the same items as in Study 4.3, $\alpha = .78$. Lastly, participants completed a sustainable behavior task in which they imagined managing a manufacturing plant that pollutes the air via smokestacks (Sachdeva, Iliev, & Medin, 2009). In order to prevent the release of pollutants, they could run filters at monetary costs. Under pressure from environmentalist lobbyist and at the risk of a new law prescribing running the filters 100% at all times, all manufacturing plants agreed with the lobbyists to run the filters at 60% of the time. The participants could choose to run filters for any 10% interval between 0% and 100%, with each incremental step costing €0.2 million. The more often the filters would run the better for the environment, but also the higher the financial costs. The other half of the participants received the same tasks in a reversed order.

Results and Discussion

Attitudes and intentions. We averaged the sustainability attitudes and intentions into a sustainability index and used this index as the dependent variable in a 2 (belief in scientific progress) x 2 (control affirmation) ANOVA,

which showed a marginally significant interaction effect, $F(1, 80) = 3.02$, $p = .086$, $\eta_p^2 = .04$, all other effects $F < 1$. Simple main effect analyses revealed that there was no effect of belief in science for participants who first affirmed control; affirmed belief participants ($M = 5.49$) and tempered belief participants ($M = 5.40$) expressed sustainability attitudes to the same extent after affirming personal control, $F < 1$. In contrast, when participants did *not* have the chance to affirm personal control before expressing sustainability attitudes and making sustainable choices, there was an effect of belief in science. As predicted, simple main effects showed that tempered belief participants ($M = 5.88$) expressed more positive sustainability attitudes than affirmed belief participants ($M = 5.39$), $F(1, 80) = 4.40$, $p = .039$. See Table 4.1.

Sustainable behavior task

Next, we entered the percentage the participants chose to run the filters as a dependent variable in a 2 (belief in scientific progress) x 2 (control affirmation) ANOVA, which yielded a significant interaction effect, $F(1, 80) = 5.73$, $p = .019$, $\eta_p^2 = .07$, all other effects $F < 1$. As predicted, simple main effect analyses showed that there was no effect of belief in science for participants who first affirmed control; affirmed belief participants ($M = 75.56$) were as likely to make sustainable choices (i.e., run the filters to prevent pollution) as tempered belief participants ($M = 72.08$), $F < 1$. In contrast, when participants did *not* have the chance to affirm personal control before making sustainable choices, there was an effect of belief in science: Tempered belief participants ($M = 83.00$) were more likely to make sustainable choices than affirmed belief participants ($M = 70.00$), $F(1, 80) = 7.20$, $p = .009$, see Table 4.1.

Table 4.1.

Participants' scores on the sustainability attitudes measure and the percentage that participants chose to run the filters in Study 4.4

Control affirmation	Sustainability attitudes		Percentage	
	Affirmed belief	Tempered belief	Affirmed belief	Tempered belief
Yes	5.49 _a (0.84)	5.40 _a (0.78)	75.56 _a (15.80)	72.08 _a (14.44)
No	5.39 _a (0.73)	5.88 _b (0.72)	70.00 _a (15.43)	83.00 _b (17.20)

Note. Means with different subscripts differ significantly, per scale, $p < 0.05$.

In sum, our findings show that affirming belief in scientific progress decreases the likelihood of behaving sustainably whereas tempering belief in scientific progress increases the likelihood of behaving sustainably. However, this effect is classified by the opportunity to affirm personal control. When people whose belief in scientific progress was tempered were first provided with a control affirmation task, they were no more likely to behave sustainably than participants whose belief in scientific progress was affirmed. This finding suggests that engaging in sustainable behavior can indeed be understood as a means to restore order via exerting personal control.

General Discussion

The majority of people find it difficult to behave sustainably, even when they are aware of the importance of doing so (Dunlap et al., 1993). The current research demonstrated that one underlying reason for this observation lies in the manner in which science is communicated; a strong focus on its ever progressing ability to provide solutions to pressing problems has detrimental effects on sustainable intentions and behavior. The underlying reason is that such a focus decreases perceptions of disorder, rendering personal actions aimed at restoring order superfluous. In contrast, questioning scientific

progress results in relatively more feelings of disorder, triggering the need to restore perceptions of order via personal actions like engaging in sustainable behavior. Study 4.4 showed that this effect disappears when a personal control affirmation task precedes the sustainable behavior measures.

This paper advances understanding of order motivation and compensatory control in several ways. First of all, it shows that affirming belief in an external source of control has a seamy side in the sense that people are less likely to take control themselves; they become more passive. It is plausible that this is not only the case for a strong belief in scientific progress, but also for a strong belief in God, government, and other external agents or institutions that provide order. Moreover, our findings extend recent findings of Banfield and colleagues (2011), who showed that individual pro-social behavior may help facilitate perceptions of a more orderly world.

Our findings additionally complement recent research on how communication about science may influence sustainable behavior (see e.g., Feinberg & Willer, 2011). Importantly, our results have crucial practical implications for designing sustainability campaigns and communicating about science in general. When sustainability campaigns or media communicating about science paint a picture of omniscient science and unconditional ongoing progress, people may become passive and behave less sustainably. Instead, looking critically at the resolving power of science may inspire people to take matters in their own hands.