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Environmental Disorder Leads to Self-Regulatory Failure

BOYOUN (GRACE) CHAE
RUI (JULIET) ZHU

This article examines the influence of environmental orderliness on consumers' self-regulation. It is proposed that a disorganized environment threatens the individual's sense of personal control. Because experiencing this control threat depletes resources, individuals exposed to a disorganized (vs. organized) environment are more likely to exhibit self-regulatory failure in subsequent tasks. The results from four studies provide support for this hypothesis. Further, they offer evidence of the underlying process by demonstrating that a perceived threat to control mediates the effect of environmental orderliness on self-regulation, and that providing individuals with an opportunity to recoup their resources mitigates this effect. This research has crucial practical implications concerning public health and consumer well-being.

An article in the *New York Times* introduced an intriguing weight-loss solution (Parker-Pope 2008). It suggested that decluttering people's physical environment helps them regain control over not only their physical environment but also their weight. This idea has been echoed by a number of popular home-organization TV shows such as *Mission Organization* (HGTV), *Clean House* (Style Network), *Real Simple*, *Real Life* (TLC), and *Hoarding: Buried Alive* (TLC). The overarching theme in these programs is that environmental disorganization is associated with a number of negative outcomes, such as health deterioration and impaired self-regulation. Thus, better organization or decluttering can improve the quality of life. Despite these beliefs, our theoretical understanding of how environmental organization or orderliness can affect cognition and behavior remains limited (Keizer, Lindenberg, and Steg 2008). We address this question in this article by focusing on the effects of environmental orderliness on self-regulation.

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Building on the resource-depletion theory (Baumeister et al. 1998) and the personal-control literature (Kelly 1963), we propose that compared with an organized environment, a disorganized environment increases self-regulatory failure. Specifically, we argue that a disorganized environment threatens the individual's sense of personal control, and this experience of control threat depletes resources, thus leading to subsequent self-regulatory failure.

This study makes several contributions. First, it empirically demonstrates a causal relationship between environmental orderliness and self-regulation, thus adding to the growing literature on the influence of the physical environment on consumer cognition and behavior. Past research has shown that characteristics of the physical environment, such as color (Mehta and Zhu 2009; Meyers-Levy and Peracchio 1995), scent (Lee, Kim, and Vohs 2011; Wilson and Stevenson 2006), ceiling height (Meyers-Levy and Zhu 2007), and crowding (Noone and Mattila 2009) can affect the way consumers think and make consumption decisions. We extend this line of research by demonstrating that another important environmental property, namely, orderliness, can affect self-regulation. Second, we provide a process explanation for this effect. We demonstrate that a disorganized environment threatens the individual's sense of personal control, which leads to resource depletion and consequently impairs self-regulation. However, when individuals are given an opportunity to recoup their resources (e.g., through engaging in a self-affirmation task or by taking a sugary drink to regain biological energy), such an effect is attenuated. Finally, this study contributes to the resource-depletion literature. Most research in this area reports that resource depletion follows

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from active engagement in some kinds of mental activities, such as controlling attention (Fischer, Greitemeyer, and Frey 2007; Gilbert, Krull, and Pelham 1988; Schmeichel 2007), suppressing thoughts (Tice et al. 2007; Wegner et al. 1987), engaging in a complex task (Baumeister et al. 1998; Webb and Sheeran 2003), and making choices (Vohs et al. 2008). In contrast, we demonstrate that mere exposure to a disorganized environment can lead to resource depletion. In addition to the above theoretical contributions, this research also offers crucial practical implications concerning public health and consumer well-being.

THEORETICAL BACKGROUND

Humans have a fundamental need to control their environment (Kelly 1963; White 1959). Such a desire (i.e., the sense of personal control) can be satisfied in a number of ways, such as through the perceived contingency between action and outcome (Gurin and Brim 1984; Weisz and Stipek 1980), the perceived predictability of events (Affleck et al. 1987; Golden and Maysel 2008; Heckhausen 1977), and the perceived ability to alter one's environment (Burger 1992; Glass, Singer, and Friedman 1969). However, when one of these conditions is not met, individuals can experience threats to their personal control. For instance, Glass and Carver (1980, 232) stated that "if a person perceives a contingency between his behavior and an outcome . . . the outcome is considered controllable. In contrast, if a person believes that his actions do not influence the outcome, the outcome is considered uncontrollable." Along similar lines, Affleck et al. (1987) demonstrated in a correlational study that individuals with low (vs. high) confidence in their ability to predict the symptoms and course of their disease (i.e., those who rated low on items such as "I can generally predict the course of my illness") reported a lower sense of personal control over the disease.

Of particular relevance to the current research is the documentation that characteristics of the physical environment can affect the sense of personal control (Cutright 2012; Glass and Singer 1972). For instance, Glass and Singer (1972) showed that people in an aversive versus a nonaversive sound environment were more likely to experience a lower sense of control. Specifically, people who were exposed to loud (i.e., 108 decibels) or unpredictable (i.e., aperiodic) noises were more distressed than those who were exposed to moderate (i.e., 50 decibels) or predictable (i.e., periodic) noises. However, making people believe they had control over the environment by giving them the option to terminate the annoying noises mitigated the effect of these noises.

Extending this line of research, we suggest that another characteristic of the physical environment, namely, orderliness, can affect the individual's sense of personal control. There is some evidence from clinical studies of a positive correlation between the two. Clinical cases of compulsive hoarding indicate that a disorganized environment is often related to various negative consequences of an impaired sense of personal control. For example, people who live in a disorganized (vs. organized) environment for an extended

period tend to have a poorer immune system (Grisham and Barlow 2005), report a higher level of stress (Frost et al. 2000), and exhibit more self-regulatory failure such as compulsive buying (Frost et al. 1998) and overeating (Timpano and Schmidt 2010). While these findings are intriguing, this evidence is solely correlational. Thus, it remains an open question whether environmental disorganization actually causes a low sense of personal control and consequently increases self-regulatory failure. We tested this causal relationship in this article.

A Disorganized Environment Threatens the Sense of Personal Control

We propose that environmental orderliness can affect an individual's sense of personal control. Compared with an organized environment, a disorganized environment may have items scattered all over the place without any clear distinctions or boundaries. The messiness and unpredictable nature of the environment are likely to make people feel that they have little personal control over their environment and their life. This proposition seems to be supported by two lines of research. First, research has shown that people in messy homes feel their lives are also out of control (Belk, Seo, and Li 2007; Bitner 1990). For instance, Belk et al. (2007) found that although people who live in a messy environment want a simpler and more organized environment, they usually question their ability to change their environment and perceive their lives as being out of control in general. Second, people tend to attribute messy homes to people's lack of ability to manage their time or their life. As shown by Bitner (1990), individuals in a disorganized environment (e.g., a messy office) are perceived to have a disorganized life and to be less competent. Based on the above findings, we expect that a disorganized environment will threaten the sense of personal control.

Experiencing Personal Control Threats Depletes Resources and Causes Self-Regulatory Failure

According to the limited-resource model (Baumeister et al. 1998; Baumeister and Heatherton 1996), people have limited cognitive resources to engage in self-regulation. Thus, when individuals are resource depleted, they are more likely to fail in self-regulation (Baumeister 2002; Vohs et al. 2008). A number of variables have been shown to cause resource depletion, including engaging in cognitively demanding tasks such as suppressing certain thoughts (Vohs and Heatherton 2000), regulating emotions (Baumeister et al. 1998; Baumeister, Faber, and Wallace 1999), overriding automatic responses (Gilbert et al. 1988; Schmeichel 2007; Webb and Sheeran 2003), engaging in complex tasks (Baumeister et al. 1998; Webb and Sheeran 2003), making choices (Bruyneel et al. 2006; Vohs et al. 2008), and changing mind-sets (Hamilton et al. 2010).

Of particular relevance to the current article is research showing that experiencing threats taxes cognitive resources

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and subsequently increases self-regulatory failure (Glass et al. 1969; Inzlicht and Kang 2010). Glass et al. (1969) found that when the sense of control was threatened (i.e., when exposed to unpredictable and uncontrollable noise), individuals were less persistent afterward on an unsolvable puzzle, presumably due to resource depletion. Additional evidence comes from a recent neuroscience study, which demonstrated that exposure to a stereotype threat increased self-regulatory failure (Inzlicht and Kang 2010). These authors demonstrated that people who experienced stereotype threats (i.e., female students asked to take a threatening math test) exhibited more subsequent self-regulatory failure such as aggression and unhealthy eating. These authors argue that experiencing as well as coping with such a threat involves resource-demanding activities such as distraction, vigilance, and continuous self-monitoring, consequently leading to self-regulatory failure. They further demonstrated that the effect of stereotype threats on self-regulation failure was mediated by inefficient activities of the anterior cingulate cortex (ACC), a brain area responsible for effortful self-regulation.

Combining the above theorizing, we hypothesize that a disorganized environment threatens the individual's sense of personal control. Because experiencing such a threat consumes substantial resources, these individuals are likely to be resource depleted and thus to exhibit more self-regulatory failure in a subsequent task. Formally, we hypothesize the following:

- H1:** People who are exposed to a disorganized (vs. organized) environment are more likely to exhibit self-regulatory failure in subsequent tasks.
- H2:** Resource depletion from the experience of threats to personal control drives the effect of environmental disorganization on self-regulation.

We present four studies to test our hypotheses. Study 1 tests hypothesis 1 by showing that a disorganized environment increases impulsive buying. Study 2 provides a theoretical replication by using another task to measure self-regulatory failure. Studies 3 and 4 illuminate the underlying process (hypothesis 2). Specifically, they demonstrate that a threat to personal control mediates the effect of environmental orderliness on persistence. Further, providing individuals with an opportunity to recoup their resources moderates the relationship between environmental orderliness and self-regulation.

STUDY 1

Study 1 tested hypothesis 1 by examining the effect of environmental orderliness on self-regulation in a consumption context. Participants were asked to indicate their willingness to pay (WTP) for a number of products, and those in the disorganized environment were expected to exhibit more self-regulatory failure by indicating higher prices (Vohs and Faber 2007).

Method

The study was a one-way (environmental orderliness: disorganized environment vs. organized environment vs. control) between-subjects design. One hundred fifty undergraduate students (90 females) at the University of British Columbia participated in this study in exchange for a course credit. This and all other studies were run individually to avoid potential social influence.

Participants were randomly assigned to one of the three conditions. In the disorganized condition, office supplies (e.g., paper, dividers, water bottles, and paper cups) were scattered along the shelves in a cluttered manner. In contrast, in the organized condition, the same quantity of items was arranged in a structured and ordered manner. In the control condition, the shelves were empty (app. A).

Upon arrival, each participant was guided into a room and asked to sit in front of a desk facing the shelves where environmental orderliness had been manipulated. To fully expose the participants to the environment, they were asked to wait while the study administrator got the materials ready. The administrator returned exactly one minute later, and asked the participant to work on a price assignment task on a computer. The participant was presented with 10 products, one at a time, each in a separate viewing. The products included a high-end HDTV, a dinner coupon for two, a mini fridge, an air conditioner, a vacation package for a ski trip, a microwave oven, a luxury chocolate gift set, a desk lamp, a high-end speaker, and a pen. Each product had a product image and a brief description, and the task was to indicate the highest amount of money the participant was willing to pay to obtain it (Vohs and Faber 2007).

Next, to assess whether our manipulation of environmental orderliness was successful, we asked two questions (i.e., "To what extent do you think this room is well-organized?" and "How messy do you think this room is?") The second item was reverse coded, and the responses to the two items were then averaged to create an environmental orderliness index; $r = .76, p < .001$. We also collected additional measures to examine alternative explanations, which will be discussed after the result.

Result

Manipulation Checks. An ANOVA with environmental orderliness perception as the dependent variable revealed that the manipulation of environmental orderliness was successful ($F(2, 147) = 115.07, p < .001$). Contrast analysis showed that participants in the disorganized condition perceived the room as more disorganized ($M = 1.73$) than those in the organized ($M = 4.79; t(147) = -14.97, p < .001$) or control condition ($M = 4.74; t(147) = -12.37, p < .001$). Ratings from the latter two conditions did not differ ($t(147) = .20, p = .85$).

Impulsive Buying. For the focal task, we first standardized and averaged the WTP values each participant gave to the products (Vohs and Faber 2007). Next, we conducted an

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ANOVA using this overall WTP index as the dependent variable, and environmental orderliness as an independent variable. As expected, we observed a significant main effect ($F(2, 147) = 4.77, p = .01$). Contrast analysis showed that participants in the disorganized condition indicated higher WTP for the products ($M = .16$) than those in both the organized condition ($M = -.10; t(147) = -2.69, p < .01$), and the control condition ($M = -.09; t(147) = -2.60, p = .01$). WTP in the latter two conditions did not differ ($t(147) = .09, p = .93$).

Alternative Explanations. We also collected measures to test various alternative explanations. First, we examined whether our orderliness manipulation affected confinement perceptions. Levav and Zhu (2009) documented that spatial confinement leads people to feel confined and consequently increased their variety-seeking tendency (as a means to reassert their freedom). While they showed that spatial confinement does not affect impulsive buying (i.e., amount of money spent on shopping), it is possible that our manipulation in fact changed the confinement perception. Thus, along with the orderliness manipulation check, we asked participants to indicate how spacious they thought the room was. Second, we tested whether our manipulation affected involvement. It is possible that participants in the disorganized environment were less involved as the disorganization might signal the researchers' lack of cares on the study. To this end, we had participants indicate the extent to which they were motivated to complete the WTP task at the end of the study. Finally, we tested whether participants perceived indication of high WTP as a means of asserting control in life (Chen, Lee, and Yap 2010). It is possible that people who feel deprived of control indicate high WTP as a way to regain their sense of control. To test this possibility, we asked two questions (i.e., "To what extent did you feel that indicating a high WTP helped you to feel empowered?" and "To what extent did completion of the price estimation task provide you with reassurance that you were in control?"; $r = .70, p < .001$). All of the above questions were measured on a scale from 1 (not at all) to 7 (very much).

Analyzing these above measures showed that our manipulation did not affect any of them. Specifically, the environmental manipulation did not affect perceptions of confinement or involvement (all $p > .17$). Further, it did not appear that participants used the WTP task as a way to regain control, as their responses to this question were comparable across all three treatment conditions ($M_{\text{disorganized}} = 3.41, M_{\text{organized}} = 3.36, \text{ and } M_{\text{control}} = 3.13; F < 1$).

Finally, a series of ANCOVA analyses with each of the three variables were conducted. The results revealed that none of these variable significantly affected the dependent variable ($p = .66$ for confinement perception; $p = .99$ for involvement; $p = .22$ for the WTP perception as a reassertion of control), and the main effect of environmental orderliness remained significant ($p = .01$ for all the analyses).

Discussion

The results of this study provide support for hypothesis 1 by showing that environmental disorder leads to higher impulsive buying. Further, such an effect appears to be driven by environmental disorganization rather than the perception of confinement. The environmental orderliness manipulation did not influence involvement or perception about the WTP as means to reassert control.

STUDY 2

Study 2 aimed to provide a replication of the results of study 1 by using another measure of self-regulation, namely, the Stroop task (Stroop 1935). Further, to provide additional evidence that a perception of confinement did not drive our effect, we specifically included a confinement condition. Finally, this study attempted to provide additional evidence that a disorganized environment impairs self-regulation through resource depletion. We assessed the extent to which participants in the different environmental conditions felt depleted upon completing a focal task.

Method

The study was a one-way (environmental condition: disorganized vs. organized and control vs. confined) between-subjects design. Eighty-nine participants (54 females) at the University of British Columbia participated in this study in exchange for 10 dollars.

We manipulated the environmental orderliness by varying the arrangement of pieces of newspaper on a wall and office supplies on a desk against the wall. In the disorganized condition, newspaper pages were posted in a disorganized manner and office supplies (i.e., pens, board pens, and cups) were scattered on the desk. In contrast, in the organized condition, the same items were arranged in a well-organized manner. In the control condition, there were no newspaper pages on the wall and no office supplies on the desk. Finally, the confined condition was identical to the control condition, except that the use of dividers made only half of the lab space available by separating the space into two sections (app. B).

The procedure was similar to that of study 1, involving one participant at a time. Participants were randomly assigned to one of the four conditions and asked to wait until the administrator came back. While waiting, the participant sat facing the wall where the environmental condition had been manipulated. A minute later, the study administrator came back and asked the participant to complete the focal Stroop task on a laptop. Specifically, participants were presented with the names of colors (e.g., black, red) on the screen in font colors that were either congruent with the word meaning (e.g., the word "black" appeared in a black font) or incongruent (e.g., the word "black" appeared in a red font). The participant's task was to name the font color of the target word as fast as possible by selecting the correct one from four options. In this study, participants completed

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64 randomized trials, of which 16 were congruent and 48 were incongruent trials.

Upon finishing the Stroop task, participants answered a few questions to assess how depleted they were at that time (see a similar procedure in Baumeister et al. 1998). They indicated the extent to which they felt burned out, frustrated, overworked, and weary, all on 7-point scales (1 = not at all, 7 = extremely). Because these four items loaded on one factor and exhibited a high reliability ($\alpha = .87$), we averaged them to create a depletion index.

Finally, we included the same two items from study 1 to measure the participant's perception of environmental orderliness (i.e., "To what extent do you think your work space is well-organized?" and "How messy do you think this work space is?" [with the second question reverse coded]; $r = .74, p < .001$). In addition, we asked three questions to assess perceptions of confinement (i.e., "How wide is your work space?" [reverse coded], "How confined do you think your work space is?," and "How narrow do you feel your work-space is?" [$\alpha = .76$]).

Result

Manipulation Check. The perception of environmental orderliness differed across conditions ($F(3, 85) = 43.61, p < .001$). Participants in the disorganized condition rated their workspace as more disorganized ($M = 2.46$) than those in the organized ($M = 5.93; t(85) = 9.97, p < .001$), control ($M = 5.80; t(85) = 9.59, p < .001$), and confined conditions ($M = 5.36; t(85) = 8.13, p < .001$). Ratings in the latter three conditions did not differ from each other (all $p > .10$).

Confinement perception also differed across conditions ($F(3, 85) = 6.42, p < .01$). Participants in the confined condition rated their workspace as more confined ($M = 4.89$) than did those in the disorganized ($M = 3.50; t(85) = 3.68, p < .001$), organized ($M = 3.71; t(85) = 3.16, p < .01$), and control conditions ($M = 3.45; t(85) = 3.86, p < .001$). Ratings in the latter three conditions did not differ (all $p > .50$).

Stroop Task. Consistent with the literature, we first analyzed the average reaction time as a measure of self-regulation (Fennis, Janssen, and Vohs 2009; MacLeod 1991). A slower reaction time would indicate greater self-regulatory failure. As the response time data were highly skewed, we first performed a log transformation on the average reaction time before submitting them to analysis. An ANOVA with the environmental condition as the independent variable and the log-transformed average reaction time as the dependent variable revealed a significant main effect ($F(3, 85) = 2.86, p < .05$). Specifically, people in the disorganized condition responded more slowly ($M = 1.72$ seconds) than those in the organized ($M = 1.57$ seconds; $t(85) = -2.10, p < .05$), control ($M = 1.56$ seconds; $t(85) = -2.28, p < .05$), or confined conditions ($M = 1.53$ seconds; $t(85) = -2.67, p < .01$). The latter three conditions did not differ (all $p > .50$).

However, as MacLeod (1991) suggested, slower reaction times might be due to more accurate responses. In that case, the slow reaction time measure might not be a good indicator of self-regulatory failure. To address this concern, we next analyzed the number of errors each participant produced for the Stroop task. A one-way ANOVA revealed no treatment effect of environmental conditions, suggesting that participants in different environmental conditions exhibited comparable performance accuracy ($F < 1$).

Resource Depletion. As anticipated, after finishing the Stroop task, participants in the disorganized environment felt more depleted ($M = 4.19$) than those in the organized ($M = 2.98; t(85) = -3.19, p < .01$), the control ($M = 3.08; t(85) = -2.93, p < .01$), or the confined conditions ($M = 3.38; t(85) = -2.08, p < .05$). Ratings for the last three conditions did not differ (all $p > .30$).

Discussion

The findings from study 2 provided a theoretical replication of study 1. By using another measure of self-regulation, namely, the Stroop task, we demonstrated that a disorganized environment leads to greater self-regulatory failure in subsequent tasks. Our data also reveal that manipulation of confinement did not impair self-regulation, as participants in the confined condition performed equally well on the Stroop task as those in the control (i.e., empty) and organized conditions. This, along with the findings from study 1, suggests that environmental disorganization rather than confinement led to greater self-regulatory failure. We discuss this distinction further in the General Discussion.

While the results from the first two studies were encouraging, certain limitations remained. First, self-regulation was always assessed in the same room in which the environmental condition was manipulated. It is possible that the impaired self-regulation was due to the distraction in the disorganized environment. To examine and rule out this alternative explanation, in subsequent studies we used the typical research paradigm in the resource-depletion literature. The core idea of resource depletion is that prior exertion of self-regulation results in resource depletion, and the resource-depleted state influences subsequent unrelated self-regulatory behavior (Baumeister et al. 1998). Thus, to obtain clear evidence of resource depletion and its spillover effect on an unrelated task, research in this area has always separated the manipulation of resource depletion and the measurement of subsequent self-regulatory behavior (Baumeister 2002; Hamilton et al. 2010; Inzlicht and Kang 2010). We followed this practice in our next two studies. Specifically, we exposed participants to the manipulation of environmental orderliness in one room and then assessed their subsequent self-regulation in a second room where no environmental orderliness manipulation had taken place.

Second, the studies reported so far offer limited evidence that resource depletion underlies the effect of environmental orderliness on subsequent self-regulatory failure. Thus, in the next two studies, we offer more process evidence by

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either providing participants with an opportunity to recoup their resources or not. We expected that when participants were not given an opportunity to recoup their resources after exposure to a disorganized environment, they would reveal the same results as we observed before (i.e., a disorganized vs. organized environment leads to greater subsequent self-regulatory failure). However, if people were provided with an opportunity to recoup their resources, the above effect should be attenuated.

To that end, in study 3 we introduced a self-affirmation manipulation. According to self-affirmation theory (Steele 1988), individuals do not strive to perceive themselves favorably in every facet of their lives but attempt to maintain a positive global perception of themselves. The basic finding is that when one aspect of the self is threatened (e.g., intelligence), people can reassure themselves by affirming another aspect of the self (e.g., physical attractiveness; McQueen and Klein 2007; Sherman, Nelson, and Steele 2000; Sherman et al. 2007). Of particular relevance to our article is a recent research finding that self-affirmation can replenish internal resources. In other words, when people's resources are depleted, self-affirmation counteracts this depletion and facilitates subsequent self-regulatory behavior (Schmeichel and Vohs 2009). For example, people who expressed their core life values (i.e., wrote a short essay about an important value in their life) after exerting self-regulation (i.e., having engaged in a difficult task) performed equally as well on a subsequent self-regulatory task as those who had not engaged in the first self-regulation task. However, those who were not given an opportunity to self-affirm in the interim displayed more self-regulatory failure in the second self-regulation task. Based on these findings, we expected that self-affirmation would counteract the resource depletion induced by a disorganized environment and thus attenuate self-regulatory failure in subsequent tasks.

STUDY 3

Study 3 examined the effect of environmental orderliness on an individual's persistence on a frustrating task (i.e., an unsolvable puzzle), which is a classic measure of self-regulation (Baumeister et al. 1998; Webb and Sheeran 2003). We anticipated that individuals exposed to a disorganized (vs. organized) environment would exhibit poorer self-regulation by giving up sooner on the unsolvable puzzle. However, if individuals were given a chance to self-affirm in the interim, the effect should be mitigated. Furthermore, we tested whether environmental orderliness manipulation could have affected mood and subsequently resulted in greater self-regulatory failure.

Method

The study was a 2 (environmental orderliness: disorganized vs. organized) \times 2 (affirmation: self-affirmation vs. no affirmation) between-subjects design. Because confinement and control (empty) conditions in the previous two studies had shown the same results as the organized con-

dition, we dropped those two conditions in this and the next study. One hundred and three (58 female) undergraduate students at the University of British Columbia participated in the study individually in exchange for a course credit.

The study was run in two rooms, with one participant at a time. Participants were exposed to the environmental orderliness manipulation in the first room and then completed the focal puzzle task in the second room with no orderliness manipulation. Upon arrival, the participants were first guided to room one, where they were exposed to either an organized or a disorganized environment. In the disorganized environmental condition, office supplies (e.g., paper, file folders, and paper cups) were scattered all over the shelves, the desk, and the floor in a cluttered manner. In contrast, in the organized environmental condition, the same number of items was placed in a structured and ordered manner (app. C).

After exposure to the environmental orderliness manipulation in room one, the participants were asked to complete a survey in this room. The first task measured their current mood. In particular, we assessed positive mood (i.e., calm, excited, happy, pleasant, and secure; $\alpha = .77$) and negative mood (distressed, upset, tense, unsettled, stressed, and jittery; $\alpha = .84$). Such mood measures were used to observe whether our manipulation of environmental orderliness had affected mood states. Next, we asked the same two questions as in the previous studies to assess the effectiveness of our environmental orderliness manipulation ($r = .91, p < .001$). Then, the participants worked on a "personal characteristic and value" task, which in reality served as the self-affirmation manipulation. The participants were presented with a list of 11 values and personal characteristics (e.g., physical attractiveness, creativity, athletics; Koole et al. 1999; Schmeichel and Vohs 2009) and asked to prioritize them in order of personal importance. Then, by a random assignment, participants were asked to either write a brief essay explaining why their top-ranked value was important to them and describing a time in their lives when it had been particularly important (i.e., the self-affirmation condition) or to write a brief essay describing why and when the value they had ranked seventh might be important to an average college student (i.e., the no-affirmation condition; Cohen, Aronson, and Steel 2000). The participants were given eight minutes to complete this task (see Schmeichel and Vohs [2009] for a similar procedure). Upon finishing this task, the participants were told that they need to move to another room for an unrelated task and were guided to the second room.

In the second room, the participant worked on the focal task, namely, solving an unsolvable puzzle. The task, labeled a "spatial abilities task," instructed the participant to trace a geometric figure on a piece of paper without retracing any lines and without lifting the pencil from the paper (Baumeister et al. 1998). To ensure that the participant fully understood the task, the study administrator first demonstrated with a solvable figure and asked the participant to trace the same figure for practice. Then the administrator presented the participant with the unsolvable figure and mentioned that "The puzzle is challenging and you can take as

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much time and as many trials as you want, but whenever you want to stop, you can just ring the bell in front of you.” The administrator then left the room and timed how long the participant persisted on the task.

Result

Manipulation Check and Mood Measure. Two data points were removed because these two participants failed to complete the environmental orderliness manipulation check and the mood assessment. Consistent with earlier findings, *t*-test analysis revealed that our manipulation of environmental orderliness was successful ($t(99) = -22.80, p < .001$), such that those in the disorganized condition perceived the room as more disorganized ($M = 1.51$) than did those in the organized condition ($M = 5.47$). As expected, the environmental orderliness manipulation did not affect positive ($p = .54$) or negative ($p = .34$) mood.

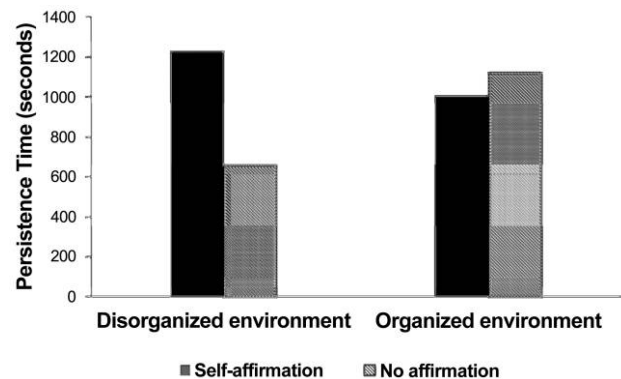
Persistence Time on Unsolvable Puzzle. Because the persistence data were highly skewed, we first performed a log transformation on the persistence data before submitting them to analysis. A 2 (environmental orderliness) \times 2 (affirmation) ANOVA revealed a marginally significant two-way interaction ($F(1, 97) = 2.88, p < .10$) with the amount of time participants persisted on the unsolvable task. Examination of the planned contrasts supported our hypothesis. When individuals were not given an opportunity to self-affirm, we replicated our earlier findings. Those who were exposed to the disorganized (vs. organized) environment were less persistent on the challenging task (all $M = 668.52$ seconds vs. 1,116.88 seconds; $F(1, 97) = 4.22, p < .05$), indicating greater self-regulatory failure. However, as anticipated, when individuals had a chance to affirm themselves after being exposed to the environmental orderliness manipulation, they were equally persistent, regardless of whether they had been exposed to the disorganized ($M = 1,262.68$) or organized environment in room one ($M = 1,003.92$; $F(1, 97) = .12, p = .74$). Looking at the other two contrasts, they suggest that the positive effect of self-affirmation on persistence was only evident among those in the disorganized environmental condition ($F(1, 97) = 4.11, p < .05$) but not among those in the organized environmental condition ($F(1, 97) = .13, p = .72$; see fig. 1).

Discussion

Findings from study 3 suggest that resource depletion appears to underlie the effect of a disorganized environment on self-regulation. We also conducted another experiment with the same setup as study 3 but with WTP as the dependent variable. This replicated the results of study 3, in that those who did not engage in the self-affirmation task replicated the findings of study 1 (i.e., the disorganized vs. organized environment produced higher WTP values), whereas for those who had a chance to self-affirm in the interim, the effect went away. For brevity, we have not included the details of this additional study. These findings

FIGURE 1

STUDY 3: PERSISTENCE AS A FUNCTION OF ENVIRONMENTAL ORDERLINESS AND SELF-AFFIRMATION



suggest that when people are not given a chance to recoup their resources, environmental disorder leads to subsequent self-regulatory failure. However, when procedures such as self-affirmation are introduced in the interim to counteract resource depletion, this effect is mitigated. We also found that the disorganized environment did not influence mood. This null effect is consistent with previous research which showed that a lack of personal control did not affect mood (Kay et al. 2008). Mood was again measured in the next study but revealed no treatment effect. Thus, for brevity we have not reported it.

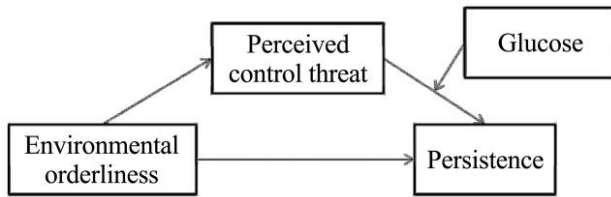
In our final study, we intended to accomplish two things. First, we aimed to replicate the findings of study 3 using another method to recoup resources, namely, providing glucose. Gailliot et al. (2007) demonstrated that self-regulatory behavior consumes resources by reducing glucose levels in the blood after engaging in such behavior. They also found that providing glucose to depleted individuals could attenuate self-regulatory failure. Following their logic, it seemed possible that providing glucose could recoup resources and consequently mitigate the effect of environmental disorder on self-regulation. We tested this prediction in the next study by providing a sugary drink that contained glucose.

The second purpose of the final study was to provide a more comprehensive test of our theory. We argue that environmental disorder threatens the sense of personal control, and that this threat depletes resources, which leads to self-regulatory failure. In the next study, we explicitly asked participants about their perception of a threat to personal control while they were exposed to a disorganized environment. We expected that perception of this threat would mediate the relationship between environmental orderliness and self-regulation among people who did not consume the glucose but not among those who did. In other words, we tested a moderated mediation model, as shown in figure 2.

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FIGURE 2

STUDY 4: THE MEDIATING EFFECT OF CONTROL THREAT ON PERSISTENCE DEPENDING ON GLUCOSE CONDITION



STUDY 4

Method

Study Design and Participants. This study used a 2 (environmental orderliness: organized environment vs. disorganized environment) \times 2 (glucose condition: glucose vs. placebo) between-subjects design. Ninety (53 female) undergraduate students at the University of British Columbia participated in the study individually.

Procedure. The study was run in three different rooms. Each participant was asked to sample a drink in the first room for the glucose manipulation. Then the participant was exposed to the environmental orderliness manipulation in a second room and finally completed the focal puzzle task in a third room. Neither the first nor the third rooms had orderliness manipulation. The glucose manipulation was adopted from Gailliot et al. (2007), and it was placed before the orderliness manipulation as it takes about 10 minutes for the glucose from the drink to be metabolized (Gailliot et al. 2007). To control for extraneous variance in glucose levels, participants were asked not to eat for 3 hours prior to the study. They were informed that the research was about evaluating a new soft drink and that fasting was needed to prevent distortion of the product evaluation. Nine people did not comply with the fasting requirement, and their responses were subsequently dropped from the data set, leaving us with a final data set of 81 participants.

Upon arrival, participants were given 250 mL lemonade sweetened with either sugar (glucose condition) or a sugar substitute (placebo condition) for the glucose manipulation. The glucose drink contained 135 calories, while the placebo drink had no calories. Participants were told they needed to consume the entire drink before completing a survey about the drink. Next, participants evaluated the drink on four aspects, namely, overall liking, appearance, color, and taste. Because these items loaded on a single factor and exhibited high reliability ($\alpha = .89$), they were averaged to create an overall product evaluation index.

Once participants had completed the product evaluation task, they were guided to the next room where environmental orderliness was manipulated as in study 1. The participants sat in front of either disorganized or well-organized shelves.

As in earlier studies, they were asked to wait for the study administrator to prepare the material. A minute later, the administrator came back with a survey and asked participants to complete it. In the survey, we included questions that assessed the participants' perception of a threat to personal control and the success of the environmental orderliness manipulation. These questions were embedded in a series of unrelated tasks, such as an advertisement evaluation task. Participants' perceptions of a threat to control were measured by five items on 7-point scales (1 = not at all; 7 = very much), such as the extent to which they felt out of control, overwhelmed, or that the workspace threatened their sense of control. These five items loaded on a single factor and revealed high reliability ($\alpha = .71$), enabling us to average them to create a control threat perception index. The success of the environmental orderliness manipulation was assessed using the same two items as before ($r = .76$, $p < .001$). The survey took about 10 minutes to finish. This time was needed for the glucose from the drink to be metabolized (Donohoe and Benton 1999).

Upon completing this second part of the study, participants were guided to the third room that had no orderliness manipulation, where they were asked to complete the unsolvable figure task used in study 3. The experimenter timed their persistence on the task.

Result

Manipulation Check and Overall Evaluation of Drink. The environmental orderliness manipulation was successful ($t(79) = -12.79$, $p < .001$). Participants in the disorganized condition perceived the room as more disorganized ($M = 1.80$) than those in the organized condition ($M = 4.78$). Next, the overall evaluation of the drink was not affected by glucose manipulation ($p = .29$).

Persistence Time on Unsolvable Puzzle. Given that the persistence times were highly skewed, we first performed a log transformation on the persistence times. We then submitted the transformed persistence times to the further analyses. A 2 (environmental orderliness) \times 2 (glucose condition) ANOVA revealed a significant two-way interaction ($F(1, 77) = 5.95$, $p < .05$). Examination of planned contrasts supported our hypothesis. In the placebo condition, we replicated our previous findings such that those who were exposed to the disorganized environment ($M = 688.86$ seconds) persisted less on the challenging task than those exposed to an organized environment ($M = 1,186.77$ seconds; $F(1, 77) = 10.35$, $p < .01$). However, as anticipated, when individuals consumed glucose before completing the unsolvable puzzle, they were equally persistent regardless of whether they had been exposed to the disorganized ($M = 1,037.69$ seconds) or organized environment ($M = 1,063.00$ seconds; $F(1, 77) = .08$, $p = .78$). Looking at the other two contrasts, the effect of glucose on persistence was only evident among those in the disorganized environmental condition ($F(1, 77) = 7.45$, $p < .05$) and not among

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those in the organized environmental condition ($F(1, 77) = .53, p = .47$; see fig. 3).

Mediation Analysis. Next we examined whether the perception of a threat to control mediated the effect of environmental orderliness on self-regulation. We adopted a moderated mediation paradigm for the analysis to examine how the mediating effect of a control threat on self-regulation was moderated by the glucose condition. We therefore specified the path from the perceived control threat to persistence as moderated by the glucose manipulation. We expected that perception of a control threat would mediate the observed effect among people in the placebo condition but not among those in the glucose condition.

The indirect effect was tested using bootstrapping procedures adapted from Preacher, Rucker, and Hayes (2007). Our results supported the predictions. Among people who did not consume glucose (placebo condition), the estimate of the indirect effect of the perceived control threat was significant (95% confidence interval [CI]: [.0024, .4621]). However, among people who consumed glucose, the estimate of the indirect effect of the perceived control threat was not significant (95% CI: [−.0382, .0994]).

Discussion

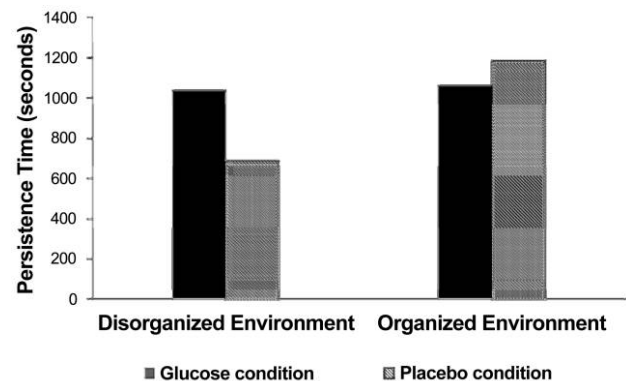
Study 4 validated our process explanation that environmental disorganization threatens a person's sense of control, which depletes resources and consequently increases self-regulatory failure. When individuals were not provided with additional resources, they revealed impaired self-regulation as a result of exposure to a disorganized environment, and this effect was mediated by perception of a control threat. However, when people had a chance to recoup their resources (e.g., by drinking sugar water), this effect was mitigated.

GENERAL DISCUSSION

In this research, we investigated the effect of environmental orderliness on self-regulation. Through a series of four studies, we showed that individuals exposed to a disorganized environment exhibited more subsequent self-regulatory failure such as impulsive buying, poor performance on the Stroop task, and reduced persistence on challenging tasks. Furthermore, we have offered evidence of the underlying mechanism. We propose that people in a disorganized environment experience a threat to their sense of personal control, and that such an experience is resource depleting. Thus, these individuals exhibit more self-regulatory failure in subsequent tasks. We validated our process explanation by showing that (1) a chance to recoup resources, such as by affirming the self or replenishing the biological source of energy (i.e., glucose), moderates the influence of environmental disorganization on self-regulation (studies 3 and 4), and (2) a perceived control threat mediates the relationship between environmental orderliness and self-regulation (study 4).

FIGURE 3

STUDY 4: PERSISTENCE AS A FUNCTION OF ENVIRONMENTAL ORDERLINESS AND GLUCOSE CONDITION



The current research makes several theoretical contributions. First, it adds to the growing environmental psychology literature. We focused on an under-researched aspect of the physical environment and illuminated the underlying mechanism by which environmental orderliness affects cognition and behavior. This research also contributes to the resource depletion literature. In particular, we showed that mere exposure to a disorganized environment can result in resource depletion. This finding is intriguing because it implies that resource depletion can occur without effortful cognitive activities such as attention control and persistence on cognitively taxing tasks. Finally, this research adds to our understanding of the broken window theory (Wilson and Kelling 1982) by providing a resource-based explanation. According to this theory, minor environmental disorders (e.g., broken windows, graffiti, etc.) increase vandalism and petty crime. Previous research has primarily used the social influence account to explain this phenomenon, namely, that broken windows signal norm violation by others and that observers are more likely to follow these others and violate other social norms. Findings from this research suggest yet another potential explanation. That is, environmental disorder can deplete the internal resources of individuals and make them less able to regulate subsequent behavior. This mechanism deserves further investigation.

In addition to theoretical contributions, this research has important practical implications concerning public health and consumer well-being. Participants in our studies were exposed to disorganized environments set by others (i.e., the experimenter). But we expect that if a messy environment is created by an individual him/herself, the environment would be more depleting, and thus resulting in even greater regulatory failure, like what we observe among people who experience hoarding. We believe that one implication of our findings is that providing individuals with opportunities for self-affirmation can reduce the negative effect of a disorganized environment. In a sense, this has

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been applied by practitioners who try to treat those who suffer from compulsive hoarding. As these individuals have difficulty changing their behavior and their environment, many specialists, instead of pushing them to change their environment directly, ask them to join a family relationship program (Steketee et al. 2000). This popular therapy can be viewed as a type of self-affirmation as it provides an opportunity for these patients to reflect on one of the most important aspects of their lives (i.e., the strength of their family support) and thus potentially helps them deal with their hoarding problem. As there are other sources of affirmation besides family ties, such as emphasizing other important merits like morality and humor, we believe that providing the compulsive hoarders with opportunities to affirm themselves on these other aspects could help them regain their control over the environment and their lives.

In this research, we found that, unlike environmental disorganization, spatial confinement did not deplete resources nor impair self-regulation (study 2). This finding is intriguing because spatial confinement has been shown to threaten feelings of freedom (i.e., autonomy; Levav and Zhu 2009). Thus, some might expect that confinement would also increase self-regulatory failure. However, similar to our findings, Levav and Zhu (2009) found that spatial confinement did not increase impulsive buying as shown in the total amount of money spent. This suggests that spatial confinement does not necessarily lead to self-regulatory failure. The question remains why environmental disorder—but not spatial confinement—leads to self-regulatory failure. We suggest that while these two constructs are similar, they might produce different kinds of threat. While environmental disorder threatens a person's sense of control, spatial confinement threatens a person's feeling of freedom or autonomy. Control and autonomy are distinct constructs in the literature. As Deci and Ryan (1985) put it, control refers to the contingency between behavior and its subsequent outcomes, whereas autonomy refers to the freedom people experience in initiating their behavior. These two constructs have been shown to have unique antecedents as well as consequences (Ryan 1982; see Skinner [1996] for a review). For instance, research has demonstrated that increased autonomy does not necessarily lead to increased perception of control (Miller 1979). Thus, there could be something specific to control

threat that leads to resource depletion and thus to subsequent self-regulatory failure. One hypothesis is that control threat, but not confinement, may lead to feelings of helplessness and thus to greater subsequent self-regulatory failure. Future research should certainly examine this distinction more thoroughly.

The findings of this study also offer avenues for future research. For example, researchers could explore whether other variables that might lead to a perceived threat to control, such as recalling past uncontrollable events (Kay et al. 2008), might affect subsequent self-regulation similarly to disorganized environments. Further, given that a threat to personal control leads people to seek structure in consumption (i.e., seeking boundaries in brand logos and products; Cutright 2012), researchers could also examine whether disorganized environments produce a similar effect.

In this research, we focused on the negative consequence of a disorganized environment, namely, self-regulatory failure. An interesting avenue for future research might be to consider the potential positive effect of a disorganized environment. For instance, a very recent article documented that a disorganization environment promotes creativeness (Vohs, Redden, and Rahinel 2013). It would be interesting to investigate when environmental disorganization is helpful and what individual differences might moderate such effects. Future research could also examine other types of environmental orderliness. For example, a perceived congruency among items presented in a given context (e.g., a computer with a mouse vs. a computer with a swimsuit) might affect an individual's sense of personal control and thus self-regulatory behavior. These and many other important questions deserve future investigation.

DATA COLLECTION INFORMATION

Grace Chae (the first author) supervised all of the data collected for study 1 (February and April 2012), study 2 (March 2012), study 3 (March and April 2011), and study 4 (March and April 2012) by research assistants at the University of British Columbia Marketing Lab. All data were analyzed by Grace Chae under the supervision of Juliet Zhu (the second author).

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APPENDIX A
PHOTOS OF ENVIRONMENTAL ORDERLINESS MANIPULATION (STUDY 1)

A. DISORGANIZED ENVIRONMENT



B. ORGANIZED ENVIRONMENT



C. CONTROL (I.E., EMPTY) ENVIRONMENT



APPENDIX B
PHOTOS OF ENVIRONMENTAL MANIPULATION (STUDY 2)

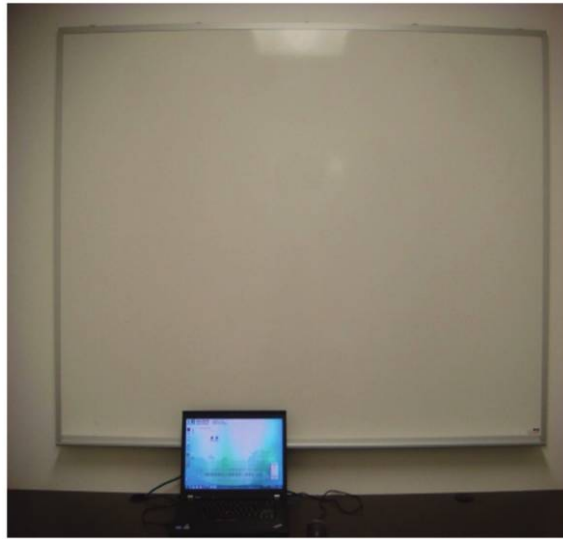
A. DISORGANIZED ENVIRONMENT



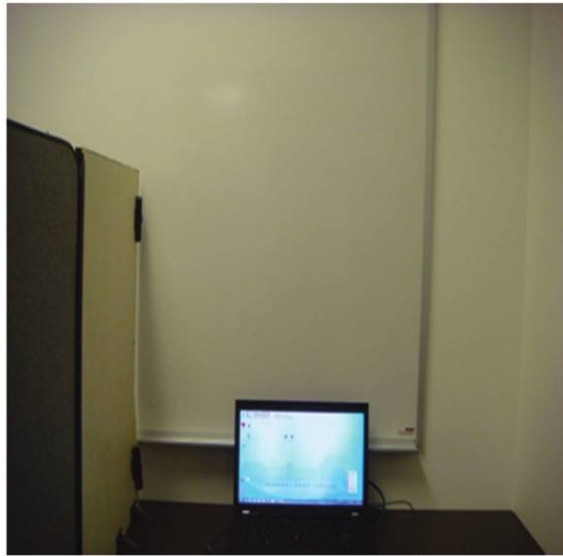
B. ORGANIZED ENVIRONMENT



C, CONTROL (I.E., EMPTY) ENVIRONMENT



D, CONFINED ENVIRONMENT



APPENDIX C

PHOTOS OF ENVIRONMENTAL ORDERLINESS MANIPULATION (STUDY 3)

A, DISORGANIZED ENVIRONMENT



B, ORGANIZED ENVIRONMENT



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