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Crossing the Virtual Boundary: The Effect of Task-Irrelevant Environmental Cues on Task Implementation

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Abstract

Task-oriented activities often involve a certain degree of waiting before the actual activities commence. We suggest that seemingly irrelevant situational cues in the task environment, such as queue guides, area carpets, or the location of another person, can serve as virtual boundaries that divide the task system into two categories: inside the system versus outside the system. Results from two laboratory and two field studies show that in-system individuals (i.e., those who have crossed the virtual boundary demarcated by these cues) are more likely than out-system individuals to adopt an implemental mind-set, as manifested by increased immediacy of action initiation, increased persistence in task-oriented behavior, and increased optimism. Further, these effects are attenuated when people are given sufficient extrinsic incentives to fulfill the task.

Keywords

motivation, implemental mind-set, queuing, task-irrelevant cues, decision making

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Although individuals' life spans may be marked by memorable experiences, they are more often filled with mundane and task-oriented activities. Whether it is sending a package using a courier company, getting a medical checkup, or buying a fast-food meal, a certain degree of waiting is often needed before the actual activity commences. This waiting may have multiple effects on individuals. In particular, waiting could lower motivation, such that people may decide to postpone, abandon, or avoid the task altogether. Other individuals may bear with the experience but emerge feeling dissatisfied and frustrated.

Task environments that involve waiting are often characterized by cues such as queue guides (poles strung with guiding tape), area carpets, floor mats, signage, and seating zones. Although these cues are a noticeable part of the task environment, they are task irrelevant and should not affect task-related decisions (e.g., whether to continue waiting in line). However, in the investigation reported here, we found that—contrary to individuals' own intuition—these cues can have a substantial impact on individuals' task-oriented behavior. Extending prior research on goal gradients (Hull, 1932; Kivetz, Urminsky, & Zheng, 2006), mind-sets (Gollwitzer, 1990, 2012), and queuing theory (Prabhu, 1997), we tested the proposal that the reason for this impact is that such task-irrelevant cues can serve as a *virtual boundary* of the task system, dividing the system into two categories: *inside the system* and *outside the system*. Once individuals cross this virtual boundary (e.g., stepping into a queue guide or onto the carpet in front of a service provider) and "enter the system," they adopt an implemental mind-set characterized by increased action initiation, increased task persistence, and increased optimism in general (Gollwitzer, 1990, 2012; Gollwitzer & Bayer, 1999).

Conceptual Framework and Hypotheses

Channel factors

Our conceptualization of task-irrelevant cues is related to the notion of channel forces, first proposed by Lewin (1951; see also Ross & Nisbett, 1991). Lewin defines channel forces as small situational factors that facilitate a specific desired behavior. Although Lewin did not explicitly say so, his work suggests that people are conscious of channel forces at work.

Researchers have subsequently used the term "channel factors" to refer to contextual interventions employed to influence behavior. For instance, Leventhal, Singer, and Jones (1965) showed that after attending a lecture on the importance of receiving tetanus inoculation, participants who had received

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a campus map with the location of the health center circled were more likely to get a tetanus shot than those who did not receive the map. Mullainathan and Shafir (2009) found a similar pattern of results among attendees of a workshop designed to encourage low-income individuals to open bank accounts: Those who could submit the first form to a bank representative at the workshop were more likely to complete the application process and use the bank services more regularly, compared with attendees who merely received the application materials.

Although the notion of channel factors is useful in thinking about contextual effects, key questions remain. Do the effects of channel factors persist in situations in which the intervention arises from environmental cues that are not central to the actual goal? Prior research has shown that seemingly irrelevant situational cues can have a substantial impact on behavior (for a review, see Custers & Aarts, 2010). For example, solving a puzzle that included achievement-related words improved performance in subsequent tasks (Bargh, Gollwitzer, Lee-Chai, Barndollar, & Troetschel, 2001), and exposure to French or German music in a wine store increased purchases of French or German wines, respectively (North, Hargreaves, & McKendrick, 1999). In a task environment, could task-irrelevant environmental cues also influence individuals' cognition and the subsequent manner in which they implemented their task?

Waiting and implemental mind-set

Past research has shown that constituents of the environment in which one is waiting can be significant drivers of motivation (Hui, Thakor, & Gill, 1998; Larson, 1987). For instance, informative display boards or slow-tempo background music can improve the palatability of waiting (Katz, Larson, & Larson, 1991; Oakes, 2003). Social comparisons, such as the number of people behind you in a queue, can affect goal desirability (Koo & Fishbach, 2010a) and waiting persistence (Zhou & Soman, 2003). Further, perceived goal progress (Soman & Shi, 2003) and focus on the remaining (vs. already completed) tasks can increase motivation (Koo & Fishbach, 2010b).

Expanding on these prior findings, we draw on the categorization literature (e.g., Tversky, 1992) and the mind-set literature (Gollwitzer, 1990, 2012; Gollwitzer & Bayer, 1999) to examine the novel effect of a different contextual factor on task implementation and mind-set activation: task-irrelevant environmental cues. Consciously or nonconsciously, people tend to categorize objects, products, and events; they find landmarks or other physical markers in the environment to define categories (Tversky, 1992). Categorization can result in decision biases. For example, individuals felt more protected against a deadly viral outbreak when they were across a state border from the disaster than when they were on the same side of the border, even if the distance from the disaster was equal (Mishra & Mishra, 2010). Similarly, we propose that objects and patterns in a waiting environment (e.g., queue guides, area carpets, or third-party positions) can also create a virtual boundary. Depending on which side of the boundary individuals perceive themselves to be, they can adopt different mind-sets and demonstrate different task-oriented behaviors.

Prior research has identified two types of mind-sets during goal pursuit: a deliberative mind-set characterized by open-mindedness and a more impartial analysis of goal-relevant information, and an implemental mind-set characterized by a more optimistic view of goal-relevant information and greater action orientation toward goal attainment (Gollwitzer, 1990, 2012; Gollwitzer, Heckhausen, & Steller, 1990).

These distinct mind-sets can be induced in different ways. Mind-sets can change from deliberative to implemental naturally as people finalize what goals they want to pursue. Alternatively, thinking about the how (vs. the why) of attaining a goal can also result in a shift in mind-set (Taylor & Gollwitzer, 1995). Further, explicitly asking people to evaluate the relative attractiveness of a set of objects from one category can enhance implementation orientation in an unrelated product category (Xu & Wyer, 2007, 2008). People's mind-set can also change as a function of physical location; for example, shoppers who have entered a grocery store tend to adopt a more implemental mind-set than those still outside the store (Lee & Ariely, 2006). In our research, we proposed that task-irrelevant environmental cues that divide the task system into in-system and out-system categories could also trigger changes in mind-set. Specifically, once people cross the virtual boundary and enter the system, we predicted that they would adopt an implemental mind-set.

Previous research has shown that once an implemental mind-set is activated, it can be manifested along both cognitive and behavioral dimensions (Gollwitzer, 2012; Gollwitzer & Bayer, 1999). On the cognitive front, compared with people who have a deliberative mind-set, people with an implemental mind-set become more optimistic in general and develop an illusory perception that they have greater control over their environment (Gollwitzer & Kinney, 1989). They also tend to rate themselves more highly on various personal attributes than their peers (Taylor & Gollwitzer, 1995). On the behavioral front, people with an implemental mind-set are more persistent in goal-directed behavior, faster at initiating action (Gollwitzer, 1990; Gollwitzer & Bayer, 1999), and are less likely to defer choice (Xu & Wyer, 2008) than people with a deliberative mind-set.

Accordingly, we predicted that crossing the virtual boundary represented by task-irrelevant cues in the waiting environment would increase individuals' task persistence, immediacy of action initiation, and general optimism. As a boundary condition, we posited that the potential effects of these cues would depend on the opportunity for the effects to manifest. Specifically, we expected these cues to have a diminished impact in situations in which the extrinsic incentive to complete the task was sufficiently high. To test our hypothesis, we conducted four studies that examined how different environmental cues activate the implemental mind-set both behaviorally and cognitively.

Study 1

In Study 1, we investigated the effect of a queue guide on people's task persistence. The results of a pretest ($N = 30$) indicated that, unlike other factors (e.g., queue length), the length of a queue guide was perceived as irrelevant to task completion and people's waiting decision (Table 1).

Method

In this field study, adapted from Zhou and Soman (2003), we observed customers at the only ATM in the concourse of a subway station in a large Asian city (see Fig. S1 in the Supplemental Material available online). Prior observations have suggested that queue lengths at this ATM typically ranged from three to nine people, and the total waiting time was from 5 to 10 min. Further, the rate at which people left the queue before reaching the ATM ranged from 20% to 25%, with most people who prematurely left doing so within the first 3 min of joining the queue.

In collaboration with the facilities manager, we observed ATM customers' behavior under three conditions in different sessions. In the short-guide condition, we placed a short queue guide next to the ATM, such that three to four people could wait within the area covered by the guide. In the long-guide condition, a longer queue guide was placed, such that six to seven people could stand in the area it covered. No queue guides were used in the control condition. Each observation session was randomly assigned to one of these conditions before the study's commencement.

Over approximately 4 weeks at three time periods daily when the concourse was fairly crowded (morning rush hour, lunch hour, and evening rush hour), a research assistant unobtrusively tracked 311 ATM customers who joined the queue at the fifth position—a position that was either inside or outside the system depending on the length of the queue guide. As the key measure, the research assistant recorded whether each customer left the queue before completing his or her transaction.

Table 1. Pretest Results From Study 1: Rated Importance of Factors That Affect Decisions Whether to Continue Waiting

Factor	Average rating
Number of people ahead in the queue	6.27**
Total length of the queue	5.33**
Number of counters opened	4.93**
Average speed of service	4.87**
Presence or absence of background music	2.53**
Number of people behind in the queue	1.97**
Decoration of the room	0.07
Length of the queue guide	0.03
Color of the floor	0.03
Whether it is Tuesday or Thursday	0.03

Note: Ratings were made on a scale from 1 (*very little*) to 7 (*a lot*). The significance of the average ratings was tested with one-sample *t* tests (comparison with 0; **$p < .001$).

Results

A chi-square test showed that the type of queue guide had a significant impact on customers' persistence in completing their ATM transaction, $\chi^2(2, N = 311) = 6.04$, $p < .05$. Specifically, significantly fewer people in the long-guide (in-system) condition ($M = 14\%$) left the queue than in the short-guide (out-system) condition ($M = 25\%$), $\chi^2(1, N = 201) = 4.07$, $p < .05$, or the control condition ($M = 26\%$), $\chi^2(1, N = 224) = 5.30$, $p < .05$.

Contrary to people's intuition, the findings in Study 1 indicated that in-system ATM customers were more likely to exhibit task-persistent behavior than out-system ATM customers by remaining in line to complete their financial transaction. One might argue that people in the short-guide (out-system) condition were more likely than people in the long-guide or control conditions to give up because queue guides signaled typical queue lengths: Although in-system individuals who stood within the queue guide might have perceived themselves to be within a queue of normal length, those outside the queue guide perceived themselves to be standing beyond the normal queue length and were thus less committed to their transactions. This conscious inference seems inconsistent with our pretest results showing that the size of the queue guide would be irrelevant to task decisions. Further, we note that rush-hour customers who used this ATM were mostly commuters who walked past the ATM daily and were hence familiar with the ATM's typical queue length. We will address this alternative account further in Study 4.

Study 2

Next, in Study 2, we sought to show that in-system individuals were more likely to adopt an implemental mind-set than out-system individuals by focusing on a different behavioral measure—immediacy of action initiation. Specifically, we examined *when* customers initiated task-related action by observing at what time they took out their ATM card in preparation for their financial transactions.

Method

We conducted this study in the lobby of an office building in an Asian city. We observed customers waiting in a common queue for one of three adjacent ATMs in this lobby. Typically, five people could stand within the area marked by a queue guide. On some days, however, we shortened the queue guide such that only three people could stand within the area marked by the guide. There were thus two conditions in this study (short guide and long guide), which were randomly assigned to different days.

Over a period of 10 working days, a research assistant unobtrusively observed the behavior of 805 individuals who

joined the queue outside the queue guide. The research assistant recorded the position at which the customers retrieved their ATM card from their pocket, wallet, or purse in preparation for their financial transactions at the machine. The first person in the queue (i.e., the next in line to use an ATM) was coded as standing at Position 1, the next person as standing at Position 2, and so forth. Observations made before the main study indicated that queue length did not differ across different working days.

Results

In the long-guide condition, the earliest position at which people retrieved their card was the eighth position, whereas in the short-guide condition, the earliest position at which people retrieved their card was the sixth position. In both conditions, the position at which customers retrieved their ATM card corresponded to the point at which they first stepped into the queue guides—when they crossed the virtual boundary and entered the in-system category (Fig. 1). When the queue guide was long (five-person capacity), significantly more customers retrieved their card when they reached the fifth position in the queue (M = 38%) than at the other positions combined (M = 9%), $\chi^2(7, N = 415) = 275.80$, $p < .0001$. When the queue guide was short (three-person capacity), significantly more customers retrieved their card at the third position (M = 45%) than at the other positions (M = 11%), $\chi^2(5, N = 390) = 244.77$, $p < .0001$.

Direct comparisons across conditions at the two key positions in the queue (third and fifth) further revealed that at the fifth position, significantly more customers in the long-guide condition (M = 38%) retrieved their ATM card than in the short-guide condition (M = 15%), $\chi^2(1, N = 805) = 50.50$, $p < .0001$. By contrast, at the third position, significantly more customers in the short-guide condition (M = 45%) retrieved their card than in the long-guide condition (M = 5%), $\chi^2(1, N = 805) = 175.71$, $p < .0001$. These results show that holding the objective position in the task system constant, people who cross the virtual boundary demarcated by a task-irrelevant cue are more likely to initiate action on the task earlier than people who have not crossed the virtual boundary. Such behavior is indicative of an implemental mind-set.

We replicated these results in a follow-up study in a different context using a different cue—an area carpet. We observed 820 international business-class travelers waiting in line at a large Asian airport who took out their travel documents (e.g., passports) to prepare themselves for checking in, and we manipulated the size of the carpet (long vs. short) in front of the check-in counter. Consistent with the results of Study 2, the majority of travelers took out their documents when they first stepped onto the carpet, regardless of their positions in the queue (Fig. 2). Similar to the situation in Study 1, this finding was contrary to pretest results indicating that carpet size is irrelevant to task-related behavior (Table 2).

Study 3

The results thus far were consistent with our hypothesis that crossing the virtual boundary defined by task-irrelevant cues induces an implemental mind-set along the behavioral dimension. In Study 3, we sought cognitive evidence for this mind-set activation. Specifically, manipulating yet another environmental cue (i.e., the position at which the experimenter stood), we tested whether task-irrelevant cues can lead to increased general optimism—a key cognitive characteristic of the implemental mind-set (Gollwitzer, 2012; Gollwitzer & Bayer, 1999).

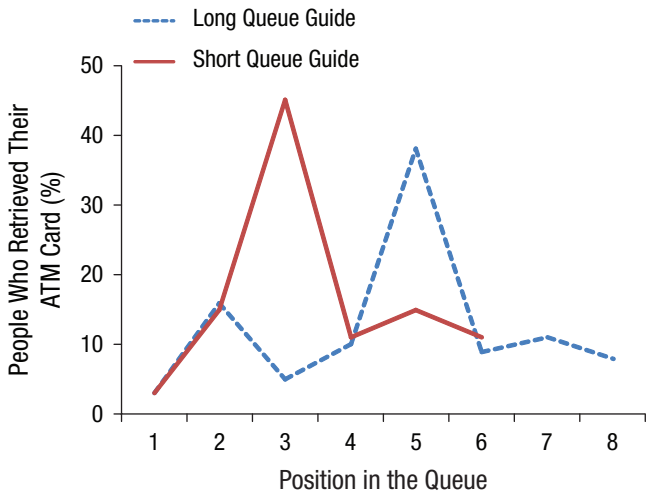

Fig. 1. Results from Study 2: percentage of people who retrieved their ATM card from their pocket, wallet, or purse as a function of their position in the queue and the length of the queue guide. The queue guide was either long (so that five people could stand inside it) or short (so that three people could stand inside it).

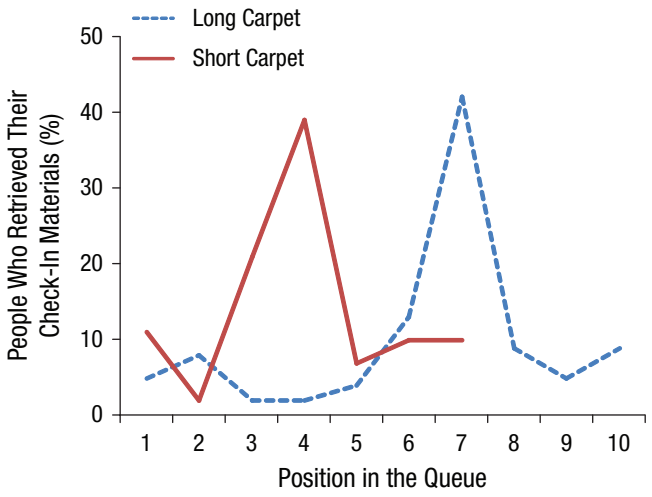

Fig. 2. Results from the follow-up to Study 2: percentage of people who retrieved their check-in materials from their pocket, wallet, or purse as a function of their position in the queue and the length of the carpet they stood on. The carpet was either long (so that seven people could stand on it) or short (so that four people could stand on it).

Table 2. Pretest Results From Study 2: Rated Importance of Factors That Affect Decisions When to Retrieve Materials to Get Ready for Service

Factor	Average rating
Number of people ahead in the queue	5.25**
Number of people behind in the queue	3.31**
Total length of the queue	2.69**
Average speed of service	1.22*
Whether listening to music	0.22
Size of the carpet	0.16
Size of the ATM	0.03
Color of the ATM	0.03
Color of the carpet	0.00
Whether it is Tuesday or Thursday	0.00

Note: Ratings were made on a scale from 1 (*very little*) to 7 (*a lot*). The significance of the average ratings was tested with one-sample *t* tests (comparison with 0; *$p < .01$, **$p < .001$).

Further, we examined the effect of this cue on willingness to make a choice—another indicator of action orientation—in an unrelated subsequent task (Xu & Wyer, 2007).

Method

Fifty-four students in a North American university participated in this study, which was conducted during the waiting period in between two parts of a long session. After completing Part 1 in a room in the lab, all participants were asked to remain in a waiting area at the lab entrance until Part 2 began (see Fig. S2 in the Supplemental Material for a sketch of the lab). The experimenter walked out of the study room with the participants and seated them in the waiting area. He then stood at a predetermined position in the lab and gave participants further instructions.

Our task-irrelevant-cue manipulation was implemented in this setting using a two-level, single-factor (perceived location of waiting: inside vs. outside) between-subjects design. In the inside condition, the experimenter stood at the lab entrance and asked participants to "please wait inside the waiting area"; participants thus perceived that they were inside the area relative to the experimenter's position. In the outside condition, the experimenter stood at the entrance of the study room and asked participants to "please wait outside in the waiting area"; participants thus perceived that they were outside relative to the experimenter's position. We alternated the experimental sessions between these two conditions such that for any given session, all participants were assigned to either the inside or the outside condition. Further, it is important to note that regardless of which condition they were in, participants waited in the same physical area in both conditions.

While waiting, participants completed two short tasks. First, they were asked to imagine they had to hit a golf ball into a hole 5 m away and to estimate how many times out of 100 attempts they would succeed. If participants in the inside condition indeed adopted an implemental mind-set, they would be generally more optimistic and predict a higher success rate than participants in the outside condition. Second, participants read descriptions of two computers and were asked to either choose one of the two or defer making a choice (Xu & Wyer, 2007, 2008). If participants in the inside condition indeed adopted an implemental mind-set rather than a deliberative mind-set, they would be more action oriented and more likely to choose one of the computers than to defer their decision.

Results

Compared with participants in the outside condition (M = 31%), those in the inside condition estimated that they could hit significantly more golf balls into the hole (M = 48%), $F(1, 52) = 3.89$, $p = .05$, and were more likely to choose one of the two computers (inside condition: M = 79%; outside condition: M = 50%), $\chi^2(1, N = 54) = 4.83$, $p < .05$. These results indicate that in-system individuals (whose perception was triggered by a task-irrelevant spatial cue in the task environment) were indeed more likely to adopt an implemental mind-set, as characterized by increased optimism and action orientation.

Study 4

In this final study, we examined a boundary condition for the effect of task-irrelevant cues on the activation of an implemental mind-set: In-system individuals' task persistence is attenuated when the extrinsic incentive to persist is high, such that there is little opportunity for task-irrelevant cues to generate an effect.

Method

Eighty-eight students in a North American university participated in this study, which was conducted during the waiting period between two parts of a 30-min session. After completing Part 1, participants were asked to form a line in front of a food-tasting station at the back of the room for a taste test. Before the session, we set up this food-tasting station (i.e., a desk with some supplies) and laid a black runner on the light-gray floor carpet under the station (see Fig. S3 in the Supplemental Material). In half the sessions, we laid a short black runner that covered only the area under the tasting station; participants thus formed a line standing on the floor carpet (out-system condition). In the remaining sessions, the black runner extended from under the tasting station to the opposite side of the room; participants formed a line standing on this runner (in-system condition). There were 8 participants in each session—information that we communicated to all participants, thus controlling for expected queue length across conditions.

After participants formed a line, the experimenter told them that the food samples were unfortunately not yet available. After pretending to call the supplier outside the lab to resolve

this issue, she returned to the room and informed participants that they had to wait for 10 more minutes. She repeated this procedure several times while keeping participants updated about the remaining waiting time (thus controlling for expected waiting time across conditions). In total, participants waited in line for about 8 min.

Finally, 3 min before the 30-min study session was scheduled to end, the research assistant informed participants that the session would run overtime and they could leave if they wished. An incentive for staying was manipulated at this moment: All participants were told that they could collect the full participation fee ($5) if they chose to leave, but half of the participants (the high-incentive condition) were promised an additional $2 if they stayed for 5 more minutes. Participants wrote whether they wanted to stay or leave on a slip of paper so as not to bias others' decisions, after which they either left or stayed as per their decisions. Study 4 thus employed a 2 (standing surface: floor carpet vs. black runner) × 2 (incentive to stay: low vs. high) between-subjects design. Our main dependent variable was participants' decision about whether to stay or leave.

Results

A chi-square test showed a significant difference across conditions in participants' decision to stay, $\chi^2(3, N = 88) = 20.10$, $p < .001$ (Fig. 3). Specifically, when the incentive to stay was lower (i.e., there was no extra compensation), we replicated the effect of task-irrelevant cues on task persistence: Participants standing on the black runner (M = 64%) were more likely to stay than those standing on the floor carpet (M = 43%), controlling for their queue position, Wald $\chi^2(1, N = 63) = 2.84$, $p = .05$. However, when the incentive to stay was high (i.e., they earned an extra $2), the effect disappeared—all participants in both conditions chose to stay (Ms = 100%).

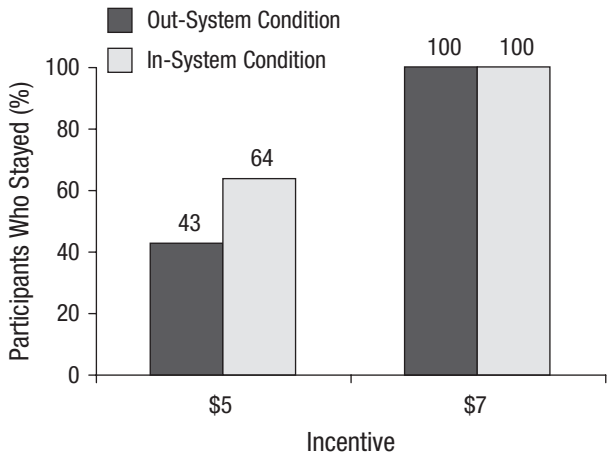

Fig. 3. Results from Study 4: percentage of participants who stayed for the taste test as a function of the incentive they were offered to stay and whether they stood on the carpet (out-system condition) or on a black runner (in-system condition) while waiting.

These results show that when the incentive for task persistence is high, task-irrelevant cues have less opportunity to activate an implemental mind-set and encourage persistence than when the incentive for task persistence is low. These findings also rule out the concern that either differential expected typical queue length or estimated waiting time across conditions could explain the effect.

General Discussion

Be it waiting in line at the bank or scheduling a medical appointment, many activities in life are task oriented and involve waiting. In this research, we demonstrated that task-irrelevant cues in the waiting environment can create a virtual boundary that divides the task system into in- and out-system categories. Once people cross this boundary and enter the system, they adopt an implemental mind-set and become more persistent in task-oriented behavior, more action oriented, and more optimistic in general than if they had not crossed this boundary.

Overall, our findings add to a growing literature that demonstrates the unconscious effects of environmental cues on motivation and behavior (Bargh & Chartrand, 1999; Chartrand, Huber, Shiv, & Tanner, 2008; Custers & Aarts, 2010; North et al., 1999). This work also contributes theoretically and empirically to the extant literature on goals and mind-sets in three ways. First, it extends Gollwitzer's (1990, 2012) mind-set theory by demonstrating that even environmental cues that are noncentral to a goal can activate an implemental mind-set with both cognitive and behavioral consequences. Second, complementing earlier research that shows the motivational force of goal-relevant progress and goal proximity (Hull, 1932; Kivetz et al., 2006), our research shows that goal-irrelevant cues can also increase task motivation. Third, on the basis of our findings, we further speculate that perceived goal progress is not necessarily a linear function of physical proximity to the goal (Soman & Shi, 2003). Rather, goal-progress perception could be disproportional when individuals move from outside the system to inside the system. Further, although our research demonstrates the important role of an implemental mind-set in individuals' task persistence, future research is needed to investigate whether this effect is related to other possible processes (e.g., greater perceived psychological costs when people are inside the system than when they are outside the system).

Our research also suggests that the role of task-irrelevant cues in the activation of implemental mind-sets has much broader implications than it does in mundane tasks, particularly in situations in which the decision to wait or not might have life-and-death consequences. Take, for example, a patient waiting for a kidney transplant. In such cases, motivating individuals to persevere and maintain an optimistic outlook can have a substantial impact on their well-being (Taylor & Brown, 1988, 1994; Taylor & Gollwitzer, 1995). The virtual-boundary idea could be used to help cancer patients stay upbeat and

optimistic during the delays between the initial diagnosis of a nonthreatening cancer and their first visit to the oncologist. Our results suggest that a short phone call from a nurse to patients acknowledging the receipt of their case reports, confirming basic information, and offering to forward any questions would alleviate the patients' anxiety by having them cross the virtual boundary en route to their goal of being treated by a specialist. As the saying goes, "A good start is half the battle."

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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.

Supplemental Material

Additional supporting information may be found at http://pss.sagepub.com/content/by/supplemental-data

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