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# Keeping Doors Open: The Effect of Unavailability on Incentives to Keep Options Viable

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Many of the options available to decision makers, such as college majors and romantic partners, can become unavailable if sufficient effort is not invested in them (taking classes, sending flowers). The question asked in this work is whether a threat of disappearance changes the way people value such options. In four experiments using "door games," we demonstrate that options that threaten to disappear cause decision makers to invest more effort and money in keeping these options open, even when the options themselves seem to be of little interest. This general tendency is shown to be resilient to information about the outcomes, to increased experience, and to the saliency of the cost. The last experiment provides initial evidence that the mechanism underlying the tendency to keep doors open is a type of aversion to loss rather than a desire for flexibility.

*Key words*: options; aversion to loss; search
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## Introduction

Imagine a student who is uncertain about whether he wants to become a computer programmer or a poet. If he wants to keep both options available, he has to keep taking classes in both majors. On the other hand, keeping both options open has its own cost. Double majoring implies that the student has to divide his time and effort and take classes in both fields—leading him to become proficient in both, but an expert in neither. Along similar lines, consider a person pursuing two potential relationships. As long as this romantic decision maker spends sufficient time with each of her potential romantic partners, she can keep them both as viable future relationships. However, once she starts spending more time with one and neglecting the other, the neglected party is likely to move on and become unavailable. Given the possible loss of the second romantic option, our enthusiastic dater might try to spend at least some of her time with her less-preferred partner, largely to maintain the viability of the relationship. However, much like the student with the double major, "keeping doors open" has its costs, drawing valuable time and energy away from the more promising relationship.

Double majoring and dating are just two examples of cases where one must invest extra time and effort to keep options available. The main questions asked here are whether the threat of future unavailability makes less-desirable options seem more appealing and whether this causes individuals to overinvest in these options. In other words, do doors that threaten to close appear more attractive than doors that remain open? And if so, will individuals overinvest just to keep them open?

From a naive, rational perspective, one could expect that the value of an option (having the ability to make a choice) would be based solely on the expected utility of the outcomes it represents. From a psychological perspective, however, there are two primary reasons why the subjective value of an option can exceed its expected value: a desire for flexibility and aversion to loss.

Initial evidence for the value of flexibility was proposed by Brehm (1956), who showed that people are willing to sacrifice consumption pleasure to increase freedom of choice (see also Simonson 1990, Gilbert and Ebert 2002). The desire for flexibility is not limited to humans; even pigeons exhibit it (Catania 1975). Such preference for flexibility implies that individuals can get utility (pleasure) from simply "having the right to choose" (keeping options open) prior to making a final choice.

Evidence for aversion to loss dates back to Kahneman and Tversky (1979).[1] The most relevant application of this aversion to loss is the case

[1] The general reluctance to give up (aversion to loss) is related to loss aversion (Tversky and Kahneman 1991). However, this general reluctance to give up does not require any comparison between the gains and losses. General reluctance to give up can, therefore, be regarded as a related phenomenon capturing the general human tendency to try to avoid losses. For instance, the endowment effect can be seen as related to both loss aversion and aversion to loss.

of endowment effect (Kahneman et al. 1990, 1991; Bar-Hillel and Neter 1996; Carmon and Ariely 2000), showing that ownership, or even deliberation (Carmon et al. 2003), can increase attachment and hence valuations. Support for aversion to loss was also provided in the context of risky choice, in particular the rejection of a pair of mixed gambles (Markowitz 1952, Williams 1966). Although options for items are very different from the items themselves—for example, the possibility of dating a person is a very different experience from actually dating that person—and although it is not possible to own an option in the same way it is to own an item, losing an option (opportunity loss) is closely related to the loss of an item. Namely, the loss of an option also implies the loss of the item. Based on this similarity in terms of loss and the large influence of loss on decision making (Tversky and Kahneman 1991), it can be argued that individuals will also experience the general aversion to loss and a pseudo-endowment effect for options. The general aversion to loss implies that the utility that individuals get from simply having the "right to choose" (keeping options open) is not a utility, but rather disutility or pain that can accompany the loss of options.

In summary, the current work asks two questions: First, whether the threat of unavailability increases the perceived value of an option; and second, if so, whether the higher valuation comes from a desire for flexibility or from aversion to loss. Four experiments were designed to provide initial answers to these questions.

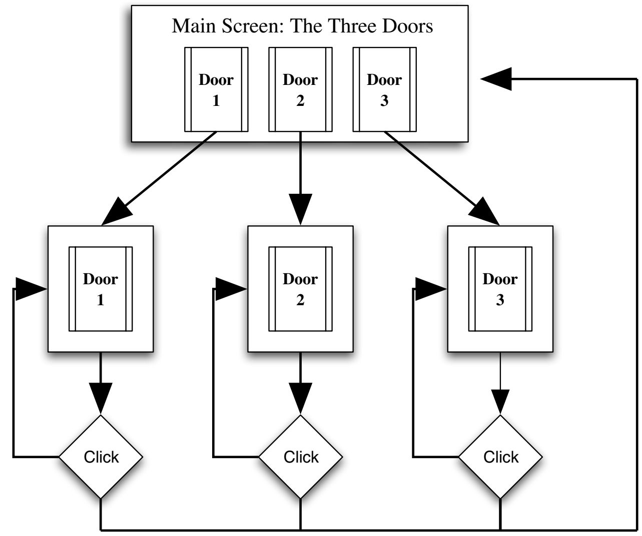
## The Experiments: General

Because all four experiments employ the same basic design, it is simpler to first describe the overall paradigm (the "game") and provide more details about specific differences as they pertain to the individual experiments.

The general structure of the game involved a sequential search task (Camerer 1995, Ratchford and Srinivasan 1993, Zwick et al. 2000), in which respondents were faced with multiple alternatives, each associated with a different payoff distribution. Respondents playing the game faced a dilemma similar to many real-life search tasks: They wanted to maximize their earnings by finding the best alternative (payoff in this game is based solely on performance), yet search is costly. Thus, respondents had to trade off the possible value of additional searching against its cost to determine their stopping rule (Saad and Russo 1996).

As a metaphor for "keeping options open," we created a computer game with three doors to three rooms (for a schematic illustration of the game, see

**Figure 1** **Schematic Illustration of the "Door Game"**




*Note.* Respondents first encountered three doors to three rooms. Clicking on any door opened that door, allowing the respondents to either click within that room or move to another room. Clicking in a room resulted in a payoff randomly sampled from the distribution of that room. Moving to a different room cost the respondents a click. Respondents were given a total click budget, and the experiment was completed when the click budget was depleted.

Figure 1). One door was red, another blue, and the third green. By clicking with the mouse on one of the doors (door-click), respondents opened that door and entered the room. Once in the room, respondents could either click in that room (room-click) or click on a door to a different room (door-click). Each room-click resulted in a payoff gain sampled randomly from that room's distribution, and each door-click transferred the respondent to another room (without a payoff). Respondents were given a click budget to use on door- and room-clicks as they wished. Once respondents used all their clicks, the game was over and they were paid the sum of their door-click payoffs. Note that charging the respondent a click to switch rooms created a switching cost. The total number of clicks was indicated clearly on the screen, in terms of both how many clicks the respondent had used and how many clicks they had left until the end of the experiment.

The main manipulation of interest was the relationship between the actions of the player and door availability (*option availability*), which was varied on two levels: *constant availability* and *decreased availability*. In the constant-availability conditions, all three rooms remained as viable options throughout the experiment, irrespective of the action of the respondent. In the decreased-availability conditions, availability depended on the action of the respondent. Every time a respondent clicked either on a door or within a room, the doors to the *other* two rooms were reduced in size by 1/15 of their original width. A *single* door-click on a shrinking door revitalized it to its original size and the process continued. Once the size of a door reached zero, it was eliminated for the rest of the game. With this shrinking factor, an option (room) that was not clicked on within 15 clicks was eliminated and was no longer visible or available.[2]

In sum, at each point, respondents had to decide whether to remain with their current choice or to continue searching while incurring switching costs. In addition, respondents in the decreased-availability condition also had to decide whether to invest in options that threaten to disappear to maintain their viability.

The analogy between the experimental game and the examples presented earlier should be clear. The three doors represent different academic or romantic options. In the decreased-availability conditions, the viability of an option is threatened when there is no investment in, or attention to, that option. Moreover, after a certain amount of neglect, options become unavailable, a state that is irreversible.

## Experiment 1: Effect of Decreased Availability

Experiment 1 was designed to determine whether the mere fact that options could become unavailable would influence decision makers' behavior. Our hypothesis was that the decreasing-availability condition would cause respondents to invest in keeping options viable. By providing an initial answer to the question of whether people switch rooms more often when there is a threat of disappearance, Experiment 1 served as a starting point for examining the possible motivation to invest in keeping options open.

### Method

**Respondents.** Advertisements were placed around campus to recruit 157 respondents, including some from within the computer lab where the experiment took place. The experiment lasted about 15 minutes. Respondents were randomly assigned to one of the two option-availability conditions (constant and decreased availability).

**Design.** The overall structure of the game was as described in the general description of the game. For this experiment, the expected value of each room-click was 3¢, but the three rooms were associated with three different distributions (Table 1). Door 1 was highly concentrated around mean 3 (normal with variance 0.64); door 2 was symmetric around the same mean, but much more diffused (normal with variance 2.25); and door 3 was highly skewed toward high numbers (chi square with 3 degrees of freedom). The payoff distributions across these three rooms ranged from −2¢ to 14¢, with the lower numbers being more frequent than the higher numbers (so that the mean value was 3¢). Respondents were given a total of 100 clicks in the experiment, which they could allocate as they saw fit between switching rooms (door-clicks) and getting payoffs within a room (room-clicks).

**Table 1** **Distributions of Payment in the Three Doors Across the Four Experiments**

| Experiment # (clicks) | Manipulation | Door 1 | Door 2 | Door 3 |
|---|---|---|---|---|
| Experiment 1 | Option availability | | | |
| (100) | Distribution | Normal | Normal | Chi-square |
| | Average ¢/variance | 3/2.25 | 3/0.64 | 3/10 |
| | Min ¢/Max ¢ | 0/7 | 1/5 | −2/10 |
| Experiment 2 | Information level | | | |
| (50) | Distribution | Normal | Normal | Chi-square |
| | Average ¢/variance | 6/9 | 6/2.25 | 6/16 |
| | Min ¢/Max ¢ | 0/14 | 2/9 | −4/19 |
| Experiment 3 | Saliency of the cost | | | |
| (100) | Distribution | Normal | Normal | Chi-square |
| | Average ¢/variance | 10/9 | 10/2.25 | 10/20 |
| | Min ¢/Max ¢ | 4/18 | 6/13 | 0/20 |
| Experiment 4 | Reactivation | | | |
| (100) | Distribution | Normal | Normal | Normal |
| | Average ¢/variance | 2.5/1.25 | 3/1.25 | 3.5/1.25 |
| | Min ¢/Max ¢ | −0.6/5.9 | 0.1/6.9 | 1.2/8.1 |

*Note.* Door 3 was a chi-square distribution with a degree of freedom, which is larger than the expected mean by 2¢. We subtracted 2¢ from the distribution to keep the same average, but encounter a few negative outcomes. For example, in Experiment 1, door 3 was a chi-square distribution with 5 degrees of freedom, where we subtracted 2¢.

**Procedure.** Upon arrival at the lab, respondents were seated individually and given instructions for the game. All respondents received instructions that emphasized that their goal in the experiment was to make as much money as possible and that the amount they made would be paid to them at the end of the experiment. In the decreased-availability condition, respondents were also given the description of the rules governing the shrinking, revitalizing, and disappearance of the doors. The instructions did not include any information about the different payoff distributions of the three doors; respondents had to learn about the distributions while playing the game.

### Results and Discussion

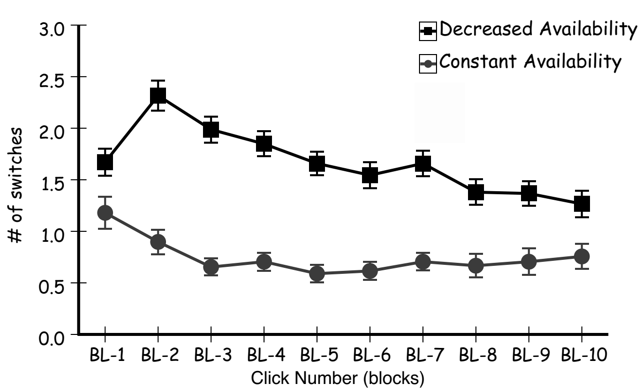
First, we compared how door-switching behavior varied across the two conditions. A comparison of the average number of room switches (door-clicks)

[2] For a robustness test, we manipulated this visual saliency of the disappearance of the doors in a separate experiment. The results showed that there was no observable impact on the player's actions, suggesting that the effect of availability was not due to the visual saliency that was used in this game.

revealed that switching was more likely to occur in the decreased-availability condition ($M = 16.70$) than in the constant-availability condition ($M = 7.47$; $t(156) = 7.82$, $p < 0.001$).

Next, we examined how the tendency to switch rooms in the two option-availability conditions changed as a function of the total number of clicks used (click number). Note that the click number is a measure of both the learning and the expected value of keeping options open, both reducing the motivation for switching. First, as the click numbers increase, respondents have more experience, better estimation of the distributions, and thus a reduced need to explore the different options. Second, the expected benefit of exploring different options is reduced with the click number because the time horizon during which this information can be used is reduced. To analyze the effect of the click number, clicks were divided into 10 blocks of 10 clicks each. An overall 2 (option-availability) by 10 (block) ANOVA revealed a significant main effect for option availability ($F(1, 1550) = 306.27$, $p < 0.0001$), a significant main effect for block ($F(9, 1550) = 5.61$, $p < 0.0001$), and a significant interaction effect between option availability and block ($F(9, 1550) = 3.82$, $p = 0.0001$). As can be seen in Figure 2, there was a decreased tendency to switch rooms later in the game. However, even in the last block of 10 clicks, more switching occurred in the decreased-availability condition ($M = 1.27$) than in the constant availability condition ($M = 0.75$; $F(1, 155) = 8.23$, $p = 0.0047$). More important, there were interesting differences in how the tendency to open other doors changed as a function of block in the two conditions, as indicated by the interaction. In particular, while respondents in the constant-availability condition switched the most during the first block, respondents in the decreased-availability condition switched the most during the second block—which was the first time they encountered a threat of option elimination.

**Figure 2** Average Number of Door Switches for Decreased- and Constant-Availability Conditions Within Each Block of 10 Clicks in Experiment 1




*Note.* Error bars are based on standard errors.

It is worth contrasting the behavior of the respondents to an optimal strategy benchmark, which in this experiment was to select a single room and remain there during the entire game, which would have earned the highest possible payoff due to the implicit opportunity cost of 3¢ for each room switch (door-click). Relative to this standard, the respondents in Experiment 1 gave up 11% of their profits (8% in the constant-availability condition and 14% in the decreased-availability condition) as a consequence of switching rooms, which occurred on the average of 12 times per respondent. Note that in this experiment, respondents had to discover the underlying payment distribution based on experience, and therefore had to switch to learn about the doors—that is, payoffs. Accordingly, the reduction in payment cannot be taken as evidence of any irrational behavior. Experiment 2 more carefully examined normative expected behavior in such cases.

In summary, Experiment 1 showed a main effect for option availability. Decision makers' interests in alternative options seemed to increase when they were threatened by their unavailability.

## Experiment 2: Effects of Knowledge on the Desire to Keep Doors Open

Although the results of Experiment 1 suggest that the respondents were willing to invest to keep their options open, it remains unclear as to whether this investment can be classified as an overinvestment. It is possible, for example, that in the face of uncertainty, the optimal strategy is to keep options open until sufficient information about distribution accumulates. Experiment 2 manipulated the level of knowledge respondents had about the distributions, the logic being that if the reason for keeping options available is lack of knowledge, providing respondents with more information about payoff distributions should eliminate, or at least substantially decrease, the difference in switching between the decreased- and constant-availability conditions. On the other hand, if the tendency to keep options open is caused by mechanisms such as preference for flexibility or aversion to loss, providing additional information should not influence the effects of option availability on room switching.

### Method

**Respondents.** Advertisements were placed around campus to recruit 105 respondents, including some from within the computer lab where the experiment took place. Respondents were randomly assigned to one of six conditions.

**Design and Procedure.** The main manipulation in Experiment 2 was a manipulation of information, which was varied on three levels: *no prior information*, *practice information*, and *descriptive information*, which was crossed with the manipulation of option availability. The distributions of the three rooms had the same mean value of 6¢ (Table 1), and respondents were allocated 50 clicks rather than 100 clicks as their clicking budget. The no-prior-information conditions were a basic replication of Experiment 1. In these two conditions (constant and decreased availability), respondents did not get any prior information about the distributions. They were simply given the opportunity to play the game. In the practice-information condition, respondents played the same game twice, first for 50 practice trials without getting paid, and then for 50 real trials. Respondents were clearly informed that the distributions associated with each room were the same in the practice and real parts, thus increasing their knowledge about these distributions for the real part of the experiment (the part for which they got paid). Respondents in the descriptive-information condition were told that the averages of the distributions of all three rooms were identical. They were also shown a graph in which the means, skewnesses, and variance of each distribution were depicted. Although the respondents in the descriptive-information condition knew the three distributions, they did not know which room corresponded to which distribution. Thus, if they were not satisfied with the equal expected value across the three rooms, they could have searched the three rooms for their preferred distribution.

### Results and Discussion

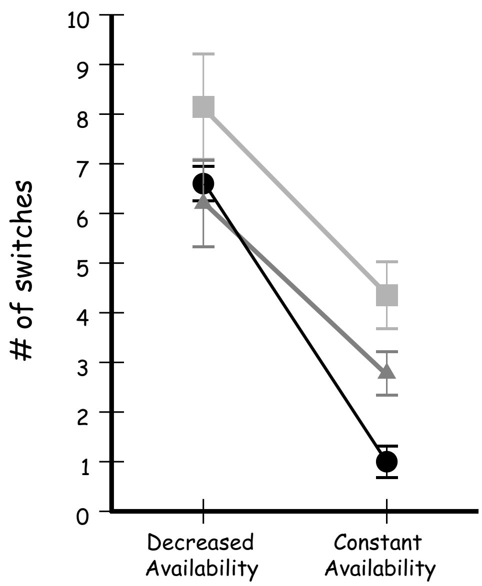
As in Experiment 1, the main dependent measure was the frequency of room switches across the different conditions, analyzed in a 2 (option-availability) by 3 (information) between-subjects ANOVA. The overall ANOVA (Figure 3a) revealed a main effect for option availability ($F(1, 99) = 56.66$, $p < 0.001$), replicating the main results of Experiment 1. The overall ANOVA also revealed an effect for information ($F(2, 99) = 6.99$, $p < 0.001$), showing that the no-prior-information conditions induced more switching than did the other two conditions ($F(1, 101) = 12.78$, $p < 0.001$), which were not different from each other ($F(1, 61) = 1.85$, $p = 0.18$). Finally, the analysis showed a nonsignificant interaction between option availability and information ($F(2, 99) = 1.32$, $p = 0.27$), demonstrating that the addition of information did not change the effect of option availability on switching behavior; that is, respondents with no prior information about the distributions exhibited the same reaction to the threat of disappearance as respondents who had more information (either descriptive or practice) about these distributions. There were a few respondents who wanted to end the experiment as fast as possible, not switching rooms at all. These respondents increased the standard errors in general but most profoundly when the mean switching was higher, which is the decreased-availability condition.

While these results demonstrate that additional information does not reduce the effect of option availability, they do not rule out rational explanations for the observed effect. For example, had respondents needed 15 clicks per room to learn its payoff distribution, respondents in the decreased-availability conditions would have had to switch rooms at least six times, while respondents in the constant-availability conditions would have had to switch only twice. To examine more carefully such possible explanations, we constructed three other measures: *pecking*, *elimination point*, and *click investment*.

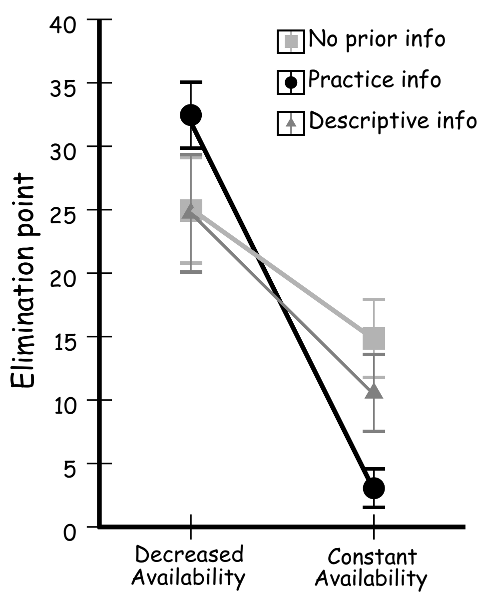
First, we examined pecking, the number of times that respondents switched to another room, clicked in that room once, and switched back (the result remains the same if we define pecking as switching to another room and switching back without clicking inside the room, or as a combined measure). From the perspective of gaining information about the payoffs, we could consider such pecking behavior as an irrational overinvestment in keeping options open because it provides little information (one more sample) at a high cost (three clicks—one for switching away, one for sampling the payoffs, and one for switching back). ANOVA analysis revealed that pecking behavior was more frequent in the decreased-availability condition ($M = 0.36$) than in the constant-availability condition ($M = 0.07$; $F(1, 99) = 5.97$, $p = 0.016$), suggesting that in the face of a threat that options could become unavailable, respondents showed "irrational" behavior more often. More important, the effect of information on pecking was not significant ($F(2, 99) = 0.682$, $p = 0.508$), nor was the interaction between option availability and information ($F(2, 99) = 0.435$, $p = 0.649$), suggesting that the different amounts of information had no effect on respondents' overinvestment in keeping options open.

In a second attempt to examine the irrational aspect of keeping doors open, the number of clicks from the start of the experiment in which each respondent stopped visiting each of the three rooms was computed and compared across the different conditions. For each respondent, the smallest number of the three was the first time he or she eliminated a door from his or her consideration—which we termed the *elimination point*. We reasoned that the comparison of this elimination point could demonstrate the amount of investment in learning across different conditions. If respondents overinvested in options to keep them, then their elimination point would be later (larger). An overall ANOVA (Figure 3b) revealed a main effect for option availability ($F(1, 99) = 44.67$, $p < 0.001$), a nonsignificant effect for information ($F(2, 99) = 0.322$, $p = 0.725$), and a significant interaction effect between option availability and information ($F(2, 99) = 4.76$, $p = 0.011$). These results indicate that although respondents felt that they did not need to revisit their least preferred room relatively early in the process (as indicated by the elimination point in the constant-availability condition: $M = 9.8$), they kept the least preferred option viable for longer in the decreased-availability condition ($M = 27.14$). Moreover, the practice-information condition showed that the addition of practice information actually increased the difference between the constant-availability and decreased-availability conditions, as the interaction suggested (Figure 3b).

**Figure 3** **(a) Average Number of Door Switches Across the Two Option-Availability and Three Information Conditions in Experiment 2**




**(b) Average Elimination Point in the Two Option-Availability and Three Information Conditions in Experiment 2**




*Note.* Error bars are based on standard errors.

The third attempt to examine the irrational aspect of keeping doors open used the behavior of respondents in the constant-availability condition to create a normative standard from which to evaluate the behavior of the decreased-availability condition. This analysis assumed that clicks that took place early in the process are best viewed as an investment of search costs to accumulate enough information[3] to determine which room to stay in. Based on this idea, we computed *click investment*, which is the number of clicks participants invested before they settled down in one of three doors. This measure captures the amount of information that respondents felt they need to determine which option to pursue. This analysis is particularly useful as a test of whether the increased number of switching in the decreased-availability condition was due to rational information search, as illustrated in the example with 6 and 2 switches above. The overall ANOVA revealed a main effect for option availability ($F(1, 99) = 64.99$, $p < 0.001$), showing that the decreasing availability leads the higher click investment in options ($M = 10.07$), compared with the constant-availability condition ($M = 4.49$). Moreover, the results also showed a nonsignificant effect of information ($F(2, 99) = 0.33$, $p = 0.72$), suggesting that respondents overinvest in information search in the face of the possibility that the option would become unavailable, irrespective of their informational state. These results are also in accord with the results of the later trials in Experiment 1 (Figure 2), showing that even when participants had more information (in the last block of 10 clicks), the effect of option availability was pronounced.

In summary, the results of Experiment 2 replicated Experiment 1 by showing that decreased availability increases the tendency to invest in keeping options open. More important, Experiment 2 demonstrates that this effect could not simply be attributed to information. Providing respondents with more experience (in the practice-information condition) or telling them

[3] What kind of information people need depends on individual preference. For some, the mean might be sufficient, while others might need more information about the distribution.

explicitly about the distributions (in the descriptive-information condition) decreased overall switching behavior a bit, but it did not change the effect of decreased availability on switching (the difference between the two option-availability conditions). Combined with the results of Experiment 1, these findings suggest that there is an inherent tendency to keep options open, even when doing so is costly. Experiment 2 also provided initial evidence that people are overzealous in their preference for keeping options open beyond the level that could be attributed to investment in learning (based on the analyses of pecking, elimination point, and click investment).

## Experiment 3: Effects of Cost Saliency on the Desire to Keep Options Open

Experiments 1 and 2 both demonstrated that the threat of option disappearance causes decision makers to sacrifice payoffs to keep options viable. Moreover, Experiment 2 showed that this tendency remained even when it became more apparent that keeping these options open had no expected value (such as in the descriptive-information condition). It is possible, however, that while respondents understood that keeping options available had little value, they nonetheless wanted them open because they did not understand the costs of keeping them available. Specifically, the cost in Experiments 1 and 2 was implemented as an opportunity cost; respondents lost a click every time they switched to a different room. While we carefully explained to the respondents that they lost a click for every door-click and presented them with an updated click-counter after every click, opportunity costs might have been less heavily weighted compared with out-of-pocket explicit costs (Thaler 1980). Respondents may have simply failed to carefully consider the value of opportunity cost, leading them to frequent switching.

Experiment 3 examined this issue by including a condition in which respondents paid explicitly for switching rooms. We reasoned that if the high level of switching in Experiments 1 and 2 were due to the low saliency of the cost, then making the cost explicit (and higher) would decrease switching and eliminate the effect of option availability. On the other hand, to the extent that room switching is not influenced by the cost, we would increase our confidence that individuals have the desire to keep options open.

### Method

The basic design of Experiment 3 differed from Experiment 1 in two ways. First, all respondents engaged in 100 practice clicks before beginning with the 100 real clicks (as in the practice-information condition in Experiment 2, but with 100 clicks). Second, there were explicit penalties for door-clicks (room switching).

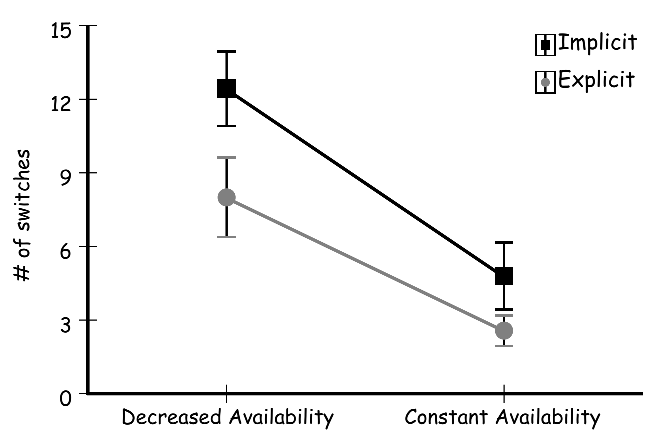
**Respondents.** Advertisements were placed around campus to recruit 86 respondents, including some from within the computer lab where the experiment took place. Respondents were randomly assigned to one of four conditions.

**Design and Procedure.** Experiment 3 included the same option-availability manipulation as in Experiment 1, with an additional manipulation of cost, which was varied on two levels: *implicit cost* and *explicit cost*, crossed with option availability. In the implicit-cost conditions, the cost of switching rooms was the loss of a click (as in Experiments 1 and 2). In the explicit-cost conditions, the cost of switching rooms was loss of a click (implicit cost) *and* a loss of 3¢. The loss of 3¢ per switch was noted on the screen for every door-click in the same way that payoffs for each room-click were posted. We selected 3¢ as the explicit cost because it was the expected value of a room-click (Table 1), making the total cost of switching in the explicit conditions twice as much as in the implicit conditions.

### Results and Discussion

An overall ANOVA of door-clicks indicated a significant main effect for option availability ($F(1, 82) = 13.41$, $p < 0.001$), a marginal effect for cost ($F(1, 82) = 3.48$, $p = 0.066$), and a nonsignificant interaction between option availability and cost ($F(1, 82) = 0.38$, $p = 0.539$). As can be seen in Figure 4, the effect of option availability replicated the previous experiments, showing that decreased availability caused more switching behavior ($M = 13.26$) than constant availability ($M = 5.36$). The effect of cost revealed that switching was more frequent, but only marginally so, in the implicit-cost condition ($M = 10.8$), compared with the explicit-cost condition ($M = 6.65$). Although the cost manipulation was marginally significant, the important aspect is that the magnitude of the cost

**Figure 4** Average Number of Door Switches Across the Two Option-Availability and Two Cost Conditions in Experiment 3




*Note.* Error bars are based on standard errors.

effect ($\lambda = 3.48$) was much lower than that of the option-availability effect ($\lambda = 13.41$). Most important, the nonsignificant interaction between option availability and cost illustrates that the desire to keep options open persisted even when the cost was more explicit, and even when its magnitude was twice as large. Finally, the amount of experience in this experiment was higher (100 clicks instead of 50), which allowed us to look at trials in which respondents had more experience—the effects of availability and cost persisted throughout the 100 clicks.

In summary, Experiment 3 suggested that the tendency to keep options open persists when the cost is explicit *and* doubled. While making the cost explicit and twice as large increased the amount of attention respondents paid to switching, and thus slightly reduced it, this cost did not prevent them from having increased interests in alternatives when there was a threat that these alternatives will be eliminated.

## Experiment 4: Aversion to Loss vs. Flexibility

The previous three experiments demonstrated that a threat to availability has a strong influence on the desire to keep options open. Both Experiments 2 and 3 demonstrated that neither information nor saliency of cost can account for the effect of option availability. Experiment 4 examined two possible psychological mechanisms that could provide an explanation for respondents' tendency to keep doors open: the desire to keep or increase flexibility in future choices, and the desire to protect against possible losses. To test these two hypotheses, we added a new manipulation of reactivation to the decreased-availability condition, allowing respondents to reactivate a door that had previously disappeared. To do this, respondents simply pressed a button, paid a known payment, which was varied (0¢, 6¢, or 30¢), and then the door would reappear and the respondent would be in that room (as if the door had been clicked). By using this reactivation manipulation, options could disappear without changing future flexibility—disassociating desire for future flexibility from disappearance (loss) of an option. If the increased switching in the decreased-availability conditions is caused by the desire for future flexibility, adding the possibility of reactivation should decrease or eliminate the effect of option availability. On the other hand, if the increased switching in the decreased-availability conditions is caused by aversion to loss, reactivation should not influence the effect of option availability. The argument here is that reactivation following the disappearance of a door can revitalize it, but it does not eliminate its disappearance (loss). Returning to the initial dating example, the reactivation is analogous to a case where our romantic decision maker knows that even if a potential romantic partner becomes unavailable, this unavailability could always be reversed at a known cost, such as a gift, flowers, or jewelry.

### Method

**Respondents.** Advertisements were placed around campus to recruit 91 respondents, including some from within the computer lab where the experiment took place. Respondents were randomly assigned to one of five experimental conditions.

**Design and Procedure.** Experiment 4 had five conditions, all of which offered respondents 100 clicks. The first two conditions were constant availability and decreased availability (as in Experiment 1). The novel conditions in Experiment 4 introduced the reactivation mechanism, which guaranteed the future flexibility of the doors in the decreased-availability settings. In the reactivation conditions, once a door disappeared, a small box appeared above the location of the door. By clicking on this box, the respondents reactivated the door and entered the room (as if the respondent had clicked on the door), and the cost of reactivation was deducted from the payoff. The cost of reactivation varied: 0¢, 6¢, or 30¢.

The expected pattern of results depended on whether switching behavior was motivated by the desire to keep, or increase, flexibility in future choices, or by protection against possible losses. If the flexibility account is correct, it would be expected that respondents would expend a similar level of effort in the three reactivation conditions as in the constant-availability condition, while a higher level of effort would be expected to keep options open in the basic decreased-availability condition. Furthermore, within the reactivation conditions, it would be expected that the level of effort would depend on the cost of exercising the reactivation. On the other hand, if the tendency to keep options open largely relates to a general aversion to losses, the reactivation manipulation should have no influence on the effect to keep options open, because reactivation does not prevent the disappearance (loss) of the doors. In terms of the cost of reactivation, the aversion to loss account suggests that because the main motivation is to eliminate loss, there will be a low sensitivity to the magnitude of the cost (because the cost of reactivation matters only after losing some options). Thus, to the extent that the aversion to loss account is correct, room switching should be the same in all four decreased-availability conditions, irrespective of reactivation.

There is another way to look at these conditions. Based on the future flexibility account, there is only one condition where the future flexibility is not guaranteed (decreased-availability condition), while in four other conditions (constant-availability condition and the three reactivation conditions), the future flexibility remains the same. In contrast, from the perspective of the aversion to loss account, there is only one condition without a threat of availability (constant-availability condition), while in the other four conditions, availability is threatened (decreased-availability condition and the three reactivation conditions).

A final prediction based on aversion to loss relates to the difference in switching between the 0¢ reactivation and the constant-availability condition. Note that these two conditions are identical from the perspective of a rational agent, but that they differ in terms of framing, such that the 0¢ reactivation condition can involve the aversion to loss mechanism.

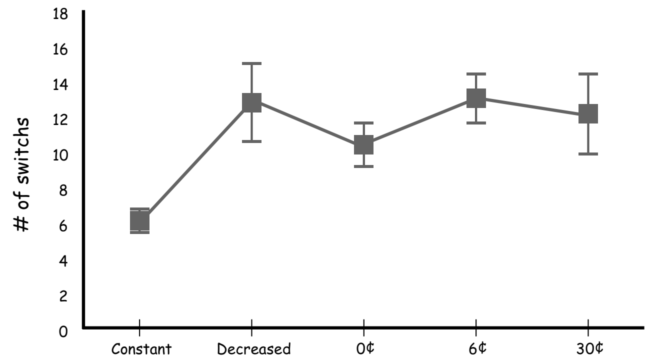
One additional feature of Experiment 4 was that it introduced a case in which the expected payoffs of the different doors were not the same (Table 1). This was done to test whether respondents in the previous three experiments might have expended efforts to keep all options open simply because they had no clear reason to keep one and discard the others (Kahneman et al. 1991, Shafir et al. 1993, Inman and Zeelenberg 2002). In Experiment 4, where all options were not equal, respondents could more easily find a reason to make decisions and thus could justify less switching than when all options were created equally and, therefore, it was difficult to find a reason to make decisions. The distributions were normal, with variance 1.25, and means of 2.5, 3, and 3.5.

### Results and Discussion

There were five conditions in Experiment 4, two of which were a replication of the main option-availability manipulation (constant availability and decreased availability) and three of which were reactivation-related decreased-availability conditions with reappearance cost of 0¢, 6¢, and 30¢. An overall ANOVA of the switching behavior revealed a main effect for option availability ($F(4, 90) = 2.73$, $p = 0.034$).

First, we examined whether these results replicated the previous experiments. As can be seen in the left side of Figure 5, the main result was replicated—switching in the constant-availability condition ($M = 6.06$) was lower than switching in the decreased-availability condition ($M = 12.76$; $t(31) = 2.83$, $p < 0.01$). Next, we investigate the effect of using distributions of different means for the different rooms, comparing the constant and decreased-availability conditions in Experiment 4 with Experiment 1, where all options had the same expected value. Using a 2 (experiment: equal/unequal distributions) by 2 (option availability) between-subjects ANOVA, the results revealed an effect of availability ($F(1, 186) = 32.52$, $p < 0.0001$), confirming our previous finding

**Figure 5** **Average Number of Door Switches in the Two Replication Conditions (Left) and the Three Reactivation Conditions in Experiment 4.**




*Note.* Error bars are based on standard errors.

of the effect of option availability. The results also showed a marginally significant effect of the experiment, where respondents switched more in Experiment 1 ($M = 12.11$) than in Experiment 4 ($M = 9.52$; $F(1, 186) = 3.66$, $p = 0.057$). Although marginally significant, this result is consistent with the idea that the different means provided the respondents with reasons to switch less. Furthermore, the interaction between experiment and option availability was not significant, demonstrating that unequal distributions did not change the effect of option availability on the desire to keep options open. To further support this idea, we replicated Experiment 1 ($N = 35$), with distributions averaging 2.5, 3, and 3.5. These results showed that respondents in the decreased-availability condition switched significantly more ($M = 10.13$) than respondents in the constant-availability condition ($M = 4.26$; $t(33) = 3.17$, $p < 0.001$).

With the knowledge that Experiment 4 replicated the previous experiments, we next examined which of the two theories (future flexibility of choices and aversion to loss) was better supported. Recall that we were interested in the relationship between the reactivation conditions to the constant- and decreased-availability conditions, *and* particularly in the comparison between these conditions and the 0¢ reactivation condition.

First, in comparing the reactivation conditions with the constant- and decreased-availability conditions, we asked whether the three reactivation conditions would be similar to the constant-availability condition, thus supporting the future flexibility explanation, or whether they would be similar to the decreased-availability condition, thereby supporting the aversion to loss explanation. As can be seen in Figure 5, the switching behaviors in the three reactivation conditions were not different from each other ($M = 11.58$; $F(2, 55) = 0.74$, $p = 0.484$), and they were also not statistically different from the decreased-availability condition ($M = 12.76$; $F(1, 73) = 0.32$,

$p = 0.5735$). The three reactivation conditions, however, were significantly different than the constant-availability condition ($M = 6.06$; $F(1, 72) = 9.34$, $p < 0.001$). These results provide support for aversion to loss over future flexibility as the driving force underlying the desire to keep doors open.

Next, in comparing the 0¢ reactivation condition with the constant- and decreased-availability conditions, we asked whether the 0¢ reactivation condition would exhibit similar switching to the constant availability (to which it was logically equivalent) or to the decreased availability, which could be the case if aversion to loss is the force that causes individuals to switch more in the face of the threat of options unavailability. This result (Figure 5) indicates that the switching behavior in the 0¢ reactivation condition ($M = 10.38$) is more similar to that of the decreased-availability condition ($t(40) = 0.72$, $p = 0.475$) than that of the constant-availability condition ($t(40) = 2.50$, $p = 0.016$), suggesting that in our set-up, aversion to loss plays a larger role than flexibility.

These results can also provide a hint as to whether the effort to keeping doors open is driven by utility (or pleasure from having more options) or disutility (or pain from having options disappear). The higher switching in the reactivation conditions (in particular, the 0¢ reactivation condition) compared with the constant-availability condition suggests that it is the disutility of having options disappear that is the driving force.

It is also interesting to examine the impact of the magnitude of a reactivation fee on switching behavior. The lowest amount of switching occurred in the 0¢ reactivation condition ($M = 10.38$), followed by the 30¢ reactivation condition ($M = 12.12$) and the 6¢ reactivation condition ($M = 13$). But there was no statistical difference between these conditions ($F(2, 55) = 0.74$, $p = 0.484$). This lack of sensitivity to the magnitude of the cost can be taken as another indication that the tendency to keep doors open is not due to a rational cost-benefit analysis.

In sum, the different ways of looking at the results of Experiment 4 all point to the same conclusion—that the threat of availability of options is aversive, and hence, respondents are willing to invest to reduce the possible experience of loss. This effect can be termed aversion to loss, or disappearance aversion, similar in some ways to the general principle of loss aversion.

## General Discussion

The current work examines a basic aspect of human behavior that extends from interpersonal relationships to abstract monetary options—valuations of options. The experiments attempted to shed some light on how individual decision makers evaluate options by examining how the threat of option unavailability influences the value of the options. Experiment 1 demonstrated that the possibility that the options will become unavailable in the future increases investments in them to keep them from disappearing. Experiment 2 tested whether this effect can be due to information, and, in addition, added three more fine-grained measures (pecking, click investment, and elimination point) to test whether the effort respondents expanded to maintain options open can be rationally explained; it cannot. Experiment 3 tested whether the distinction between implicit and explicit cost is the reason that our respondents overinvested in keeping doors open; it was not. Finally, Experiment 4 contrasted two psychological theories—flexibility and aversion to loss—as possible mechanisms for the overinvestment in keeping options open. The results from this experiment point to aversion to loss as being the more powerful of the two (at least in our set-up).

In a further test of aversion to loss, we created a new measure aiming at examining whether the room that respondents "gave up on" first (elimination point) was one for which they had more or less information about compared with the one they "gave up on" second (second elimination point). We argue that from an informational point of view, subjects should abandon a room they have more information about, because the amount of information indicates their certainty in the quality of the room. On the other hand, from an aversion to loss perspective, a room that had attracted more clicks might also have a higher attachment associated with it, thus leading to a lower tendency to abandon such a room. Analyzing this measure in Experiment 2 revealed that the respondents were four times more likely to first abandon rooms they have less information about, thus supporting the attachment and aversion to loss ideas. Moreover, the increased impact of availability on the practice-information condition in Experiment 2 strongly supported the aversion to loss explanation (Figure 3). The experience of actual feeling of the losses of the options during the practice trials seemed to cause respondents to be even more resistant to experiencing more losses during the actual trial.

In summary, the experimental evidence presented suggests that individuals value options in a way that is different from the expected value of these options, and, in particular, that decision makers overvalue their options and are willing to overinvest to keep these options from disappearing. Based on the results of Experiment 4, we believe that the desirability of keeping options open is a kind of disutility from loss rather than utility from "having more options to choose from."

In a world where maintaining options has no cost, such a tendency would have been nonconsequential. However, we believe that in most day-to-day cases, there is substantial cost to keeping options open, which would lead to erroneous behavior. There are many situations in which decision makers encounter trade-offs between the future availability of options and their maintenance costs. We have already mentioned dating and choosing a major in college. Other examples include trade-offs between focusing on one's current work and looking for new employment elsewhere; whether to specialize in a way that suits one's current employer or instead to invest in skills that are valued by other potential employers. These results might also shed light on one of life's greater mysteries: Why do some people channel surf rather than, for example, enjoy a single movie? The answer might be the fear of losing other options.

These results might also be generalized to one-shot cases. For example, when buying a new computer, consumers face the dilemma of deciding whether to buy a system that suits their current needs or purchase an expandable system (e.g., more slots for cards, and more memory) that is more expensive but could better fit their uncertain future needs. In this case, the main source of the dilemma is the uncertainty as to whether future expansion will be needed, compared with the current additional cost. Our computer buyer is faced with a situation that is analogous to the door game one click before a door disappears. She can take a costly action at purchasing time to ensure that the expansion option remains available to her whether she subsequently decides to expand or not.

Other examples in which consumers face "disappearing" options are deciding whether to purchase an extended warranty when buying a new electronic product and deciding whether to buy pictures of oneself on whitewater rafting trips. In such cases, consumers are given the opportunity to act on the options (the warranty or the pictures), while realizing this is their only opportunity to take this action, and that not acting on the options is irreversible and may cause the "pain" of losing these options. We suspect that the effectiveness of such tactics is based on the option's nonavailability in the future, which would cause these options to be perceived more favorably and to be acted on more frequently.

There remain numerous unanswered questions. For example, what are the mechanisms that underlie the fear of losing options? What is the relationship between keeping options open and indecision, particularly when deciding means committing to one out of a multitude of other possibilities (see also Amir 2004)? What is the impact of options' prospective lifetime and unavailability on their subjective value? Faced with a large number of options, would decision makers still value options (Iyengar and Lepper 2000)? What is the number of options people would like to keep? Finally, under what conditions will individuals want to actively eliminate options? We keep these research opportunities open for the future.

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