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Stairs or Escalator? Using Theories of Persuasion and Motivation to Facilitate Healthy Decision Making

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To encourage an increase in daily activity, researchers have tried a variety of health-related communications, but with mixed results. In the present research—using the stair escalator choice context—we examined predictions derived from the Heuristic Systematic Model (HSM), Self Determination Theory (SDT), and related theories. Specifically, we tested whether (as predicted by HSM) signs that encourage heuristic processing ("Take the Stairs") would have greatest impact when placed at the stair/escalator point of choice (when processing time is limited), whereas signs that encourage systematic processing ("Will You Take the Stairs?") would have greatest impact when placed at some distance from the point of choice (when processing time is less limited). We also tested whether (as predicted by SDT) messages promoting autonomy would be more likely to result in sustained motivated behavior (i.e., stair taking at subsequent uncued choice points) than messages that use commands. A series of studies involving more than 9,000 pedestrians provided support for these predictions.

Keywords: choice, Heuristic Systematic Model (HSM), Self Determination Theory (SDT), persuasion, decision making, physical activity

The benefits of physical activity are numerous and profound. These benefits span physical and psychological health and occur in both men and women and across all ethnic groups and age categories (Warburton, Nicol, & Bredin, 2006). Despite these undisputed benefits, more than 60% of American adults are not regularly physically active, and 25% of American adults are not active at all (Lloyd-Jones et al., 2010; U.S. Department of Health & Human Services, 1996). Similar inactivity rates are seen across most industrialized nations (Martinez-Gonzalez et al., 2001). This inactivity results in high levels of avoidable human suffering: it has been estimated that approximately one third of all coronary heart disease incidence, one quarter of strokes, and for those over 45, one quarter of noninsulin-dependent diabetes, and one half of hip fractures are preventable with increased physical activity (Kerr, Eves, & Carroll, 2001). The financial cost of inactivity in the United States exceeded half a trillion dollars in 2006 and has been growing ever since (Chenoweth & Leutzinger, 2006; Pratt, Norris, Lobelo, Roux, & Wang, 2014). For all these reasons, motivating people to be more physically active is one of the highest societal priorities in the industrialized world.

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Unfortunately, the ambitious guidelines for vigorous activity provided to the public in the early 1990s proved to be largely ineffective (Dunn, Andersen, & Jakicic, 1998). Policymakers then scaled back their guidelines to emphasize the importance of *accumulating* 30 min or more of moderate activity on most days of the week. This recommendation was based on evidence that spurts of activity throughout the day provide benefits that are equivalent to one sustained session (Schachter, Busch, Peloso & Sheppard, 2003). Furthermore, policymakers suggested the incorporation of these spurts of activity into the daily routine, because modest, routine-driven lifestyle changes have been shown to enable the long-term adoption of active behavior (Haskell, Blair, & Hill, 2009; Laitakari, Vuori, & Oja, 1996).

One such lifestyle change is taking the stairs whenever possible. Stair-climbing opportunities are abundant, and stair climbing does not require monetary outlay or special training and equipment. Furthermore, it provides a good return on time investment: stair-climbing uses nearly 10 times the energy used at rest, making it more efficient than walking or even jogging (Ainsworth et al., 2000). In these respects, stair climbing is an ideal way to accumulate physical activity. Indeed, research has revealed that there are important health benefits associated with taking the stairs on a daily basis even when no other lifestyle changes are made (Boreham, Wallace, & Nevill, 2000). Cross-sectional data have supported this finding: a survey of housing and health, conducted by the World Health Organization in eight European cities, found that among men, residence on a higher floor was associated with lower body mass indices (BMIs; Shenassa, Frye, Braubach, & Daskalakis, 2008). In an experimental study (Boreham, Wallace, & Nevill, 2000), participants randomly assigned to climb a standardized staircase 4 times a day for 7 weeks showed

improvements on several health measures, relative to controls who did not climb the staircase.

Given the many benefits and few costs of stair-climbing, several prior interventions have attempted to promote stair use over escalators and elevators (Soler et al., 2010; Webb, Eves, & Kerr, 2011). These interventions have used widely differing approaches: some have attempted to create *durable* shifts in attitude, whereas others have sought to persuade the pedestrian to take the stairs *once* to break their inertia of always taking the escalator or elevator; some researchers have used the mass media (e.g., radio, TV) to affect pedestrian behavior from a *distance*, whereas others have placed messages (e.g., posters, signs) near the stair/escalator point of choice to create *immediate* influences on pedestrian choice (Soler et al., 2010).

These interventions have produced widely differing outcomes. Some studies targeting immediate effects reported no measureable impact in increasing stair use, whereas others increased stair use by approximately 250% in targeted groups (Bauman, Smith, Maibach, & Reger-Nash, 2006; Marcus, Owen, Forsyth, Cavill, & Fridinger, 1998; Soler et al., 2010; Webb, Eves, & Kerr, 2011). Similarly, some studies targeting durable effects reported no attitude change toward the benefit of taking the stairs, whereas others reported substantial changes in attitudes and self-efficacy toward taking the stairs (Marcus, Owen, Forsyth, Cavill, & Fridinger, 1998).

Because these studies were not theoretically motivated, it has proven difficult to identify the factors that make a message more or less effective either in terms of immediate or durable effects. An urgent challenge for psychologists is to provide clear guidance for policymakers who are interested in fashioning public health interventions designed to promote healthy behavior such as taking the stairs. To date, there has been no clear empirically based guidance regarding which types of communications might be most effective in which contexts in this domain. Addressing this gap was the primary motivation for this study series.

Our starting point was the observation that over 90% of prior interventions that we examined (52 out of 57), across posters, risers, banners and signs, featured either imperative phrasing or interrogative phrasing. Specifically, both categories of messages typically started with a value-reminder that emphasized the benefit of taking the stairs (e.g., "Stair Climbing Improves Health"). Messages in the imperative category followed the value-reminder with a command phrase (e.g., "Take the Stairs"). Prior signs in this category included "*Stay in Form. Take the Stairs*" (Boen, Maurissen, & Opdenacker, 2010), "*Your Heart Needs Exercise. Use the Stairs*" (Soler et al., 2010), and "*Improve Your Waistline. Use the Stairs*" (Soler et al., 2010). Messages in the interrogative category followed the value-reminder with a question phrase (e.g., "Will You Take the Stairs?"). Prior signs in this category included "*Doctors have found that 7 minutes of stair climbing a day halves your risk of a heart attack . . . can you spare 7 minutes to live longer*?" and "*Free fitness program! Have you had your exercise today?*" (Webb & Cheng, 2010). The few signs (less than 10%) that neither fit the imperative nor the interrogative category had value reminder statement(s) that were not followed by an imperative or interrogative phrase. Prior signs in this category included "*Your Heart Needs Exercise. Here's Your Chance*" (Estabrooks, Courneya, & Nigg, 1996). To our knowledge none of the prior studies (including broader reviews, such as Soler et al., 2010; Webb, Eves & Kerr, 2011) noted that imperative and interrogative phrasing led to two different categories of messages, and no prior studies compared the relative effectiveness of these categories using hypotheses informed by psychological theories.

This is unfortunate, because two sets of persuasion and motivation theories seem directly applicable to an analysis of the effects of imperative and interrogative forms. First, dual process theories of persuasion such as the Heuristic Systematic Model (HSM; Chen & Chaiken, 1999) and the similar Elaboration Likelihood Model (ELM; Petty & Cacioppo, 1986) posit that messages can be processed in one of two ways: heuristically (i.e., with a minimal expenditure of cognitive resources) or systematically (with more elaborated processing). As discussed later, imperative forms may invite (heuristic) obedience, whereas interrogative forms may invite more elaborated (systematic) processing, a difference which has implications for when each type of communication should have maximal impact. Second, theories of motivation, such as Self Determination Theory (SDT; Deci & Ryan, 1985) and introspective self-talk theories (e.g., Senay, Albarracín, & Noguchi, 2010), posit that autonomous, nondeclarative contexts may increase intrinsic motivation. As discussed later, interrogative forms that inquire rather than command are more likely to preserve autonomy than imperative forms, a difference that has implications for the durability of effects.

Compared with the interrogative form, the imperative form (e.g., "Take the Stairs") only requires following a simple rule to formulate a course of action. The command structure does not summon deep analysis or extended valuations. Instead, it offers an avenue that requires minimal cognitive effort. These are the characteristics of heuristic processing (Chaiken, Liberman, & Eagly, 1989). By contrast, the interrogative form (e.g., "Will You Take the Stairs?") does not offer a simple, easy to follow option. Rather, it invites a considered analysis of the value of all relevant information pertaining to the available options. It demands cognitive effort. These are the characteristics of systematic processing (Chaiken, Liberman & Eagly, 1989). Furthermore, with its autonomy preserving content, the interrogative form enables individuals to identify an activity's value and integrate it into their sense of self. This integration leads to durable increases in intrinsic motivation (Deci & Ryan, 1985).

These observations allow us to formulate testable predictions. In particular, the HSM (and related theories) suggest that processing time will mediate the effectiveness of imperative and interrogative forms. Imperative forms that invite quick heuristic obedience will be effective in decision contexts in which only a brief amount of processing time is available (Chaiken, Liberman & Eagly, 1989). Conversely, interrogative forms that invite elaborated, systematic processing would require a greater amount of processing time to be effective. By contrast, SDT (and related theories) do not emphasize available processing time as an important variable affecting the effectiveness of imperative and interrogative forms.

The two sets of theories also differ on predictions regarding the duration of their effects. The SDT and related theories predict that the interrogative form with its inherent autonomy will create more persistent effects that will persist to subsequent uncued choice points (Deci & Ryan, 1985; Senay, Albarracin, & Noguchi, 2010). The HSM and related theories do not make any definite claims in this regard.

To test these predictions, we used the stair/escalator decision context. We began by crafting representative imperative and in-

terrogative signs. The Imperative Sign read, "*Stair Climbing Improves Health. Take the Stairs.*" The Interrogative Sign read, "*Stair Climbing Improves Health. Will You Take the Stairs?*" As discussed earlier, these signs are structurally similar to imperative and interrogative messages used in the prior literature. As in prior signs, they begin with a value reminder phrase ("*Stair Climbing Improves Health*") and end with either an imperative phrase ("*Take the Stairs*") or an interrogative ("*Will You Take the Stairs?*").

We first asked an important preliminary question: Are the command part of the Imperative Sign (i.e., "Take the Stairs") and/or the question part of the Interrogative Sign (i.e., "Will You Take the Stairs?") the "active ingredients" of such signs? Or is whatever effectiveness these signs may posses attributable to the reminder phrase (i.e., "Stair Climbing Improves Health")—which makes the health benefits of stair climbing more salient? To test this issue, we compared each sign to a Reminder Sign that read "*Stair Climbing Improves Health.*" As we describe in Study 1, when signs were placed near the stair/escalator point of choice, the command part of the Imperative Sign (but not the question part of the Interrogative Sign) was a real contributor to its efficacy.

We next sought to test whether, as predicted by the HSM and related theories (but not by SDT and related theories), the Imperative Sign would be more effective than the Interrogative Sign when the signs were placed near the stair-escalator choice point (and processing time was limited) and whether the Interrogative Sign would be more effective than the Imperative Sign when the signs were placed further away from the stair escalator choice point (and processing time was less limited). As we describe in Study 2, this question was answered in the affirmative.

Finally, we sought to test whether, as predicted by SDT and related theories (but not by HSM and related theories) the Interrogative Sign would have more persistent effects than the Imperative Sign in that it would drive more pedestrians to elect the stairs at a subsequent stair-escalator choice point that had no signs related to the stair/escalator decision. Study 3 showed this to be the case.

Study 1: Determinants of Effectiveness in Imperative and Interrogative Signs

In our review of prior interventions, 100% of all messages encouraging stair use contained a reminder phrase that cued the benefits of stair taking (e.g., "Stair Climbing Improves Health"). In addition to the reminder phrase, most prior signs either had a command phrase (e.g., "Take the Stairs") that appeared to act as a heuristic inviting action or a question phrase that promoted autonomy and appeared to invite systematic processing (e.g., "Will You Take the Stairs?").

We sought to test whether the command phrase and the question phrase would make the Imperative Sign ("Stair Climbing Improves Health. Take the Stairs") and the Interrogative Sign ("Stair Climbing Improves Health. Will You Take the Stairs?") more effective than the Reminder Sign ("Stair Climbing Improves Health"). We reasoned that if the command/question phrase was influential, the Imperative/Interrogative Sign would outperform the Reminder Sign that did not include the command/question phrase (in pairwise comparisons—Imperative vs. Reminder or Interrogative vs. Reminder). Conversely, if the command/question phrase played a limited role, the Imperative/Interrogative Sign would perform similarly to the Reminder Sign.

Method

Subjects and materials. The choices of 1,597 pedestrians approaching (ascending) stair/escalator banks outside two train stations in the San Francisco Bay Area during the commute hours of 7a.m. and 10 a.m. and 4 p.m. to 6 p.m. were observed and recorded. Measurements were made in two different stations on two consecutive weekdays over a duration of approximately 9 hr. Staircases in both stations had approximately 50 steps. All signs were displayed on a 22" × 28" placard that was placed on a floor-standing sign stand (Figure 1). The signs used black lettering printed on white poster paper. None of the signs included images.

Procedures. Pedestrians with items larger than a computer bag or a handbag were excluded because these items would influence their choice. We excluded individuals carrying a baby for similar reasons. In addition, we counted groups of individuals larger than two as one choice, because people in these groups typically went along with the choice of the first pedestrian in the group.

Experimenters were positioned so that they could not be observed by pedestrians at the point of choice. Each experimenter was armed with two counters—one for the stairs and one for the

Figure 1. The Imperative Sign placed 6 ft in front of the stair/escalator point of choice. A similar font and format was used for other signs. See the online article for color version of this figure.

escalator. A pedestrian was counted when she fully ascended the stairs or escalator. An observation involved counting the number of pedestrians who took and did not take the stairs in a 15 interval and computing the percentage of people who took the stairs. Observations were alternated for each of the two signs being compared (i.e., 15 min for the first sign and 15 min for the second). Experimenters were instructed to note any instance of a choice being driven by congestion on either the stairs or the escalator. No such instances were observed. A 2-min break between conditions provided experimenters time to place, or replace, signs. The break also provided sufficient time to ensure that pedestrians who observed the experimenter handing the sign were not included in the study set. A stopwatch was used to mark 15-min measurement intervals. Pedestrians in the process of ascending as the 15-min measurement interval ended were not included.

The dependent measure for each sign was the percentage of pedestrians who chose to take the stairs. Pedestrians who chose to walk up the escalators (as opposed to standing through out the escalator ride) were counted as having chosen the escalator for three reasons: (1) not including such pedestrians as stair-takers was the most conservative measure of sign-effectiveness, (2) we were interested at the decision made at the point of choice, and (3) pedestrians climbed varying number of escalator steps at varying rates. It is unclear how these varying rates could have been factored into any potential dependent variables.

Design. In this study, the Imperative and Interrogative Signs were each compared separately with the Reminder Sign in a pairwise design (i.e., Imperative vs. Reminder and Interrogative vs. Reminder). All signs were placed 6 ft from the stair/escalator point of choice. The placement and the font size of the signs were designed so that they would be read as pedestrians walked by them, and not much before. An independent observer, unaware of the design intent, confirmed (by recording the behavior of a representative sample) that this was indeed the case.

Results and Discussion

The Imperative Sign outperformed the Reminder Sign (19.9% vs. 10.5%; $\chi^2 = 6.89$, $df = 1$, $N = 397$, $p = .008$, V = 0.13). A Cramer's V of 0.1 is considered to be the minimum threshold for concluding that there is a substantive relationship between two variables. The Interrogative Sign and the Reminder Sign were not significantly different in persuasive efficiency when placed at the point of choice (12.0% vs. 9.1%; $\chi^2 = 2.68$, $df = 1$, $N = 1200$, $p = .10$, V = 0.05).

Study 1 supported the interpretation that the command phrase "Take the Stairs" is a crucial driver of the efficacy of the Imperative Sign. By its clear directive the command phrase "Take the Stairs" may act as heuristic that ends internal debate and facilitates taking the stairs. Heuristics and automatic thinking are commonly used when processing time or resources are limited (Chen & Chaiken, 1999). Thus, the Imperative Sign may be particularly effective in situations in which decision makers must make their choice quickly (as they did in Study 1 where signs were encountered 1–2 s before the stair/escalator point of choice). Study 1 also demonstrated that there appeared to be no incremental value of the question phrase of the Interrogative Sign when it was placed at the point of choice. Given the large N (1,200) in this comparison, the lack of a significant result is not likely to be driven by a lack of power.

Study 1 was not designed to directly compare the Imperative and Interrogative Signs. This was because frequency measurements for the two signs were done at different times (and potentially on different days). We reasoned that pedestrian tendencies might vary depending on the hour they took the train. Proceeding conservatively, we therefore required comparisons to be made by frequency measures in close temporal proximity to each other (or where "No Sign" base rates were equivalent), which meant that we could not draw conclusions regarding the relative effectiveness of the Imperative and Interrogative Signs. An additional limitation of Study 1 was that it did not compare either sign with the "No Sign" condition (which provides base rate information). To address these issues we conducted Study 2.

Study 2: Available Processing Time Determines the Relative Effectiveness of Heuristic and Interrogative Signs

Using the HSM and related theories, we predicted that if time were constrained, then the Imperative Sign would be most effective. However, if time were less constrained, then we expected the Interrogative Sign would be most effective.

Method

The choices of 5,941 pedestrians were recorded. As in Study 1, observations were recorded in the commute hours of 7 a.m. and 10 a.m. and 4 p.m. to 6 p.m. Measurements were made in six different stations on weekdays over a duration of approximately 30 hr. The number of steps in each station ranged between 38 and 58, and the average was 48. As in Study 1, Experimenters were instructed to note any instance of a choice being driven by congestion on either the stairs or the escalator. No such instances were observed.

We created two distance conditions: near and far. In the near condition (which was identical to Study 1), signs were placed 6 ft from the stair/escalator point-of choice. This gave pedestrians 1–2 s to process sign information and make their choice. In the far condition, signs were placed 60 ft from the stair/escalator point of choice. This gave pedestrians approximately 10–20 s to process and react to sign information. The location of the sign in the near condition was chosen to maintain consistency with prior studies (e.g., Iversen, Händel, Jensen, Frederiksen, & Heitmann, 2007) and to ensure that pedestrians would have to make their decision nearly immediately after they passed the sign. The location of the sign in the far condition was chosen to ensure that pedestrians had a processing interval equivalent to the transient attention span—the time period for which a stimulus temporarily attracts attention—estimated to be approximately 10 s (Weinreich, Obendorf, Herder, & Mayer, 2008).

We created a study design in which the near and far conditions were fully crossed with sign type—Imperative Sign, Interrogative Sign and No Sign. Each of the three sign variants was used, in turn, for 20 min in one condition (e.g., near) and then the cycle was repeated for the other condition (e.g., far). We balanced the order of measurement—the near condition was deployed first (i.e., at 7 a.m.) on alternate days; on other days the far condition was deployed first.

The "No Sign" sign type was operationally identical in the near and far conditions; however we reported near and far "No Sign" data separately because the No Sign in the near (or far) condition was measured in close temporal proximity (i.e., in the same hour) with other signs in the near (or far) condition. We reasoned that temporal proximity is important because pedestrian tendencies might vary depending on the hour they took the train. Because of temporal proximity each "No Sign" condition was a good control for signs in its respective condition. However, it was not necessary the case that the "No Sign" base rate in the near condition would have been equivalent to the base rate in the far condition. If the base rates in each of the two "No Sign" conditions had differed, we could not have compared effectiveness of signs in the near and far conditions. As we will discuss, this was not the case.

As in Study 1, the dependent variable was the percentage of pedestrians who elected to take the stairs. All methods not discussed earlier were identical to Study 1.

Results and Discussion

The percentage of stair climbers for each condition is shown in Figure 2. When the signs were placed near (6 ft) the stair/escalator point-of-choice, the Imperative Sign was more effective than the Interrogative Sign in persuading pedestrians to take the stairs over the escalator. Conversely, when the signs were placed further away (60 ft) from the point of choice the Interrogative Sign was more effective than the Imperative Sign. To formally test the interaction we used a log-linear analysis for a 2 × 2 × 2 (Near/Far × Imperative/Interrogative × Stairs/Escalator) table of cross-categorized frequency data. The interaction was significant ($G^2 = 24.76$, $df = 4$, $p < .001$).

In the Near Condition, as predicted, the Imperative Sign outperformed the Interrogative Sign (17.13% vs. 10.31%; $\chi^2 = 19.12$, $df = 1$, $N = 1982$, $p < .001$, V = 0.10). Both the Imperative Sign and the Interrogative Sign outperformed No Sign (Imperative vs. No Sign: 17.13% vs. 6.24%; $\chi^2 = 61.83$, $df = 1$, $N = 2055$, $p < .001$, V = 0.17; Interrogative Sign vs. No Sign: 10.31% vs. 6.24%; $\chi^2 = 12.35$, $df = 1$, $N = 1{,}993$, $p < .001$, V = 0.08).

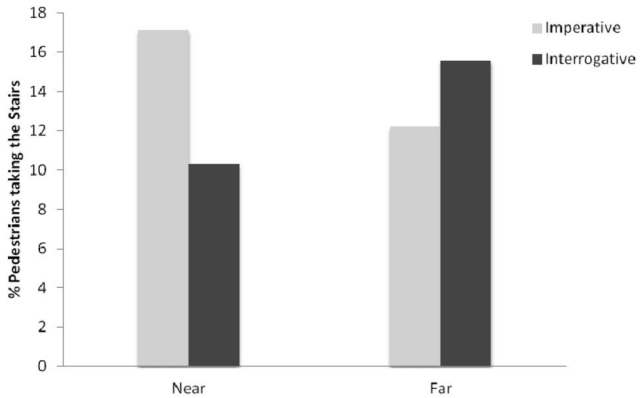

Figure 2. Percentage of pedestrians taking the stairs for the Imperative and Interrogative sign type by distance condition. There is a crossover interaction, with the Imperative Sign being most effective in the Near Condition and the Interrogative Sign being most effective in the Far Condition.

However, in the Far Condition, as predicted, the Interrogative Sign outperformed the Imperative Sign (15.56% vs. 12.20%; $\chi^2 = 5.23$, $df = 1$, $N = 2009$, $p < .02$, V = 0.05). Both the Imperative Sign and the Interrogative Sign outperformed No Sign (Imperative Sign vs. No Sign: 12.20% vs. 6.11%; $\chi^2 = 21.58$, $df = 1$, $N = 1{,}941$, $p < .001$, V = 0.11; Interrogative Sign vs. No Sign: 15.56% vs. 6.11%; $\chi^2 = 45.08$, $df = 1$, $N = 1{,}902$, $p < .001$, V = 0.15).

The "No Sign" frequency in the Near Condition and Far Condition were nearly identical (6.24% vs. 6.11%). The above results were unchanged if we used a single "No Sign" frequency that was the average of these two frequencies.

Study 3: Systematic Communications Have the Most Durable Effects. Based on the SDT and related theories, we thought it possible that the Interrogative Sign—because of its autonomy promoting content—might increase participants' intrinsic motivation thereby producing more *durable* changes than the Imperative Sign.

Method

The choices of 470 pedestrians were recorded. We placed the Imperative Sign and the Interrogative Sign (one at a time) 6 ft from a stair/escalator bank (Choice Point 1) as in Study 1. We measured the fraction of pedestrians choosing to take the stairs under both sign conditions. We then measured the fraction of stair-climbers (out of the total number of stair-takers in the prior stair-case) who persisted with taking the stairs at the subsequent stair/escalator bank (Choice Point 2). The number of stairs after Choice Point 1 was less than 50% of the stair cases used in Study 1–2 (approximately 20 stairs), which is likely to have a contributed to a larger fraction of pedestrians choosing to take the stairs in the Results. It was imperative that we used this particular site for Study 3 because it was one of the few that allowed measurements at a subsequent staircase. Observations were recorded over 1 weekday between the periods of 7 a.m. to 10 a.m. and 4 to 6 p.m. for a period of 5 hr.

As in Study 1 and 2, experimenters were instructed to note any instance of a choice being driven by congestion on either the stairs or the escalator at either of the choice points. No such instances were observed.

Results and Discussion

Replicating the findings from Study 2, we found that at Choice Point 1, the Imperative Sign outperformed the Interrogative Sign (29.6% vs. 21%; $\chi^2 = 4.61$, $df = 1$, $N = 470$, $p = .031$, V = 0.09). However, at Choice Point 2, 70% of the stair climbers who had viewed the Interrogative Sign at Choice Point 1 persisted with taking the stairs at Choice Point 2. Only 49% of the stair climbers who had viewed the Imperative Sign at Choice Point 1 persisted with taking the stairs at Choice Point 2. The difference is significant ($\chi^2 = 5.11$, $df = 1$, $N = 112$, $p = .023$, V = 0.21). Thus, the Interrogative Sign had more durable effects than the Imperative Sign as assessed by responses to a subsequently encountered staircase. This finding is consistent with findings from the domain of risk processing in which systematic processing has been found to positively correlate to attitude strength (Griffin, Neuwirth, Giese, & Dunwoody, 2002).

In Study 3, our hypothesis was that the Interrogative Sign would create durable effects that would persist to a subsequent stair

escalator choice point which did not contain any sign related to taking the stairs. To test this hypothesis we created conditions that were unfavorable to the Interrogative Sign (i.e., we placed signs in the near condition in Choice Point 1). This provided the most conservative test of our hypothesis.

General Discussion

Increasing physical activity levels has proven very difficult. An urgent challenge is to find effective and efficient methods to create this change. Prior efforts in the important stair escalator domain—undertaken without the benefit of theoretical models—have met with mixed success. In this research, we applied two sets of theories—the HSM and related theories and the SDT and related theories—to craft health-related communications that are tailored to be effective in different decision making contexts.

According to the HSM, decision-makers either use heuristic "rules of thumb" or they systematically process the value of the available options. When resources including processing time are limited, the HSM suggests that heuristic processing should be most effective. When resources including processing time are less limited, the HSM suggests that systematic processing should be most effective.

According to the SDT, communications emphasizing autonomy create greater intrinsic motivation and should therefore be more durable than behavior changes created by communications that do not emphasize autonomy.

Our results (summarized in Table 1) bore out the predictions of the HSM (and related theories) and SDT (and related theories). In Study 1, when signs were placed near the stair/escalator point of choice, the command part of the Imperative Sign (but not the question part of the Interrogative Sign) was a real contributor to its efficacy. In Study 2, as predicted by the HSM, the Imperative Sign proved more effective than the Interrogative Sign when processing time was constrained, but the Interrogative Sign was more effective than the Imperative Sign when processing time was less constrained. In Study 3, as predicted by the SDT, the Interrogative Sign was the most effective in motivating people to persist with taking the stairs at a subsequent stair/escalator choice point.

Collectively, our studies confirm that the ideal content of health related communications may vary with the context of the public health campaign. If a campaign's goal is to break people's inertia and quickly get them moving, then heuristic based signs are likely to be most effective. However, if a campaign seeks to create longer lasting—but potentially slower developing—changes in behavior, then communications promoting systematic processing and emphasizing autonomy are called for. In general, it would seem important to tailor communications to the characteristics of the targeted group and the context of the targeted site. For example, if a location is frequented by a large number of daily commuters, an effective strategy may begin with heuristic communications (to initially maximize stair use) and then transition to systematic communications (to enable maintenance and longer term changes in behavior). Similarly, if a site involves one set of stairs followed by several others, it may be best to begin with communications emphasizing autonomy (to maximize durable effects) and end with heuristic communications (to efficiently influence persistent escalator users to take the last remaining set of stairs).

While our findings were obtained in the stair/escalator context, they may also apply to changing other activity patterns such as persuading pedestrians to walk or use a bicycle whenever possible. Even more broadly, our findings may have implications for non-activity related choice contexts. For example, a restaurant trying to create demand for its premade salads might be best served by placing an Imperative Sign ("Order a Salad!") near the point of choice. On the other hand, a public health campaign dedicated to improving nutrition habits in general may use a sign that encourages more autonomy ("Will you order a salad for your health?") and situate it some distance away from the point of choice. Similarly, traffic police trying to reduce texting on a particular street near a playground may be best served by using a heuristic approach, but a broader-based campaign would be better served by inducing systematic and autonomic processing. More generally, our studies suggest that persuasion contexts requiring the creation

Table 1
Results Summary

			%			
Study	Condition	Comparison	No sign (NS)	Reminder (R)	Imperative (Imp)	Interrogative (Int)
1	Near	Imp vs. R		10.5	19.9	
1	Near	Int vs. R		9.1		12.0
2	Near	Imp vs. Int			17.1	10.3
2	Near	Imp vs. NS	6.2		17.1	
2	Near	Int vs. NS	6.2			10.3
3	Near	Imp vs. Int			29.6	21.0
		M	*6.2*	*9.8*	*20.9*	*13.4*
2	Far	Int vs. Imp			12.2	15.6
2	Far	Imp vs. NS	6.1		12.2	
2	Far	Int vs. NS	6.1			15.6
		M	*6.1*		*12.2*	*15.6*
3	Subsequent	Int vs. Imp			49% of prior	70% of prior

Note. The marginal means (shown in italics) are not weighted so that results are representative of all data collection intervals and do not overweight high traffic intervals. Weighted marginal means are very similar to the frequencies shown here.

of short-term behavior change in limited time windows may be best served by content enabling heuristic processing; persuasion contexts requiring more lasting change in less constrained time windows may be best served by content enabling systematic processing. Contexts requiring a change in intrinsic motivation are likely to be best served by communications emphasizing autonomy.

Our studies are among the first to apply persuasion and motivation theories with the goal of changing health behavior in the activity domain. We believe that our studies can be extended in several ways. First, we have examined contexts in which temporal constraints bring either the heuristic or the systematic processing mode to the forefront, but not both. The HSM posits that there may be situations in which both processing modes may co-occur and produce independent or interdependent effects (Neuwirth, Frederick & Mayo, 2002). Future studies must create and test such situations. Second, our studies have focused on testing predictions in a single, albeit important, real-world domain. Future studies must test predictions in other health-related domains, targeting such goals as increasing exercise, improving nutrition, decreasing alcohol and tobacco usage, and reducing sedentary behavior. It remains unknown whether the HSM and SDT would be useful in shaping behavior in these important domains. Third, our studies did not measure the impact of repeated exposure to the signs. Our work was designed to measure the effectiveness of signs upon first viewing—by changing sites after one day of measurement, we ensured that commuters were unlikely to encounter the same sign twice. Further research must test the effects of repeated sign-viewing. Fourth, our studies did not measure the long term effects of our manipulation. In Study 3, we observed the effects of our intervention on a subsequent stair/escalator choice point encountered a few minutes after pedestrians observed the original sign. It remains unknown whether these effects persist for a longer duration (i.e., a few hours or days) or if they extend to staircases that are longer or shorter than the staircase after Choice Point 2 in Study 3. Last, our study series did not evaluate the effects of individual differences in decision-making. It is conceivable that customizing messages for particular demographics would show even greater levels of impact (Johnson et al., 2012). Future studies must investigate this possibility in the stair/escalator decision context.

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