Testing the theory underlying the success of point-of-choice prompts: A multi-component stair climbing intervention

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ABSTRACT

Objectives: Point-of-choice prompts consistently increase stair climbing in public access settings. This study investigated the single and combined effects of a volitional and motivational component of a stair climbing intervention to test the theory underlying the success of point-of-choice prompts.

Design: Quasi-experimental, interrupted time series cross-over design.

Methods: Ascending stair/escalator choices were observed in a UK tram station (n = 38,187). Baseline observations (2 weeks; stage 1) preceded a 2-week point-of-choice prompt positioned alone (stage 2) followed by an additional message positioned at the top of each climb (6 weeks; stage 3). Four weeks after message removal, another baseline (2 weeks; stage 4) preceded installation of the intervention components in reverse order. Thus, the message positioned alone at the top of each climb (4 weeks, stage 5) was supplemented with the point-of-choice prompt (2 weeks, stage 6). Logistic regression analyses of stair/escalator choice included the independent variables of intervention components, gender, time of morning and pedestrian traffic volume.

Results: There was no change in stair climbing percentages when only one intervention component was used, i.e. only the point-of-choice or the message at the top of each climb. In contrast, stair climbing increased when both components of the intervention were installed. Additionally, men took the stairs more than women and stair climbing was more common earlier in the morning and at higher pedestrian traffic volumes.

Conclusions: A motivational component targeting intentions increased the effectiveness of a volitional point-of-choice prompt for stair climbing in a setting where choice of the stairs incurred a time penalty for pedestrians due to the site layout.

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Physical inactivity is responsible for 6% of deaths globally such that it is the fourth leading risk factor for global mortality (World Health Organization [WHO], 2010). Overweight and obesity account for 5% of global mortality (as cited in WHO, 2010). Regular participation in physical activity not only reduces the risk of non-communicable diseases, such as hypertension, coronary heart disease and stroke and diabetes, but is a significant contributor to energy expenditure and subsequently weight control. However, levels of physical inactivity are continuing to rise. Critically, the accumulation of physical activity during daily living is one current public health approach to increase energy expenditure and help achieve the recommended amounts of activity per week (Department of Health [DOH], 2005; Haskell et al., 2007; WHO, 2010).

Active transport is one way of integrating physical activity into daily living. Unlike walking, an activity of moderate-intensity, stair climbing is a vigorous lifestyle activity that may have important implications for the accumulation of calorific expenditure during daily living. For example, an 80 kg man who climbs a standard 3 m flight of stairs in his own home ten extra times a day would expend approximately 28 kcal d⁻¹. Over a year that adds up to more than 10,000 kcal which is equivalent to 3 lbs of fat (Olander & Eves, 2011). As stair climbing involves raising one's weight against gravity, more energy is expended by overweight than normal weight individuals. Furthermore, stair climbing opportunities are abundant and available to most population groups, enabling it to be readily incorporated into daily life. Besides the increase in energy expenditure, stair climbing has been linked to improved cholesterol profile, cardio-respiratory fitness and weight loss (Boreham et al., 2005; Kennedy, Boreham, Murphy, Young, & Mutrie, 2007; Meyer et al., 2010).

One effective way to increase stair climbing is a point-of-choice prompt, i.e. a message positioned at the point-of-choice between

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methods of ascent encouraging individuals to take the stairs for their health. Point-of-choice prompts have proved consistently effective in a travel context such as train stations (Andersen et al., 2006; Blamey, Mutrie, & Aitchison, 1995; Boen, Maurissen, & Opdenacker, 2010; Brownell, Stunkard, & Albaum, 1980; Eves, Olander, Nicoll, Puig-Ribera, & Griffin, 2009; Iversen, Handel, Jensen, Fredriksen, & Heitmann, 2007; Kerr, Eves, & Carroll, 2001a; Nomura, Yoshimoto, Akezaki, & Sato, 2009; Olander, Eves, & Puig-Ribera, 2008; Puig-Ribera & Eves, 2010). Thus, increased population levels of stair climbing as a means of increasing physical activity as a part of daily life is a realistic public health goal and a current UK government guideline (DOH, 2011). This paper tests the theoretical mechanisms underlying the success of point-of-choice interventions.

It is well established that a person’s motivation towards a goal in terms of direction and intensity, i.e. their intentions, is an essential requirement for lifestyle changes (Sheeran, 2002; Sniehotta, Scholz, & Schwarzer, 2005; Sniehotta, Schwarzer, Scholz, & Schu, 2005). The formation of intentions, however, does not always result in successful changes, i.e. positive intentions are not always translated into behaviour (Orbell & Sheeran, 1998). This has been termed ‘the intention–behaviour gap’ (Sheeran, 2002). Thus, when attempting to change behaviour, it is imperative to differentiate between motivational interventions that aim to change one’s attitude and intention and volitional interventions that aim to transform prior intentions into behaviour (Gollwitzer, 1999). Motivational approaches, e.g. mass media campaigns that provide information about the benefits of physical activity, target attitude and intentions. In contrast, volitional interventions that function to narrow the gap between intention and behaviour take two main forms (Sniehotta, Scholz, et al., 2005; Sniehotta, Schwarzer, et al., 2005). Coping planning aims to prevent the derailment of positive intentions by barriers to behaviour such as tiredness or insufficient time. Thus, they involve planning, in advance, to cope with potential barriers when they are encountered. In contrast, interventions based on implementation intentions aim to initiate the behaviour when the envisaged context and cues are encountered (Gollwitzer & Sheeran, 2006; Milne, Orbell, & Sheeran, 2002). Thus, individuals specify the time and place for acting on their intentions. For example, as part of a worksite intervention to prevent weight gain, Kwak and colleagues asked participants to specify when and where at work they would take the stairs instead of the lift (Kwak, Kremers, van Baak, & Brug, 2007). Participants forming such an implementation intention about stairs were more likely to choose the stairs than those who were asked to make an implementation intention about cycling in leisure time (83.3% and 66.7%, respectively), despite equivalent levels of general intentions to be more active.

Concerning stair climbing, it has been argued that point-of-choice prompts change the contextual cues at the place where the behaviour occurs with the aim of disrupting habitual behaviour (Kerr, Eves, & Carroll, 2001b). Choice of escalators and lifts is rewarded by energy conservation, and hence, the choice of the escalator and lift, over time, becomes habitual. This choice will be linked to the contextual cues associated with successful energy conservation and requires minimal conscious deliberation (Aarts, Paulusse, & Schaalma, 1997; Verplanken & Aarts, 1999). By changing the contextual cues, point-of-choice prompts provoke deliberation by pedestrians about the behaviour rather than choosing the escalator in a ‘mindless’ manner (Webb & Eves, 2007a). This allows substitution of a health enhancing alternative to the habitual choice of the escalator. Nonetheless, exposure to a prompt is brief, almost an incidental part of the overall journey and it seems unlikely that point-of-choice prompts change attitudes to physical activity per se and intentions to be more physically active when encountered. Rather, when an individual already has an intention to be more physically active, the prompt to take the stairs for their health ‘reminds’ them of their intentions and enables them to be fulfilled. Hence, point-of-choice prompts are similar to volitional interventions for action initiation; a prior intention to be more physically active is required for the prompt to be effective. In effect, point-of-choice prompts enable individuals to select health-promoting alternatives after they have opted to improve their health, i.e. they are post-decisional aids to health behaviour (Olander & Eves, 2011). To change intentions for stair use, a different approach is required.

One frequently employed approach to modelling intentions is the Theory of Planned Behaviour (Ajzen, 1991). Within this model, attitudes, i.e. the positive and negative consequences of the behaviour, and perceived behavioural control, i.e. the perception that one has control over the behaviour, have strong influences upon intentions to be physically active (Hagger, Chatzisarantis, & Biddle, 2002; Hardeman et al., 2002; Sutton, 2002). Mass media interventions, a common public health approach to increase population levels of physical activity, target attitudes by providing information about the possible benefits of behaviour or costs of health threats (Sutton, 2002). While 66% of the UK population would like to be more physically active (Health Survey for England, 2008), qualitative research has indicated that individuals do not consider stair climbing to be a physical activity with health benefits (NHS Health Scotland, 2004). Thus, a motivational approach that targeted attitudes by detailing the specific benefits obtainable from stair climbing (Webb & Eves, 2007b) might increase intentions to climb stairs. As a result, a subsequent encounter with a point-of-choice prompt could translate any new or modified intentions into behaviour.

In this paper, we report an intervention that assessed the effects of volitional and motivational components of a stair climbing intervention in a public access setting. A recent worksite intervention added an extended message targeting attitudes to a conventional point-of-choice prompt (Eves, Webb, & Mutrie, 2006). In contrast to simple point-of-choice prompts, the extended message quantified the amount of stair climbing required to achieve the desired outcome with an aim of increasing regular use of the stairs. This multi-component approach produced an increase specific to stair climbing that has proved elusive in worksite interventions (Eves, 2008, 2010; Eves & Webb, 2006). Here, we adapted this multi-component approach for use in a public access setting, i.e. a tram station.

This study investigated the single and combined effects of an extended message, positioned at the top of the stairs and a conventional point-of-choice prompt positioned at the base of the stairs. Initially a simple point-of-choice prompt, i.e. a volitional intervention, which read “Regular stair climbing helps to prevent weight gain” was positioned, alone, at the bottom of the climb. Two weeks later, an extended message was added at the top of each climb for six weeks; the message “Well Done Stair Climbers! You have just burnt a 16th of the calories needed to avoid weight gain” was employed. This novel component, i.e. a motivational intervention targeting the consequences of stair climbing into lay terms (Eves et al., 2006; Olander & Eves, 2011). The origin of this message was the estimate by Hill and colleagues that daily excess intake relative to energy expenditure of 100 kcal d⁻¹ produced 95% of the weight gain of the US population over eight years (Hill, Wyatt, Reed, & Peters, 2003). Stair climbing is a vigorous activity that expends 9.6 times the energy used at rest (Teb & Aziz, 2002). The height of the stairs at this station (6.45 m), coupled with 34.2 m of walking on the level, meant that a single ascent would expend approximately 6.25 kcal. Hence, choosing the stairs once, based on the estimates of Hill et al. (2003), would expend approximately a 16th of the daily energy expenditure required to avoid weight gain. The
message specified an achievable behaviour, i.e. a single ascent, which we hoped represented meaningful progress towards the desired outcome of weight control.

It was envisaged that the extended message, i.e. the additional component, would provide a ‘take-away’ message about the specific benefits of the climb that travellers had or could have completed. Thus, travellers could contemplate the calorific consequences of stair climbing as they continued their journey and, hopefully, change their intentions. Importantly, the position of this message at the top of the climb meant that information was provided after the choice of stairs or escalator had been made. Hence, it could only affect a subsequent decision to use the stairs. As such, it functioned as an educational tool in the natural environment, i.e. a motivational intervention, which might require the volitional elements of a point-of-choice prompt to translate any changed intentions into the desired behaviour. All intervention components were then removed for six weeks (four weeks plus two weeks additional baseline observations). In the second phase, the order in which the posters were installed was reversed. The extended message was repositioned alone, at the top of each climb, for four weeks, and then supplemented with the point-of-choice prompt, at the bottom of the climb, for a further two weeks. This reversal of the order of the components tested whether the motivational component alone, which we hoped would increase intentions, was sufficient to increase stair climbing or whether it required the volitional element at the bottom of the climb for its effectiveness. Overall, the study aimed to augment the effects of the point-of-choice prompt by providing specific information about the benefits of stair climbing. Hence, we predicted greater effects for the two components than either component alone.

Current approaches to increased lifestyle physical activity employ a socio-ecological model that incorporates effects of the physical environment and the social milieu, as well as intra-individual processes such as intention (Giles-Corti & Donovan, 2003; Sallis, Bauman, & Pratt, 1998; Sallis et al., 2006). For example, a physical environment with utilitarian destinations within walking distance will encourage physical activity whereas restricted connectivity in the street network may impede activity choices (Saelens & Handy, 2008; Sallis et al., 2006). Similarly, stairs are more likely to be chosen if they are encountered before the escalator (Eves et al., 2009; Kerr, Eves, & Carroll, 2003) and represent the quickest route to the destination (Webb & Eves, 2007c). Like other types of lifestyle activity, stair climbing can also be influenced by the social environment. Pedestrian traffic flow, i.e. the number of pedestrian using the site, has major influences on the behaviour; as traffic increases the escalator becomes full and pedestrians can avoid delay by opting for the stairs (Eves et al., 2009; Eves, Lewis, & Griffin, 2008; Kerr et al., 2001a, 2001b; Olander et al., 2008; Puig-Ribera & Eves, 2010; Webb & Eves, 2007a, 2007c). Furthermore, in travel contexts, time of day can influence stair choice (Eves & Masters, 2006; Eves, Masters, et al., 2008; Eves et al., 2009). In particular, commuters in the UK were more likely to take the stairs before 09:00 than after, independently of pedestrian traffic volume (Eves et al., 2009). As 09:00 is the start of the working day for many employees in the UK, these effects of time of morning may reflect people choosing the quickest route to work. If the escalator is full, stair climbing could be quicker than waiting. Here, we quantified the effects of traffic in the tram station and standardised it within the range 0–1 to facilitate comparison between the effects of the interventions and the social environment.

**Methods**

Ethical approval was obtained from the ethics subcommittee of the School of Sport and Exercise Sciences, University of Birmingham, Birmingham, UK. The intervention site was a UK tram station with a 43-step staircase (height = 6.45 m) positioned 16.5 m beyond the escalator. In 2008/2009, two observers (inter-observer reliability: average kappa = 0.97, range = 0.95–0.98) recorded stair/escalator choices of ascending travellers, coded by gender, between 08:00 and 09:59 on Tuesday and Thursday each week. Travellers constrained in their ability to use the stairs by large bags (larger than a briefcase or medium-sized bag), accompanying children (head below shoulder height of accompanying adult), or a physical incapacity were not recorded (Kerr et al., 2001a; Olander et al., 2008).

In a quasi-experimental, interrupted time series cross-over design, baseline observations (2 weeks; stage 1) were followed by a 2-week point-of-choice prompt positioned alone at the base of the escalator (stage 2), presenting the message “Regular stair climbing helps to prevent weight gain” on an A1-sized (594 × 841 mm) poster. Following this stage, an additional, A1-sized poster was positioned at the top of each climb (stage 3) for six further weeks with the message “Well Done Stair Climbers! You have just burnt a 16th of the calories needed to avoid weight gain”. All intervention posters were removed for 4-weeks after which a second 2-week baseline stage (stage 4) commenced. Next, the order in which the intervention posters were installed was reversed; the A1-sized poster from stage 3, i.e. the extended message, was positioned at the top of each climb, alone, for 4-weeks (stage 5). For a further and final two weeks, the original point-of-choice prompt (see stage 2) was added at the bottom of the climb (stage 6). While no pilot work was undertaken with the messages, point-of-choice prompts based on calorific expenditure and weight control have been successful in previous research and we expected success with our intervention (Andersen, Franczowiak, Snyder, Bartlett, & Fontaine, 1998; Eves, Webb, Griffin, & Chambers, unpublished data; Olander et al., 2008; Olander & Eves, 2011).

**Data reduction and statistics**

The pulsatile nature of pedestrian flow in stations means that a negatively accelerated function can describe the relationship between traffic and stair climbing such that a logarithmic transformation of traffic is appropriate (see Eves, Lewis et al., 2008; Lewis & Eves, unpublished data). Preliminary inspection of the baseline data for this site, however, revealed that the relationship between the number leaving each tram and the number using the stairs was essentially linear (adjusted $R^2 = 0.77, F(1,126) = 430.04, p < 0.001$), with no additional contribution from the natural log of traffic ($R^2 = 0.01, F(1,125) = 1.67 ns$). Hence, a logarithmic transformation was not required in this study. While there were no differences in traffic levels between successive stages of the study (all comparisons $p > 0.20$), pedestrian traffic was greater in the early morning period (08:00–08:59; mean = 90.43 ± 24.63 pedestrians tram$^{-1}$; 09:00–09:59; mean = 58.96 ± 22.75 pedestrians tram$^{-1}$). To allow assessment of the effects of time of morning unconfounded by differences in overall traffic volume, the data were mean centred for each time period prior to analysis. Mean centring of data retains the variability in the data but removes any average differences between time periods or sites in traffic volume (Eves et al., 2009; Webb, Eves, & Kerr, 2011). The net outcome for this study is that effects of pedestrian traffic volume could be assessed independently of time of morning as the data for each time period had the same average value, i.e. zero, when the mean of each period was subtracted from the data.

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1 The differences in length of the stages for the second phase of testing relative to the first reflected operational decisions based on access to the site and availability of coders.
Logistic regression analyses used stair/escalator choice as the dichotomous dependent variable and, intervention stage, gender and time of morning (08:00–08:59 vs. 09:00–09:59) as dichotomous predictor variables. Pedestrian traffic was entered as a continuous variable, with traffic standardised to range 0–1 by dividing by the highest value to facilitate comparison with the binary variables.

Results

A total of 38,187 pedestrians were coded (58.0% female). Table 1 summarises the results of analyses for the first half of the study (stage 1–3). For these analyses, each stage was compared to the preceding one. As can be seen from the table, there was no significant change in stair climbing when the point-of-choice prompt was positioned alone (stage 2). In contrast, addition of the extended message at the top of the climb (stage 3) to the point-of-choice prompt resulted in a significant increase in stair climbing. Consistent with previous studies, stair climbing was more common during the first half of observation sessions (i.e. 08:00–08:59; Eves et al., 2009) and at higher traffic volumes (Eves et al., 2009; Kerr et al., 2001a; Olander et al., 2008; Puig-Ribera & Eves, 2010).

Further, an effect of gender was present for the comparison between stages 2 and 3, such that men were more likely to take the stairs than women as in previous studies (Eves et al., 2009; Kerr et al., 2001a; Olander et al., 2008; Puig-Ribera & Eves, 2010). While effects of gender were not statistically reliable for the comparison between the baseline and the point-of-choice prompt alone, it is possible that the smaller sample size, relative to previous studies, is responsible. Follow-up analyses revealed no interaction between the intervention components and gender, time of morning or pedestrian traffic volume (all p > 0.20). Percentage stair climbing overall, and broken down by gender for each stage of the intervention, is presented as electronic supplementary material (ESM) with explanatory notes (see ESM Fig. 1).

Comparison between the first and second baseline stages (stages 1 and 4), showed that stair climbing remained elevated four weeks after the intervention was removed (odds ratio [OR] = 1.17, 95% confidence interval [CI] = 1.03–1.31, p = 0.02). Further, comparison between stages 3 and 4, i.e. the point-of-choice prompt and extended message vs. the second baseline, revealed that there was no significant difference in stair climbing (OR = 0.99, 95% CI = 0.90–1.09, p = 0.86). Table 2 summarises the results of analyses of the second half of the study, when the order of installation of the different intervention components was reversed. There was no significant change in stair climbing when the extended message was positioned alone at the top of the climb (stage 4 vs. 5). Furthermore, there was no significant difference in stair climbing between stages 1 and 5, i.e. the first baseline stage and the motivational component positioned alone (OR = 1.07, 95% CI = 0.94–1.22, p = 0.33). As in the first half of the study, however, there was a significant increase in stair climbing when both intervention components were positioned simultaneously (i.e. stage 5 vs. 6). Consistent with previous research and earlier stages, stair climbing was more common during the first half of observation sessions (i.e. 08:00–08:59) and at higher traffic levels. A significant effect of gender (i.e. men were more likely to take the stairs than women) was also present throughout. Once again, follow-up analyses revealed no interaction between intervention components and gender, time of morning or pedestrian traffic volume (all p > 0.27).

Discussion

This study assessed the effects of volitional and motivational components of a stair climbing intervention in a public access setting, i.e. a tram station. We tested the single and combined effects of a conventional point-of-choice prompt at the base of the stairs (volitional) and an extended message positioned at the top of each climb (motivational) in a cross-over design. The data revealed no effect upon behaviour when either intervention component was positioned alone. In contrast, the simultaneous positioning of both components increased stair climbing.

Point-of-choice prompts are similar to volitional interventions for action initiation in that they are post-decisional aids to health behaviour; they function to convert prior intentions to be physically active into behaviour. To change habits, the situation in which the behaviour occurs needs to be altered to facilitate alternative responses (Holland, Aarts, & Langendam, 2006; Wood & Neal, 2009). Point-of-choice prompts change the contextual cues linked to habitual choice of the escalator, promoting a more deliberative mindset (Kerr et al., 2001b; Webb & Eves, 2007a). When an individual intends to be more active, the health-promoting prompt both ‘reminds’ them of their intentions and provides an immediate opportunity for their fulfilment. This later point, we believe, is critical; whilst point-of-choice prompts can disrupt habits and encourage people to think about their actions, new choices are guided by prior intentions (Verplanken & Wood, 2006). Without a prior intention to be more active, a prompt encouraging stair climbing as one way to achieve increased activity would have no effect. In this travel context, it is likely that commuters were regularly exposed to the point-of-choice prompt. This repeated exposure to the message could, in theory, improve attitudes, and hence intentions, towards stair climbing. Prior research, however, reveals no change with repeated exposure to point-of-choice prompts alone in stations consistent with any incremental effects on intentions (Lewis & Eves, unpublished data; Olander et al., 2008). Indeed, in shopping malls, repeated exposure to prompts is associated with a modest diminution in responsiveness (Webb

### Table 1

<table>
<thead>
<tr>
<th>Time of morning</th>
<th>Intervention</th>
<th>Odds ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>08:00–08:59</td>
<td>Men &gt; women</td>
<td>1.08 (0.94–1.23)</td>
</tr>
<tr>
<td>09:00–09:59</td>
<td>Men &gt; women</td>
<td>1.19 (1.09–1.29)</td>
</tr>
<tr>
<td></td>
<td>Time of day</td>
<td>1.71*** (1.46–2.00)</td>
</tr>
<tr>
<td></td>
<td>Traffic</td>
<td>3.98*** (2.49–6.36)</td>
</tr>
</tbody>
</table>

### Table 2

<table>
<thead>
<tr>
<th>Time of morning</th>
<th>Odds ratios and confidence intervals for stair climbing for intervention stages 4, 5 and 6 (n = 20,638).</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Extended message alone (stage 4 vs. 5) (n = 9457)</td>
</tr>
<tr>
<td></td>
<td>OR (95% CI)a</td>
</tr>
<tr>
<td>Intervention</td>
<td>0.93 (0.82–1.05)</td>
</tr>
<tr>
<td>Gender (men &gt; women)</td>
<td>1.36*** (1.21–1.54)</td>
</tr>
<tr>
<td>Time of morning</td>
<td>1.53*** (1.34–1.75)</td>
</tr>
<tr>
<td>Traffic (continuous)</td>
<td>2.98*** (2.10–4.24)</td>
</tr>
</tbody>
</table>

a OR indicates odds ratio, CI, confidence interval.
b *p < 0.05; **p < 0.01; ***p < 0.001.
Hence, repeated incremental effects of the prompt component on intentions seem unlikely.

The new component of this study, the extended message positioned at the top of the ascent, differed from a conventional point-of-choice prompt in that it functioned as a motivational intervention in the environment. Critically, however, the extended message was installed after the method of ascent has been chosen. Hence, it could only affect a subsequent encounter with the choice-point. It seems likely that this new component increased intentions to use the stairs, which could subsequently be converted into behaviour by the conventional point-of-choice prompt. Attitudes, one determinant of intentions within the Theory of Planned Behaviour, describe the outcomes that result from the behaviour (Ajzen, 1991; Eves & Hoppe, 2009; Hagger et al., 2002). The extended message about the calorific consequence of a single ascent detailed a specific outcome obtainable from stair climbing, a message format that has been reported as more likely to motivate stair climbing (Webb & Eves, 2007b). Both stair and escalator users were exposed to this message and could contemplate it as they continued their journey. While the extended message targeted attitudes towards stair climbing, and hence intentions, only a subsequent encounter with the point-of-choice prompt could translate any more positive intentions into behaviour. Importantly, in this setting, both components of the intervention were required to change stair climbing. Unlike other studies in the travel context of train stations, the point-of-choice prompt alone was ineffective here (Andersen et al., 2006; Blamey et al., 1995; Boen et al., 2010; Brownell et al., 1980; Eves et al., 2009; Iversen et al., 2007; Kerr et al., 2001a; Nomura et al., 2009; Olander et al., 2008; Puig-Ribera & Eves, 2010). Visibility of the prompt cannot be an issue as it was effective when combined with the message at the top of the stairs (c.f. Olander et al., 2008). It is possible that the message on the prompt itself was sub-optimal; it had not been tested previously. Nonetheless, the weight control message here, “Regular stair climbing helps to prevent weight gain”, is conceptually similar to one successful in a US shopping mall, “Improve your waistline, use the stairs” (Andersen et al., 1998). Further, a prompt with the weight control message “Stair climbing burns more calories per minute than jogging. Take the stairs” was successful in a UK train station (Olander et al., 2008). Hence, the message theme and type of behavioural context, i.e. shopping vs. travel, seem unlikely explanations of the anomalous result. One plausible explanation for the ineffectiveness of the prompt alone concerns how the layout of this tram station, i.e. the physical environment, constrains stair choice.

It is helpful to conceptualise stair and escalator choices as part of a journey, with both methods of ascent as hurdles to be overcome on the way to the destination (Eves, 2008, 2010). Disembarking passengers in travel contexts such as stations will always be travelling elsewhere. Time to complete the journey is an important consideration in both public access settings (Eves, Lewis et al., 2008; Kerr, Eves, & Carroll, 2001c) and worksites (Kerr, Eves, & Carroll, 2001d; Nicoll & Zimring, 2009). For most public access settings, the escalators and stairs are adjacent and immediately available, though choice of the escalator may entail a small delay to the journey incurred by a full escalator can be avoided by opting for the stairs. To illustrate the magnitude of the effect of traffic, Fig. 1 depicts the number climbing stairs plotted against pedestrian traffic for the effective intervention periods here, i.e. installation of both components, and the remainder of the data. The lines on the figure represent the linear relationship between the two variables.

This figure reveals two things. First, effects of the intervention were superimposed on a large magnitude effect of pedestrian traffic. Researchers attempting to increase this activity need to
consider the context in which it occurs. Failure to include the effects of contextual variables in analyses, risks misleading conclusions should these contextual variables change independently of the intervention. Second, from the 500 different trams depicted in the figure, stair climbing first appears after 21 pedestrians have left one of the trams. Overall, the number on stairs, $y = \text{traffic} \times 0.209 - 6.272$. Solving this equation for one person on the stairs suggests that, on average, 35 pedestrians would need to leave a tram for one of them to take the stairs. Clearly, methods of ascent were biased towards the escalator and the layout of the station, such that stairs were situated behind the escalator, could only exacerbate this bias.

Finally, men took the stairs more than women in three of the four analyses. The absence of a statistically reliable gender difference for the comparison between stages 1 and 2 (i.e. the point-of-choice prompt alone) was anomalous. Whilst two studies have reported an absence of gender differences (Andersen et al., 2006; Lewis & Eves, unpublished data), men typically take the stairs more than women in public access settings (see Webb et al., 2011). The relatively small sample size of this analysis compared to previous studies, coupled with some random variation may account for the anomalous result. It should be noted that there was no evidence that men and women differed in their response to this calorific expenditure intervention.

Study limitations

One limitation of this study is that a single tram station was used, without a control site. The contrast between increased stair climbing when both intervention components were installed and ineffectiveness of single components makes it unlikely that spontaneous changes in behaviour could be responsible. Additionally, some effects may be station specific. As noted earlier, the layout of the station influenced the response to this intervention and effects may differ in settings where stairs and escalators are adjacent. Whilst this new, multi-component intervention provides an insight into the mechanisms underlying point-of-choice interventions, future research should seek alternative settings to test the magnitude of the effects of each component alone. Further, where stairs are lower than in this setting, the reduced calorific cost of an ascent, may reduce effectiveness of the motivational message whereas higher stairs may increase its effectiveness. Concerning message content, a message based on calorific expenditure would not have universal appeal, as is true for any message; one size rarely fits all.

Nonetheless, success with messages relevant to weight control (Andersen et al., 1998; Eves et al., 2006; Olander et al., 2008; Olander & Eves, 2011) suggest that the topic is a useful intervention target.

Conclusion

In summary, this paper tested the theoretical mechanisms underlying the success of point-of-choice interventions for stair climbing by adding a motivational component targeting intentions to a conventional volitional point-of-choice prompt. Simultaneous positioning of both components was required to increase stair climbing at this site. It is likely that the motivational component targeting intentions increased effectiveness of a volitional point-of-choice prompt for stair climbing, where choice of the stairs incurred a time penalty for pedestrians due to the layout, i.e. the physical environment. In addition, pedestrian traffic volume, i.e. the social environment, had large magnitude effects on the behaviour.

Conflict of interest

The authors declare no conflict of interest.

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Appendix. Supplementary data

Supplementary data associated with this article can be found, in the online version at [doi:10.1016/j.psychsport.2011.10.001].

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