

# Does perceived steepness deter stair climbing when an alternative is available?

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**Abstract** Perception of hill slant is exaggerated in explicit awareness. Proffitt (*Perspectives on Psychological Science* 1:110–122, 2006) argued that explicit perception of the slant of a climb allows individuals to plan locomotion in keeping with their available locomotor resources, yet no behavioral evidence supports this contention. Pedestrians in a built environment can often avoid climbing stairs, the man-made equivalent of steep hills, by choosing an adjacent escalator. Stair climbing is avoided more by women, the old, and the overweight than by their comparators. Two studies tested perceived steepness of the stairs as a cue that promotes this avoidance. In the first study, participants estimated the steepness of a staircase in a train station ( $n = 269$ ). Sex, age, height, and weight were recorded. Women, older individuals, and those who were heavier and shorter reported the staircase as steeper than did their comparison groups. In a follow-up study in a shopping mall, pedestrians were recruited from those who chose the stairs and those who avoided them, with the samples stratified for sex, age, and weight status. Participants ( $n = 229$ ) estimated the steepness of a life-sized image of the stairs they had just encountered, presented on the wall of a vacant shop in the mall. Pedestrians who avoided stair climbing by choosing the escalator reported the stairs as steeper even when demographic differences were controlled. Perceived steepness may be a contextual cue that pedestrians use to avoid stair climbing when an alternative is available.

**Keywords** Geographical slant perception · Stair climbing · Demographics · Resource costs · Pedestrian behavior

## Introduction

This article deals with the choices pedestrians make while navigating the environment. Perception of hills is exaggerated in explicit awareness; for example, a 5° hill is reported to be 20° (Bhalla & Proffitt, 1999; Proffitt, Bhalla, Gossweiler, & Midgett, 1995). Fatigue and added weight in a backpack increase these exaggerations. To climb hills, individuals require strength in their legs to raise their weight against gravity. Being tired or carrying a large bag would require a greater proportion of available strength to climb a hill than when unaffected by these factors, and individuals may adopt a slower speed of ascent to reflect any resource depletion (Proffitt, 2006). Importantly, exaggeration of hill slant is stratified by demographic grouping. With increasing age, leg strength declines (McCardle, Katch, & Katch, 2007), and older participants report steep hills—for example, 25°—as steeper than do younger participants (Bhalla & Proffitt, 1999). Additionally, women report hills as steeper than do men (Proffitt et al., 1995). On average, women have lower leg strength than do men, coupled with a greater proportion of their body weight as fat (McCardle et al., 2007). Thus, an average woman has a lower strength-to-weight ratio than does an average man—that is, reduced resources for climbing. Although Proffitt has argued that effects of resource availability on explicit awareness of hill slant influence choice—for example, walking speed—no behavioral evidence supports this contention.

Parallel research in public health reveals that the effects of demographic grouping on hill perception are echoed by differences in pedestrian behavior at stairs. In many public access settings, such as train stations, pedestrians can avoid using resources to climb stairs by choosing an adjacent escalator. Pedestrians who carry large bags, are older, and are female avoid stairs more than do their comparison groups (Eves, 2013); naturally occurring pedestrian behavior mirrors

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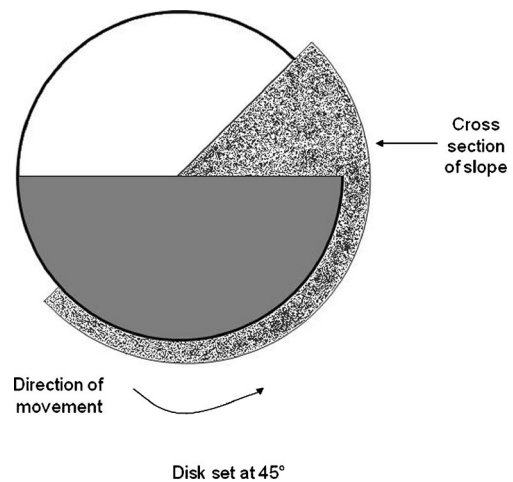
the effects of demographic grouping on perceptual measures. In this behavioral evidence, however, groups with reduced resources for climbing are more likely to avoid further depletion. Thus, perceived slant may function as a cue that deters use of resources when an alternative is available. Demographic differences in perception of stair slant, a necessary precondition for this proposal, are tested in the first study.

To date, no studies have reported the effects of body weight on slant perception, despite obvious parallels with the addition of weight in a backpack. Body mass index, the standardized measure of weight status, is calculated from weight in kilograms divided by height squared in meters. Inclusion of height in the index aims for a measure of weight status that standardizes the index across differences in overall size; for example, men are generally both taller and heavier than women. For perception of the environment, however, height is a variable of interest in its own right. Height of the eyes above the ground is related to the perception of the “climbability” of stairs (Mark, 1987; Mark & Voegelé, 1987) and “passability” of apertures, such as doors (Warren & Whang, 1987; Wraga, 1999). Eye height can be used to scale the world into the intrinsic metrics of the perceiver. The first study tested height, as a proxy for eye height, and body weight as potential independent demographic associates of the perceptual variables.

To measure perception of hill slant, termed *geographical slant perception*, Proffitt and co-workers obtained three different measures. Individuals report verbally the slope in degrees and perform a visual matching task to estimate the perceived angle of the slope in cross-section (Fig. 1). For the final measure, termed *haptic*, individuals adjust the slope of a palm-board with their hand until it is parallel with the hill facing them (see Fig. 2). Verbal and visual measures reveal exaggerated estimates of slope and are sensitive to differences in demographics, whereas the palm-board measure is both less prone to exaggeration and, generally, unaffected by demographic grouping (Bhalla & Proffitt, 1999; Proffitt et al., 1995),<sup>1</sup>

In a train station, verbal, visual, and palm-board measures of staircase slant were obtained at the foot of the stairs and at a distance of 15 m. We reasoned that if perceived slant were to influence behavioral choice, effects should be present before reaching the slope of the stair/escalator complex. In a major departure from previous studies of slant perception, the

<sup>1</sup> Although Durgin, Hajnal, Li, Tonge, and Stigliani (2011) have argued that the relatively greater accuracy of palm-boards is an artifact of wrist motion and perception, a newly developed haptic measure that avoids reliance on the wrist joint revealed that this relative accuracy remained, particularly for the steeper slopes characteristic of staircases (Taylor-Covill & Eves, 2013a).



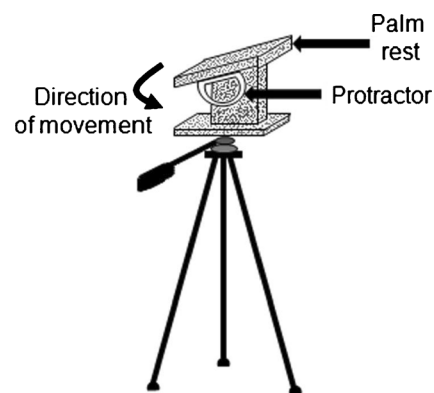
**Fig. 1** The adjustable disk used to provide the visual matching measure of slant

primary analyses used multiple regressions to test for simultaneous, independent influences of demographic variables. Since males are generally taller and heavier than women, the body size components of weight and height were mean centred for each sex to avoid confounding the effects of size with participants’ sex.

## Study 1

### Method

Participants waiting for their train in a U.K. station with a 39-step staircase (height = 6.45 m; overall angle, including half-landings = 23.4°; each unbroken stair section = 28.0°) adjacent to an escalator were asked if they could spare 5 min for a brief study about the environment. Information on demographic differences in stair avoidance in this station is provided in the [Appendix](#). Measures of perceived slant when facing the stairs were obtained either 1 m from the foot of the stairs ( $n = 120$ ) or 15 m away ( $n = 160$ ). Participants were



**Fig. 2** The adjustable palm-board used to provide the haptic measure of slant

asked to report the slant of the staircase in degrees, having been told that 0° was horizontal and 90° was vertical (verbal). They adjusted the wedge-shaped segment of the disk (Fig. 1) until the angle of the segment matched the perceived angle of the stairs in cross-section, with the matched angle read from an unseen protractor on the reverse (visual). For the haptic measure, participants placed the palm of their right hand on the palm-board, positioned just above waist height on a tripod (Fig. 2) and adjusted the angle of the board, without looking at their hand, until it was parallel with the stairs. A potentiometer attached to the pivot of the board and custom circuitry displayed the angle of the board in degrees from the horizontal on the side of the apparatus. Prior to measurements, the palm-board was zeroed to horizontal with a spirit level. Ethical approval throughout was obtained from the ethics subcommittee of the School of Sport and Exercise Sciences, University of Birmingham, UK.

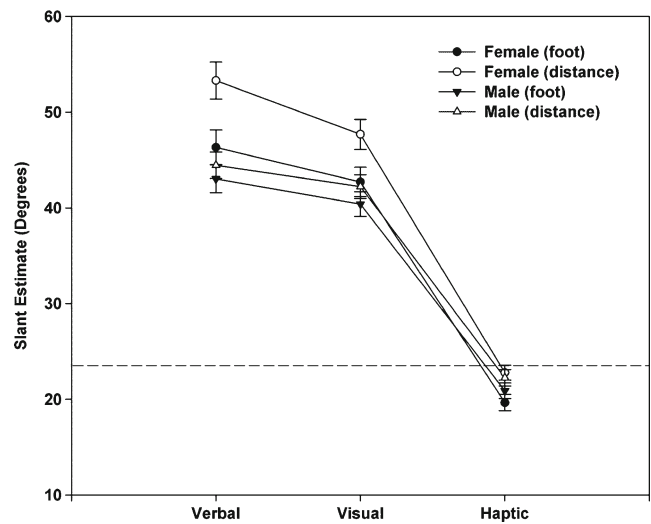
Results

Five far outliers from boxplots were excluded. The final sample ( $n = 269$ ; 48 % female, 20.8 % nonwhite) was 38.1 years old ( $SE = 0.87$ , range 18–84), the average weight was 72.7 kg ( $SE = 0.80$ , range 43–111), and the average height was 1.72 m ( $SE = 0.006$ , range 1.50–2.01). There were no differences in demographics between the samples recruited for the foot of the stairs or further away (all  $ps > .12$ ).

Figure 3 depicts the measures of staircase slant separately for each sex and distance from the stairs. A 2 (sex: male, female) × 2 (distance: foot, distance) × 3 (measure: verbal, visual, haptic) repeated measures analysis of variance revealed a main effect of distance,  $F(1, 265) = 10.53, p = .001, \eta_p^2 = .04$ , which did not interact with measure,  $F(2, 530) = 0.71$ . The stairs were estimated as steeper at a distance (overall  $M = 38.8^\circ, SE = 0.70$  vs. overall  $M = 35.4^\circ, SE = 0.68$ ).<sup>2</sup> There were main effects of sex,  $F(1, 265) = 10.02, p = .002, \eta_p^2 = .04$ , and measure,  $F(2, 530) = 557.0, p < .001$  (verbal > visual > haptic, all  $ps < .001$ ), which interacted,  $F(2, 530) = 7.84, p = .001$  (see below).<sup>3</sup> There was no significant interaction involving distance and sex,  $F(1, 265) = 2.98, p = .089$ , nor a three-way interaction involving measure,  $F(2, 530) = 0.67, p = .51$ .

<sup>2</sup> Not specifying a fixated point for the staircase will have added variability to the magnitude of the distance effect.

<sup>3</sup> It has recently been argued that geographical slant measures proportional to the mean error in estimation might be appropriate when comparing verbal, visual, and haptic estimates (Durgin et al., 2011). Repeating the analysis with the data converted to a proportion of the mean error revealed a main effect of sex,  $F(1, 265) = 6.41, p = .012$ , which interacted with measure,  $F(2, 530) = 5.96, p = .004$ . Females made greater proportional exaggeration for verbal and visual (both  $prob < .004$ ) but not haptic measures ( $p = .89$ ).



**Fig. 3** Verbal, visual, and haptic measures of staircase slant ( $\pm SE$ ) plotted separately for each sex and distance from the stairs. Broken line represents the overall angle of the stairs

Table 1 contains the standardized coefficients and summarizes the results of multiple regressions with the potential predictors of distance, sex, age, weight, height, and skin color, a variable related to stair avoidance (see the Appendix). Sex and age were associated with verbal and visual measures, but not the haptic one. The indices of weight and height were positively related to the verbal measure, such that heavier and shorter people reported stairs as steeper than did their comparators. Weight was also related to the haptic measure. There were no effects associated with skin color.

Discussion

The stairs here had an overall angle of 23.4°, including half-landings, with each unbroken stair section at 28.0°. As with hills, verbal and visual measures greatly exaggerated the slant,

**Table 1** Standardized coefficients for the effects of distance and demographic variables on measures of staircase slant

Variable	Verbal	Visual	Haptic
Far > near	.182** <sup>a</sup>	.167**	.192**
Female > male	.232***	.180**	.010
Age (years)	.190**	.182**	.055
Weight (kg), mean centred	.134*	.041	.168*
1/Height <sup>2</sup> (meters), mean centred	.160*	.050	.122
Skin color	-.006	.050	.091
Adjusted R <sup>2</sup>	.142	.078	.056
F(6, 262)	8.40***	4.79***	3.63**

\* $p < .05$

\*\* $p < .01$

\*\*\* $p < .001$

whereas the palm-board did not. Extrapolating from Proffitt's student data with linear interpolation suggests that hills in the range 23.4°–28° would be associated with verbal and visual measures of 43.1°–48.8° and 38.9°–44.6°, respectively. Estimates at the foot of the stairs, verbal = 44.7° and visual = 41.5°, were within these ranges. Women and older participants gave greater estimates with the verbal and visual measures, but not the palm-board. The pattern of differences for the perceptual measures and effects for the demographics of sex and age, confined to the verbal and visual measures, suggest a commonality of geographical slant perception across natural and man-made slopes.

Increasing weight was associated with steeper estimates for verbal and, surprisingly, palm-board measures (see below). Thus, the effects of body weight on explicit perception appear consistent with effects of added backpacks (Bhalla & Proffitt, 1999). Height was also relevant; shorter people reported stairs as steeper, suggesting that perceived stair slant may be scaled by intrinsic metrics consistent with another perception relevant to the built environment, stair riser height (e.g., Warren, 1984). One caution is appropriate. The total weight of any individual is composed of dead weight, including fat, which must be “carried” up the stairs and muscle mass that has the strength to do the carrying. Thus, weight is composed of variables with opposite effects on stair-climbing resources that renders it an imprecise indicator of these resources. Separation of these contributors into lean and fat mass should provide more accurate information on the effects of weight on stair perception.

Effects involving palm-board measures are unusual in the geographical slant literature. Sensitivity to distance from the fixated part of the slope has been reported previously (e.g., Feresin & Agostini, 2007), and these field data confirm steeper haptic estimates at a distance from the foot of the climb. Additionally, Proffitt et al. (1995) reported steeper palm-board estimates when looking down a steep hill rather than up and sex differences in an omnibus analysis with a sample of over 400 participants. The multivariate approach here may facilitate detection of effects for palm-boards by partialling out other influences on overall perception. Importantly, multivariate analyses provided no evidence of perceptual differences associated with skin color to accompany consistent effects on stair avoidance in the behavioral data (see the Appendix).

There are two alternative accounts to an embodied one for the data here. Durgin and colleagues have argued that demand characteristics and explicit beliefs offer alternative explanations for the effects of resources (Durgin et al., 2009; Durgin, Klein, Spiegel, Strawser, & Williams, 2012). Some individuals wearing a backpack might “deduce” that the stairs should appear steeper. While age and weight status might have explicit effects on beliefs and, hence, perceptual judgments, it is unclear why women and shorter people should “expect” to

see steeper stairs, making explicit beliefs an unlikely explanation. Alternatively, estimates could include nonvisual factors, such that perceptual reports were influenced by how the individual “felt” about the stairs (see Woods, Philbeck, & Danoff, 2009). Climbing the same staircase requires a greater proportion of the available resources of an average woman, relative to an average man, making the staircase “feel” steeper to women. While mean centering removed size-related explanations of sex differences, sex and age could still influence how the stairs might “feel” to climb. Unlike Woods et al., however, any effects of “feel” for age and sex were present for both verbal reports and visual matches to the stimulus.

Demographic differences in perceptual estimates of stairs fulfil the necessary precondition for a model in which the cue of perceived slant can deter climbing when an alternative is available; demographic differences in avoidance were echoed by differences in perceptual estimates. To further test potential effects of perception on behavior, a quasi-experimental study unobtrusively audited pedestrian choices in a shopping mall—that is, whether an individual climbed the stairs or avoided them—and then recruited individuals making each choice. If perceived steepness is to deter stair climbing, individuals avoiding the stairs should report them as steeper than those who climb them. Since demographic grouping is related to perception and behavioral choice, we stratified our sample by sex, age, and weight status in an attempt to partial out demographic influences on reported steepness from choice. In essence, we tested whether an old man of healthy weight who avoided climbing stairs would report them as steeper than an old man of healthy weight who chose to climb them.

Previous observations without any intervention at this site revealed that, overall, 91.4 % (95 % confidence interval [CI] = 91.1–91.7) of pedestrians avoided the stairs, with avoidance more common in women, older people, and those carrying large bags ( $n = 26,428$ ; Kerr, Eves, & Carroll, 2001b; Webb & Eves, 2005; Webb, Eves, & Smith, 2011). We predicted steeper verbal and visual estimates for those avoiding the stairs than for those who climbed them, but no palm-board differences.

## Study 2

### Method

#### *Perceptual measures*

The stimulus was a 24-step staircase (height = 4.08 m; overall angle, including half-landings, = 25.2°; each stair section = 29.0°) adjacent to an escalator. A digital photograph taken 3.6 m away at a height of 1.6 m, the eye height of the photographer, with a 5.0 megapixel Olympus C-5050 camera

(see Fig. 4) was displayed using a Hitachi CP-SX1350 multimedia projector linked with a Dell Latitude D610 laptop on a white wall in a vacant shop, 30 m from the top of the staircase. Participants, facing the life-sized image at a distance of 3.6 m, provided three measures of staircase slant as in the previous study. Equivalent effects of slant perception for stairs in the field and life-sized images in the laboratory have been reported (Taylor-Covill & Eves, 2013b).

### Procedure

Observers inconspicuously noted the choices of pedestrians at the top of the climb and alternated sampling from each choice group, stratifying the sample by sex, age, and weight status. Pedestrians were asked if they could spare 10 min for a brief interview about the environment. Following consent, participants were led to the shop, positioned facing the image of the stairs, and made their perceptual estimates. Finally, individuals were asked their age, their height was measured (Leicester measure), and they were weighed clothed (Seca 118). Those unwilling to be weighed were coded visually as healthy-weight or overweight. Participants were paid £3 for their time.

### Data reduction and statistical analyses

From an initial sample of 249, participants who did not wish to be weighed ( $n = 12$ ; 100 % female, 83 % overweight, both prob.  $< .03$ ) and far outliers in boxplots were excluded ( $n = 8$ ). The final sample was 33.8 years old ( $SE = 0.90$ , range 18–65), average weight was 72.7 kg ( $SE = 1.13$ , range 42–145), and average height was 1.70 m ( $SE = 0.006$ , range 1.45–1.94). There were no differences between the retained sample and those removed for perceptual or demographic variables (all prob.  $> .73$ ) nor any demographic differences between the

stairs ( $N = 102$ ) and escalator ( $N = 127$ ) choice groups (all prob.  $> .09$ ). Analysis employed a repeated measures ANCOVA with the between-subjects factors of choice (stair vs. escalator) and sex (male vs. female) and the within-subjects factor of measure (verbal, visual, haptic). Age and the size-related variables weight and the reciprocal of height in meters squared, mean centred within each sex to avoid confounding, were included as covariates. Follow-up  $t$ -tests used Bonferroni corrected probabilities.

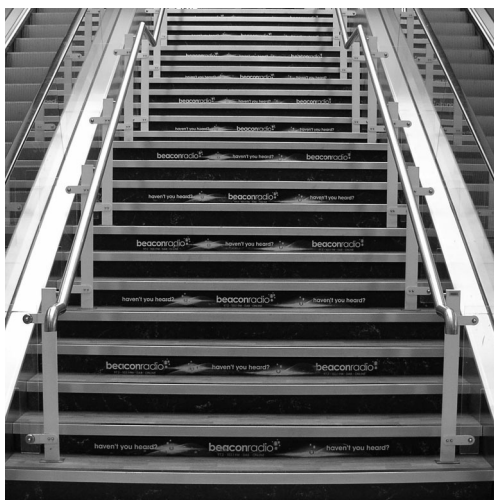
### Results

Figure 5 depicts the measures of staircase slant for those choosing the escalator and the stairs. There was a main effect of choice,  $F(1, 222) = 6.40$ ,  $p = .012$ ,  $\eta_p^2 = .03$ , such that, overall, the stairs were estimated as steeper by those choosing the escalator ( $M = 42.4^\circ$ ,  $SE = 0.85$ ) than by those who climbed the stairs ( $M = 39.5^\circ$ ,  $SE = 0.91$ ). In addition, the main effect of measure,  $F(2, 444) = 50.39$ ,  $p < .001$  (verbal  $>$  visual  $>$  haptic, all prob.  $< .001$ ), interacted with choice,  $F(2, 444) = 4.06$ ,  $p = .018$ . Follow-up simple effects revealed differences between the choice groups for the verbal measure,  $F(1, 222) = 9.86$ ,  $p = .001$ ,  $\eta_p^2 = .04$ , but not for the other two perceptual measures (both prob.  $> .24$ ).

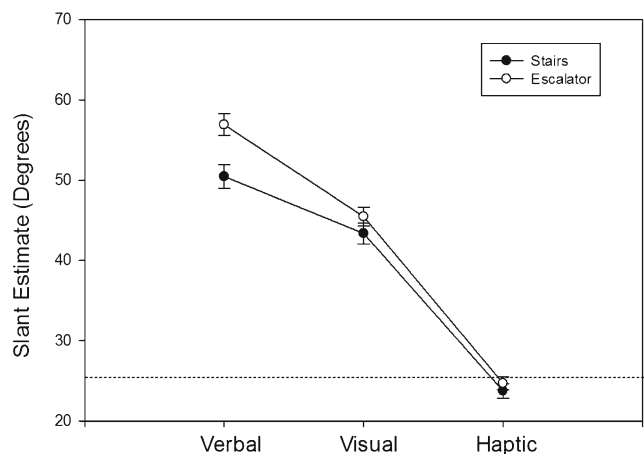
### Discussion

As was predicted, pedestrians who avoided the stairs reported them as steeper than did those who chose to climb them, even when demographic influences on perception were controlled by sampling and subsequent analyses. Only effects for the verbal estimate were found.

Despite quasi-experimental evidence of a link between perception and behavior, an alternative explanation is possible. Successful completion of a behavior increases one's belief that



**Fig. 4** Staircase image used for perceptual estimates



**Fig. 5** Verbal, visual, and haptic measures of staircase slant ( $\pm SE$ ) plotted separately for those choosing the stairs and the escalator. Broken line represents the overall angle of the stairs

the behavior *can* be performed, and self-efficacy beliefs have wide-ranging effects (Bandura, 1997). Any increased self-efficacy could result in less steep estimates of the just-climbed stairs. A follow-up study recruited pedestrians at a site where choice to climb was audited *before the behavior occurred* and perceptual measures obtained before the ascent (Taylor-Covill & Eves, *submitted*); verbal and visual estimates of the slant were lower for those choosing to climb *prior to ascent*. This follow-up used an angle knowledge test to exclude participants with uncertain knowledge, a methodological enhancement that may have facilitated detection of effects with visual matching that were absent here. A second follow-up aspect is informative; more pedestrians chose stairs (58.8 %; Eves, unpublished) than in the mall (8.6 %). A commonality for effects of reported steepness across sites with differing default preferences, even when demographic influences were removed, suggests that perceived slant is a cue that deters climbing when an alternative is available. “Feel” may influence perceptual estimates (Woods et al., 2009), just as it may influence navigation of the built environment (Eves, 2013). It is untested, however, whether a climb that “feels” steeper also “looks” steeper. Verbal reports of angle in degrees use a uniquely human metric. Only visual matches, malleable to manipulation, could begin to address the question.

The small effect size for differences between choice groups merits comment. Many factors influence slant perception, with separable effects for the demographics of sex, age, weight, and height controlled here. Other unmeasured variables are relevant. Fatigue from previous physical and mental exertion, levels of fitness and health, and current mood have all been reported to influence slant perception (Bhalla & Proffitt, 1999; Proffitt et al., 1995; Riener, Stefanucci, Proffitt, & Clore, 2011; Schnall, Zadra, & Proffitt, 2010). Given this multiplicity of potential influences, large effect sizes for a single variable of choice are likely to be rare in multivariate approaches to slant perception, particularly when variance from major demographic influences on choice and perception is removed by stratified sampling. Furthermore, there may be unmeasured effects related to the specific journey. Fatigue can exaggerate slant perception, and the distance pedestrians had traveled to reach the choice-point was not measured here (Bhalla & Proffitt, 1999; Proffitt et al., 1995; Taylor-Covill & Eves, 2013b). Additionally, glucose levels that are related to food intake have been linked to slant perception (Schnall et al., 2010); food outlets within the shopping mall may have been the destination for some pedestrians. The time required for a journey is also important. It seems likely that time pressure for a specific journey (Eves, Lewis, & Griffin, 2008) and any conscious planning associated with that journey would override subtle effects of perceptual cues that bias choice away from the stairs.

While Shaffer and Flint (2011) questioned the relevance of resources to verbal estimates of stair slant, potential effects of demographics are relevant to their null result. The study

overrecruited females (55 %) at the escalator and underrecruited them at the stairs (45 %). Demographics affect reported angle, and this imbalance could only inflate the estimated angle of the escalator relative to the stairs. Furthermore, women, older individuals, and the overweight are more likely to choose escalators for ascent (Eves, 2013). Thus, any pedestrian sample near an escalator could be biased toward those who both avoid stairs and exaggerate their steepness; overrecruiting of females at the escalator *did* occur. Comparison of a staircase at a university with an escalator in a department store compounds sampling problems. A younger, fitter, and possibly of healthier weight sample from a university campus should report stairs as less steep. No information on pedestrian behavior or demographics that would allay these concerns was recorded (Shaffer, personal communication, August 2013). Biased recruiting would tilt the result toward steeper reported slants at the escalator and less steep ones at the stairs and would run counter to any potential effects of the method of ascent on slant estimates. Matched angles, stratified sampling, and subsequent multivariate control for effects of demographics would be more informative, as would visual and palm-board measures that were not collected.

These studies demonstrate that exaggerated measures of slant perception that Proffitt has linked to explicit awareness mirror demographic differences in avoidance. Slant was related to behavioral choices of naturally behaving pedestrians, even when demographic influences on choice and perception were controlled. The studies appear to confirm Proffitt’s contention that slant perception can influence the behavioral choice of pedestrians.

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## Appendix Pedestrian behavior in the station

### Introduction

Information on the demographics of stair choice is rarely obtained in stations. The simultaneous exit of many passengers from the station hinders accurate coding of multiple demographic features of individual pedestrians as they negotiate the stairs and escalator (e.g., Kerr, Eves, & Carroll, 2001a; Lewis & Eves, 2011). A companion study coded stair and escalator choices at the staircase for which we planned perceptual measures. This observational study

sought to confirm that demographic effects on choice in shopping malls were also characteristic of a station setting. While coding of weight status did not survive pilot testing (see the **Observational coding** section), one additional demographic was coded. Consistently, in the U.K., individuals who appear Caucasian—that is, with white skin—avoid stairs more than do the remaining pedestrians (Kerr et al., 2001b; Webb, Eves, & Kerr, 2011). Similar effects have been reported in respect to African-Americans in the U.S. (Anderson, Franckowiak, Snyder, Barlett, & Fontaine, 1998; Andersen, Franckowiak, Zuzak, Cummings, Barlett, & Crespo, 2006). Skin color was coded and analyzed in both studies.

### Observational coding

During June 2007, two observers recorded stair/escalator choices of ascending travelers as they left each train between 10:00 and 3:00 for four weekdays. This period of the day avoided busy commuter trains for which accurate coding was precluded by the number of passengers leaving each train. The coding of demographic groupings of sex, apparent age over 60 years, skin color, and presence of large bags used previously employed criteria (Kerr et al., 2001a; Webb, Eves, & Kerr, 2011). Double coding confirmed good reliability for these observational categories (interobserver reliability: average kappa = .97, kappa range .94–1.00). In contrast, tests of simultaneous coding for weight status were unacceptable (kappa < .80), and it was not included (cf. Lewis & Eves, 2011).

### Analyses

Logistic regression analysis was conducted with the dichotomous outcome variable of stair/escalator choice and the dichotomous predictors of sex, age, skin color, and presence of large bags. In addition, pedestrian traffic volume—that is, the total number of pedestrians leaving each train—was entered as a continuous variable. Typically, in public access settings, increases in pedestrian traffic volume are associated with reduced avoidance of the stairs by pedestrians in stations (Eves et al., 2008) and shopping malls (Webb, Eves, & Kerr, 2011).

### Results

For the observations ( $n = 2,510$ ), 42.4 % were coded as female, 24.4 % as older than 60 years, 12.2 % as nonwhite, and 19.1 % carrying large bags. Overall, 86.7 % avoided the stairs by choosing the escalator. Table 2 contains the odds ratios and 95 % CIs for the effects of demographic grouping on stair avoidance. The data confirm that women, older pedestrians, nonwhite individuals, and those carrying large bags were more likely to avoid the stairs in this station. For

**Table 2** Effects of demographic grouping on stair avoidance at Snow Hill Station (U.K.)

Variable	OR	95 % CI
Females > males	1.34*	1.06, 1.70
Old > young	2.72***	1.94, 3.82
Nonwhite > white	2.26***	1.46, 3.47
Bag > no bag	1.61**	1.16, 2.23
Pedestrian traffic volume (continuous)	0.992	0.981, 1.002

\* $p < .05$

\*\* $p < .01$

\*\*\* $p < .001$

this relatively small data set, there was no statistically significant effect on choice of the number of passengers leaving each train (pedestrian traffic volume).

### Discussion

These observational data confirm that women, older pedestrians, nonwhite individuals, and those carrying large bags avoided stairs more frequently than did their comparison groups in this station, consistent with findings in shopping malls (Webb, Eves, & Kerr, 2011). While coding of weight status was not performed here due to unreliability of the measure in pilot testing, subsequent work using a visual standard to improve coding reliability confirms reduced stair choice in the overweight for this climb (Lewis & Eves, 2011), consistent with the stair observational studies in a range of contexts (Brownell, Stunkard, & Albaum, 1980; Eves, 2013).

The West Midlands region has the most multicultural population after London in the U.K., with individuals of south Asian (8.5 %) and Afro-Caribbean origin (2.7 %) representing the majority of those classed as nonwhite in the population (14 %; Medland, 2011). Consistent with other observations in this region of the U.K. (Kerr et al., 2001b; Webb, Eves, & Kerr, 2011) and the U.S. (Andersen et al., 1998, 2006), nonwhite individuals were more likely to avoid the stairs by opting for the escalator. To date, no explanation has been provided for these consistent demographic influences on behavioral choice. There was no evidence here that these differences in behavior were echoed by any differences in perceptual measures.

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