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Step up: Exploring the impact of social prompts on stair use in a university setting

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ABSTRACT

Objectives: The purpose of this research was two-fold: (1) to explore the relationship between descriptive and injunctive norm perceptions on stair-use, and (2) to examine the impact of social and non-social stair prompts on stair use.
Design: Study 1 employed a cross-sectional design, and Study 2 had a time-series experimental design, with two baseline periods and two intervention periods.
Method: A total of 226 adults completed the online survey for Study 1, reporting their social norm perceptions and individual stair use. For Study 2, 8007 individuals entered the stairwell or elevator over the four-week observation period, either measured by infrared people-counters installed across the entrance to the stairs or by observed trainers positioned near the elevators.
Results: Study 1 showed a positive relationship between descriptive and injunctive norm perceptions and individual stair use. Study 2 found social prompts to significantly increase the proportion of individuals taking the stairs compared to baseline. The non-social prompts did not increase stair use beyond the effects of the social prompts.
Conclusions: Individuals perceptions of what is typical and/or desirable behaviour relates to individuals self-reported stair use. Further, findings support the use of social messages as an alternate message for prompting stair use in a university setting. Health practitioners may wish to harness the power of social influence and emphasise that stair use is *typical* and *desirable*.

1. Introduction

Regular engagement in physical activity is associated with many physical and psychosocial benefits (Penedo & Dahn, 2005). The current guidelines to achieve these benefits suggest that individuals should engage in 150 min of moderate- or 75 min of vigorous-physical activities per week (Tremblay et al., 2011). However, there is emerging evidence that argues *any activity* is better than none (de Souto Barreto, 2015), with even low levels of light intensity physical activity associated with positive health outcomes (Healy, Matthews, Dunstan, Winkler, & Owen, 2011, 2015). As western societies are typically not meeting these physical activity guidelines (e.g., Canadian Society for Exercise Physiology, 2011), to encourage individuals to initiate physical activity, it has been argued that the emphasis should shift from reaching the recommended levels of physical activity to promoting any form of activity incorporated throughout one's day (Levine, Vander Weg, Hill, & Klesges, 2006; Sallis, Linton, & Kraft, 2005).

One activity that can be integrated into day-to-day life is taking the stairs (instead of the elevator/escalator). Daily stair use has been associated with multiple health benefits (Kennedy, Boreham, Murphy, Young, & Mutrie, 2007), including reduced cholesterol levels (Boreham, Wallace, & Nevill, 2000), decreased body fat (Fardy & Ilmarinen, 1974), and increased strength of the lower limbs (Loy et al., 1994). Despite these benefits, the proportion of stair users compared to elevator/escalator users is usually less than 10% in observational studies of stair use (Bauman, Milton, Kariuki, Fedel, & Lewicka, 2016). To increase this low proportion of individuals using the stairs, interventions have typically used point-of-decision prompts (called 'prompts' herein; Bellicha et al., 2015). These prompts motivate individuals to take the stairs by placing a sign at individuals' *point-of-decision making* (i.e., where an individual decides between taking the elevator/escalator or the stairs). The most recent review of 50 studies found that prompts increased stair use by an average of 2.2% compared to baseline (Bauman et al., 2016).

Majority of stair intervention studies to date have used prompts that emphasise the health benefits or energy expenditure (calories/kilojoules) associated with taking the stairs (Eves, Webb, & Mutrie, 2006; Ferrara & Murphy, 2013). While both health and energy expenditure have been identified as important reasons why people might take the

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stairs, the presence of others has also been cited as a motivating factor related to stair use (Thomas, Puig Ribera, Senye-Mir, Greenfield, & Eves, 2015). It may be that the presence of other people on the stairs provides information to individuals as to whether stair use is *typical* or *desirable* behaviour, thus affecting whether an individual decides to take the stairs.

An individual's perception of what is typical or desirable are considered social norms (Cialdini & Trost, 1998). The focus theory of normative conduct (Cialdini, Reno, & Kallgren, 1990) distinguishes between what is typical and what is desirable through two different types of norm perceptions: descriptive and injunctive. The descriptive norm refers to what most others are doing (what is typical). An individual will perceive whether others are (or are not) taking the stairs, which will serve as an indication as to the most effective and adaptive action in a given situation, and subsequently lead individuals to behave similarly to what is descriptively normative. The injunctive norm reflects an individual's perception of the social pressure to engage or abstain from a given behaviour. While in some aspects similar to the subjective norm construct from the theory of planned behaviour (Ajzen, 1991), whereby social pressure is exerted through what behaviour is expected from others, the injunctive norm reflects what is perceived to be acceptable behaviour in a particular situation. In other words, individuals will act in ways that promote approval, and avoid disapproval, from others (what is desirable).

For the descriptive norm, a positive relationship between the perception of others physical activity and an individual's own physical activity has been repeatedly found (Okun et al., 2003; Okun, Karoly, & Lutz, 2002; Priebe & Spink, 2011). In one particular study, Priebe and Spink (2011) explored whether descriptive norm perceptions were associated with individual physical activity after controlling for individuals' reasons for being active (i.e., health, appearance). Results indicated that the *typical* physical activity levels of others related to individuals' own physical activity patterns, beyond one's motivation to be physically active for health or appearance reasons.

To expand on the cross-sectional nature of that study, Priebe and Spink (2012) explored the effectiveness of descriptive norm messages compared to non-normative messages. In particular, participants were assigned to one of four conditions: those who received messages with descriptive norm information (e.g., be active because others are), health benefits (e.g., be active to improve health), appearance benefits (e.g., be active to look better), and a general control (e.g., be active). The results showed that those who received the normative message about others' physical activity showed a significantly greater increase in mild physical activity levels compared to other conditions (Priebe & Spink, 2012). Specifically related to stair use, Burger and Shelton (2011) found that a descriptive norm-focused stair prompt (i.e., most people take the stairs) was more effective at changing behaviour compared to a control message (i.e., stair use is a form of exercise). Prompting individuals that most people took the stairs led to a significant decrease in the percentage of participants using the elevator. Taken together, results of these studies provide evidence that messages about others physical activity (i.e., the descriptive norm) can influence individual activity behaviour, and is an important consideration when motivating individuals' to be active.

In addition to the growing evidence on descriptive norms, researchers have also begun to examine the injunctive norm in physical activity settings. However, most of this research to date has been guided by the theory of planned behaviour (Ajzen, 1991), measuring the subjective norm component (e.g., Kim, Dunn, Rellinger, Robertson-Wilson, & Eys, 2017; Nigg, Lippke, & Maddock, 2009), which assesses an individual's perception of others *expectations* to engage or abstain from a given behaviour. More recently, studies that have assessed the injunctive norm (i.e., approval) have found a positive relationship between perceived others approval and individual physical activity (e.g., Abraído-Lanza, Shelton, Martins, & Crookes, 2017; Rhodes & Courneya, 2003). Further, Crozier and Spink (2017b) found that adult recreational athletes who received injunctive norm messages reported greater effort compared to a no-message control condition. Together, the results suggest that injunctive norms are an important aspect to consider when targeting physical activity behaviour change.

Although no research has examined injunctive norms in relation to stair use specifically, there is some evidence to suggest that injunctive norms may be a factor relevant to stair use. Specifically, adults have described peers as being either encouraging (i.e., showing approval for taking the stairs) or judgmental (i.e., showing disapproval of taking the elevator) in relation to one's stair use (Obiaka, 2014). In line with the tenets of focus theory of normative conduct (Cialdini et al., 1990), it may be that these (dis)approval perceptions may impact individuals' stair use.

The studies in this paper were conducted for two main purposes. The first purpose was to examine the relationship between descriptive and injunctive norm perceptions and self-reported stair use. Study 1 examined whether normative perceptions were associated with stair use beyond an individual's other reasons for taking the stairs (i.e., health, energy expenditure). Using Locke's (2015) advice for using replication with variation, Study 1 sought to replicate and expand on the study by Priebe and Spink (2011). The variation was the addition of assessing individuals' injunctive norm perceptions, as the focus theory of normative conduct proposes both descriptive and injunctive norm perceptions as relevant to individuals' behaviour (Cialdini et al., 1990). Based on the tenets of focus theory of normative conduct (Cialdini et al., 1990) and previous research (Priebe & Spink, 2011), it was hypothesized that both descriptive and injunctive norm perceptions would be positively related to stair use, after controlling for individuals' health-related reasons for taking the stairs.

The second purpose was to explore the effectiveness of social prompts on stair use. Study 2 examined the impact of social prompts on the proportion of individuals using the stairs instead of the elevator. In particular, the effectiveness of social and non-social prompts on the pedestrian choice between stairs and elevators were assessed, using a time-series design with two control periods. First, it was hypothesized that the social prompts would have a positive influence on stair use. Second, it was hypothesized that the non-social prompts would not increase stair use beyond the effects of the social norms prompts. The rationale for these hypotheses were based on research showing social messages were more effective than non-social messages at increasing physical activity levels (Priebe & Spink, 2012). The following sections present Study 1 and Study 2 separately; with the results of Study 1 informing the methods of Study 2.

2. Study 1

2.1. Methods

2.1.1. Participants and design

A total of 281 adults, from a variety of countries, participated in Study 1. Majority of participants were from Australia (n = 189; 67.3%), followed by Canada (n = 76; 27.1%), Europe (e.g., Ireland, England; n = 9; 3.2%), the United States of America (n = 6; 2.1%), and New Zealand (n = 1; 0.4%). Participants were female (*n* = 224; 79.7%), male (n = 55; 19.6%) and transgender (n = 1; 0.4%), with one person not indicating their gender. The average age of participants was 32.7 years (*SD* = 11.3; range = 18–65). Participants were employed full-time (50.5%), studying full-time (23.5%), employed part-time (15.7%), unemployed (2.8%) and other (e.g., on leave, retired; 7.5%).

2.1.2. Procedures

Ethics approval was attained for this study from the Human Research Ethics Committee. Participants were recruited through social media outlets, from September 14 to 28, 2016. Specifically, study information and a website link leading to the online survey was posted on Facebook and Twitter. To reach a larger proportion of our target sample

(i.e., adults aged 18–65), snowball sampling was used. Individuals who viewed the study information had the opportunity to "share" the original post among their own networks, which led to the study information reaching a broader network of potential participants.

Interested individuals were invited to click the website link, which took them to the online survey where they were presented with information regarding the study and were asked to provide informed consent. Participants then completed demographic and inclusion criteria questions. Individuals were excluded from completing the study if they reported having physical restrictions (i.e., injury, doctor's orders to not use stairs, and/or use walking aids) limiting their ability to take the stairs during the previous four weeks, and if they reported never having the choice between taking the stairs or the elevator. Participants who indicated they at least occasionally had the option of taking the stairs over an elevator were included in the study. Eligible participants then completed measures of individual stair use, motivations for taking the stairs, and normative perceptions of stair use. Completion of the survey took less than 10 min and occurred on an electronic device (e.g., portable cell phones, computer, laptop) when convenient. Participants were informed that at any time during the survey if they did not wish to participate any further, they could exit the survey by closing their web browser.

Of those who accessed the survey (N = 355), 17 consented but then did not complete any other questions (including demographics); 54 were deemed ineligible due to injury (n = 42) or if they reported never having to decide between taking the stairs and elevator (n = 12) and thus were excluded from the study; and four participants completed the demographics page, but none of the independent or dependent variable measures. As such, a total of 281 adults completed the survey.

2.1.3. Measures

Demographics. Participants reported their gender, age, employment status, and country of residence.

Personal reasons for stair use (motivations). To assess participants' reasons for taking the stairs, two questions adapted from ones used previously by Priebe and Spink (2011) to assess motivations for physical activity were used. The two questions in this study asked about different reasons which have been identified in the broader literature as motivating factors for stair use (Thomas et al., 2015). A general health-related question was asked first ("In deciding to take the stairs instead of the elevator, how important is it to you that it improves your health"), with the second related to energy expenditure ("In deciding to take the stairs instead of the elevator, how important is it to you that you will burn calories"). Participants answered each motivation on a 7-point Likert scale, ranging from 1 (not at all important) to 7 (very important). While other reasons have also been cited (Thomas et al., 2015), these two were chosen as they have also been used on prompts aimed at motivating people to take the stairs (Eves et al., 2006; Ferrara & Murphy, 2013).

Normative perceptions. As the conceptual definition of norms involves individual perceptions (Cialdini et al., 1990), the normative questions assessed individuals' perceptions about others' approval for stair use (injunctive norm) and their perceptions about the stair use of others (descriptive norm). This aligns with previous research conducted in activity settings which have assessed norm perceptions (Priebe & Spink, 2011; Spink, Crozier, & Robinson, 2013). Further, focus theory of normative conduct suggests that norms are more likely to motivate behaviour when the norm is salient, or focal, to the individual (Cialdini et al., 1990). In other words, individuals need to pay attention to normative information in order to act in norm-consistent ways (e.g., Berkowitz, 1972). It has been suggested when developing items to create salience among participants would be to provide more specificity regarding the reference group (Darker & French, 2009). In other words, norms are more likely to influence behaviour if information is provided about those who are more (versus less) relevant to the individual (Campo et al., 2003; Polonec, Major, & Atwood, 2006; Priebe & Spink, 2011). As such, individuals were specifically asked to reflect on their perception of those who were *important to them*, in an effort to prompt participants to think of the people who might influence them the most.

Two questions were used to assess normative perceptions. To assess the injunctive norm, participants were asked to answer, "How much do people who are important to you approve of you taking the stairs instead of the elevator?" Responses were made on a 9-point Likert scale, ranging from 1 (not very much) to 9 (very much so). For the descriptive norm question, participants responded to the question, "How often do people important to you take the stairs instead of the elevator?" on a 9-point Likert scale, ranging from 1 (never) to 9 (all of the time). Thus, for each item, higher numbers indicated grater norm perceptions for stair use.

Individual stair use. To assess how often participants used the stairs, one question was developed specifically for this study. Participants' were first instructed to reflect on instances when there was an option to take the stairs versus the elevator over the previous four weeks. The four-week time-frame was utilized as it was deemed a long enough period for participants to reflect on multiple opportunities where they had to choose either to take the stairs or the elevator. Participants' answered the question, "During the last four weeks, how often did you choose to take the stairs instead of the elevator?" Participants responded on a 9-point Likert scale, with anchors at 1 (never), 5 (half the time) and 9 (always).

2.1.4. Data analyses

To examine whether social factors related to stair use beyond participants' other reasons for taking the stairs (i.e., health, energy expenditure), a hierarchical regression analysis was conducted. The purpose for using hierarchical regression and the specific variable entry used was two-fold. First, we sought to replicate the data analysis methods used by Priebe and Spink (2011). Second, as previous experimental studies have mainly used messages targeting other reasons for stair use (health, energy expenditure), examining the relationship between social norms and stair use beyond these reasons was of interest to this study. As such, the two reasons for stair use (health, energy expenditure) were entered on step 1, while the injunctive- and descriptive-norm perceptions were entered on step 2 of the regression equation as the independent variables. Individual stair use was entered as the dependent variable.

2.2. Results

2.2.1. Preliminary analyses

Prior to conducting the main analysis, data were screened for outliers and normality using histograms and standardized scores. No outliers were found, and all variables were normally distributed; scatterplots of the standardized residuals showed randomly scattered points with no distinct pattern. Further, collinearity statistics (tolerance = 0.71-0.91; VIF = 1.1–1.4) were all within acceptable values (O'Brien, 2007). Taken together, results indicate that the assumptions for linearity and homoscedasticity were met, and multicollinearity was not an issue in the present dataset. However, it was found that 37 participants had missing data on relevant items. As suggested by McKnight, McNight, Sidani, and Figueredo (2007), Little's (1988) test was conducted to examine how data were missing (e.g., missing completely at random, missing not at random) across the variables. A non-significant chi-square test (χ^2 (16) = 10.98, p = .81) was found, suggesting that the data were missing completely at random (MCAR). As such, analyses were conducted using listwise deletion. Descriptive statistics (means, standard deviations, correlations) of all variables can be found in Table 1.

2.2.2. Main analyses

Results of the overall regression model including both the individuals' reasons and normative perceptions were significant, F(4,

Table 1
Descriptive statistics and correlations among study variables in study 1.

	Mean	*SD*	Scale	1	2	3	4	5
1) Stair Use	7.62	2.16	1–9	–				
Motivations			1–7					
2) Health	5.75	1.47		.18**	–			
3) Burn Calories	4.75	1.83		.15**	.52**	–		
Norm Perceptions			1–9					
4) Injunctive	6.61	2.35		.22**	.07	.19**	–	
5) Descriptive	6.03	2.16		.21**	.02	.03	.29**	–

Note. **$p < .01$.

239) = 6.66, $p < .001$, explaining 10.2 percent of variance in stair use. Upon examination of variable entry into the regression model, the reported reasons (motivations) entered onto the first step significantly predicted stair use, $F(2, 241) = 4.52$, $p = .01$, and explained 3.6 percent of the variance. Taking the stairs for health ($\beta = 0.14$, $p = .05$, $\eta_p^2 = .12$) was positively related to stair use, however energy expenditure was not a significant motivation related to stair use ($p = .32$).

As predicted, the addition of the normative perceptions on the second step was significant, F_{change} (2, 239) = 8.70, $p < .001$, explaining an additional 6.5 percent of the variance in stair use. Of main interest to this study, both descriptive norm ($\beta = 0.17$, $p = .01$, $\eta_p^2 = .16$) and injunctive norm ($\beta = 0.15$, $p = .02$, $\eta_p^2 = .14$) perceptions positively predicted stair use (see Table 2). Further, the health reason maintained its positive relationship with stair use ($\beta = 0.15$, $p = .04$, $\eta_p^2 = .17$).

2.3. Study 1 discussion

The results of Study 1 provide preliminary evidence that social norm perceptions may be an important factor to consider when assessing stair use. These results extend those found by Priebe and Spink (2011), by showing a positive relationship between different social norms and physical activity. As majority of research guided by focus theory of normative conduct in physical activity has focused on the descriptive norm (Crozier & Spink, 2017a; Priebe & Spink, 2011), by including the assessment of injunctive norm perceptions as well, these findings add to the growing literature on social norms in activity settings (Kim et al., 2017).

In addition, results align with previous research, whereby social norm perceptions were associated with stair use beyond an individual's reasons for taking the stairs (Priebe & Spink, 2011). This finding suggests that social norms are an important factor to consider when considering what motivates individuals to take the stairs, providing initial support for the use of social prompts to increase stair use. Further, although it was found that the associated health benefits were a reason that was positively related to individual stair use, an individual's motivation to expend energy was not significantly related to taking the stairs. While stair prompt intervention studies have sometimes used energy expenditure as a motivator to increase stair use (Eckhardt, Kerr, & Taylor, 2015; Ford & Torok, 2008), the results of Study 1 suggest that burning calories while taking the stairs may not be the most important reason to target in these prompts. However, given that health benefits and energy expenditure were moderately correlated ($r = 0.52$, Table 1), it may be that the positive effect found for health benefit reasons was limiting the ability to find that being motivated to take the stairs to burn calories a significant predictor of stair use.

In summary, the results of Study 1 showed that both descriptive and injunctive norms, as well as health beliefs, predicted stair use. The results of Study 1 thus guided the design of stair prompts used in Study 2.

Table 2
Hierarchical regression results for descriptive and injunctive norms predicting stair use.

Independent Variables	β	η_p^2	R^2	R_Δ^2	F_Δ	$F_{overall}$
Step 1			.037			4.57*
Motivations						
Health	.14*	.12				
Burn Calories	.09	.07				
Step 2			.101	.064	8.46	6.66**
Motivations						
Health	.14*	.12				
Burn Calories	.08	.07				
Norm Perceptions						
Injunctive	.15*	.14				
Descriptive	.17*	.16				

Note. *$p < .05$, **$p < .01$. η_p^2 = partial eta square

3. Study 2

3.1. Methods

3.1.1. Participants

Participants were adults using either a stairwell or an elevator to go up or down one or more levels in one building on a university campus. All participants appeared to be 18 years of age or older. As majority of individuals using the elevators would be students or staff, the typical age range of participants would be 18–65 years old, although some (visitors to the building, staff) may have been older. Participants who appeared to have a reason for using the elevator instead of the stairs (i.e., observable/obvious injury, moving a trolley, carrying a large/heavy item) were not included.

3.1.2. Procedure

One building on a university campus was identified to conduct the observational study. This building was a seven-story building with five upper floors that consisted largely of faculty offices, department offices, and classrooms. The ground-level consisted of a student lounge and one large classroom, and the one lower level housed a general practitioner clinic, an exercise physiology laboratory, and a small university-run gym facility. This building had a bank of three elevators, with one stairwell located approximately 20 feet to the left of the elevators, which was not directly visible (i.e., around a corner). Ethical approval was obtained by the Human Research Ethics Board prior to conducting the research, and university management dictated the approved weeks/months available to conduct the research.

Observations were conducted during four weeks of a semester, for 2 h per day, five days a week. While some observation periods were busier than others (e.g., as students were entering or leaving classes), observers reported no problems recording data during these busy times. The times selected for observation were varied throughout the week, and were made during the same time periods each week.

To assess elevator use, observers were trained undergraduate students positioned on the ground level of the building so that they could clearly see the elevator. One observer recorded the number of individuals entering the elevator, using pencil and paper. The observer situated themselves in an inconspicuous location and hid the fact that they were counting people. Observers included only individuals who appeared to be at least 18 years old and excluded individuals who had an observable legitimate reason for using the elevator (i.e., mobility issues, carrying large items). If observers were questioned as to their purpose, a one-page flyer was given to interested individuals explaining the purpose of the observer and they were asked to allow the observer to continue counting uninterrupted. This occurred twice during the observation periods, and observers indicated this interaction did not interfere with counting people entering the elevators.

As the stairs were not visible from the elevators, it was impossible for the one observer to also record stair use. As such, to assess frequency of stair use, a digital bi-directional LCD display people counter was installed on either side of the stairwell, and counted the number of

people entering and exiting the stairwell. Data were collected continuously, and observers were trained to examine the count on the display before and after each observation period to determine the number of individuals who entered the stairs.

A time-series experimental design, with two baseline periods, was used. Data collection occurred from February to the end of March 2017. To determine baseline stair use, no signs were posted during the first week of observation. The social prompts were then posted for two weeks, with observation of the intervention effect occurring during the second week. After the second week, the signs were removed and no observations occurred for three weeks. This control period was similar in length to other stair-prompt studies utilising a time-series experimental design (e.g., Marshall et al., 2002), and included a mid-semester teaching break and a state holiday. Observations then resumed for one-week with no signs posted, to act as a second baseline period. The non-social prompts were then posted for two weeks, with observations occurring during the second week. At the conclusion of the study, posted signs were removed.

3.1.3. Messages

During the two intervention periods, two 8.5-inch by 11-inch signs were posted at approximately eye-level, just above each of the elevator call buttons. Each sign had the same tag line "Step Up", with a stick-figure person walking up a set of stairs, and the university logo located in the bottom right corner. The signs during the first intervention period had a social focus, whereas the signs during the second intervention period had a non-social focus.[1]

Social prompts. The design of the social prompts were guided by the results of Study 1, as well as the tenets of focus theory of normative conduct (Cialdini et al., 1990). Specifically, the social prompts were designed to try to influence individuals' perceptions of others' behaviour as well as others approval of stair use. However, as the baseline data indicated that a majority of individuals were *not* taking the stairs (see results below), providing a message that *most* staff and students took the stairs was deemed unbelievable. In addition, previous research has shown that indicating *few* are engaging in a behaviour is detrimental to behaviour change (Stok, De Ridder, De Vet, & De Wit, 2012). Therefore, in an attempt to change individuals' perceptions that others relevant to potential participants (e.g., staff, students) were taking the stairs, the prompt read, "We're doing it! Are you? Join staff and students in taking the stairs today!" with two stick figures using the stairs. Though not providing a particular statistic as to how many people use the stairs, the message was suggesting that others (staff and students) use the stairs. To target others' approval levels, the prompt read, "Take the stairs today! Most staff and students think we should increase stair use on campus" along with happy faces surrounding the stick figure.

Non-social prompts. The non-social prompts were developed to encourage individuals to take the stairs for (a) their health, and (b) to expend energy (calories/kilojoules). These two messages were chosen as they reflect cited reasons why individuals take the stairs (Thomas et al., 2015), and similar messages have been used previously in point-of-decision prompt research to encourage stair use (Eves et al., 2006; Ferrara & Murphy, 2013). The health message read, "Did you know … regular stair climbers have stronger lungs, legs and hearts? Take the stairs for your health!" with a red heart superimposed on the stick-figure's chest. To target energy expenditure, the sign read, "Did you know … Stair climbing burns seven times more calories than taking the lift? Burn calories – take the stairs!" with kilojoules located on every other step of the stairs.

3.1.4. Data analysis

The proportion of individuals who used the stairs instead of the elevator before and after each intervention period was calculated by dividing the number of people who entered the stairs by the total number of individuals who entered the stairs *and* the elevator during that period of observation. As highlighted above, individuals who were deemed to have an observable legitimate reason for choosing the elevator over the stairs were not included. The proportion of stair users from baseline to intervention period were then compared. Chi-square analyses were used to compare whether the proportion of individuals using the stairs from baseline to the intervention period were significantly different.

3.2. Results

Over the four weeks, a total of 8007 counts were measured either using the stairs (n = 1851) or the elevator (n = 6156) during observation periods (40 h of observation over the four weeks). The proportion of stair users over the study periods can be seen in Table 3.

3.2.1. Change in proportion of stair use

Results of the chi-square analyses indicated a significant change in stair use in the social prompts condition, $\chi^2(1, N = 4215) = 5.85$, $p = .02$, 95% CI [0.565–5.70], from the first baseline to intervention period. When looking at Table 3, a 3.13% increase was observed in the proportion of individuals using the stairs compared to the elevator. In contrast, no significant effect was found in the non-social prompts condition, $\chi^2(1, N = 3794) = 0.17$, $p = .68$, 95% CI [-2.17–3.33], with only a 0.57% increased proportion of stair use among participants during the second intervention period compared to the second baseline.

3.3. Study 2 discussion

The results of Study 2 indicated that social prompts were effective at increasing the proportion of individuals taking the stairs versus the elevator. This finding aligns with previous point-of-decision prompt research which found descriptive norm information about others behaviour decreased elevator use (Burger & Shelton, 2011). Study 2 results provide preliminary evidence that social messages with a normative intent (i.e., to increase the perception that others approved of or were taking the stairs), when presented simultaneously, can have a positive effect on stair use. These findings support previous research in sport, which found both descriptive and injunctive norm messages to positively influence self-reported effort to a similar degree (Crozier & Spink, 2017b).

Results also indicated that the non-social messages did not increase stair use. One potential reason for this discrepancy is that Study 2 assessed the impact of non-social prompts *after* measuring the impact of the social prompts. As previous research has shown health-focused prompts to be effective at increasing stair use (Eves et al., 2006), the current results only suggest that the non-social prompts used in Study 2 did not *further* increase stair use beyond the effects of the social prompts. Indeed, the social prompts increased stair use by 3.1%, which is slightly higher than the average 2.2% increase found with stair use intervention research (Bauman et al., 2016). It may be that the non-social prompts were not effective simply due to being the second message presented. As we were provided access to only one multi-story building, it was not possible to compare the impact of social versus non-social prompts. As such, the results only suggest that the non-social prompts did not *further* increase behaviour change. Future research could explore the effects of message (social versus non-social) content by using a multi-building experimental design.

3.4. General discussion

The purpose of these two studies were to (1) examine the relationship between social norm perceptions and self-reported stair use, and (2) to explore the impact of social and non-social prompts on stair use. Results provide additional evidence of the positive relationship

[1] To view the four prompts, please contact the corresponding author.

Table 3
Proportion of participants using the stairs.

	Baseline	Intervention
1) Social Prompt	21.29	24.42*
2) Non-Social Prompt	23.24	23.81

Note. *change from baseline to intervention is significant at $p < .05$

between social perceptions and physical activity: Study 1 found a positive association between both descriptive and injunctive norm perceptions and self-reported stair use in an adult population, while Study 2 found social prompts to increase the proportion of individuals using the stairs in a university building.

In line with the focus theory of normative conduct (Cialdini et al., 1990), findings indicate that perceiving stair use as *typical* and *desirable* are factors related to individual stair use. This adds to the growing literature showing a positive relationship between social norms and physical activity (Crozier & Spink, 2017b; Priebe & Spink, 2011, 2012; Rhodes & Courneya, 2003). Further, the results of Study 2 found social prompts to be effective at increasing stair use, adding to the literature showing the positive effect of social norm messages on different physical activity behaviours (Crozier & Spink, 2017a; Priebe & Spink, 2012, 2015).

The findings of the current study also add to the messaging literature in physical activity settings. Recent research has shown that providing individuals with a message emphasising the group benefits of an exercise class (i.e., forming relationships with class members), was related to greater affective attitudes, task self-efficacy and intentions to attend the class compared to messages emphasising the personal benefits of an exercise class (Howle et al., 2017). Similarly, the current study found that emphasising others behaviour and expectations led to an increased proportion of individuals taking the stairs, while messages emphasising personal benefits (i.e., health, energy expenditure) did not further increase stair use. Taken together, there is increasing evidence indicating messages with a social focus may be more beneficial than other non-social messages at influencing individual physical activity cognitions and behaviours.

Some researchers have recently argued that there is sufficient evidence regarding the use of signage-based stair use interventions (Bauman et al., 2016). While the main purpose of the current study was not to determine whether point-of-decision prompts were effective, I sought to explore the content of the message more specifically. In particular, the current study adds to the stair prompt literature by targeting a different motivational basis (i.e., social motivation) than what majority of the other stair prompt interventions have targeted (i.e., health, energy expenditure). As the relative increase in stair use observed in the current study (3.1%) was similar to that seen in most stair interventions (2.2%; Bauman et al., 2016), results provide an additional type of motivational message that health promotion specialists may use, if wanting to find an alternative to the typical health messages used previous.

The use of a two-study design was a strength of this research, as the results of Study 1 guided the development of the prompts used in Study 2. As research suggests that messages should be evaluated prior to implementation to make sure the message content is appropriate for the target population (Bauman, Smith, Maibach, & Reger-Nash, 2006), Study 1 provided evidence of a positive relationship between social perceptions and stair use among an adult population. As such, the social prompts were designed to reflect social perceptions, and results indicated these messages increased stair use, providing additional evidence to the potential impact of social messages on physical activity patterns (Crozier & Spink, 2017a; Howle et al., 2017; Priebe & Spink, 2012, 2015).

Despite this, several limitations are noteworthy. In Study 1, each variable was only measured by one-item developed specifically for this study. While use of a multiple-item measure would allow for the estimation of a measure's reliability (Loo, 2002), researchers have found that single-item and multiple-item scales often have similar construct validity and method variance, suggesting that neither method is superior to the other (Gardner, Cummings, Dunham, & Pierce, 1998). The use of single-item measures to assess personal reasons for physical activity and normative perceptions was guided by previous research (Priebe & Spink, 2011; Spink et al., 2013), and compliments how normative perceptions have been conceptualised (Ajzen, 1991; Cialdini et al., 1990). In addition, as the purpose of this study was to assess an individual's *overall* perception of their own stair use, previous research has supported the use of one-item to assess similar global-type questions (Gardner et al., 1998). However, it is recognized that self-reported stair use may differ from actual stair use, and results of Study 1 should be interpreted as showing a relationship between normative perceptions and self-reported stair use.

A limitation of Study 2 relates to the social prompt that was aimed at targeting the perception of others stair use (i.e., descriptive norm). In contrast to previous research (Burger & Shelton, 2011; Crozier & Spink, 2017a; Priebe & Spink, 2012, 2015), the current study did not provide a prevalence number indicating that a majority of individuals used the stairs. However, baseline data of Study 2 indicated that less than 22 percent of participants were taking the stairs. In other words, it was descriptively normative to *not* take the stairs. Therefore, indicating that a majority of people took the stairs for the social prompt may have been unbelievable to participants using the stairs. As such, the prompt did not directly identify that stair use was descriptively normative, and only implied that others were using the stairs. However, recent research has identified that when a message indicates that a minority norm is *trending* to increase, an increase in the uptake of that behaviour follows (Mortensen et al., 2017). Thus, future research may wish to assess the effects of a message indicating that physical activity is not the norm, but is becoming more popular (i.e., trending minority norm), on individuals' physical activity levels.

Further, the two social prompts were presented simultaneously in the social prompt intervention. As such, whether the increase in stair use occurred because of the presence of only one of the messages cannot be determined. However, as focus theory suggests that descriptive and injunctive norms motivate behaviour through different pathways (Cialdini et al., 1990), examining the impact of messages emphasising what is *typical* compared to messages that emphasise what is *desirable* is an important avenue for future research. Despite this, the results of Study 2 did provide additional evidence to the limited research examining social prompts on stair use (Burger & Shelton, 2011).

As focus theory (Cialdini et al., 1990) suggests that norms will only influence behaviour when made salient, it may be that the results of Study 2 were impacted by using a less salient referent group. Whereas Study 1 focused on norm perceptions of *important others* as the referent group, Study 2 used *staff and students* as the referent group within the social prompts. The results of Study 2 may have been stronger if a *more* important referent group (i.e., friends) was used. Indeed, previous research has found that the norms of friends have been more strongly related to physical activity behaviour than other colleagues/students (Priebe & Spink, 2011). Though the referent group 'staff and students' were used in Study 2 to make the messages applicable to most individuals that would encounter the intervention, future researchers will want to consider using more salient referent groups to enhance the effect of normative messages.

Last, Study 2 was conducted in only one-building on a university campus, which limits the generalisability of the findings. Having only one building also limited the researchers to a time-series design with two baseline periods. As such, the proportion of participants taking the stairs prior to the first intervention was much lower than prior to the second intervention. This may explain why a larger increase was observed after the social prompts compared to the non-social prompts. Potentially, the time between the first and second intervention was not

long enough to bring activity levels back to initial baseline level, which indicates a carryover effect from the first intervention. As such, the independent effect of the non-social prompts may have been undermined as those messages were implemented second.

In addition, it is unclear at this stage whether results would have differed if the order of the messages was reversed (i.e., the non-social messages were presented prior to the normative message). Indeed, researchers have found that social norms predicted self-reported physical activity beyond individuals' health motivations (Priebe & Spink, 2011), suggesting that social norms may be able to explain behaviour beyond non-social reasons. Further, as researchers have shown that attaching descriptive norm information with positive outcome expectations is effective for physical activity engagement (Crozier & Spink, 2017a), it may be that a greater increase in stair use would be found when social messages are combined with non-social content (e.g., health outcomes). However, future research with access to multiple buildings similar in design would be better able to tease apart the influence of social versus non-social prompts.

4. Conclusion

Taken together, the results of these two studies highlight the potential power of social influence to increase a specific physical activity task: stair use. The findings add to the evidence base that prompts are an effective tool to increase stair use (Bauman et al., 2016) by providing support for the positive impact of social messages (Burger & Shelton, 2011). Health practitioners interested in increasing stair use in office or university settings may wish to harness the power of social influence and emphasise that stair use is *typical* and *desirable*.

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References

Abraído-Lanza, A. F., Shelton, R. C., Martins, M. C., & Crookes, D. M. (2017). Social norms, acculturation, and physical activity among Latina women. *Journal of Immigrant and Minority Health, 19*, 285–293.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*, 179–211. https://doi.org/10.1016/0749-5978(91)30020-T.

Bauman, A., Milton, K., Kariuki, M., Fedel, K., & Lewicka, M. (2016). Is there sufficient evidence regarding signage-based stair use interventions? A sequential meta-analysis. *BMJ Open, 7*, e012459. https://doi.org/10.1136/bmjopen-2016-012459.

Bauman, A., Smith, B. J., Maibach, E. W., & Reger-Nash, B. (2006). Evaluation of mass media campaigns for physical activity. *Evaluation and Program Planning, 29*, 312–322.

Bellicha, A., Kieusseian, A., Fontvieille, A.-M., Tataranni, A., Charreire, H., & Oppert, J.-M. (2015). Stair-use interventions in worksites and public settings—a systematic review of effectiveness and external validity. *Preventive Medicine, 70*, 3–13.

Berkowitz, L. (1972). Social norms, feelings, and other factors affecting helping and altruism. In L. Berkowitz (Ed.). *Advances in experimental social psychology* (pp. 63–108). (6th ed.). San Diego, CA: Academic Press.

Boreham, C. A., Wallace, W. F., & Nevill, A. (2000). Training effects of accumulated daily stair-climbing exercise in previously sedentary young women. *Preventive Medicine, 30*, 277–281.

Burger, J. M., & Shelton, M. (2011). Changing everyday health behaviors through descriptive norm manipulations. *Social Influence, 6*, 69–77.

Campo, S., Brossard, D., Frazer, M. S., Marchell, T., Lewis, D., & Talbot, J. (2003). Are social norms campaigns really magic bullets? Assessing the effects of students' misperceptions on drinking behaviour. *Health Communication, 15*, 481–497. https://doi.org/10.1207/S15327027HC1504_06.

Canadian Society for Exercise Physiology (2011). Canadian physical activity guidelines for adults – 18-64 years. Retrieved from http://www.csep.ca/CMFiles/Guidelines/CSEP_PAGuidelines_adults_en.pdf.

Cialdini, R. B., Reno, R. R., & Kallgren, C. A. (1990). A focus theory of normative conduct: Recycling the concept of norms to reduce littering in public places. *Journal of Personality and Social Psychology, 58*, 1015–1026. https://doi.org/10.1037/0022-3514.58.6.1015.

Cialdini, R. B., & Trost, M. R. (1998). Social influence: Social norms, conformity and compliance. In D. T. Gilbert, S. T. Fiske, & G. Lindzey (Vol. Eds.), *Handbook of social psychology: 2*, (pp. 151–192). New York, NY: McGraw-Hill.

Crozier, A. J., & Spink, K. S. (2017a). Effect of manipulating descriptive norms and positive outcome expectations on physical activity of university students during exams. *Health Communication, 32*, 784–790. https://doi.org/10.1080/10410236.2016.1172295.

Crozier, A. J., & Spink, K. S. (2017b). Examining the effects of normative messages on perceived effort in sport. *The Sport Psychologist, 31*, 56–64.

Darker, C. D., & French, D. P. (2009). What sense do people make of a theory of planned behaviour questionnaire? *Journal of Health Psychology, 14*, 861–871.

Eckhardt, M. R., Kerr, J., & Taylor, W. C. (2015). Point-of-decision signs and stair use in a university worksite setting: General versus specific messages. *American Journal of Health Promotion, 29*, 291–293.

Eves, F. F., Webb, O. J., & Mutrie, N. (2006). A workplace intervention to promote stair climbing: Greater effects in the overweight. *Obesity, 14*, 2210–2216.

Fardy, P. S., & Ilmarinen, J. (1974). Evaluating the effects and feasibility of an at work stairclimbing intervention program for men. *Medicine & Science in Sports, 7*, 91–93.

Ferrara, C., & Murphy, D. (2013). Motivational signs, artwork, and stair use in a university building. *California Journal of Health Promotion, 11*, 76–83.

Ford, M. A., & Torok, D. (2008). Motivational signage increases physical activity on a college campus. *Journal of American College Health, 57*, 242–244.

Gardner, D. G., Cummings, L. L., Dunham, R. B., & Pierce, J. L. (1998). Single-item versus multiple-item measurement scales: An empirical comparison. *Educational and Psychological Measurement, 58*, 898–915.

Healy, G. N., Matthews, C. E., Dunstan, D. W., Winkler, E. A., & Owen, N. (2011). Sedentary time and cardio-metabolic biomarkers in US adults: NHANES 2003-06. *European Heart Journal, 32*, 590–597. https://doi.org/10.1093/eurheartj/ehq451.

Healy, G. N., Winkler, E. A. H., Brakenridge, C. L., Reeves, M. M., & Eakin, E. G. (2015). Accelerometer-derived sedentary and physical activity time in overweight/obese adults with type 2 diabetes: Cross-sectional associations with cardiometabolic biomarkers. *PLoS One, 10*, e0119140. https://doi.org/10.1371/journal.pone.0119140.

Howle, T. C., Dimmock, J. A., Ntoumanis, N., Chatzisarantis, N. L., Sparks, C., & Jackson, B. (2017). The impact of agentic and communal exercise messages on individuals' exercise class Attitudes, self-efficacy beliefs, and intention to attend. *Journal of Sport & Exercise Psychology, 39*, 397–411. https://doi.org/10.1123/jsep.2017-0084.

Kennedy, R. A., Boreham, C., Murphy, M. H., Young, I. S., & Mutrie, N. (2007). Evaluating the effects of a low volume stairclimbing programme on measures of health-related fitness in sedentary office workers. *Journal of Sports Science and Medicine, 6*, 448–454.

Kim, J., Dunn, E., Rellinger, K., Robertson-Wilson, J., & Eys, M. (2017). Social norms and physical activity in American and Canadian contexts: A scoping review. *International Review of Sport and Exercise Psychology,* 1–23. https://doi.org/10.1080/1750984X.2017.1354229.

Levine, J. A., Vander Weg, M. W., Hill, J. O., & Klesges, R. C. (2006). Non-exercise activity thermogenesis: The crouching tiger hidden dragon of societal weight gain. *Arteriosclerosis, Thrombosis, and Vascular Biology, 26*, 729–736. https://doi.org/10.1161/01.ATV.0000205848.83210.73.

Little, R. J. (1988). A test of missing completely at random for multivariate data with missing values. *Journal of the American Statistical Association, 83*, 1198–1202.

Locke, E. A. (2015). Theory building, replication, and behavioral priming: Where do we need to go from here? *Perspectives on Psychological Science, 10*, 408–414. https://doi.org/10.1177/1745691614567231.

Loo, R. (2002). A caveat on using single-item versus multiple-item scales. *Journal of Managerial Psychology, 17*, 68–75. https://doi.org/10.1108/02683940210415933.

Loy, S. F., Conley, L. M., Sacco, E. R., Vincent, W. J., Holland, G. J., Sletten, E. G., & Trueblood, P. R. (1994). Effects of stairclimbing on VO2 max and quadriceps strength in middle-aged females. *Medicine & Science in Sports & Exercise, 26*, 241–247.

Marshall, A. L., Bauman, A. E., Patch, C., Wilson, J., & Chen, J. (2002). Can motivational signs prompt increases in incidental physical activity in an Australian health-care facility? *Health Educ. Res. 17*, 743–749. https://doi.org/10.1093/her/17.6.743.

McKnight, P. E., McNight, K. M., Sidani, S., & Figueredo, A. J. (2007). *Missing data: A gentle introduction.* New York, NY: The Guilford Press.

Mortensen, C. R., Neel, R., Cialdini, R. B., Jaeger, C. M., Jacobson, R. P., & Ringel, M. M. (2017). Trending norms: A lever for encouraging behaviors performed by the minority. *Social Psychological and Personality Science, 1-10*. https://doi.org/10.1177/1948550617734615 Advanced online copy.

Nigg, C. R., Lippke, S., & Maddock, J. E. (2009). Factorial invariance of the theory of planned behavior applied to physical activity across gender, age, and ethnic groups. *Psychology of Sport and Exercise, 10*, 219–225. https://doi.org/10.1016/j.psychsport.2008.09.005.

O'Brien, R. M. (2007). A caution regarding rules of thumb for variance inflation factors. *Quality and Quantity, 41*, 673–690. https://doi.org/10.1007/s11135-006-9018-6.

Obiaka, L. A. (2014). *Promoting worksite stair use by launching the "stepping up campaign": A mixed methods study.* Ph.D. DissertationThe University of Alabama at Birmingham.

Okun, M. A., Karoly, P., & Lutz, R. (2002). Clarifying the contribution of subjective norm to predicting leisure-time exercise. *American Journal of Health Behavior, 26*, 296–305.

Okun, M. A., Ruehlman, L., Karoly, P., Lutz, R., Fairholme, C., & Schaub, R. (2003). Social support and social norms: Do both contribute to predicting leisure-time exercise? *American Journal of Health Behavior, 27*, 493–507.

Penedo, F. J., & Dahn, J. R. (2005). Exercise and well-being: A review of mental and physical health benefits associated with physical activity. *Current Opinion in Psychiatry, 18*, 189–193.

Polonec, L. D., Major, A. M., & Atwood, L. E. (2006). Evaluating the believability and effectiveness of the social norms message "most students drink 0 to 4 drinks when they party". *Health Communication, 20*, 23–34.

Priebe, C. S., & Spink, K. S. (2011). When in Rome: Descriptive norms and physical activity. *Psychology of Sport and Exercise, 12*, 93–98. https://doi.org/10.1016/j.

psychsport.2010.09.001.
Priebe, C. S., & Spink, K. S. (2012). Using messages promoting descriptive norms to increase physical activity. *Health Communication, 27*, 284–291. https://doi.org/10.1080/10410236.2011.585448.
Priebe, C. S., & Spink, K. S. (2015). Less sitting and more moving in the office: Using descriptive norm messages to decrease sedentary behavior and increase light physical activity at work. *Psychology of Sport and Exercise, 19*, 76–84. https://doi.org/10.1016/j.psychsport.2015.02.008.
Rhodes, R. E., & Courneya, K. S. (2003). Investigating multiple components of attitude, subjective norm, and perceived control: An examination of the theory of planned behaviour in the exercise domain. *British Journal of Social Psychology, 42*, 129–146. https://doi.org/10.1348/014466603763276162.
Sallis, J. F., Linton, L., & Kraft, M. K. (2005). The first active living research conference: Growth of a transdisciplinary field. *American Journal of Preventive Medicine, 28*, 93–95.
de Souto Barreto, P. (2015). Has WHO set a smart goal for physical activity? *British Medical Journal, 350*, 15–17.
Spink, K. S., Crozier, A. J., & Robinson, B. (2013). Examining the relationship between descriptive norms and perceived effort in adolescent athletes: Effects of different reference groups. *Psychology of Sport and Exercise, 14*, 813–818. https://doi.org/10.1016/j.psychsport.2013.06.006.
Stok, F. M., De Ridder, D. T., De Vet, E., & De Wit, J. B. (2012). Minority talks: The influence of descriptive social norms on fruit intake. *Psychology and Health, 27*, 956–970. https://doi.org/10.1080/08870446.2011.635303.
Thomas, E. L., Puig Ribera, A., Senye-Mir, A., Greenfield, S., & Eves, F. (2015). Testing messages to promote stair climbing at work. *International Journal of Workplace Health Management, 8*, 189–205.
Tremblay, M. S., Warburton, D. E., Janssen, I., Paterson, D. H., Latimer, A. E., Rhodes, R. E., … Zehr, L. (2011). New Canadian physical activity guidelines. *Applied Physiology Nutrition and Metabolism, 36*, 36–46.