



## Public perceptions on the role of wayfinding in the promotion of recreational walking routes in greenspace—Cross-sectional survey

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### ABSTRACT

The study explored public perceptions of the role that wayfinding signage can play to enhance engagement with recreational walking routes in greenspaces. A mixed-methods online survey was distributed within Northampton, England and there were 266 respondents. The survey had Likert scale and open text answer options to allow for respondents to share richer opinions. Key themes suggested recreational wayfinding signage could increase participants' confidence to explore, perceptions of safety, motivation to walk further, and reduced anxiety. 33% strongly agreed that wayfinding signage for recreational walking routes should be installed in public parks and footpaths. Respondents felt strongly that motivational statements and monthly route usage statistics should not be included on signage. Wayfinding signage may promote increases in greenspace physical activity by addressing anxiety, confidence, safety, motivational and social norm barriers.

### 1. Introduction

Public Health England recommends that access to greenspace must be improved as a method to address ongoing population health issues, including physical inactivity, mental health, and wellbeing (Public Health England, 2020). Globally, there has been an increased focus on the engagement with open-green-blue spaces for physical activity and well-being enhancement, with the International Society for Physical Activity and Health identifying Active Urban Design as one of eight key investments to enhance physical activity levels (International Society for Physical Activity and Health, 2020), the World Health Organisation publishing multiple reports on greenspace and health (WHO, 2017; World Health Organization Regional Office for Europe, 2016), and multiple agencies within the United Kingdom issuing guidance and recommendations on how the environment can influence physical activity participation (NICE, 2019; Public Health England, 2016; Sport England, 2019a). Access to greenspace often focusses on the distance from homes, the amount of greenspace, and the physical accessibility for those with limited mobility. However, little attention has been paid to the coherence or navigation of greenspace, known as wayfinding, as a potential barrier to walking for recreation activities within these environments (Vandenberg et al., 2016).

The National Institute for Health and Care Excellence (NICE)

recommends the implementation of community-wide walking programmes are based on accepted theoretical frameworks of behaviour change (National Institute for Health & Care Excellence (NICE), 2012). The COM-B (Capability, opportunity, motivation, behaviour) model identifies three essential conditions for behaviour change: capability, opportunity, and motivation, which are encapsulated by nine intervention functions aimed at addressing deficits in one or more of these conditions (Michie et al., 2011). Within the current study, for example, people may be more likely to walk for recreation if they have the capability, opportunity, and motivation to engage in walking over other activities. Wayfinding signage may then facilitate increased walking through components of the behaviour change wheel such as: Persuasion, Environmental Restructuring, Modelling, Education, and Enablement (Michie et al., 2011). Furthermore, the design of wayfinding signage for recreational walking and subsequent interventions to determine wayfinding signage efficacy for increasing walking could impact the outer Policy behaviour change wheel, by informing design Guidelines, Regulation of installation or locations, and Environmental/Social Planning policies.

Walking for recreation is one of the most accessible forms of physical activity. Throughout the coronavirus pandemic, there has been a surge in participation in England, with an estimated increase of 2.2–2.5 million people engaging in recreational walking activities between May

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to November 2020, in comparison to 2019 (Sport England, 2021a). However, in Northampton, England (the location of the current research) only 38.7% participated in walking for recreation in the last 28 days, in comparison with 44.8% for the rest of England (May 2019–2020 Active Lives Query Tool (Sport England, 2021b)). Research has focused on identifying key barriers and facilitators to recreational walking. For example, a Scottish focused review identified 12 factors, one of which being ‘knowledge of routes and options’, as an important facilitator as resources, such as maps, can provide reassurance of route suitability (Kelly et al., 2019) and potentially reduce the fear of becoming lost. This review called for an increased provision of local route and mapping information, as well as for research to address evidence gaps on where, and for whom, this information is most needed and what the most suitable format is for communicating this information (Kelly et al., 2019). Wayfinding signage is defined as purposely located information to assist “the interactive, problem-solving process by which people use environmental information to locate themselves and navigate from place-to-place” (Vandenberg et al., 2016) and could provide a solution to address (Kelly et al., 2019) recommendations and reduce barriers to recreational walking.

Investment in wayfinding signage is an important facilitator to greenspace usage. Findings from Los Angeles, USA found that investment in signage explained 37% and 39% of the variance of increases in park users and energy expenditure, respectively, with Park Authorities spending 51% of a \$4000 budget on signage (Cohen et al., 2013). When given the opportunity, 32 out of 33 intervention parks (Cohen et al., 2013) invested in signage, demonstrating that signage is a popular investment for Parks Authorities and thus requires further investigation to determine the most effective design principles for signs to maximise physical activity participation within greenspace.

Small-scale interventions, like wayfinding signage, tend to have less barriers to implementation unlike large scale changes to the environment, such as segregated on-road cycle lanes (Aldred et al., 2019). There are some promising examples of such small-scale interventions. For example, a Scottish intervention to upgrade paths and host group activities within woodland significantly increased physical activity, visits to local woodlands, and connectedness to nature, in comparison to control locations (Ward Thompson et al., 2019). Whilst in Estonia, temporary upgrades to a coastline wasteland, which included path resurfacing, sunbathing decking, trimming of vegetation, changing areas, and seating resulted in an increase in physical activity and increase in women visiting the area (Unt and Bell, 2014). Finally, in Hong Kong, the installation of 27 moveable (32 cm × 32 cm × 32 cm) polyethylene boxes in three public spaces increased social activity, sitting opportunities, and, unexpectedly, children playing with the boxes (Rossini, 2019). These examples of small-scale interventions demonstrate that human behaviour can be positively influenced for a relatively small amount of investment and commitment in environmental interventions.

The current research article is part of a larger research project that has installed recreational wayfinding signage along a circular walking route within Delapré Park, Northampton, England as part of a collaborative project between the University of Northampton, Delapré Abbey Preservation Trust, and Northamptonshire Sport (project pre-registered (Ryan, 2021)). The larger research project is currently (at the time of writing) monitoring changes in footpath use along the newly signposted walking route across a 12-month follow-up period as well as conducting ‘go-along’ interviews with park users to understand how and why they interact with the new signposts. The current participatory study occurred at the start of the research project and focused on enhancing public engagement and identifying perceptions toward the proposed installation of wayfinding signage at Delapré Park, Northampton, England to assist walking for recreation. The aim of the current study was to determine public perceptions of wayfinding signage for recreational walking within greenspace, including design features and information. It was hypothesised that the public would perceive the installation of

wayfinding signage as a benefit to the local community by increasing route awareness (by showing the location of paths), perceptions of safety (by identifying routes of higher footfall and providing familiarity with the area), and decreasing the anxiety of walking unfamiliar routes (by showing where paths lead to).

## 2. Materials and methods

### 2.1. Study design

The study utilised a cross-sectional online survey with a mixture of quantitative Likert questions and qualitative open-ended questions to collate public perceptions of recreational wayfinding signage.

### 2.2. Participants

Participants were conveniently sampled by advertising the online survey (Online Surveys, Jisc, Bristol, UK) through online and local radio media outlets between 23rd March 2021 and 3rd May 2021. The survey was accessed predominantly through the University of Northampton website, with associated press releases involving local partners (Delapré Abbey Preservation Trust and Northamptonshire Sport) and stakeholders (Local Public Health, Local Authority, and Local Health Care Services) who advertised the study on their social media feeds (mainly Twitter). To enhance participation from the local community, the local British Broadcasting Corporation Radio also ran a news story twice across two weekends, providing an overview of the entire project and a call to action for residents to get involved and complete the survey.

Participants were 18+ years old and self-declared the mental capacity to provide signed informed consent. The online survey included a participant information sheet and participants could not complete the survey without providing informed consent via a checkbox question at the end of the information sheet. No personally identifiable information was collected in the survey and no incentives were offered. Ethical approval was granted by the Faculty Research Ethics Committee (ethics code: 202102). The overall project methods were pre-registered and published on Open Science Framework prior to starting data collection (Ryan, 2021) to reduce the risk of bias in the selection of reported results within natural experimental studies (Benton et al., 2016).

### 2.3. Theoretical underpinning

At the conception of the project, an initial logic model (Fig. 1) was developed to outline the suggested causal relationships between the intervention and public health outcomes, in order to identify pertinent components to evaluate (Benton et al., 2021; Moore et al., 2015; Public Health England, 2018). The proposed ‘changes in judgement’ were underpinned by existing recreational walking and wayfinding for transport research (Kelly et al., 2019; Vandenberg et al., 2016), which suggested that wayfinding anxiety, self-efficacy, perceived safety, competency, knowledge of routes, and negative attitudes to walking may act as barriers to recreational walking. Utilising the COM-B model (Michie et al., 2011), questions were designed to reflect possible changes in Capability, Opportunity, and Motivation, as wayfinding signage may help increase conditions for recreational walking by using communication to stimulate engagement in walking (Persuasion), enhancing public knowledge of routes for walking (Environmental Restructuring and Education), generate individuals’ perceptions of the environment being used by the community for walking (societal and locality norms; Modelling), and reducing wayfinding associated barriers to walking (Enablement). The purpose of the survey was to scope-out the contribution of these hypothetical causal pathways of behaviour change with members of the public to help refine the follow-up intervention.

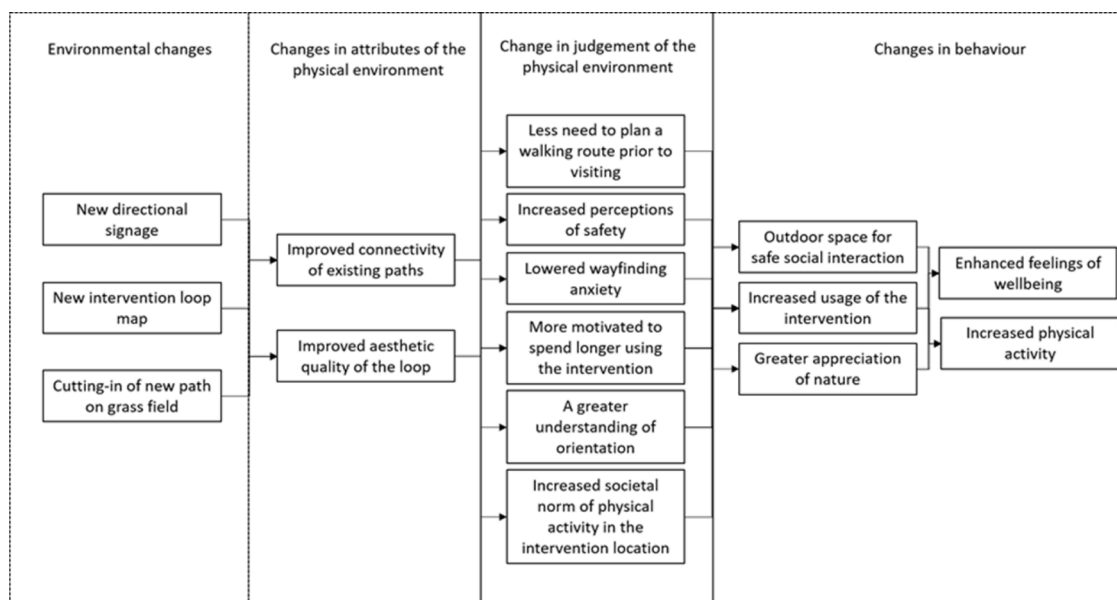


Fig. 1. Logic model of the role wayfinding signage could have on increasing recreational walking and wellbeing.

#### 2.4. Survey design

The survey was primarily developed by the principal investigator and was reviewed by local collaborating stakeholders for question content and clarity before publishing. The details of survey design are outlined below.

##### 2.4.1. Attitudes

The attitudes toward wayfinding signage comprised of 12 multiple-choice questions and one open text question to capture additional public opinions. The questions were based on the Perceptions of Walking questions recommended by the Department for Transport Good Practice Guidance (Department for Transport, 2020). Survey items included a series of statements that the respondent reported their level of (dis) agreement with on a 5-point Likert scale; Strongly Disagree, Disagree, Not Sure, Agree, Strongly Agree. The questions were broadly designed around the COM-B model (Michie et al., 2011). For example, questions about perceived confidence, safety, anxiety, and ease of route planning represented Psychological Capability. Social Opportunity was represented through questions about perceived community interest, whilst agreement with wayfinding signage installation represented Physical Opportunity. Additionally, questions focused on motivation to walk, as well as preferences for wayfinding tools represented Motivation, with Behaviour represented by questions about instinctively following wayfinding and the likelihood of following wayfinding signage.

##### 2.4.2. Wayfinding signage information

Participants were asked to provide their 5-point Likert level of (dis) agreement for 13 wayfinding signage design components, as well as an open text question to capture any additional components. These design components were:

- 1 A route name
- 2 Directional arrows
- 3 Total distance of the route
- 4 The amount of distance completed from the starting point
- 5 The amount of distance remaining to the finishing point
- 6 The average time to walk, run, or cycle the route
- 7 A map of the route
- 8 Landmarks on the route to help with your navigation

- 9 Local information of interest, such as historical or nature information
- 10 Motivational statements to encourage walking, running and cycling
- 11 The amount of people who have used the route each month
- 12 Consistent colours and fonts
- 13 Emergency contact information

##### 2.4.3. Demographics

To determine the level of community representation across respondents, demographic information about physical activity level (Zwolinsky et al., 2015), age group, gender, ethnicity, home postcode, highest level of education, and annual household income were included. These demographic questions were included as they reflect wider determinants of health (Public Health England, 2021a) and can be used to display differences in physical activity levels (Sport England, 2021a).

### 3. Data analysis

Due to large variances in group sizes and ordinal data, descriptive statistical comparisons were made across different demographic groups, using Excel software (Office 365, Microsoft, Washington, USA). Question response comparisons were drawn across all demographic categories: gender, ethnicity, physical activity status, age group, educational status, and household income. Within gender, ethnicity, and age categories there were only up to two cases per category where answers were not provided. In these instances, the 'Unknown' responders were grouped into the most commonly responding group (e.g., Women, White, 46–60 years). For Level of Education and Household Income, item non-responders ( $n = 18$ ,  $n = 32$ , respectively) were placed into their own groups.

Overall, there were 266 respondents, including 200 Women, 63 Men, one Non-binary, one Intersex, and one Unknown gender. Women, Non-binary, Intersex, and Unknown genders were grouped together for response comparison as they tend to have lower physical activity levels than Men (Sport England, 2021a). Furthermore, gender identities other than Men, tend to report more barriers to outdoor engagement in physical activity (Kilgour and Parker, 2013; Pride Sports and Sport England, 2019). 254 respondents were of White Ethnicity, 11 respondents were of a Black, Asian, Minority Ethnicity, and one Unknown ethnicity (HM Government, 2011). All Ethnic groups, other than White, were

combined into one group as they tend to report lower physical activity levels than their White counterparts (Sport England, 2021a). The authors recognise that respondents from the grouped gender and ethnicity identities are not homogenous and may have differing beliefs and ideologies and the decision on groupings was informed by population trends in physical activity and barriers to participation.

Quantitative survey data comparisons looked primarily at those who “strongly agree”, to mitigate the tendency of acquiescence response bias, to focus on how the firmest attitudes relate to activity, as well as health and social outcomes, in accordance with guidance from Sport England (Sport England, 2021c). The full range of question responses can be found in Additional File 1. All responses are reported as frequencies in absolute and relative values.

Qualitative data from open ended questions was analysed using thematic analysis (Braun and Clarke, 2006), whereby participant responses were read several times, followed by the identification of initial codes pertinent to the research question. This was followed by combining similar codes into larger themes, with those that did not have enough data to support discarded. Secondary data analysis followed with all researchers discussing findings, followed by the refinement, naming and defining of themes. Example quotes were then chosen to best highlight these themes. The analysis was inductive, with no a priori structures applied to the data. A focus was on where views converged or diverged, to give meaning to participant responses and illustrate participant narratives around directional signposts.

## 4. Results

### 4.1. Demographics

The online survey received 266 respondents. From the 33 closed-ended questions in the survey, there were a total of 87 missing responses out of a possible 8778 responses (33 questions  $\times$  266 respondents). For the two open-ended questions, there were 58 and 39 responses, respectively. The University website page that hosted the link to the online survey had 1148 unique views, providing a response rate of 23%, which is similar to previously published surveys (Nulty, 2008;

Ogilvie et al., 2008; Smith et al., 2019).

Ninety-seven percent of respondents resided in the county in which the project was taking place within (198 postal codes provided; Fig. 2). Women were overrepresented, representing 75% of respondents in comparison to 51% for Northamptonshire estimates (Public Health England, 2021b). The age range distribution of respondents had similarities with the Northamptonshire population estimates of 2019 (Public Health England, 2021b) for the 18–30 years and 31–45 years age group. However, 46–60 years age group were overrepresented, whilst 60+ years were underrepresented (18–30 years: 11%, 14%; 31–45 years: 30%, 26%; 46–60 years: 44%, 28%; 60+ years: 16%, 32%, respectively). 96% of respondents were of White Ethnicity which is similar to the Northamptonshire population (91.5%, 2011 Census) (Public Health Northamptonshire, 2020). Fairly Active populations were overrepresented whilst Inactive and Active were underrepresented in the respondents in comparison to Northamptonshire estimates (Fairly Active: 61%, 14.1%; Inactive: 2%, 25.5%; Active: 36%, 60.4%, respectively (Sport England, 2021)). Respondent’s tended to have a bachelor’s degree and household income between £30,000 and £51,999 (Table 1).

### 4.2. Attitude towards wayfinding signage in public parks

#### 4.2.1. Psychological capability

Overall, 47% of respondents strongly agreed that directional signposts would make them feel more confident about trying new routes (Fig. 3A). There appeared to be a trend in social gradients with a decline in the percentage of strongly agree responses as physical activity status increased (physically inactive to physically active) and age group increased (18–30 years to 61+ years). Meanwhile, there tended to be an increase in strongly agree responses across educational status and household income (Fig. 3A). Increasing confidence to explore and escape was also a key theme within participant narratives:

“I like to explore paths that are signposted and then that gives me the confidence to explore further knowing I can find the pathway back.” (Woman, 46–60 years)

Maximising individual engagement with greenspace is important, particularly in unfamiliar, larger spaces or longer routes. When visiting a

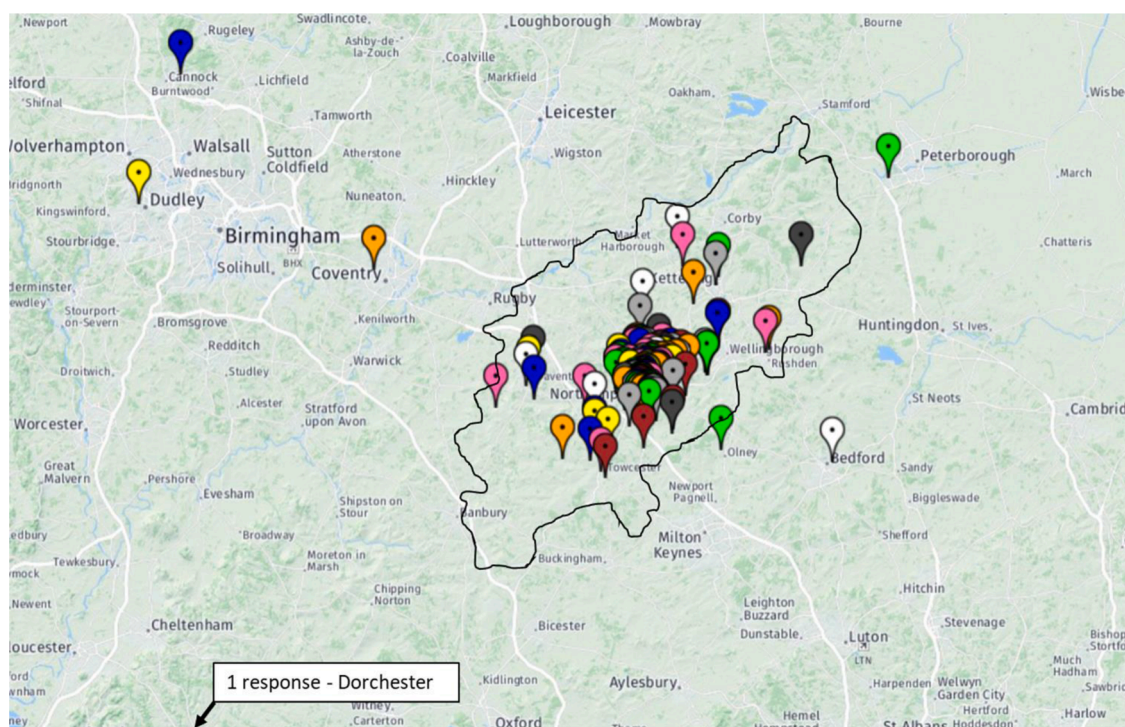


Fig. 2. Postal codes of respondents who provided this data ( $n = 198$ ). Pins denote postal codes and black line represents Northamptonshire county borders.

**Table 1**  
Respondent demographic characteristics.

Characteristic	n	% of Overall
Overall	266	
Men	63	23.7%
Women	200	75.2%
Non-binary	1	0.4%
Intersex	1	0.4%
Gender Unknown	1	0.4%
White Ethnicity <sup>a</sup>	255	95.5%
Black, Asian, Minority Ethnicity <sup>a</sup>	11	4.1%
Unknown Ethnicity	1	0.4%
Inactive <sup>b</sup>	5	1.9%
Fairly Active <sup>b</sup>	162	60.9%
Active <sup>b</sup>	97	36.5%
18 - 30 years	28	10.5%
31 - 45 years	79	29.7%
46 - 60 years	116	43.6%
61+ years	41	15.4%
Age Unknown	2	0.8%
Less than High School Diploma	12	4.5%
High School Degree	14	5.3%
College Degree	59	22.2%
Bachelor's Degree	105	39.5%
Master's Degree	38	14.3%
Doctorate	12	4.5%
Professional Degree	14	5.3%
Education Unknown	18	6.8%
Less than £18,000	18	6.8%
£18,000 - £29,999	43	16.2%
£30,000 - £51,999	80	30.1%
£52,000 - £100,000	76	28.6%
More than £100,000	17	6.4%
Household Income Unknown	32	12.0%

<sup>a</sup> Following definitions from (HM Government, 2011). <sup>b</sup> Sport England Single Item Measure defined Inactive - zero days of at least 30-min of moderate intensity physical activity, Fairly Active - one to five days of at least 30-min of moderate intensity physical activity, and Active - six to seven days of at least 30-min of moderate intensity physical activity.

new place for recreational activity, it is essential for individuals to feel comfortable, at ease and make the most of their experience. Familiarity is usually key to this, as in familiar spaces individuals can use existing cognitive maps and can be confident about routes taken. In unfamiliar spaces, or when exploring new routes, wayfinding signage assists with route choices and provides reassurance when this existing knowledge is not present.

Thirty-nine percent of respondents strongly agreed that directional signposts would make them feel less anxious about walking on paths that they were not familiar with (Fig. 3B). Across the demographic groupings the highest strongly agree responses occurred in women, non-binary, intersex, and gender unknown (42% of  $n = 203$ ), Black, Asian, Minority Ethnicities (55% of  $n = 11$ ), fairly active (excluding inactive for small group size) (46% of  $n = 162$ ), 31 - 45 years (47% of  $n = 79$ ), Bachelor's degree educational status (45% of  $n = 105$ ), and £52,000 - £100,000 household income (46% of  $n = 76$ ) (Fig. 3B). Participants also discussed how wayfinding signage would reduce route anxiety, by enhancing orientation and wayfinding, particularly for younger, women respondents on unfamiliar routes:

*"I think having clearly defined parameters would actually encourage people to explore a little further."* (Woman, 46-60 years)

Recreational signage appeared to help reduce negative feelings like anxiety, allowing individuals to better understand and navigate the space. This is likely to increase their sense of control over the space, reducing anxiety, while maintaining a sense of autonomy to try new routes. Many participants would be "hesitant to walk" if they felt they might "get lost" and, signage would increase their confidence in finding their way back.

Overall, 23% of respondents strongly agreed that directional signposts would make them feel safer (Fig. 3C). Strongly agree responses

from men (13% of  $n = 63$ ) were 14 percentage point lower than women, non-binary, intersex, or unknown (27% of  $n = 203$ ). However, the largest percentage point difference in strongly agree answers existed between respondents with less than High School Diploma or High School Degree (12% of  $n = 26$ ) and respondents with a Master's degree (34% of  $n = 38$ ).

Perceived safety was a particularly prominent theme from women in the sample, who shared previous experiences where signs had not existed, been poorly maintained, or provided inaccurate information as they had pointed the wrong way:

*"Just having signs pointing us in the right direction would be a great start."* (Woman, 31-45 years)

Due to this, some had become 'sign blind', as they rarely trusted information provided to them in this way. This further emphasised the importance of design and implementation. Others shared examples where they had felt unsafe engaging in recreation wayfinding alone on foot:

*"There are some lovely "hidden" bits locally that I'd like to explore but the issue I've always found...is that these places are often neglected, lonely and the paths overgrown and, frankly, a bit dank & dreary. I'd explore in company or by myself on my bike but not necessarily on my own by foot... [locally, some of] the little tracks littered with rubbish, needles etc...frankly a bit scary...it's very lonely and...as a lone woman, even one who is usually very confident, I sort of wished I'd had a friend with me!"* (Woman, 46-60 years)

Perceptions of safety can influence both route choice and recreational walking motivation. While directional signage is unlikely to change the feel of an entire route, respondents explained that directional signage would help them to feel more comfortable within an area. Signage would also contribute to the overall view that a greenspace is cared for or maintained, while directing others to the area and making it feel more occupied.

Finally, 38% of respondents strongly agreed that directional signposts would make route planning easier for them. There tended to be a positive social gradient in strongly agree responses across educational status (less than high school diploma or high school degree to doctorate or professional degree) and household income (less than £18,000 to more than £100,000; Fig. 3D). Strongly agree responses were higher in women, non-binary, intersex, or gender unknown (42% of  $n = 203$ ) in comparison to men (29% of  $n = 63$ ; Fig. 3D). Interestingly, many participants engaged in recreational walking to get lost, so many sought unfamiliar routes deliberately:

*"I think directional signposting totally takes the fun and adventure out of a walk. It loses the sense of enjoyment from exploration and discovery."* (Woman, 46-60 years)

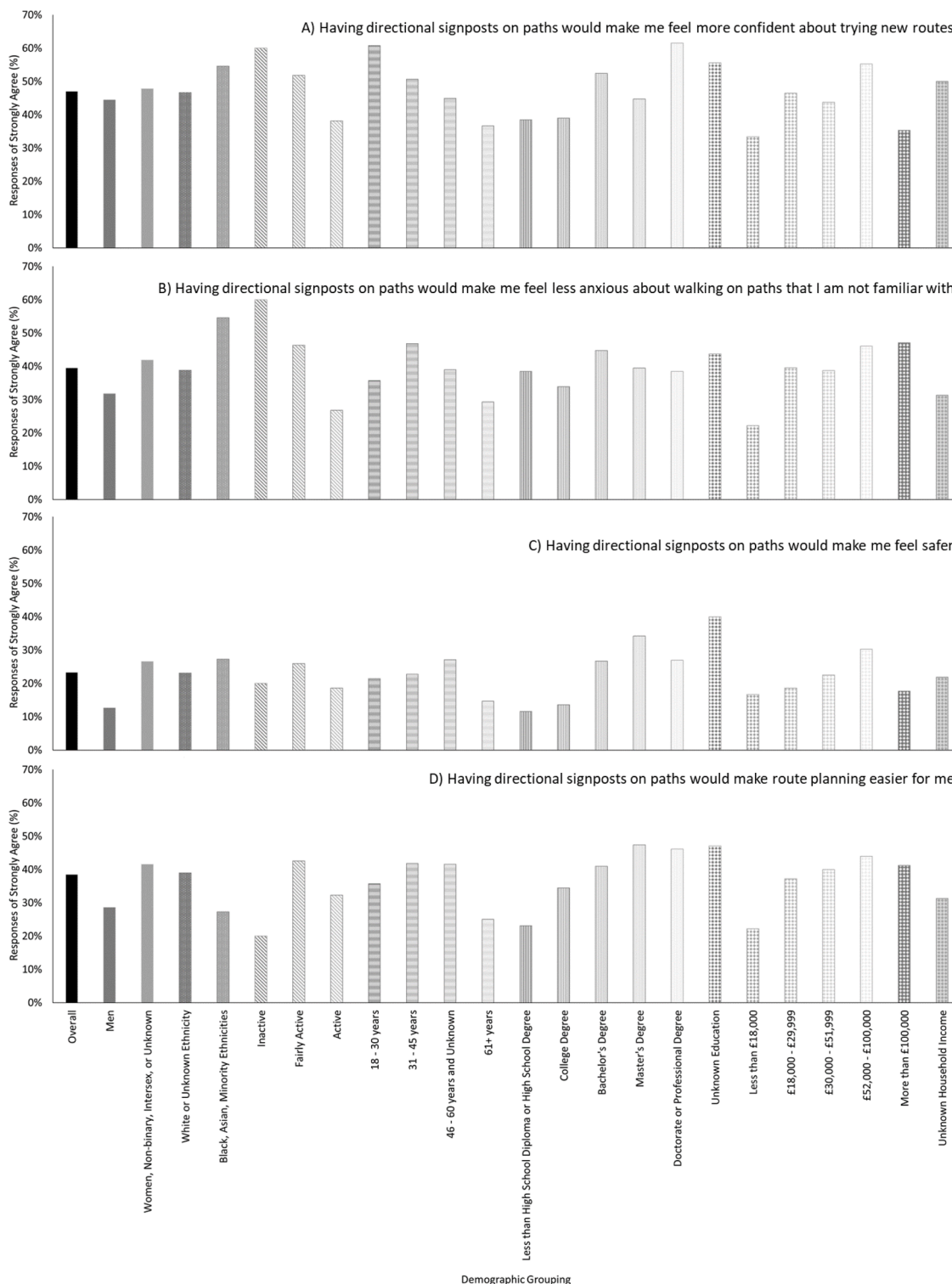
In this sense, many sought to escape technological restraints while engaging in recreational walking, as it was "time to be away from phones". Virtual maps or other technology were thought to "stops people exploring" and "takes the fun out of it":

*"Defeats the object of walking and giving your brain a rest in my eyes. I fully support the signs around the county."* (Woman, 31-45 years)

While many respondents sought to enhance route planning, many explained how they preferred to do this on route, particularly when engaging in other activities, such as cycling or running. This contrasts to the increased availability and accessibility of directional technology on handheld or wearable devices and the immersion of this within everyday life, providing further support for directional signposts as an alternative route planning aid. However, some participants felt that over-use of directional signposting within a route may also limit the opportunity for wayfinding and discovery, so getting this balance right was important, possibly by having signs only at key points along routes.

#### 4.2.2. Social opportunity

Overall, 21% strongly agreed that directional signposts would make walking and running seem like a popular activity within the local community (Fig. 4A). Responses tended to be similar across



**Fig. 3.** Percentage of strongly agree responses for questions related to psychological capability across demographic groups. A) Confidence, B) Anxiety, C) Safety, and D) Ease of route planning. The full range of responses, Strongly Agree to Strongly Disagree, can be found in Additional File 1.

demographic groups with Black, Asian, Minority Ethnicities (36% of  $n = 11$ ), 18–30 years (29% of  $n = 28$ ), Doctorate or Professional Degree (35% of  $n = 26$ ), Unknown Education (44% of  $n = 18$ ) and Unknown Household Income (31% of  $n = 32$ ) providing the highest percentage of strongly agree responses (Fig. 4A).

Fifteen percent of respondents strongly agreed that following directional signposts is something the majority of the community would do (Fig. 4B). Strongly agree responses appeared similar across demographic

groups with the lowest strongly agree responses in 61+ years age group (2% of  $n = 41$ ), Inactive (0% of  $n = 5$ ), and Master’s Degree educational status (8% of  $n = 38$ ; Fig. 4B).

Overall, 18% strongly agreed that directional signposts would encourage the community to walk, run, or cycle for leisure more frequently and once again, strongly agree responses appeared similar across demographic groups (Fig. 4C). From the written responses, it was clear that many participants had developed a sense of ownership and

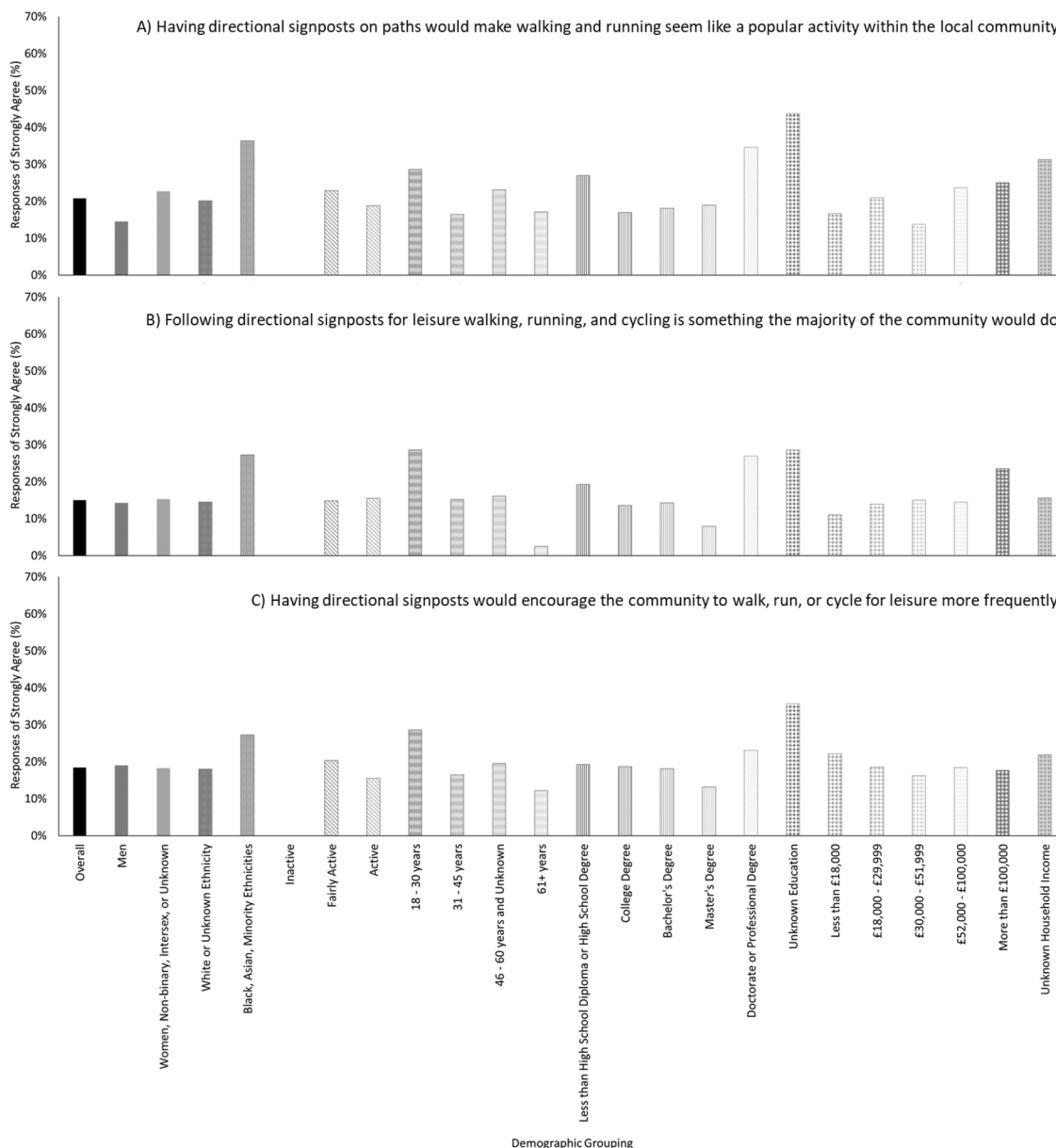


Fig. 4. Percentage of strongly agree responses for questions related to social opportunity across demographic groups. A) Popular Activity, B) Community Engagement, and C) Community Encouragement. The full range of responses, Strongly Agree to Strongly Disagree, can be found in Additional File 1.

belonging for local greenspaces, which they frequented regularly. For many, these areas were an extension of their homes and where they lived, so they felt strongly that community members should be at the front and centre of decision making about the use of these spaces and any additions to them. This included being at the front and centre of consultations decisions being made to implement directional signage.

4.2.3. Physical opportunity

Overall, 33% of respondents strongly agreed that wayfinding signage should be installed in public parks and footpaths (Fig. 5). The highest percentage of strongly agree responses occurred in the Black, Asian, Minority Ethnicities (45% of n = 11), Doctorate or Professional Degree (46% of n = 26), and Unknown Educational Status (44% of n = 18) groups (Fig. 5).

Key to participant narratives was ensuring that signage increased space accessibility and inclusivity. For example, many felt that directional signage should be inclusive of all space inhabitants and all activities to be carried out on that route, which each activity clearly

denoted:

*“I prefer complet(e) map signpost with optional walk, cycle a(n)d run route distances in different colours and kept separately to keep walkers safe.”* (Woman, 46–60 years)

It is important to ensure inclusivity is at the centre of implementing recreational wayfinding signage and that this is appropriate for all those who use these greenspaces. For example, respondents explained how signs should include assistive technology, QR codes, raised surfaces or tactile maps to help those who were visually impaired, as well as different colours to highlight wheelchair friendly walks, or pictures to ease readability where there may be language barriers. Other information would also be useful:

*“Not everyone who wants to be active has the same level of sight.”* (Woman, 46–60 years)

In making route decisions, many participants reflected on whether a route was for them. Many participants had mobility issues, used walking aids, wheelchairs, or needed to rest regularly when engaging in recreational walking activities. Others spoke about how these route features

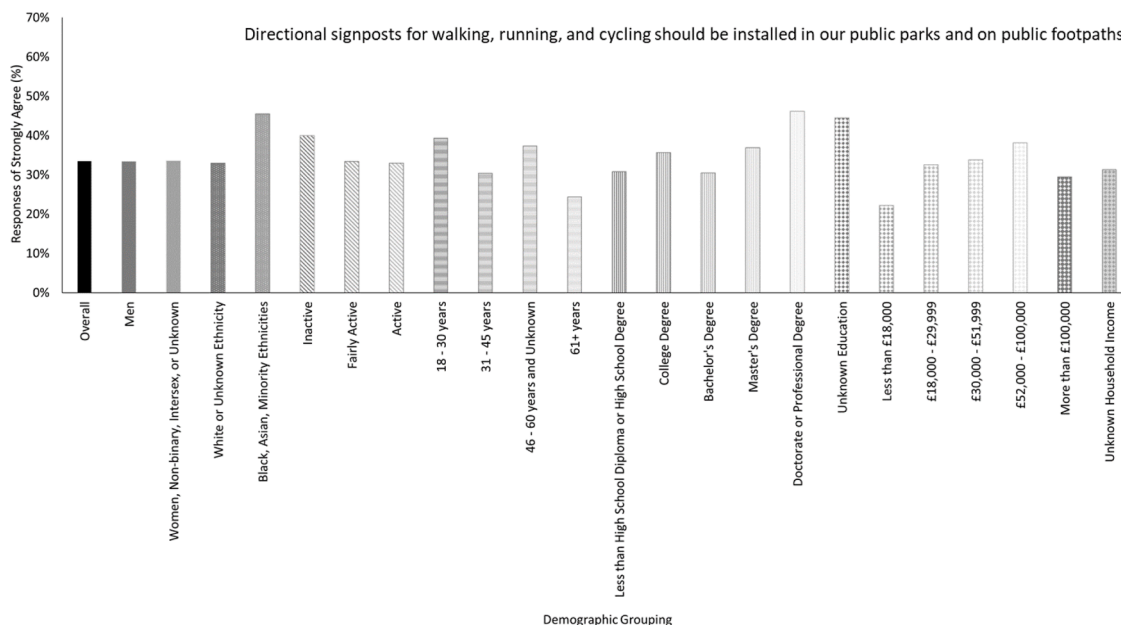


Fig. 5. Percentage of strongly agree responses for directional signposts should be installed in public parks or footpaths. The full range of responses, Strongly Agree to Strongly Disagree, can be found in Additional File 1.

were important for those they shared these activities with (e.g., children, elderly family members or friends):

*have additional needs. I've sometimes had to turn back due to stiles which weren't marked on a map or walk leaflet.* (Woman, 61+ years)

*“Knowing the sort of terrain you are walking on is really helpful if you*

*Importantly, some respondents mentioned how accessibility could*

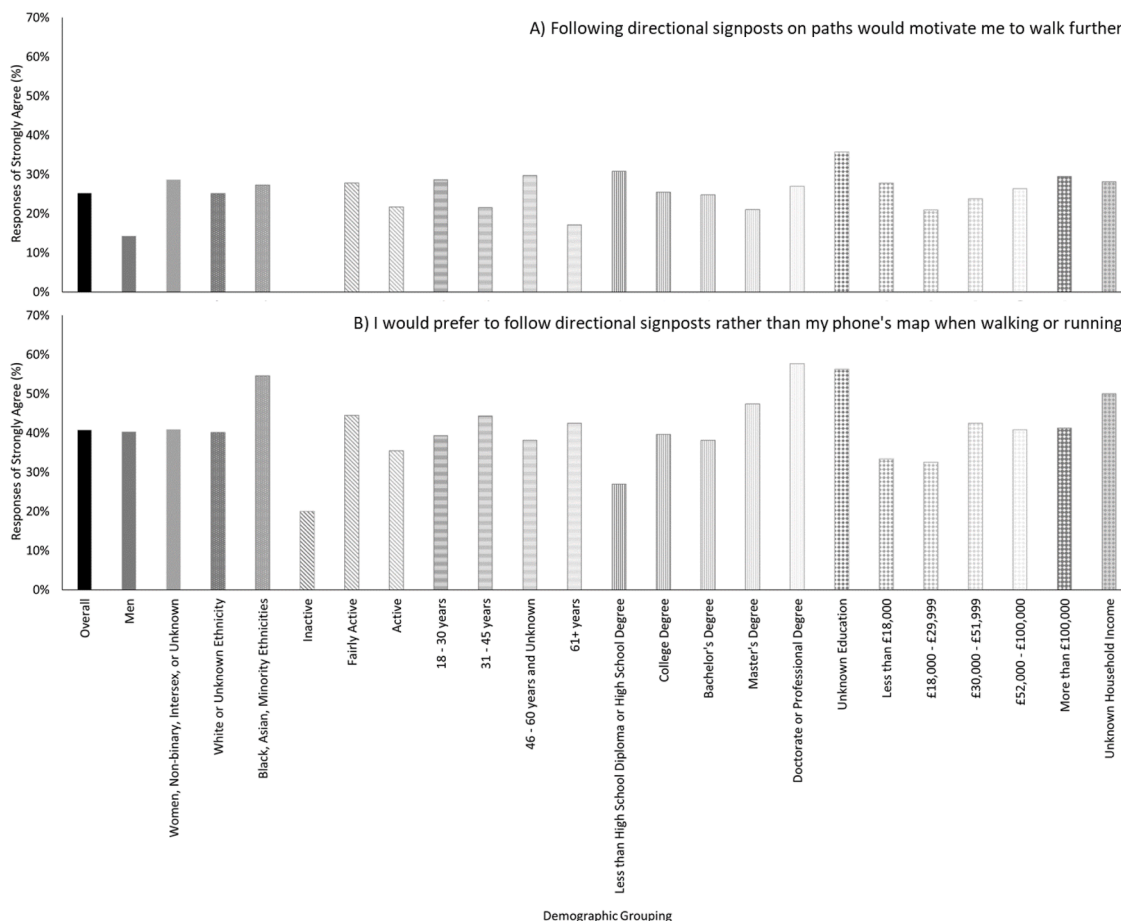


Fig. 6. Percentage of strongly agree responses for questions related to motivation across demographic groups. A) Motivation, and B) Preference. The full range of responses, Strongly Agree to Strongly Disagree, can be found in Additional File 1.



actually be impeded by the introduction of signposts (e.g., by placing them in areas not accessible to all, or that the posts themselves could make routes narrower). This further highlighted the importance of not just implementing recreational walking routes for others but designing them with others and through their own perspectives. For example, by highlighting route distance, terrain, steepness and providing other important information which would guide these types of route decisions, such as where the next space to rest may be. This further suggests that directional signage with this route information was incredibly important, but also that this information was maintained, accurate and kept updated.

4.2.4. Motivation

Twenty-five percent of respondents strongly agreed that directional signposts would motivate them to walk further (Fig. 6A). Strongly agree responses were lower in men (14% of n = 63) in comparison to women, non-binary, intersex, or unknown gender (29% of n = 203), while responses appeared similar across other demographic groups (Fig. 6A). This was further supported in the open-ended question responses:

*“If you have a clearly defined route, it’s easy to amble off and have a little poke around in the undergrowth!”* (Woman, 46–60 years)

Forty-one percent of responses strongly agreed that they would prefer to follow directional signposts than their smartphone map application (Fig. 6B). Strongly agree responses were highest in Black, Asian, Minority Ethnicities (55% of n = 11) and Doctorate or Professional Degree (58% of n = 26) and Unknown Educational Status (56% of n = 18) groups (Fig. 6B). Engaging in recreational walking to escape technology was another prominent theme, providing more support for such signposts:

*“I HATE looking at phone constantly to check I’m going the right way.”* (Woman, 31–45 years)

4.2.5. Behaviour

Overall, 46% of respondents strongly agreed that they would instinctively follow directional signposts on a route they were not familiar with (Fig. 7A). The percentage of strongly agree responses appeared to decrease across age groups but increase across household income groupings (Fig. 7A). As mentioned above, this key route information appeared to aid route choices, particularly for unfamiliar routes:

*“I am more likely to walk a route knowing how far it is and the time it would take before hand. Otherwise may just wonder around keeping close to car/home/the familiar.”* (Woman, 31–45 years)

Twenty-one percent of respondents strongly agreed that they would be more likely to frequently use a route with directional signposts than a route without directional signposts (Fig. 7B). The greatest percentage point difference appeared between men (10% of n = 63) and the women, non-binary, intersex, or gender unknown group (25% of n = 203; Fig. 7B).

Overall, respondents had strongly agreeing views for many components of the logic model such as, easier route planning and orientation, lower anxiety and increased confidence, motivation to walk further or for longer, and to some extent increased perception of safety and societal norms of the activity. Within the COM-B model of behaviour change, the respondents suggested there would be perceived changes to psychological capability, physical opportunity, social opportunity, motivation, and behaviour with the potential introduction of recreational way-finding signage.

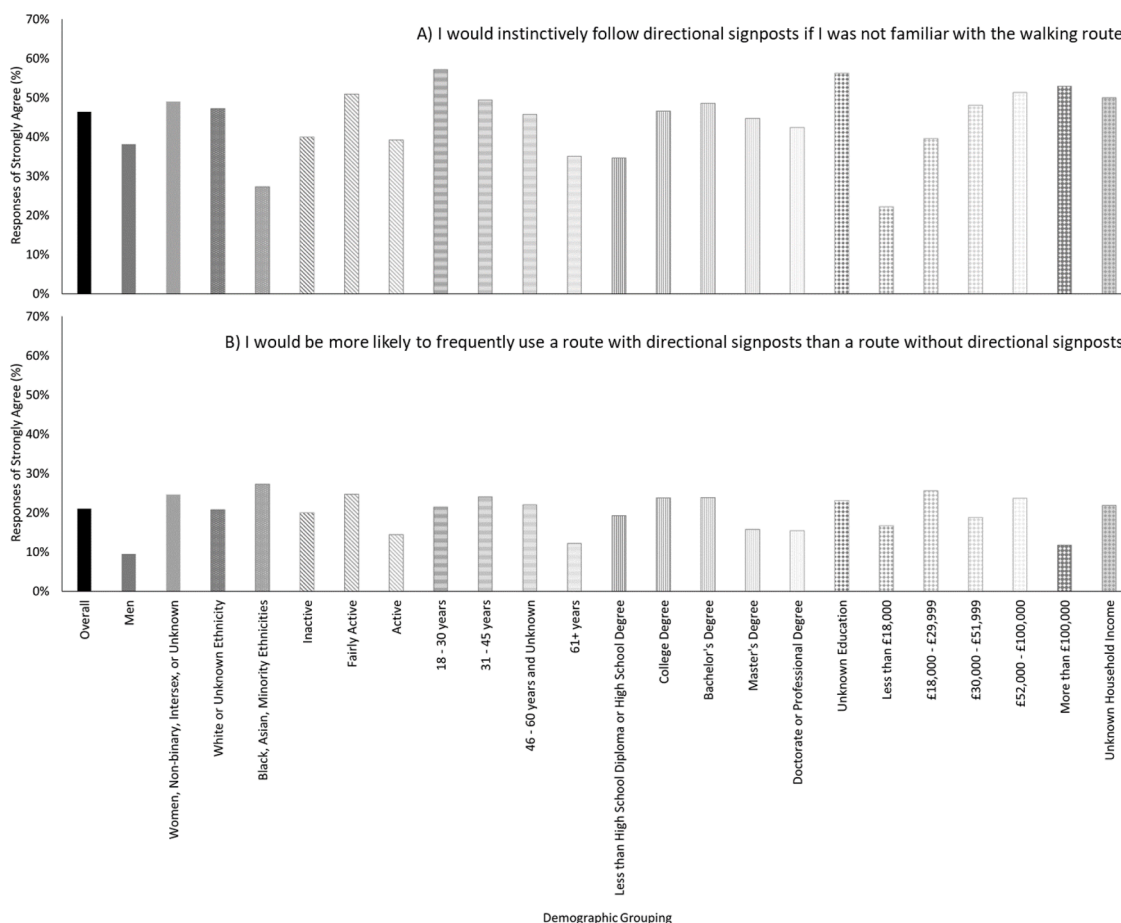


Fig. 7. Percentage of strongly agree responses for questions related to behaviour across demographic groups. A) Instinct, and B) Likelihood. The full range of responses, Strongly Agree to Strongly Disagree, can be found in Additional File 1.

### 4.3. Public design preferences on wayfinding signage

Directional arrows, total distance of the route, consistent colours and fonts, a map of the route, local information of interest, and emergency contact information were the top six components, respectively, that respondents, overall, strongly agreed should be included on wayfinding signage for recreational walking (Fig. 8). These components were also most frequently strongly agreed across demographic groups. Comparisons across demographic groups showed that the aforementioned six components were consistently ranked within the top six components to include on wayfinding signage for recreational walking. Emergency contact information was the component that most frequently fell out of the top six rankings, falling to ranking 7 to 10 for the following demographic groupings: Men, Physically Active, 46–60 years or Unknown Age, Bachelor’s Degree, Master’s Degree, and More than £100,000. Notably, motivational statements to encourage walking, running and cycling, and the amount of people who have used the route each month were consistently the least popular components, ranked 12th and 13th, respectively, to include on wayfinding signage for recreational walking. In fact, overall, respondents reported a level of disagreement more frequently than agreement for these two components, suggesting that these components are the least important to include on wayfinding signage. The similarities in strong agreement across demographic groups suggests that wayfinding signage may not need to be bespoke to target populations.

Participants also provided some important design features and practice features that they felt recreational wayfinding signage should contain and where they felt signage should be placed. For example, many felt that information about route suitability was key, but also suggested relevant facts, local landmarks and photo locations would also increase route usage. This also included clear and consistent font, good use of colour and uncluttered signs that were easy to read. In terms of sign placement, participants felt strongly that signs should enhance the local area, particularly when historical sites were involved, including natural colours, non-obtrusive placement, or by aiding wildlife (e.g., by having bee homes in the back of them):

“Signposts should not disturb the landscape they are installed in. E.g., not blight the beauty of the area.” (Woman, 31–45 years)

Designers therefore have a challenge between ensuring signs promote accessibility and space usage, while also ensuring they do not detrimentally impact the area they are placed in. Interestingly,

participants also wanted any suggestions of competition on signs to be avoided:

“Including an average time of completion could lead to negative feelings e. g., “I am unfit/slow compared to the average person” and may stop them from walking that route again...it may make them walk faster with the sole intention of being closer to the average time but reducing the fun factor of the walk.” (Man, 18–30 years)

Many found motivational statements, or information about monthly route users to actually be demotivating and unappealing. While both showed a greater amount of disagreement than agreement responses, this also sits in contrast to existing research on motivational or social interventions. Findings further demonstrate the importance of designing routes and signage with those who would be using them.

## 5. Discussion

The aim of the current study was to determine public perceptions of wayfinding signage for recreational walking within greenspace, including design features and information. The results aligned with the hypothesised logic model, with respondents strongly agreeing that the presence of wayfinding signage for recreational walking would make route planning easier (38% strongly agree), increase perceptions of safety (23% strongly agree), reduce wayfinding anxiety (39% strongly agree), increase motivation to walk further (25% strongly agree), increase confidence to try new routes (47% strongly agree) and make walking seem like a popular activity within the local community (21% strongly agree). Overall, 75% of respondents agreed that wayfinding signage for recreational walking, running, and cycling should be installed in public parks and footpaths. The results suggested that recreational wayfinding should include directional arrows, the total distance of the route, consistent colours and fonts, a map of the route, local information of interest, and emergency contact information. However, suggestions of competition such as, the amount of monthly users and motivational statements should not be included on signage.

### 5.1. Public perceived self-influence of reactional wayfinding signage on behaviour

Lacking knowledge of routes and options has been highlighted as an individual factor that acts as a barrier to recreational walking (Kelly et al., 2019). Developing knowledge of route options aligns with

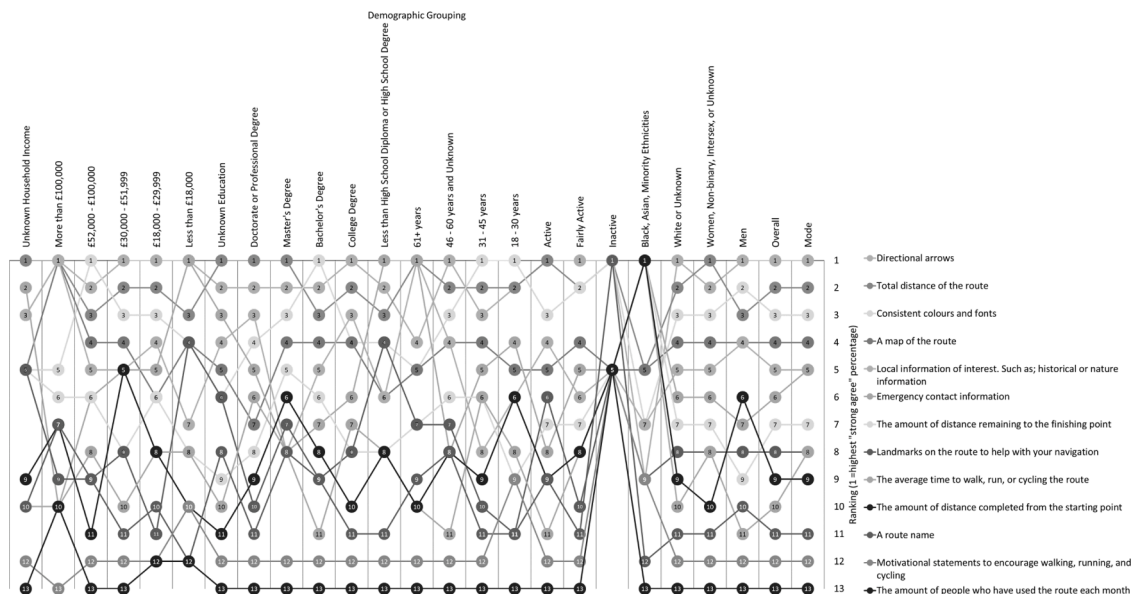


Fig. 8. Public opinion on what information is most pertinent to include on wayfinding signage for recreational walking, grouped by demographics. Ranked on the percentage of “strongly agree” responses, 1 = highest “strongly agree” percentage per demographic group.

psychological capability, within the COM-B model of behaviour change (Michie et al., 2011) and the evidence from the current study demonstrates that wayfinding signage for recreational walking may enhance psychological capacity by addressing issues of self-perceived anxiety, confidence, safety, and route planning. Interestingly, not all respondents were positive towards wayfinding signage within greenspaces, as they felt it could detract from their self-immersion in and enjoyment of greenspace and possibly detrimentally impact health benefits (Craig et al., 2018). Having this nuanced understanding is critical to reduce potential unintended harms from these sorts of interventions that policy/decision makers might not think about when designing and implementing these small-scale interventions. These unexpected consequences on individuals' experiences have also been highlighted in green social prescription programmes for patients with long-term mental health conditions such as depression and anxiety (Tester-Jones et al., 2020). Questionnaire responses from 18,838 participants, across 18 countries, identified that, while the perceived pressure to visit nature caused by green social prescriptions may increase nature visits, it risks undermining intrinsic motivation and the emotional benefits that might be achieved from nature visits (Tester-Jones et al., 2020). This outcome further resonates with the findings of the current study, in which respondents disagreed with the presence of motivational statements and reports of monthly users on recreational walking wayfinding signage. These were the only two components of wayfinding signage design where there were more 'disagree' than 'agree' responses within the current study. It could be postulated that motivational statements and monthly usage of signage may act as a perceived pressure to greenspace visitors and thus undermine intrinsic motivation and emotional benefits. Therefore, future projects that implement wayfinding signage for recreational walking need to ensure they act as a facilitator rather than a pressure to recreational walking.

Considering cultural norms and context has been identified as a vital component of the whole system approach to addressing health conditions (Stansfield et al., 2020). The current study suggested that the presence of wayfinding signage for recreational walking would make walking and running seem like a popular activity within the local community (21% strongly agree). Social opportunity that dictates the way we think about things has been highlighted as an avenue for intervention within the COM-B behaviour change model (Michie et al., 2011) and has been highlighted as a promising avenue for increasing physical activity levels (Bauman et al., 2012). Therefore, the presence of wayfinding signage for recreational walking may act as a form of media campaign to drive changes in cultural norms about physical activity.

### 5.2. Public views on sign design for recreational wayfinding

The design principles of wayfinding materials have been heavily researched from a task completion perspective of arriving at a destination (Farr et al., 2012; Malinowski and Gillespie, 2001; Soh and Smith-Jackson, 2003) and there is guidance on inclusive public realm signage design (Barker and Farser, 2000; Natural England, 2008). Sport England provides guidance to Active Partnerships and Park Managers on the use of wayfinding to promote physical activity however, this guidance does not provide recommendations for what should be included on wayfinding signage, beyond arrow size and colour for navigating Public Rights of Way (Sport England, 2019b). The current study adds the public's perspective of pertinent information to include on wayfinding signs, which can act as additional guidance for Active Partnerships and Park Managers, who are looking to promote physical activity through wayfinding. The current study also demonstrates the importance of public consultation when developing wayfinding for recreational walking to ensure signage is relevant to the local community. Further research is needed to obtain wider population perspectives of what to include on wayfinding signage for recreational activity, in order to increase the generalisability of the current study's findings and to help create standardised guidance for recreational physical activity

wayfinding as these interventions become more popular in the public realm.

### 5.3. Focus on designing with route users, not just for them

The importance of co-creating public health interventions has received growing attention (Leask et al., 2019), in order to provide individualised locally relevant programmes and has become a key feature of the whole-systems approach (Stansfield et al., 2020). The expectation from local communities to be involved in decision making was evident within the current study, as respondents who frequently visited the park had a strong sense of ownership and were wary of change. This finding aligns with research by Cleland et al. (2014), which demonstrated community "ownership" and relevancy to the local context were key components of intervention development and success from community group leaders' and residents' perspectives, as they ensured communities understood the intervention and found the intervention accessible. Overall, the current study, in agreement with previous studies, demonstrates that the community engagement during walking route development is an essential component of effective intervention design that should be adequately funded and resourced to ensure the community local context, interest, and need is incorporated.

### 5.4. Strengths and limitations

The survey distribution adopted a convenience sampling approach by distributing the survey through the University's and stakeholders' websites, local print, radio and social media. The convenience sampling approach meant that the study did not specifically target inactive, deprived communities, or park nonusers, who are likely to experience the largest benefits from greenspace physical activity and thus arguably should be a population of focus for such research topics. Therefore, the local sub-communities who may benefit the most from recreational wayfinding, may not have shared their input into the design and thus could be less likely to engage with the subsequent intervention. This issue is not uncommon in walking research, with intervention studies often adopting a trial and error approach to recruitment methods, with most recruiting mostly White, well-educated, middle-aged women (Foster et al., 2011); a trend evident in the current study. The review (Foster et al., 2011) highlighted specific case examples that appeared to increase recruitment of target sub-communities, such as using a mediator to bridge and reduce the gap between the recruiters and recruited, using word-of-mouth promotion within the target community, or follow-up phone calls (subsequently cancelled due to resource cost).

The questions were phrased with a response-direction that may enhance bias to 'agree' responses. To counteract the influence of bias, the current study applied approaches from Sport England (Sport England, 2021c) by predominately focusing on how the firmest attitudes ('strongly agree') related to the survey questions. In addition, the use of qualitative responses was a strength that helped to counteract the influence of bias from the quantitative questions. Although the questions were developed from Government best practice guidance, they did not undergo any assessment of reliability and validity therefore, some caution needs to be applied in the interpretation of findings between participants.

The survey was developed from a hypothesised logic model of the project, as recommended by the UK Government (Public Health England, 2018), whilst also considering the COM-B behaviour change model (Michie et al., 2011). Therefore, the study has been able to investigate the ecological validity of the researchers' hypothesised logic model. Furthermore, with a sample predominately within the intervention region and the survey providing a combination of closed and open answer responses, the current study provided a perspective from the community within a hyper-local context. These strengths align with previous arguments that park-use research should have a greater focus on qualitative approaches to provide a richer contextual understanding

of individual responses to greenspace engagement (Hitchings, 2013) and Public Health work should adopt a 'hyper-local' focus to ensure programmes consider cultural issues in their planning and delivery (Stansfield et al., 2020).

### 5.5. Next steps

The current study is the first phase of a longitudinal research project that will investigate the effect of installing recreational wayfinding signage on public greenspace footfall and individual perceptions of the new signage, in addition to changes in physical activity and wellbeing (Ryan, 2021). The longitudinal research project attempts to follow best practice guidance for natural experimental studies (Benton et al., 2016) by utilising multiple control groups, pre-registration of methods, multiple follow-up measurements, and a combination of continuous electronic counts and intermittent manual observations. Furthermore, signage may have wider benefits beyond wayfinding and physical activity, such as the provision of nature education that could facilitate engagement with the natural surroundings and thus lead to wider wellbeing benefits. In line with this thought, 'go-along' interviews are planned for the end of the longitudinal project to understand how and why park visitors utilise the signs on their walk through the greenspace. Upon completion of the longitudinal research project, the authors will have mixed-methods evidence that will be used to refine the initial logic model (Fig. 1), which decision/policy makers and researchers can use as a theory of change for similar intervention projects. Given that research from USA suggests 32 of 33 park managers will purchase signage when provided with funding (Cohen et al., 2013), this project should serve as an evidence base for the efficacy of retrofitting wayfinding signage for recreational walking within urban parks.

## 6. Conclusion

Overall, the current study has obtained public perceptions of the role that wayfinding signage can play in behaviour change to increase recreational walking in public greenspaces. The findings demonstrated that the presence of wayfinding signage can aid physical activity engagement by potentially reducing self-perceived anxiety while increasing confidence, safety, motivation, and ease of route planning. These self-perceived changes should promote behaviour change by altering the capability, opportunity, and motivation of individuals, based on the COM-B behaviour change model. The findings further validate the authors' initially hypothesised logic model, for the wider project, of how wayfinding signage could promote increased physical activity within public greenspaces. Finally, as the popularity of wayfinding signage to promote recreational walking and running routes in parks increases, the current study provides suggestions of what the public perceive as the most pertinent information to include on signage in addition to existing overarching wayfinding guidance.

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### Data statement

All data generated or analysed during this study are included in this published article and its supplementary information files.

### Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.wss.2022.100111.

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