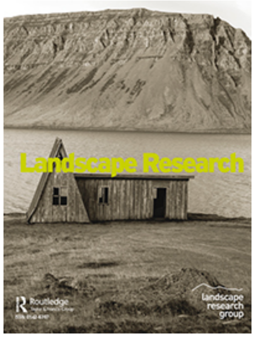

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Active Urbanism and choice architecture: Encouraging the use of challenging city routes for health and fitness

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ABSTRACT

Inactivity is one of the major health risks in technologically developed countries. This paper explores the potential of a series of urban landscape interventions to engage people in physical activity. Online surveys were conducted with 595 participants living in the UK by inviting them to choose between conventional pavement or challenging routes (steppingstones, balancing beams, and high steps) using photorealistic images. Across four experiments, we discovered that 80% of walkers claim they would pick a challenging route in at least one of the scenarios, depending on perceived level of difficulty and design characteristics. Where a challenging option was shorter than a conventional route, this increased the likelihood of being chosen by 10%, and the presence of handrails by 12%. This suggests that people can get nudged into physical activities through minor changes to the urban landscape. We discuss implications for policy makers and urban designers.

KEYWORDS

Active urbanism; choice architecture; exercise; invigorating landscape; health; sociopsychology; urban design

Introduction

Problem

The current level of inactivity in many countries is often described as an 'Inactivity pandemic' (Kohl et al., 2012) and is fueled further by technological development, availability of personal transport, goods delivery, and working from home (Dobbie, Hydes, Alam, Tahrani, & Cuthbertson, 2022).

Health organisations such as WHO (Word Health Organisation) and the British NHS (National Health Service) recommend at least 150 minutes of Moderate or 75 minutes of Vigorous activity spread over a week, including a variety of activities aimed at enhancing bones, muscles, and agility to stay healthy. In addition, adults over 65 are advised to perform strength, flexibility, and balance exercises (NHS, 2018).

Although increasing physical activity is a widely recognised aspect of health promotion, engaging sedentary people in exercise requires better motivation: nearly 39% of the UK population do not meet the recommended targets (Sallis & Owen, 2015; Teixeira, Carraça, Markland, Silva, & Ryan, 2012). The current consensus on physical activity promotion is to encourage exercise that is incorporated into daily routines (Pate et al., 1995; Tesler, Endevelt, & Plaut, 2022).

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Furthermore, studies show a strong influence of the context on human behaviour and suggest a notable potential of the design of cityscapes on health outcomes (Anderson, Ruggeri, Steemers, & Huppert, 2017; Thaler & Sunstein, 2009; TRB, 2005). Serendipitous exercising 'on the go' has the benefit of being time-flexible and allows multitasking, thereby avoiding some of the main constraints of organised sport and health programs: travel, cost, health-related anxieties, and thoughts about finitude of life (Goldenberg & Arndt, 2008).

The design principles for the built environment to improve health and well-being of users form the central question of an increasing number of research studies (Baker, Nick, & Steemers, 2019; Barton, Grant, & Guise, 2020; Chen, Nguyen, & Comaroff, 2021; Fudge, Grant, & Wallbaum, 2020; Guo & Mell, 2021; Marques, McIntosh, & Kershaw, 2021; Steemers, 2015). Some of the insights from such research have already been incorporated into planning guidelines and policies (Barton, Tsourou, & WHO 2000; Department for Transport, 2020a; Healthy Streets for London, 2017; Ministry of Housing & Community & Local Government, 2021). This paper contributes to this growing literature by focusing on modifications to the urban pedestrian landscape that could nudge pedestrians into safe and intrinsically motivated exercise whilst on their daily routine walks: to work, shopping, or promenading. The main target group of the research are sedentary people not meeting the NHS activity recommendations, however additional exercise would benefit others as well.

Statistics in the UK show that 69.9% of UK residents walk over 30 min/day, and 86% walk over 10 min/day (Department for Transport, 2020b). There is a negative correlation between doing vigorous sports (such as football or running) and regular long walks (Table 6). The above suggests that there is a significant overlap between the target group (not active enough people) and walkers. Slow walking on an even pavement is better than no exercise but it causes no significant increase in heart rate so only qualifies as mild exercise (Burton, Stokes, & Hall, 2004). It also does not significantly improve balance and bone density if it does not include jumping, balancing, and stepping down (Boldina, Gomes, & Steemers, 2022, Boldina, Henry, Santos, & Steemers, 2022; Karlsson & Rosengren, 2012). We are looking for potential modifications to the urban environment that could facilitate a wider range of exercises incorporated in waking.

The questions that the paper is aiming to answer are: what proportion of participants would show an intention to choose a more challenging exercise route over a conventional one, and how can this proportion be increased through changes to the design of the route?

Psychology of persuasion and choice architecture

The approaches taken in this research are based on several existing concepts:

'Choice Architecture' refers to making good choices easier and less beneficial choices harder and has been actively explored and applied by governments and organisations in the last decade. The concept is based on the observation that humans do not process all their decisions with the same depth and often base their decisions on impulses ('thinking fast'), rather than on logical cognition of remote goals ('thinking slow') (Christenfeld, 1995; Kahneman, 2013; Petty & Cacioppo, 1986; Thaler & Sunstein, 2009). Simply reminding people of their long-term goals and values (such as being healthy) can work as a nudge (Kerr, Eves, & Carroll, 2001).

Another way to encourage healthier choices has been evidenced through the application of 'Fun theory' which is a strategy whereby physical activity is made more exciting, such as the use of 'piano stairs' which play notes when stepped on, replacing ordinary stairs (Peeters, Megens, van den Hoven, Hummels, & Brombacher, 2013). Designing more of such opportunities into the cityscape encourages improvisation and interaction with strangers and can make people feel like the spaces 'belong' to them (Anderson et al., 2017; Jacobs, 1961; Sennett & Sendra, 2020).

Beyond making choices easier and more fun, six main principles of persuasion: reciprocity, consistency, social proof, authority, liking, and scarcity (Cialdini, 2007) can be projected to cityscape design. For example, walking straight can be perceived as more consistent than walking circuitously (Rom, 2003). People tend to be influenced by social norms such as seeing how others choose their routes in the same landscape (de Groot, Bondy, & Schuitema, 2021). The degree to which a route is 'liked' is influenced by aesthetics, functionality, and perception of safety (Hoogendoorn & Bovy, 2004; Seneviratne & Morrall, 1985).

Part of the decision-making process may not be fully conscious and the person in question may not be able to articulate their own choice for taking one route over another (Hoogendoorn & Bovy, 2004). Those route choices correlate with psychological traits: for example, drivers who scored higher on sensation seeking, neuroticism, extraversion and consciousness have been found to change their routes more often than others (Gila, Tomer, & Ben-Zion, 2011; Tawfik & Rakha, 2012).

Studies show that if the motivation behind the intention, for example to exercise is intrinsic – it is likely to involve stronger feelings of personal investment, autonomy, as well as self-identification and as a result a person is more likely to change their behaviour for an extended period of time (Hein, Müür, & Koka, 2004).

Knowledge gap

Previous research on healthy route choices has primarily focused on people's likelihood of walking instead of using transport (Barton et al., 2020), but not how likely people are to pick a more challenging route over a conventional one and which design characteristics influence such choices. Some studies investigated whether pedestrians would displace from a tarmac walkway to an informal path in the grass but did not elaborate on the physical parameters of both routes (Arnberger & Haider, 2017). Moreover, existing research on pedestrian route choices has not considered the personal characteristics of people beyond demographics. This can be limiting as marketing theory argues that segmentation (targeting subgroups rather than undifferentiated mass audience) can make choice architecture more effective (Wymer, Knowles, & Gomes, 2021): for example sensation seekers can be influenced in a different way to health enthusiasts (Rune, Waaler, Halvari, Skjesol, & Ulstad, 2022). This paper addresses these gaps by investigating correlations between personality traits with the selection of city routes that represent varying levels of difficulty and challenge in terms of physical activity.

In summary, this paper aims to contribute to the implementation of active landscape through assessing and recommending design interventions in the pedestrian landscape that encourage increased physical activity and subsequent well-being.

The experiments

Method

To find out how likely people are to pick a more challenging route over a conventional one and what can influence such choices, we created photorealistic images presenting two or more routes. Participants were shown those images on a computer screen and asked which of those would they choose for walking - a method successfully used in urban and landscape research for decades to determine reactions to real situations (Daniel et al., 1976; Needham, Rollins, & Wood, 2004; van der Ham, Faber, Venselaar, van Kreveld, & Löffler, 2015).

The parameters that can potentially influence participants' choices were identified through literature review and street observations. Discrete choices were complemented with open ended questions to understand the rationale of participant's preferences. The insights gained from each experiment informed the design of subsequent experiments, resulting in a sequence of five experiments outlined in Table 1. Pictures of all scenarios, the data, as well as the exact wording

Table 1. Experiments and basic participant data 2.

	Date	Number of participants	Percentage female	Mean age	Scenarios
Pilot study	Feb 2021	33	42	–	Method testing 7 scenarios
Study 1	March 2021	203	62	34.01	12 Scenarios
Study 2	July 2021	303	55	37.3	9 Scenarios with 2–4 randomised variations
Study 2a (patch)	July 2021	56	–	–	Amended versions of scenarios 2 A and 2 J from Study 2
Supporting study – route difficulty	Feb 2022	11			Data from this study was used to define correlations in main studies.

of the questions can be found on the Open Science Framework https://osf.io/574jv/?view_only=098567dd6f90463dba70f09b0b2ac93c.

Participants

Recruiting participants through social networks of the researchers can lead to sampling and social desirability biases. To minimise this effect, the online crowdsourcing platform Prolific Academic was used to invite anonymous UK residents to complete an online Qualtrics questionnaire in February-July of 2021. They were paid £5.50 per hour.

A power analysis revealed that a sample size of 210 was required for a final experiment (Study 2) to detect a medium effect size of $f^2 = 0.25$ with a power of 0.95 in a 2×2-between subject ANOVA ($\alpha = 0.05$).

Scenarios

Each study contains 7–12 scenarios: images of places shown to participants, with one, two or four variations. Scenarios are assigned with numbers: P1–P7 for the Pilot study, 1A–1Y for Study 1 and 2A–2J for Study 2. Photorealistic collages were created using Adobe Photoshop software based on photographs from British cities.

The pilot study was designed to form a general understanding of various people's thinking, to grasp the main directions of further research, and to test whether our method is understood by the participants. We defined a list of encouraging/discouraging parameters to be tested in the scenarios (e.g. handrail or other people present vs absent). Scenarios that showed potential for useful results (such as P3) were developed further, scenarios where participants showed little interest in picking the challenging route (such as P2) were not included in Experiments 1 and 2. Some of reasoning participants gave responding open-ended questions informed additional scenarios

In the pilot study and Study 1 we varied only one parameter in each scenario. This allowed us to calculate the proportion of participants showing the intention to pick a challenging route, while Study 2 is aimed to quantify the effect of each design parameter (e.g. presence of unusual sculpture). To measure the effect of one parameter all others needed to be constant, and therefore a calibrated images method with two-by-two design was applied: each scenario had four variations to test the effect of 2 parameters per scenario, such as route length or the presence of a handrail (Appendix A). As an exception due to ambiguous parameters that encourage some people and discourage others, participants saw in questions 2F and 2H one of two pairs of images and were offered the choice between picking a challenging route in only one of the images, in both or in neither (Figure 1).

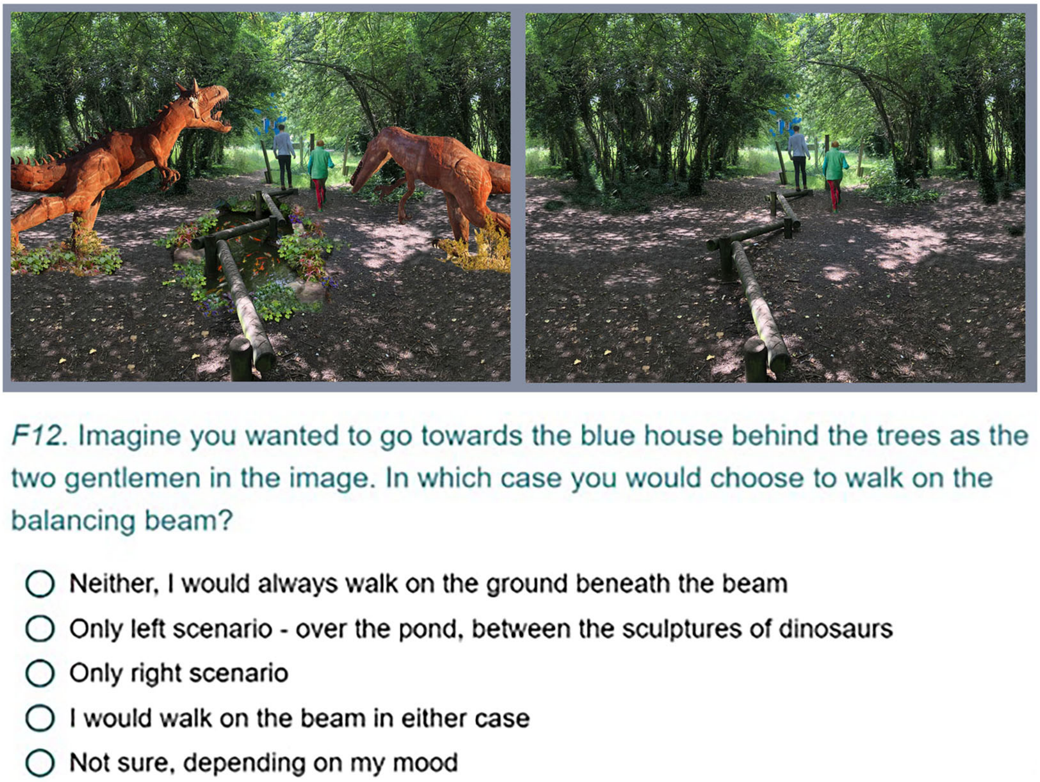

Figure 1. Scenario F. Example of question with paired images in Study 2.

Parameters were distributed between scenarios so that each parameter was tested in two or more scenarios (Table 2). This allowed us to test the impact of various manipulations, while keeping the number of participants and length of the survey manageable.

Results of scenarios A and J in Study 2 were skewed by technical issues with images, so 'patch' Study 2a was created which only included correct images for those scenarios.

For Studies 1 and 2, we ran a survey to examine the perceived level of difficulty of each route. Participants were asked to assign a score from 1 (as easy as walking on level tarmac) to 7 (I would not be able to do it). More details on the method can be found on the Open Science Framework https://osf.io/574jv/?view_only=098567dd6f90463dba70f09b0b2ac93c .

Demographics and personality variables

To test whether the tendency to choose challenging routes is linked to demographic and personality factors, participants were asked to answer questions about their age, gender, habits, health, occupation, and personality traits (such as sensation seeking or general anxiety). A standard alpha-level (α) of 0.05 was used to determine statistical significance.

Sensation Seeking was measured with the 8-item Brief Sensation Seeking Scale (BSSS). The internal consistency of this widely used test was adequate (Cronbach's $\alpha = 0.73$) (van Dongen, de Groot, Rassin, Hoyle, & Franken, 2022). Generalised Anxiety was measured with the 4-item version of the Generalised Anxiety Scale (GAD-7, $\alpha = 0.76$) (Spitzer, Kroenke, Williams, & Löwe, 2006).

The participants' occupation was incorporated as a variable in Study 2: 30% of participants self-reported as students, 31% employees, 12% managers, 8% business owners, 10% unemployed, 8% retired, and 1% other, showing a reasonable resemblance to the UK population.

Table 2. Scenario summary descriptions and organisation.

Pilot study		
Challenge	Scenario number	Description
Balancing beam	P1	Participants could choose between a shortcut in a park across a balancing beam, or a conventional route on pavement which is 1.8 times longer
	P2	Balancing beam and stepping pyramid by a river path running parallel, hence same length.
Stepping stones	P3	Shortcut in a park with steppingstones, default route on pavement is 1.8 times longer
	P4	Existing steppingstones shortcut in Stratford Olympic Park (London), large and easy to use, 5 times shorter
	P5	Timber steppingstones in water, compared to 1.5 times longer route around
	P6	Tall concrete steppingstones in a park, running parallel with a conventional route, of the same length, with a poster saying 'Exercise! To stay fit and healthy'
Cobbled stones	P7	Choice between even pavers and cobblestones in a Cambridge college with poster saying 'try walking on cobblestones, improve your balance'

Study 1		
Challenge	Scenario number	Description
Steppingstones, wave, and balancing beam	1A,1F & 1D	Shortcut in a park with steppingstones or balancing beam (developed from P3)
	1C & 1E	Pedestrian street by St. Paul's Cathedral (London) with a combination of challenging and conventional routes. 1C has only a narrow steppingstone pass next to wide conventional pavement. In 1E conventional pass is narrow and most of the width is taken by various challenging routes: timber wave, steppingstones, beams. Sign 'way to get fit and healthy'.
	1G	Existing steppingstones shortcut, large and easy to use (P4)
	1Y & 1H	Stone steppingstones over water with and without handrail (P5)
	1J	Tall concrete steppingstones with a variety in heights (P6)
Jumping down	1B & 1I	Jump down from a box before and after osteoporosis/bone density information. Other 2 options are steps and ramp.
Cobbed stones	1K	Choice between even pavers and cobblestones in an old Cambridge college.

Study 2 and 2a				
Challenge	Scenario	Description	Parameter 1 tested	Parameter 2 tested
Stepping stones	2A	Steppingstones shortcut in a park with flowers (Freeman et al., 2021) or winding tarmac route around (1A)	Geometrical layout	Flower beds design suggests the steppingstones are the main route
	2H	Pair of images with steppingstones: right in water, left in grass. Complemented with a follow-up study	Handrail	Chance of falling into water
	2J	Tall steppingstones with a nudging poster (developed from P6,1J)	Wording of poster	Presence of people
Balancing beam	2E	Log with a handrail over a lake as one of 2 routes to the ice-cream van. In half of the variations, we changed the pavement to make the route over the log look like an extension of the main route.	Geometrical layout, pavement colour	Distances
	2G	Balancing beam as shortcut towards fountain. In 2 of 4 variations, we added flowers and a sculpture of a woman riding a bear.	Handrail	'Fun effect'
	2F	Balancing beam in a forest or pass next to it. Comparison of 2 options	Presence of water, beam width and layout	

(*continued*)

Table 2. Continued.

Study 2 and 2a				
Challenge	Scenario	Description	Parameter 1 tested	Parameter 2 tested
Timber wave	2C	Choice between 4 routes by St. Paul cathedral (London): timber wave, conventional pavement	Presence of even more challenging option	Presence of people
Jump down	2B	Choice between 3 routes: steps, ramp or jump, London. Jumping is suggested from a red box into a target painted on the ground.	Screening with bushes	
	2D	Step down or ramp with distinctly different aesthetics.	Handrails	Design of ramp

The data was analysed using Qualtrics built-in tools, as well as SPSS and R statistical software.

The research approach was based on existing techniques but applied in a novel way, and produced a rich combination of quantitative data and qualitative insights, which are discussed in the following sections.

Results

Proportion of the population willing to take a challenging route in each given situation

The proportion of participants who stated they were willing to pick a more challenging route varied from 14% (Scenario 1D) to 78% (Scenario 2E) depending on the perceived difficulty of the route and to various situational advantages of the challenging route compared to other route(s), discussed in more detail below.

There were a great variety of reasons for picking challenging routes, including tendencies to take a shorter route: ‘Because stepping down on the lightbox is quicker’, staying healthier both physically and mentally: ‘Because I’m still agile so I’m gonna use it before I lose it’, ‘Practising balance is an important part of staying fit and healthy’, ‘Changes in heights make your brain work’, ‘The ramp is for those unable to use the step’ and experiencing new sensations: ‘The ramp looks boring’, ‘I like unconventional way of exiting a place’,

The participants who picked conventional routes had concerns about safety stating: ‘because it doesn’t look safe for all makeshift not solid looking’, ‘don’t want to break my ankle’.

Another often mentioned reason was peer pressure from observers and a concept of how an adult should behave. Participants were worried about how they would look and if they might do something that would be frowned upon: ‘I feel like the pavement is there for a reason and the balancing beam is built for children. I guess, there are other adults around so would not want to go on the beam for no apparent reason’, ‘Seems like it would be less "natural" and possibly embarrassing to be seen trying to reach the floor using the lightbox. Also, there are no signs suggesting that the lightbox is suitable or intended for this use’.

Participants expressed their concerns about damage that activity might do to their clothes and hair: ‘don’t want to mess up the hair plus that looks more like a jump’, ‘don’t like muddy shoes’.

Role of individual design characteristics of the routes

Physical parameters

The perceived levels of difficulty (noted in Table 3 as ‘DL’) of each route (cf. Figure 2) were calculated as the average from the supporting study participants’ responses. This parameter of the route was negatively correlated with the proportion of participants willing to take it. For the

Table 3. Overview summary and highlights of results for studies 1 and 2.

Type of challenge & potential health benefit	Scenario and complexity level (cl; 0- obstacle course, 1-complex, 2- medium, 3-easy).	Proportion of participants picking the challenging r.	Most mentioned encouraging effects (multiple answers possible).	Most mentioned discouraging effects (in scenarios without open-end question column left blank)
Stepping-stones Balance, increased metabolic rate, mindfulness calming effect, more leg muscles co-activating (Boldina, Gomes, et al., 2022; Fattorini et al., 2012; Voloshina et al., 2013)	1A DL 3.0 steppingstones shortcut with long route around	36% $N = 203$	Of participants who picked shortcut: 81% fun, 20% shorter/faster, 8% view, 3% curiosity	Of participants who picked conventional route ($N = 74$): 29% indicated that steppingstones are safer, 20% easier, 12% assumed for children, 11% not meant for walking, 9% dirty shoes, 6% embarrassment, 5% wanted to walk longer/take more steps
	1F DL 3.0 steppingstones shortcut	38%	–	–
	1C DL 2.1 Round stepping stones in grass	29%		50% Too crowded, 49% slippery, 39% too high, 3% too low, 37% not clear its for walking on, 27% stones too far from each other
	1E four options: DL 2.1 round stepping- stones on a lawn	28%		10% Overcrowding 6% safety
	DL 3.1 tall stepping-stones in grass	17%		
	Total	45%		
	1G DL 2.2 wide steppingstones	64%	18% Faster/shorter, 31% fun	
	1Y DL 3.6 rough stone steppingstones across water, no handrail (Figure 4(a)).	18%		
	1H DL 3.1 rough stone steppingstones across water with handrail	30%	26% Of those who picked the conventional route would pick the challenging route if with friends or children. 5% would try only if drunk.	18% Who did not pick the challenging route mentioned water as a discouragement, especially in cold weather or when dressed up.
	1J DL 3.1 tall concrete steppingstones	37%		
	2A DL 3 shortcut with stones (Figure 4(b))	63% $N = 303$	Fun and quicker	SHOES concerns
	2H DL 2.3/3.1/3.6 steppingstones across grass and water with or without handrail (comparison)	32% grass+ 10% water + 33% both =75%	Thrill: 'it's more fun when there's risk involved'	concerns about weird texture on shoes, danger of trauma or embarrassment
	2J DL 3.1 tall concrete steppingstones	56%	Sign giving playing legitimacy for adults	Embarrassment, danger of trauma
Balancing beam.	1D DL 4.3 shortcut-balancing beam	14% $N = 203$		
Balance, mindfulness, more upper body, arms and legs muscles co-activating	2E DL 2.6 log with a handrail as one of 2 routes to ice-cream van.	59% $N = 303$ 78% $N = 75$	16% Scenic: 10% Fun	12.5% Safety concerns: 'unless there are handrails over the plank or someone with me, again safety issues.'

(*continued*)

Table 3. Continued.

Type of challenge & potential health benefit	Scenario and complexity level (cl; 0- obstacle course, 1-complex, 2- medium, 3-easy).	Proportion of participants picking the challenging r.	Most mentioned encouraging effects (multiple answers possible).	Most mentioned discouraging effects (in scenarios without open-end question column left blank)
	2E DL 2.6 variation with van on the left and design suggesting left.			
	2G DL 4.3 balancing beam as a shortcut towards fountain	28% $N = 303$	Excitement: 'because there is bluebells and a woman riding a bear'	Danger of falling
	2F DL 4.9 balancing beam: comparison of 2 images	14% With dinos. +17% without + 34% both =65%	Change to daily routine, to prove own fitness: 'just to prove that I could still keep my balance when I am in my seventies'	Danger of injury
	1F DL 2.2 variation with straight wide beam.	47%+ 15%+17% = 79% $N = 75$		
Timber wave. Increased heart rate and calves stretching	1E DL 1.7 timber wave, other option conventional	42% $N = 203$	New experience: 'the timber wave is fascinating'	Danger of trauma
	2C DL 1.7 timber wave, one of 3 challenging options.	23% def. + 25% prob. + 35% pos. =303	Good balance of interesting and not too difficult	Pavement is still easier
Assault course. Increased HR, agility, strength	2C DL 5.9 assault course with monkey bars, one of 3 challenging options	5% Definitely + 11% prob. + 26% possibly	New experience, interest	Insufficient fitness, childish.
Jump/step down. Bone density	1B DL 2.2 step down 0.5 m, other options: conventional steps or ramp	45% Picking ≥20/100 and 22% ≥50/100.	16% Fun, 9% faster/ shorter route	28% Safest (18–75yo), 17% easiest, 10% worried about opinion of others, 8% prefer what they are used to
	1I DL 2.2 step down 0.5 m after health info, other: conventional steps or ramp,	59%≥20/100, 35%≥50/100	16% Bone health 'for health reasons, I'll jump because it may help my bone density'	Embarrassment: 'less attention grabbing, but if I'm with others I may choose the red cube as I am aware of the benefit'
	2B DL 2.2 step down 0.5 m into circle, other opt.: conventional steps or ramp.	10% Def. + 20% probably + 39% maybe	20% Fun	13% Safer, 8% particular health issues, 4% it's for children
	2D DL 3.1 jump/step down on lightbox, or ramp.	11% Def. + 13% maybe		
Cobblestones leg muscles co-act., reflexology	1K DL 1.3 rounded cobblestones with info poster, alternative: even pavement.	47% $N = 203$	Following the sign recommendation	Pain in the feet, danger of trauma

Note. DL: difficulty level.

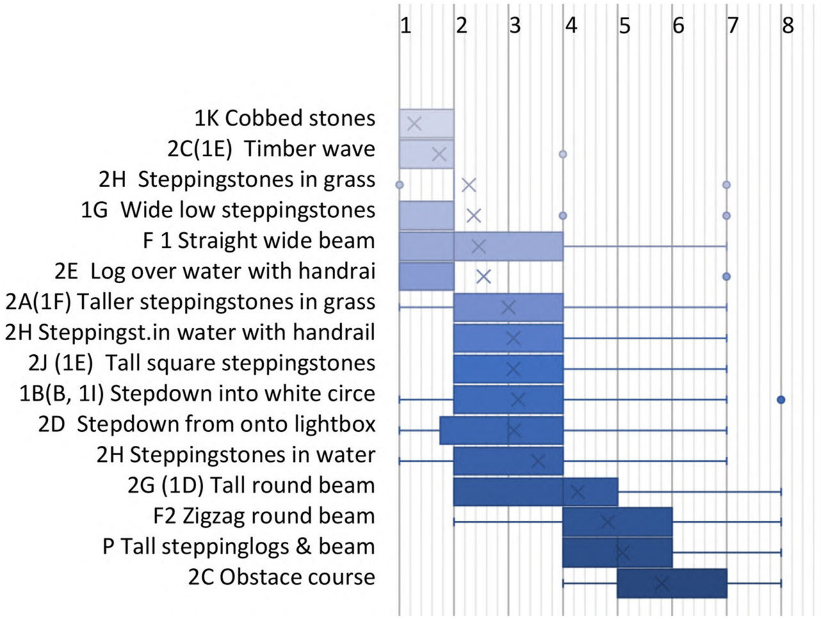

Figure 2. Level of difficulty of each route scored and ranked from 1 (easy) to 8 (hard).Graph by the authors.

Figure 3. Scenarios 1A and 1F, similar scenarios, but with different length of the route around.

assault course in scenario 2C including monkey bars and jumping pads 16% of participants were inclined to choose it over the conventional, while for the least complex route – wide low steppingstones in scenario 2G – 78% of participants were willing to take it.

Handrails next to the steppingstones increased the number of participants willing to choose that particular route by12%. In multiple choice questions, 26% of participants picked 'handrail for safety' as one of the aspects that would encourage them to use the challenging route.

Shortcuts

Making challenging routes shorter than conventional ones appears to be the most effective layout, encouraging between 36 and 55% of participants ($n = 203$) to choose such a route. Interestingly, the *extent* of reduction of a route with a shortcut did not make a significant difference (Figure 3).

Layout

The design of pavement, lighting, and flowerbeds can work as a nudge, for example in Scenario 2E, the test version colouring of the pavement suggested the challenging route was the continuation of the main road while the conventional looked as a side turn. In the control variation, challenging and conventional routes had the same pavement. 10% more participants picked the challenging route in the test version (Figure 4).

Aesthetics plays an important role as a choice factor: in Scenario 1A, 8% of participants mentioned the view as an incentive to pick the challenging route. In other scenarios, participants mentioned the elements of nature and intriguing objects as motivation.

Signs were mentioned both as a reason to take a challenging route: 'The sign is pointing at the stones, would probably check them out' (Scenario 2J), and as a reason not to: 'The sign frustrates me; I don't want to be told what to do' (Scenario 1J). In scenarios without signs, participants often mentioned they didn't know if they were meant to walk there: '.... Also, there are no signs suggesting that the lightbox is suitable or intended for this use'.

Perceived behaviour and social norms

The presence of people can have a positive effect (up to 9%) in reassuring participants that the steppingstones are for walking on rather than an artistic display (Scenarios 1H, 1Y, and K1). However, it can have a negative effect when it is perceived as causing overcrowding or observation (Scenarios 2A, 2D, 2E, and 2J). When answering the question 'how do you pick your route…?' 3% mentioned following other people and 10% avoiding people. However, in Study 1, 40% of participants stated that active presence of other people on a challenging route was an aspect that encouraged them to also choose that route. Participants, especially 20–25-year-old ones, expressed concerns about being observed and judged by others.

Demographics and personality

Correlations between participants' personal characteristics (age, gender, personality traits etc.) and their route choices and reasoning were calculated with SPSS software to identify the most important correlations. Table 4 shows the ones applicable for cityscape design. Unrelated correlations, such as between age and sensation seeking, are not reported.

CCR (Choice-of-Challenging-Route) for each participant was calculated as a sum of their choices in all scenarios taken together, from 0 (would always pick only conventional routes) to 48 (would definitely pick all the challenging routes in all scenarios). Numbers in-between mean the participant would either pick only a few routes or would 'maybe'' take some of them. The correlation of this variable with the regular physical activity level of participants was non-significant ($r = 0.024$-0.047, $ps > .05$), which suggests that people of all levels of activity are equally likely to pick a challenging route on an image. However, for the most difficult routes – participants who regularly engaged in strength and balancing exercises – were more likely to choose them.

There is a significant negative correlation of CCR with age but the percentage of participants who would take only the conventional route in all scenarios was low in all age groups (Figure 5). Despite being less prepared to take adventurous routes themselves, older generations were of the concept just as much as younger ones.

Participants' opinions about the concept of exercise route

Study 2 ($N = 303$) included a question 'What do you think about introducing one of the designs you have just seen into your local park? Which ones?…', 76% of participants were positive, 6% explicitly negative, and 18% were found to be indifferent or gave no explicit approval of the overall idea but were in favour of some elements.

Positivity of response to introducing Active Landscape in cities did not correlate with age, gender, place of birth, sensation seeking, or anxiety. It only correlated with choosing exercise routes $r = 0.393$, $p < .001$.

(a)

Figure 4. Effect of the path appearance on route choice. (a) Scenario E. Two landscape designs. (b) Effect of the design on preferences.

The reasons people gave to explain why they like the concept can be grouped into 3 main categories: (1) providing easily available, inclusive exercise (the main target of this research), (2) providing entertainment (this was meant only as a tool to encourage exercise), (3) adding visual variety to the landscape (a pleasant side-effect)

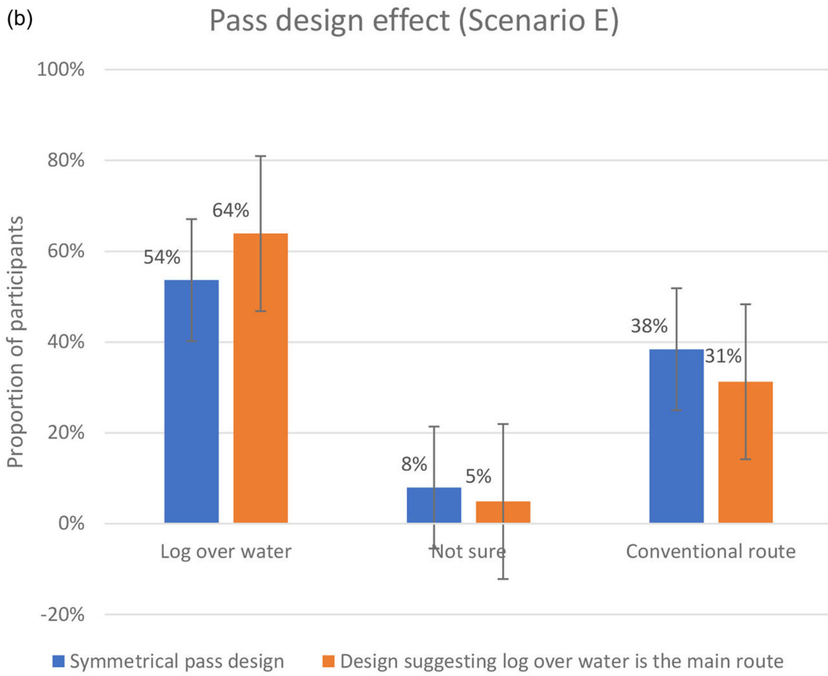

Figure 4. Continued.

The concept of making exercising seamless and enjoyable was fully understood by 14% of respondents: 'All of them, it makes exercising fun and less like a chore'.

Discussion and practical application for the built environment

The proportion of participants willing to pick a more challenging route varied from 14% for the most difficult to 78% for the easiest of our challenges. While the increase in level and extent of activity level can be modest in some cases, when projected to millions of people using cityscapes on a daily basis, it can have a significant and beneficial impact on public health. Previous examples of promoted travelling exercises, such as cycling and walking up the stairs have resulted in a stable increase of activity (Assunçao-Denis & Tomalty, 2019; McGann, Jancey, & Tye, 2013). Repeated on a regular basis Active Landscape could shift the calorie intake/expenditure balance (Hill et al., 2003), as well as improve heart, bone, and mental health, especially when it results in the formation of new, healthier habits (Verplanken & Wood, 2006).

Regarding the best locations to apply Active Landscape, people appeared to be more open to exercise routes in their leisure time, accompanied by friends or children and not viewed by too many onlookers. Routes that incorporate more difficult challenges, such as obstacle courses and narrow balancing beams, would benefit from being placed in areas more likely to be frequented by younger users.

Making challenging routes even a little shorter than conventional ones is an effective measure to encourage people to pick them. The intention to save time by taking a shorter route might be the main reason, or there is a cognitive bias supporting an inclination to try something entertaining (Weiner, Graham, Peter, & Zmuidinas, 1991): further experiments could make the reasons clearer and inform design decisions.

Table 4. Significant correlations of demographic and personality of participants with the choices they make, $N = 198$.

Personal characteristic		Correlated with perceptions of active landscape characteristics.	Pearson's r [95% CI]
Age		Choice-of-challenging-route	−0.287*** [−0.15, −0.41]
		Concerns about being seen.	−0.155* [−0.02, −0.29]
Occupation (binary: 0: no, 1: yes)	Director	Understanding heath benefit of exercise route	0.206*** [0.07, 0.34]
	Student	Pick a route because it is straightforward0.	0.235*** [0.10, 0.36]
Sensation seeking (BSSS)		Choice-of-challenging-route	0.491*** [0.38, 0.59]
		Picking route between scary dinosaurs in scenario 2F	0.327*** [0.20, 0.44]
Anxiety (GAD 7)		Concerns about being seen and judged when taking challenging route.	0.243*** [0.11, 0.37]
		Seeing stepping down as childish	0.424*** [0.30, 0.53]
Walking pattern: leisurely walk over 30 min at least once a week		Playing football	−0.250*** [−0.38, −0.12]
		Being a student	−0.186** [−0.05, −0.32]
		Sometimes walk over an hour	0.307*** [0.18, 0.43]
Exercising per week		Doing what is meant to be done	0.185** [0.05, 0.32]
Regular strength exercises		Jumping from the box into blue circle (Scenario 1B)	0.254*** [0.12, 0.38]

Note. *$p < .05$; **$p < .01$; ***$p < .001$.
Self-reported occupation categories included: students, employee, don't manage anyone else, managers, business owners, company directors, unemployed, retired, and others. 1-yes, belong to this category, 0-no. Excel table of correlations can be found on the Open Science Framework https://osf.io/574jv/?view_only=098567dd6f90463dba70f09b0b2ac93c.

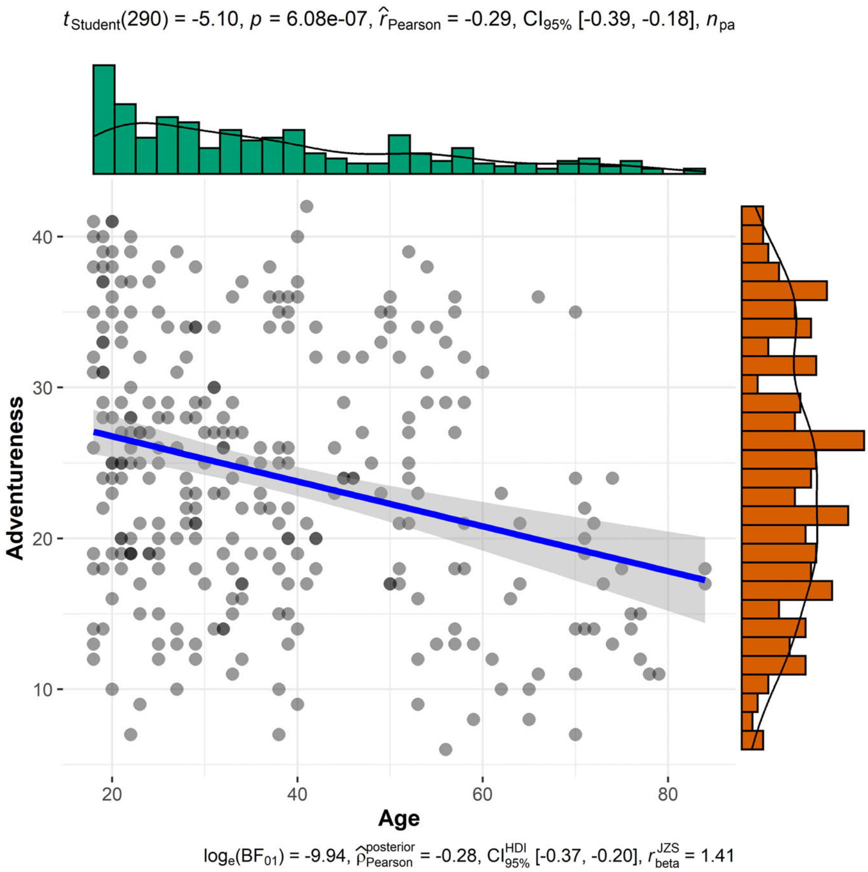

Figure 5. Association between age and adventurousness. Graph by authors.

The least intimidating of challenging routes were those with wide, steady-looking balancing beams (Scenarios 2F and 2E) and wide steppingstones (Scenarios 1G, 2A and J), especially with the presence of handrails. At the same time, more challenging routes have larger health benefits. Combining wide and narrow beams would accommodate a wider range of skill sets and confidence levels. Multiple options generally tend to normalise the idea of the unusual routes available and attract more people to try at least one (Scenario 1E). The effect of handrails can be explained as providing support while walking, a safety measure in case of slipping or losing balance, or as a sign that the beam is meant for walking on (Gamble & Walker, 2016). Structures need to *be* as well as *look* strong and steady: participants raised concerns about the stability of the structure in scenarios where a step looked less solid (Scenario 2D and others) (Ghosn, Alama, & Azhari, 2021).

In the scenarios presented, participants were sometimes unsure if a route was for walking or only to be observed as an art display. Various scenarios showed that signage, materials, and layout can help to reassure people that they are meant and encouraged to take this route. Adding handrails works both for added perceived safety and for making it clear that the route is for walking. Due to often raised by participants structural stability concerns, structures need not only to be but also to look steady.

The assumption that routes are for children only, and not for adults, came up in multiple responses and could be addressed by means of colours, design styles, and signage. At the same time, 'fun' was most often given as a reason for picking the exercise routes, and some respondents commented specifically on enjoyable features of routes, such as the dinosaur sculptures or the target painted on the pavement. Making exercising more interesting can turn it into an enjoyable activity that participants want to repeat (Vernadakis, Kouli, Tsitskari, Gioftsidou, & Antoniou, 2014).

Similarities to nature tend to remind people of pursuits like hiking, which makes walking over water and natural materials, such as plants, timber, and stones especially popular. Glass and concrete suggest more formal behaviour (Scenarios 2A, 2C, and 2E) (Sennett & Sendra, 2020).

The correlation with personality traits sets the basis for potential market segmentation: attracting Sensation Seekers might require exciting art pieces and a sense of adventure while for people keen to improve their health, posters with information might be more effective.

While our findings are new in the area of Active Landscape, they are conceptually related to research aimed to increase active travel such as walking or cycling (McLeod, Babb, & Barlow, 2020). For example, providing relevant and safe infrastructure alongside pro-cycling policies and programs has been effective for promoting those activities (Assunçao-Denis & Tomalty, 2019).

The findings can be applied outdoors or indoors, and our research supports those initiatives underpinned by intuition in some designs from around the world (Figure 6).

Limitations

Data was collected on the Prolific platform, which can only collect answers from people who have access to the internet through a computer (Peer, Rotschild, Evernden, Gordon, & Damer, 2021). Thus, our findings might be slightly different in representative samples.

We measured intention rather than behaviour in our study, because this allowed us to get a better first impression of what factors can increase intentions to select a more challenging route. While intentions and actual behaviour are correlated (Webb & Sheeran, 2006) and interventions to change intentions also tends to result in behaviour change (McDermott, Oliver, Iverson, & Sharma, 2016), future research is needed to test whether our interventions also lead to actual behaviour change.

The main concept of this research is intrinsic motivation for exercise: giving people the opportunity to exercise because they want to do this move right now, rather than because they

(a)

(b)

Figure 6. (a) Corridor in Bad Blumau spa hotel, Hundertwasser (Bad Blumau website). (b) Arena sculpture by John Maine, author's photo and (c) pavement in Hague, Netherlands, author's photo.

believe it is expected of them. The way participants explained their choices demonstrate that the scenarios offered all three types of intrinsic motivation (Teixeira et al., 2012): to know (curiosity to try unusual route); to accomplish (prove oneself to be able to do it), and to experiencing

(c)

Figure 6. Continued.

stimulation (see closer flowers and sculptures, be elevated above ground and water), and hence the behaviour is likely to follow the intention.

The nature of the experiments reveals the self-reported behaviour intentions, which can deviate from actual behaviour. However, digitally created images have been successfully used for decades in urban and landscape research (Daniel et al., 1976; Needham et al., 2004; van der Ham et al., 2015) and industry to study the reaction to yet-to-be-built environments (Bateson & Hui, 1992). Dichotomous choice analysis was also used to quantify the effect of various social factors on the choice of routes in parks and overcrowding on walking, cycling, and jogging (Arnberger & Eder, 2011; Muhar, Reichhart, & Arnberger, 2007). The theory of planned behaviour suggests that an individual's decision to engage in a specific behaviour can to a reasonable extent be predicated by their intention to engage in that behaviour (Jones, Pykett, & Whithead, 2013; Marteau, 2018). Applying our findings to test sites or in natural experiments would enable the results to be checked in terms of showing if people choose the same routes as they chose on calibrated images, if they keep choosing them consistently and to what extent it will improve their health.

Scenarios that look exciting at the first glance might become less appealing after some time resulting in reduced use. On the other hand, people might make it a habit to use the more exciting routes, thereby constantly improving their fitness. Being 'nudged' into using active routes, and through positive feedback people might be inclined to continue their routines frequently and automatically, thus changing their habits over time (Neal et al., 2016; Verplanken & Wood, 2006).

There are many ways to encourage people to be more active and some of them might be more effective than the ones explored in this paper. However, Active Landscapes, if implemented more widely, provides an additional opportunity that could be promoted through school education, health systems, or mass media.

The experiments were performed with UK residents as participants and might therefore not replicate in other countries. Additional/comparative studies in other cultural/legal/climatic conditions could be beneficial.

Conclusion

We discovered that up to 78% of walkers would be prepared to take a moderately more challenging route and that the majority of participants (76%) were approving of the concept of Active Landscape, once familiarised with it. Based on the research, we identified key design principles that increased a route's attractiveness, which in turn nudged increased active usage

Applying the above principles in the design of public space might improve the overall physical and mental health of a population. This study provides a framework of research evidence to support and guide policy makers, urban designers, and communities in improving health and promoting wellbeing.

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Ethical approval

Research was approved by the University of Cambridge Faculty of Architecture and History of Art Ethical Committee.

Disclosure statement

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Anna Boldina (BA(Hons), Diploma), after working for 15 years as an Architect/Urban Designer and Developer in London and internationally, Anna Boldina is now applying her collected experience to her PhD research in Urban Design/Sociopsychology/Biokinetics. They are developing a toolbox to provide attractive opportunities to exercise more effectively during daily pedestrian experiences, whether commutes or walks for pleasure. Anna is keen to apply her research in practice through policies and design.

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