AFFECTIVE EXPERIENCES OF BUILT ENVIRONMENTS AND THE PROMOTION OF URBAN WALKING

ABSTRACT

According to psychological theories of environmental affect, the physical environment moderates the walking experience and its psychological wellbeing benefits. The present paper further demonstrates that affective experiences also influence intentions to walk. A study to explore the influence of affective experiences of walking on walking intentions is reported. A sample of adults working or studying in Bristol, UK (n = 384) participated in an experiment involving virtual exposure to one of five environments, with evaluations of their affective experience and of intentions to walk in the setting. A subsample (n = 14) then took part in photo-elicited semi-structured interviews. Multiple regression analyses showed that affective experiences of walking influenced walking intentions. Interview analyses highlighted the role of traffic, city busyness, and poor aesthetics. This is the first empirical study that examines the walking experience and related walking intentions from the pedestrian perspective employing theories of environmental affect. The findings indicate that safety, comfort, and moderate sensory stimulation are crucial elements for the walking experience. Following this, a strategy to promote active mobility in the built environment can be constructed around safety, comfort, and moderate sensory stimulation by targeting the micro elements that prevent them.

1. Introduction

Walking is a travel mode that has important health benefits (Robertson et al., 2012; Warburton et al., 2006). These include improvements in short-term subjective wellbeing, e.g. people's cognitive and affective evaluations of their lives (Diener, 2000, p. 34), for example improvements in happiness and contentment (*hedonic tone*; Roe and Aspinall, 2011), engagement (Johansson et al., 2011), relaxation and stress reduction (Roe and Aspinall, 2011, Van den Berg et al., 2003), and positive affect (Hartig et al., 1991). However, environmental settings vary in the extent to which they support particular activities, and the environments in which walking is performed can moderate the benefits of walking (Frank et al., 2016;

Gatrell, 2013; Johansson et al., 2011). Considering that walking has generally declined in the United States and Western Europe over the past four decades (DfT, 2017b; Buehler and Pucher, 2012), understanding which environmental features limit individuals' walking intentions is essential. The present paper contributes to this initiative by exploring how affective experiences of walking influence intentions to walk in the future, focusing on negative features of built settings that can limit intentions to walk. While in a previous study we found that different settings were associated to different walking experiences (Author hidden, 2018a), in the present study we explored how these experiences influence intentions to walk. To this end, we employed ideas from the field of psychology on the influence of environments on experiences and behaviours and explored these empirically with a mixed-methods strategy involving a simulated experiment and photo-elicited interviews. In psychology, some scholars argue that environmental affect is the key to understand individuals' response to the physical environments (Russell, 2003). The main relevant theories are summarised in the next section.

1.1 Theoretical perspectives on environments, wellbeing, and behaviours

Restorative environments theories (Kaplan and Kaplan, 1989; Ulrich. 1984, 1983) posit that environments elicit affective and cognitive responses in individuals, and such responses subsequently influence behaviours. Kaplan and Kaplan's Attention Restoration Theory (1989) focuses on the effect of environments on cognitive demands, while Ulrich's Stress Recovery Theory looks at the influence of environments on affect. According to Kaplan and Kaplan (1989) and to Ulrich et al. (1991), it is exposure to natural settings that promotes greater restoration than contacts with urban environments. One explanation proffered for this effect, from an evolutionary perspective, is that individuals have an innate inclination towards natural environments over built settings (Ulrich et al., 1991).

Second, the theory of environmental stress suggests that some urban environments present several environmental stressors and trigger an imbalance between environmental demands and response capabilities (Evans, 1984). Elements such as noise, crowding, and air pollution can affect psychosocial processes and thus bear a negative impact on psychological wellbeing (Evans, 2003).

Finally, Russell's concept of environmental affect (Russell, 2003, 1980) theorises the influence of environments on experiences and behaviours. Russell proposed that affect is crucial to understanding responses to physical environments; the way individuals perceive physical settings through affect influences reactions, activities, and behaviours. Affective state is defined as "a neurophysiological state that is consciously accessible as a simple, non-reflective feeling that is an integral blend of hedonic (pleasure–displeasure) and arousal (sleepy–activated) values" (Russell, 2003, p. 145). Affective states are characterised by degrees of valence (degree of pleasantness) and arousal (degree of intensity). Affective states vary in intensity and pleasantness, but core affect is a flow that is always present. According to Russell and Lanius (1984), positive affective experiences encourage behaviours and intentions (*approach*), while negative ones elicit *avoidance*.

In the transport field, scholars have suggested that the affective travelling experience also influences future behaviours and intentions, with individuals likely to choose the travel mode that provides a positive experience (De Vos et al., 2018, 2016; De Vos and Witlox, 2017; Páez and Whalen, 2010; Gatersleben and Uzzell, 2007). Similarly, the literature on travel satisfaction highlights the long-term implications of immediate walking experiences. This generally indicates that walking results in high levels of travel satisfaction (e.g., Zhu and Fan, 2018; Ye and Titheridge, 2017; De Vos et al., 2016; Mokhtarian et al., 2015; St-Louis et al., 2014), including when it is combined with cycling (Friman et al., 2013; Olsson et al., 2013; Paez and Whalen, 2010). In addition, satisfaction with walking trips is also associated with higher life satisfaction (De Vos, 2018; St-Louis et al., 2014; Bergstad et al., 2011), longer-term wellbeing (Martin et al., 2014) and satisfaction with leisure time (Chatterjee et al., 2017). As noted by Gatersleben and Uzzell, affective appraisals of the travel experience produce important implications for the promotion of sustainable transport and pedestrian mobility specifically, as they provide "insight into the reasons that people prefer certain travel modes to others" (2007, p. 417). However, scholars have given little attention to the role of physical characteristics of settings in affecting walking benefits and associated behaviours. Considering that built environment exposure will increase globally due to urbanisation (UN, 2014), it is crucial to explore the specific characteristics of current built environments restrict the psychological benefits of walking and thus engagement in walking. While a growing body of literature from environmental psychology has documented the positive wellbeing benefits

of walking in nature (Roe and Aspinall, 2011; Thompson Coon et al., 2011; Van den Berg et al., 2003), the comparative influence of the urban environment is often identified as negative (Johansson et al., 2011; Ulrich et al., 1991). Several experimental studies have found that actual or simulated walks in urban settings were associated with negative affective outcomes (Johansson et al., 2011; Ulrich et al., 1991). These included, for example, a commercial area with heavy traffic (Johansson et al., 2011), an industrial area in urban outskirts (Hartig et al., 2003), but also city centre environments such as a traffic-congested areas (Laumann et al., 2003), and a busy urban road with shops (Tilley et al., 2017). However, the specific elements that can contribute to these negative outcomes remain unclear.

Cross-sectional walkability studies also indicate that certain characteristics of built environments are associated with higher levels of walking, including density, diversity, and accessibility to destinations (e.g., Ewing and Cervero, 2010). However, there is an apparent lack of literature related to the built environment characteristics that have positive or negative affective benefits and, ultimately, influence walking intentions from the pedestrian perspective (Davison and Curl, 2014; Andrews et al., 2012). Some exceptions include Gatersleben and Uzzell's 2007 study, which examined affective appraisals of daily commutes among university employees, and found that traffic, low-quality infrastructure, and perceived danger negatively contributed to walking quality. Nevertheless, no analysis was conducted on whether affective experiences and these elements limit walking intentions. An experimental study by Johansson et al. (2016) did begin to address these relationships, in finding that affective valence predicted intentions to avoid or to choose specific routes, and that perceived complexity and aesthetic quality, upkeep and order, and presence of well-maintained greenery all positively influenced both affective valence and walking intentions. However, these elements were included as a *single* variable, hence there is no indication as to which aspect is more important.

1.2 Aims

Taking into account the limited literature on the features of built environments that can influence affective experiences of walking and subsequent walking intentions, the present paper advances this debate by examining the relationship between affective walking experience, walking intentions, and characteristics of built environments. To this aim, it builds

on psychological theories of the influence of environments on wellbeing and behaviours (Kaplan and Kaplan, 1989; Ulrich, 1984; Russell, 2003; Evans, 2003, 1984). Specifically, the current study aimed to:

1. Empirically examine whether and, if so, how affective experiences of walking influence intentions to walk in the future (Aim 1);
2. Propose a systematic, empirical characterisation of the barriers to positive affective walking experiences from the pedestrian point of view (Aim 2).

Building on the findings, urban policy recommendations are also outlined.

2. Methods

The current study was part of a larger, two-study mixed-methods research project investigating the influence of built environments on the walking experience ([Author hidden] 2018). The present paper reports on those findings from both the quantitative phase of data collection (simulated experiment) and the qualitative phase (photo-elicited interviews). In a previous paper, we discussed how walking in built environments can support positive affective perceptions (Author hidden, 2018b). The research project was approved by the University Ethics Committee.

2.1 Experimental phase

In order to assess affective experiences of walking, and how these influenced intentions to walk in the future (Aim 1), an experiment was conducted in Bristol, UK, with 384 adults who were working and/or studying locally. One hundred and thirty were undergraduate psychology students and 254 were employees of organisations based in and around Bristol city centre. Around two-thirds (70.1%) were females, whilst participant ages ranged from 18 to 67 years old (M = 35.01, SD = 13.89). Employees were approached via key contacts in city centre-based organisations and were invited to the study via email; students were recruited through a psychology department student participation programme. None of the participants were known to the experimenter(s).

The experiment employed a between-participants methodology involving a video and audio-based virtual walk with five conditions, similarly to previous research (Ulrich et al., 1991;

Laumann et al., 2003). A one-minute video of a simulated walk was filmed for each environment with a GoPro HERO 35 mm camera; videos reproduced the feeling of movement and included sound in order to give a realistic representation of the walking experience. Participants rated their affective states before and after watching the video. For more details of the methodology, please refer to [Author hidden] (2018a).

Hence, the empirical data were derived from five distinct environments in Bristol city centre. Here they are analysed in aggregate, although elsewhere have been subject to comparative between-sites analysis. In summary the five sites were: a pedestrianised historic environment in Bristol's Old Town, characterised by neoclassical buildings and cobbled paving (Figure 1); one pedestrianised modern environment in a complex of concrete and glass-fronted buildings (Figure 2); a pedestrianised environment with a mix of greenery and historic elements, framed by Bristol Cathedral (Figure 3); a commercial road with high street retail outlets and cafés and a single-lane road with moderate moving traffic, constituted by cars and buses (Figure 4); and an urban park (Figure 5) (see Author, 2018a). As explained further below, the same videos were also used as exemplar contextual material in the qualitative phase.

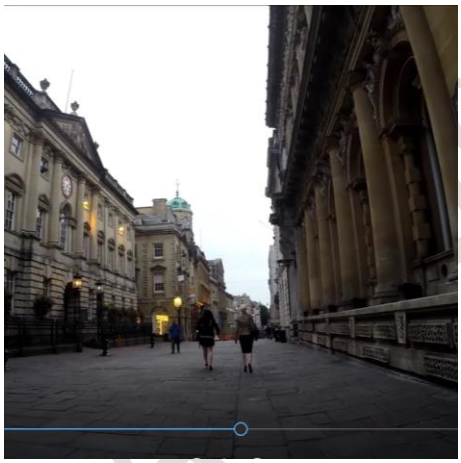

Figure 1: Pedestrianised Historic environment

Figure 2: Pedestrianised Modern environment

Figure 3: Pedestrianised Mixed environment

Figure 4: Commercial road with traffic

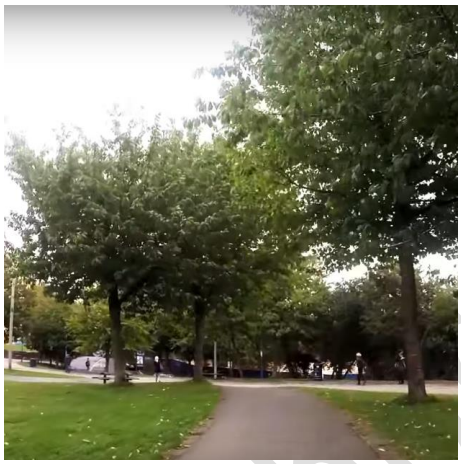

Figure 5: Park

The current study employed the variations in stress and hedonic tone (e.g. happiness and contentment – Roe and Aspinall, 2011) as independent variables for regression analyses. The two variables were selected as they are two typical dimensions of the travelling experience (Anable and Gatersleben, 2005). Stress and hedonic tone measures were based on the UWIST MACL scale (University of Wales Institute of Science and Technology Mood Adjective Checklist – Matthews et al., 1990). They were measured before and after watching the video, each by four survey items respectively (stress: nervous, tense, relaxed, calm; hedonic tone: happy, content, sad, sorry), on a 4-point scale (1 = 'definitely not'; 4 = 'definitely'). The total scores were obtained by summing up the scores. Possible scores for stress and hedonic tone range from 4 to 16.

Additional independent variables included environmental perceptions, measured with two scales: *aesthetics* and *interestingness* (Karmanov and Hamel, 2008), which "are considered to be the two fundamental dimensions of aesthetic evaluation" (Oostendorp and Berlyne, 1978, quoted in Karmanov and Hamel, 2008, p. 119). These included five and three bipolar items respectively:

- Aesthetics (*ugly–beautiful, unpleasant–pleasant, unfriendly–friendly, unenjoyable–enjoyable, repulsive– inviting*);
- Interestingness (*uninteresting–interesting, average–exceptional, dull–exciting*);

Other measures included: travel mode to work/place of study ('*What is your main mode of travelling to work/place of study*?'); walking habits ('*How many days per week do you walk for at least 30 minutes?*'); age and gender. The outcome, walking intentions, was measured by the question: '*If this kind of environment was on your way to work/university, to what extent would you be more likely to walk to work/university more often?*') using a 5-point scale (1 = 'definitely not'; 5 = 'definitely yes').

2.2 Photo-elicited interviews

A qualitative phase explored findings in more detail and addressed Aim 2 on the barriers to positive affective walking experiences and walking intentions. This consisted of 14 semi-structured interviews with participants (eight females, six males; eight employees, six students) – identified with pseudonyms in Table 1. They were selected from the experimental sample with a purposeful strategy. Sampling criteria included walking habits (regular versus non-regular walkers), urban orientation (urban versus nature orientation) and age (under 25 years old; 26 to 40 years old; over 41 years old). Participants' ages ranged from 18 to 53 years (M = 31.69, SD = 8.63). Interviews were based on individual walks taken by participants. Participants were asked to take a walk in the city centre and photograph "*the things of the surroundings that draw [their] attention during the walk and make [them] feel good or bad"*. The current study reports findings related to the elements that contribute to a negative affective walking experience and to the intention to avoid walking.

Table 1: Participant characteristics (photo-elicited interviews)			
Pseudonym	**Walking habits**	**Urban orientation**	**Age range**

Layla	Regular walker	Urban-oriented	Under 25 (student)
Debbie	Regular walker	Urban-oriented	26 to 40
Sarah	Regular walker	Urban-oriented	Over 41
Julia	Regular walker	Nature-oriented	Under 25 (student)
Henry	Regular walker	Nature-oriented	Under 25 (student)
Rachel	Regular walker	Nature-oriented	26 to 40
Michael	Regular walker	Nature-oriented	Over 41
Steve	Non-regular walker	Urban-oriented	Under 25 (student)
James	Non-regular walker	Urban-oriented	26 to 40
Eran	Non-regular walker	Urban-oriented	Over 41
Mark	Non-regular walker	Nature-oriented	Under 25 (student)
Charlotte	Non-regular walker	Nature-oriented	Under 25 (student)
Michelle	Non-regular walker	Nature-oriented	26 to 40
Grace	Non-regular walker	Nature-oriented	Over 41

While previous studies applied quantitative methods (Johansson et al., 2016; Gatersleben and Uzzell, 2007), a qualitative phase was included to explore in detail the affective walking experience and identify the elements of built environments that can deter walking intentions. Photo-elicitation is a popular tool in health and psychology research (Bagnoli, 2009; Frith et al., 2005), and had received some application in relation to transportation and walking research (Belon et al., 2014; Guell and Ogilvie 2013). The approach has the advantage of uncovering details, memories, and feelings related to in situ experiences (Bagnoli, 2009; Frith et al., 2005). In fact, affective walking experiences cannot be fully explored through traditional, ex-post interviews, due to the fact that emotions are extremely transient (Ettema and Smajic, 2015). Photo-elicitation is a quasi-mobile method of data collection that allows participants to experience the walk in the absence of the researcher, thus not disturbing the normal phenomenon.

Interviews took place one or two days after the walking journey. Participants were asked to share their photographs with the researcher before the interview in order for the photographs to be discussed during the interview. The interviewee had the chance to talk freely about his/her journey; subsequently the researcher asked specific questions on perceived affective outcomes (e.g.: What were your feelings? Was it stressful/relaxing/enjoyable? Why?) and perceived cognitive experiences (To what extent did you feel refreshed and better able to concentrate on things?). During the interview all of the

five videos used in the experimental stage were shown to each participant, as additional example environments, acting as a further aid to the discussion. Interviews lasted between 35 and 90 minutes, and were recorded with a digital recorder. Data were analysed with thematic analysis (Braun and Clark, 2013) with a deductive approach building on environmental stress theory (Evans, 2003) and restorative environments theories (Kaplan and Kaplan, 1989; Ulrich, 1983).

3. Results

3.1 Quantitative results

3.1.1 Preliminary analysis

The analysis of individual factors indicated that 37% of participants walked to work/university and 48.3% walked daily for transport or leisure purposes (Table 2). Descriptive statistics for aesthetics, interestingness, and affective experiences are reported in Table 2. Aesthetics and interestingness had very good inter-item reliability (Chronbach alpha: α = .79and α = .84 respectively).

Table 2: Descriptive data across all settings (n = 384)

	N	Mean/Percentage	Standard Deviation
Travel mode to work/university	379		
Car		18.4%	
Bus/train		24.7%	
Bike		15.6%	
Walk		37.1%	
Other		3.6%	
Walking habits	379		
Walks everyday		48.3%	
1 – 3 times a week		41.1%	
Less than 1 time a week		8.5%	
Environmental perceptions	384		
Aesthetics		3.55	0.72
Interestingness		3.19	0.82
Affective experiences	254		
Stress/Relax		1.31	2.34
Hedonic tone		4.18	2.12
Walking intentions	378	3.55	1.12

3.1.2 Multiple linear regressions

Multiple linear regression analysis was carried out to address Aim 1 and explore associations between *walking intentions* and a series of independent variables: affective appraisals, environmental perceptions, walking habits, and socio-demographics. Two models were computed (Table 3). In the first model, environmental perceptions, walking habits, and socio-demographics were included as potential predictors. In the second model, affective variables were added as additional predictors.

Table 3: Multiple Regression Models

	Model 1: Walking intentions $F(6, 351) = 22.109$, $MSE = 132.651$ $p < .001$, $R^2_{adj} = .298$				**Model 2: Walking intentions with affective experiences** $F(8,206) = 11.113$, $MSE = 88.906$ $p < .001$ $R^2_{adj} = .350$			
Predictor variables	***B***	***Std. Error***	***Beta***	***t***	***B***	***Std. Error***	***Beta***	***t***
(Constant)	1.012	.281	-	3.599	1.633	.382	-	4.276
Δstress	-	-	-	-	-.061	.025	-.172*	-2.407
Δhedtone	-	-	-	-	.070	.031	.171*	2.254
Interestingness	.364	.084	.314**	-1.462	.267	.109	.229*	2.441
Aesthetics	.295	.077	.282**	3.827	.195	.103	.185	1.894

* p < .05 ** p < .001

Controlling for age, walking habits, gender.

Model 1 assessed whether walking intentions were influenced by aesthetics, interestingness, walking habits, and socio-demographics. Aesthetics ($p < .001$) and interestingness ($p < .001$) were significant predictors of *walking intentions*. Age, gender, mode to work, and walking levels were not significant predictors.

In Model 2, the affective variables were included. The model was significant, with more variance accounted for compared with Model 1. The variable *walking intentions* was influenced by Δstress ($p = .017$), Δhedtone ($p = .025$), and interestingness ($p = .016$), with aesthetics ($p = .060$) no longer identified as significant. Walking habits and socio-demographics were also not significant.

2.2 Qualitative results

The photo-elicited interviews addressed Aim 2 and explored the elements of the built environment that represent barriers to a positive affective walking experience and that, in

turn, deter walking intentions. The multiple regression analyses had already demonstrated that walking intentions were influenced by affective experiences. The role of the interviews was to assist in developing explanations for this finding.

Participants discussed both positive and negative elements. While the positive elements are discussed in a previous paper (Author, 2018b), the key negative elements were identified as motor traffic, city busyness, and poor aesthetics. These are considered in turn in the next three subsections. Due to the focus on negative elements, the discussions focussed mostly on participants own photographic evidence, plus the exemplar video of the commercial road with traffic (Figure 4), with the other four videos generating far less commentary.

2.2.1 Motor traffic interferes with walking

Motor traffic was one of the crucial elements associated with negative perceptions on the affective walking experience and with walking intentions. For example, Sarah[1] explained that heavy traffic is an influential element in her route choices and she generally prefers to avoid situations like those she viewed in the video 'commercial area with traffic', due to the high levels of congestion:

> *I do choose some of my routes to avoid heavy traffic. Fumes annoy me (Sarah, 53).*

The same was true for Michael, who "deliberately chose a route that avoided the main road", and for Debbie, who preferred to avoid busy routes and chooses an underpass through a park where she could "almost not hear any traffic":

> *I kinda take the less busy routes, so I try to stay away from traffic, and I go under in St James Park, under the roundabout. And I find it really, really peaceful… You can walk there and you can almost not hear any traffic, it is just grass. It is actually quite nice and relaxing (Debbie, 32).*

Participants explained that traffic requires a lot of cognitive and affective effort. They noted that they needed to "pay more attention", "get focused" and "be constantly aware of the surroundings" in areas with traffic. The polluting effect of traffic in terms of noise and air was the most basic sources of affective and cognitive disturbance. Taking one example (Figure 6):

[1] Pseudonyms are used to guarantee anonymity and confidentiality.

There's so much noise from the cars, it is very hard to focus (Julia, 20).

Figure 6: Motor traffic represented by participants' photographs

As also highlighted by the quotes above, traffic noise was identified as annoying and associated with negative effects on concentration. Participants also talked about their daily strategies to overcome noise; some of them use headphones to listen to music and "avoid listening to all of that". Others mentioned that they "literally block [their] ears to avoid the noise". Turning to air pollution, the interviewees reported feelings of frustration (see also the quote above by Sarah):

> *I'm thinking of how much of it gets into my lungs… the air pollution. I started to think that maybe I should be wearing a mask. Sometimes you get a big lorry passing you, and that air of the diesel is pretty foul. […] That concerns me (Rachel, 34).*

An additional negative aspect of motor traffic is the numerous interruptions to the walking flow. It emerged that "keeping the walking rhythm" is a crucial aspect of walking for pedestrians, and walkers like to "turn off" during walking. Therefore, "having to pay attention to the surroundings is a hassle" and disturbs daydreaming. For example, James, 37, took a picture of a 'WAIT' traffic light to represent the frustration of waiting at crossing points in areas such as the experimental video of the commercial area with traffic (Figure 7). He explained that when he walks the Brunel Mile route – a pedestrian route in Bristol that

facilitates pedestrian flow with high-quality pedestrian infrastructure, signage system, and information panels – his affective walking experience is enhanced:

> *That's another feature of my walk. Stop here, stop there… when you walk you have to stop. [This] makes the experience not as enjoyable. You've got like a natural flow into thinking, and sometimes I walk [the Brunel Mile], and it is quite a nice flow. It's designed quite well. I think if there were more things like that, it would help (James, 37).*

Figure 7: A pedestrian crossing representing the frustration of waiting at crossing points

These interruptions to daydreaming also negatively affect mood. Talking about her walk, Julia explained how she experienced walking from a green area to a road crossing:

> *Then I go up the road, and I become more aware. I stop daydreaming in a sense, and I prepare myself to cross that road. […] it is literally there, that my mood changes […]. I don't like that road because it is so busy, I never know what's happening, I just wait for the green man and I run across (Julia, 20).*

The quote above also highlights concerns related to safety and power. Crossing the road was perceived as a dangerous activity by some participants. Interviewees felt that they had to be very attentive and "watch for cars and buses". Michael described his negotiation and reflection before crossing:

I have to negotiate, so I was thinking how to cross, which stop I am aiming for. It is possible to get across here, without waiting for the green man, if you know what you are doing, but of course there is your life in your hands. It saves you a little 30 seconds, but when you are walking it is nice to keep the rhythm and not stop, keep the momentum. It is nice if lights are green (Michael, 41).

Hence, while interrupting the walking flow and "the momentum" even for a few seconds can be frustrating for pedestrians, it is challenging to find a balance between keeping the flow and safety. In some cases, other than during road crossing, participants also felt threatened when walking on the pavement, as a result of vehicular incursion into the space allocated to, or perceived as reserved for, pedestrians[2]. Related to this, it emerged that some interviewees felt powerless towards cars. This idea was put into words by Julia:

I feel like a lot of people watching me. And because they have got a car, and I'm just walking, it is kind of like they win (Julia, 20).

These power dynamics can characterise pedestrians' perceptions of cars, due to the fact that cars dominate the road and have priority – e.g., "they win".

Participants talked about walking in pedestrianised areas including the ones presented in the experimental videos, and this was not characterised by the same issues. Participants explained that it felt "quieter", ''wider'', "less constricted", "more open", as "you have the whole pavement to move around". Walking in pedestrianised areas felt "safer [because] you don't need to pay a lot more attention to what is going on around you". For example:

I do like being into places that are not near a road. Any opportunity to be off, away from a road is good. […] I think it is not being by the side, is the noise, the movement, and also, you feel a bit more able to sort of move around really (James, 37).

2.2.2 City busyness: 'the city never seems to rest'

City busyness – e.g., the feeling that "the city never seems to rest" – was also perceived as a negative element. Urban settings were sometimes perceived as overwhelming due to the

[2] The findings relate to normal incidents; there was no reference by participants to security issues related for example to the vehicle-based terror attacks on pedestrians seen in a number of cities around the world in recent years.

multiple activities and stimuli that take place at the same time. A first issue that emerged related to pavements. Participants noted that high pedestrian density made the walking experience uncomfortable and frustrating, and moving in crowded spaces required more attention and time:

> *Pavements are quite small in Bristol, and that's quite annoying. They get crowded; that stresses me out a lot (Charlotte, 23).*

Some participants also had the perception that other people did not "care" about others. In some cases, pedestrians felt "small" and powerless compared to the crowd, a finding that echoes the dynamics between pedestrians and motor vehicles described in the previous section. Julia explained:

> *Walking uphill you can't see the top; what you can see is the crazy amount of people. It is horrible, there are so many people walking towards you, and a lot of them wouldn't move out of the way. […] Sometimes they touch you, because they are in a hurry. Even though they don't mean it, it makes you feel quite small. Because it makes you think that people aren't noticing you. […] it is not very nice (Julia, 20).*

Some participants also reported that when they could choose between a crowded route and a quieter one, they tended to choose the latter, even when it is longer. Charlotte reported that walking in busy shopping areas is stressful, hence she preferred to avoid it:

> *I prefer avoiding walking through busy areas. [It is] full of people, people are so rude, I don't like walking [if] there's someone in front of me, slowing me down (Charlotte, 23).*

The second element of 'city busyness' is visual pollution. It emerged that the city environment sometimes imposes heavy loads in terms of stress and cognition. Participants noted the excessive number of high street shops in the city, which attract pedestrians' attention in an overwhelming way. James explained that when he walked in a central shopping area, such as in the commercial area depicted in Figure 4, his mood changed "from being relaxed to not quite relaxed" due to the high number of "for sale-signs, fast-foods, and high street shops", which made him feel "gloomy" (Figure 8). In the quote below, James referred to the same major UK supermarket company four times:

There's [brand name] everywhere, such marginalisation, we already passed a [brand name] down there, this is like the fourth [brand name] I passed, we don't need more [of that brand] (James, 37).

Figure 8: Multitude of signs represent increased cognitive load

Similarly, tall buildings made some people feel "overwhelmed", "enclosed" and "claustrophobic". Some noted that walking in the commercial area with traffic (Figure 4) felt "imposing" because "buildings are so massive". Julia put into words the claustrophobic feeling of walking in an area with tall buildings:

My buildings has 12 floors, so I'm really small compared to it, and it is not even the tallest one. And it is quite daunting, especially because it blocks out the sun and light, because it is so tall… not very nice (Julia, 20).

Finally, scaffolding and construction sites that obstruct the pavement represented another feature that made participants avoid certain routes. Some participants reported that they "felt uncomfortable" when walking under scaffolding and that they preferred to avoid the road. Construction sites and scaffolding could also be "noisy" as noted by one participant, thus mirroring the negative auditory implications of traffic perceived by participants (Figure 9):

It is just ruined, because all you hear is the drilling, people shouting, and it ruins the mood almost. It is not nice to see it […]. (Mark, 22).

Figure 9: Construction work and related signs disturb the pedestrian

However, while overstimulation seemed to negatively influence affective experiences, under-stimulating environments also seemed to be associated with negative perceptions in some cases. The lack of variety and details in architectural and urban design features could trigger boredom, thus helping to explain the importance of interestingness within the multiple regressions (Section 3.1.2). Many participants reported that walking through housing estates was "boring [because] every house looks the same [and] there is nothing to look at". Some people stated that the modern built environment of Bristol can be "bland", "basic", "uniform", and "not that interesting" as "everything looks built for purpose". While variety was described as stimulating, some participants felt that lack of variety was boring and uninspiring, and decided to avoid walking in certain areas. For example, Mark reported that he did not like the walk around housing estates on the way to the university campus because they were "boring"; as a consequence, he reported that he tends to avoid walking to the university and he prefers to take the bus:

> *I don't like housing estates, because every house looks the same, it is so boring. I'd always prefer to take a bus instead. It is just not fun, there is nothing to look at, nothing to do. Just not nice, really. No particular great views, so you can't stand back for a second (Mark, 22).*

James also explained why variety is important for cognition and thinking, as it can expand thought and reflection, while monotony can limit creativity and mental activity:

Variety is quite important, otherwise it just feels a bit… I don't know, maybe that's the way you think as well, if you see things that look a bit different, they make your mind sort of travel a bit, whereas if you think things are just the same… your brain takes on shortcuts and everything is the same (James, 37).

2.2.3 Poor aesthetics

Poor aesthetics also seemed to interfere with a positive walking experience. Participants reported feelings of discontent and stress when walking in "ugly" or "unpleasant" areas, including the commercial area with traffic presented in experimental video. These feelings were triggered by litter, fly-tipping, overflowing bins, or tagging (Figure 10):

There are bits of Bristol that I find negative because they are the dirtiest. That is disgusting! There are bits of glass there, so it is something that makes me look on the floor and make sure that I'm not stepping on them (Henry, 18).

Figure 10: Poor aesthetics and lack of care trigger negative emotions

Poor aesthetics also seemed to affect travel choices. Henry explained that he would "always choose to walk where it is clean; that is much more inviting to walk, than all the rubbish and stuff". Poor aesthetics were often interpreted as perceived lack of care, and in some cases were associated with safety concerns. Talking of the 'Bearpit'[3], Charlotte explained that she

[3] The Bearpit is a public area inside the St. James Barton Roundabout, Bristol (UK). It is a sunken open space underneath the road level linked to street-level pedestrian facilities via four interlinked tunnels (Buser, 2017). It is large enough to accommodate shops, a café, public seating and street activities.

444 did not like the aesthetics of a graffiti because it made her think of the people who made the
445 graffiti:

446 *I don't like it because its dark colours, and it makes it quite… intimidating, it makes*
447 *it not a nice place to be, because it makes me think of the people who hang out*
448 *here and did the graffiti (Charlotte, 23).*

449 Similarly, it emerged that also abandoned buildings, litter, or illegal tagging (Figure 11) made
450 some people concerned and "on the edge" about the "wrong type of people" who may
451 frequent an area.

452

453 *Figure 11: Litter can make walking unpleasant and deter walking intentions*

454 ## 3. Discussion

455 The current paper has presented quantitate and qualitative findings on how intentions to
456 walk more in the future are influenced by the affective walking experience and by physical
457 features of the built environment. The findings have shown that affective experiences of
458 walking influenced intentions to walk in the future, thus confirming Aim 1, and that motor-
459 traffic, city busyness, and poor aesthetics can represent barriers to a positive affective walking
460 experience (Aim 2). These results are discussed below.

461 ### 4.1 The urban pedestrian's needs for safety, comfort, and moderate stimulation

462 Results from multiple regression analyses showed that affective experiences of stress and
463 hedonic tone have a direct impact on walking intentions. These findings confirm the
464 theoretical perspectives of psychology that affective experiences influence behaviours
465 (Russell and Lanius, 1984). These ideas were applied specifically to walking behaviours, thus
466 offering an important novel contribution to the limited literature. While previous studies
467 comparing satisfaction among travel modes found that a positive experience with a certain
468 mode increases the chance that the mode will be chosen for a future trip (De Vos et al., 2018,
469 2016; De Vos and Witlox, 2017), the current study adds that this is the case for walking trips
470 specifically. Results advanced findings by Johansson et al. (2016) that affective valence
471 influence intentions to avoid or to choose specific routes. While Johansson et al. (2016)
472 assessed affective walking experiences in terms of arousal (degree of activation) and valence
473 (degree of pleasantness), the current study considered the affective states of stress and
474 hedonic tone, and found that these influence walking intentions. By further examining the
475 affective walking experience with qualitative research employing psychological literature on
476 environments, wellbeing, and behaviours (Evans, 2003; Russell, 2003; Kaplan and Kaplan,
477 1989; Ulrich, 1984), it was possible to identify micro-aspects of built settings that represent
478 barriers to a positive affective walking experience and walking intentions. This approach
479 emphasises that it is potentially possible to mitigate individuals' negative perceptions of
480 traffic, city busyness, and poor aesthetics on psychological health, if one or more of these
481 micro-aspects are addressed (see policy implications in Section 4.2). First, it was illustrated
482 that motor traffic can discourage people from walking. The specific micro-features of traffic
483 that cause such an avoidance behaviour were identified as noise and air pollution,
484 interruptions to walking flow, and safety and power dynamics, thus partially reflecting the
485 framework of environmental stress (Evans, 2003, 1984). Previous research on environmental
486 affect has suggested that the auditory experience of motor traffic is negative (Benfield et al.,
487 2014; Payne, 2013); the current study showed that this is also the case specifically during
488 walking. Turning to air pollution, the direct health risks related to exposure to motor traffic
489 are well known (Barnes and Chatterton, 2017). However, the current study uncovers that
490 being exposed to traffic pollution also bears *indirect* health risks, as it triggered frustration
491 and concerns. The current findings also stress the importance of keeping a 'flow', a steady
492 progress, to walking, thus confirming ideas from Edensor (2010) and Crust (2011). Finally, it
493 also emerged that safety and power concerns are perceived as negative for the psychological

494 experience of walking, ideas that seem to have received some theoretical attention (e.g.,
495 Taylor, 2003) but for which there is little empirical evidence (with some exceptions: see Susilo
496 and Cats, 2014). In regards to traffic, Mindell et al. (2017) offer a recent reminder of the
497 effects of motor traffic in the form of community severance and impeding the movement of
498 individuals, and that this can have negative impacts on social and health variables. The
499 present paper has demonstrated that traffic can harm psychological wellbeing specifically,
500 and environmental affect was shown to be the key element that encouraged certain
501 avoidance behaviours (Russell and Lanius, 1984). This helps the understanding of previous
502 research findings that wide and busy roads are associated with low walking levels (e.g., Cain
503 et al., 2017). Results highlight that noise and air pollution, interruptions to walking flow, and
504 safety and power concerns might be among the reasons why some people do not walk in or
505 avoid congested routes.

506 Second, city busyness – pedestrian density, noise and visual pollution – were described as
507 negative features of walking. Poor quality of pedestrian infrastructure and building height can
508 trigger negative affective outcomes such as frustration, stress, and concerns, thus supporting
509 ideas by Evans (2003). These results help to explain previous findings that low-quality
510 pedestrian infrastructures (Cain et al., 2017; Kerr et al., 2016) and building height (Cain et al.,
511 2017; Borst et al., 2008) were associated with negative self-reports. In addition, it was found
512 that visual pollution – advertisements, shops, and signboards – was also associated with
513 perceived negative affect. This topic seems to have received limited attention in the transport
514 literature, and further research on the impact of visual pollution on the affective walking
515 experience is warranted. On the other hand, it emerged that also a lack of variety in the
516 environment can have a perceived negative impact on the affective walking experience, and
517 ultimately discourage walking in some areas. This finding reflected the result from multiple
518 regression analyses that perceived interestingness had a direct impact on walking intentions.
519 The importance of interestingness is a novel and important finding. While the benefits of
520 walking in natural quiet spaces such as parks and rural areas are well-known (e.g. Van den
521 Berg et al., 2014; Crust et al., 2011), this study stresses the importance of a stimulating urban
522 environment as opposed to monotonous settings (see Authors, 2018b for a discussion on
523 engagement with place and psychological wellbeing benefits).

Third, poor aesthetics – litter, fly-tipping, and overflowing bins – seemed to be associated with negative experiences of walking. The idea that perceived poor aesthetics is negatively associated with walking levels has received substantial support (Sinnett et al., 2011; Borst et al., 2008; Saelens and Handy, 2008), especially in relation to older people (e.g. Sugiyama and Ward Thompson, 2008; Stradling et al., 2007). It was further revealed through the current study that these patterns might be due to walker having safety concerns in areas with poor aesthetics.

Generally, these findings highlight the importance of the *pedestrian scale.* While urban design defines human scale as the degree to which physical elements fit human size and walking speed (Ewing and Handy, 2009), it is concluded here that the pedestrian scale is a matter of micro-elements of built environments. The crucial features that make walking positive for psychological wellbeing and encourage walking intentions are perceived safety, comfort, and moderate stimulation. These findings are in line with Alfonzo's (2005) model of walking needs concerning the importance of safety and comfort. They also offer a novel empirically-based classification of the micro-elements that are related to these needs.

4.2 Towards the healthy walking city: short and long-term implications for city and transport planning

This study has shown that affective experiences represent an accurate proxy of walking experiences and, subsequently, of walking intentions, confirming that environmental affect can reveal important insights related to the promotion of pedestrian mobility (see Gatersleben and Uzzell, 2007). The implication for policy is that, in order to encourage walking mobility (see DfT, 2017a), physical barriers need to be tackled, and safety, comfort, and moderate stimulation need to be guaranteed to create pedestrian-scaled environments. When major redevelopments of the urban realm are not possible – e.g. in the short-medium term or when funds are limited – a strategy to promote active mobility in the built environment can be constructed around safety, comfort, and moderate sensory stimulation by targeting the micro elements that have a negative influence on the affective experience of walking. Importantly, the regression analyses have indicated that socio-demographics and walking habits do not influence walking intentions, hence the policies below have the potential to increase walking levels across social groups.

554 Regarding traffic, a growing number of cities are implementing, or considering implementing,
555 environmental zones such as traffic-free areas or access restrictions linked to vehicle noxious
556 emissions standards. The findings here concerning affective wellbeing provide additional
557 evidence in support of such policies, alongside the physical health and urban space
558 management justifications. In relation to the issues of safety concerns and power dynamics
559 with cars, several measures could be taken to improve perceptions of traffic. Speed limits
560 could be reduced, as lower speeds are also associated with residents' enhanced safety
561 perceptions (Pilkington et al., 2018). In places where space allows, the physical separation
562 between the pavement and the carriageway could be enhanced, for example, with barrier
563 planting. Such interventions would be more practical, and higher-value, alongside busy, wide
564 arterial routes. (Gaps would be provided as necessary to allow pedestrians to access
565 designated crossing points).

566 Turning to walking infrastructure, there are incremental improvements that would minimise
567 the discomfort for pedestrians during walking, such as enlargement and improvement of
568 pavements to avoid pedestrian congestion and the reduction of waiting times at crossing
569 points. Improving the aesthetics of streets was confirmed as a strategy that can enhance the
570 affective walking experience, improve safety perceptions and encourage walking intentions.

571 Finally, the results indicate the relevance of an optimal level of stimulation in the urban
572 context. Visual pollution can be associated with negative perceptions in relation to the
573 affective walking experience. With regard to achieving a human scale, some cities have issued
574 limits to building height (Davies, 2016) and street advertisements (Mulholland, 2014). Further
575 research is warranted on the psychological wellbeing effects of these policies for pedestrians,
576 and the extent to which 'high rise' cities can also be successful affective environments for
577 walking. As regards the 'healthy city', research on the optimal level of stimulation that can
578 maximise the psychological benefits of walking is also needed, and the field of psychology can
579 offer important insights on the role of perceived complexity (e.g. Joye, 2011).

580 Some limitations related to the current study need to be discussed. First, in relation to the
581 study participants: 37.1% reported that walking was their main travel mode to work,
582 compared with the Bristol figure of 19% (Bristol City Council, 2016). It is possible that by
583 involving non habitual-walkers, further insights into the reasons why individuals decide not
584 to walk would have emerged. However, this is countered by the view that existing

585 experienced walkers could offer the best insights on the affective walking experience, hence
586 the analysis was 'rich and thick' (Braun and Clarke, 2013), thus respecting high quality
587 standards for qualitative research. In addition, research participants were relatively young
588 adults and over two-thirds were females. It is likely that a more varied group of participants,
589 for example including older or disabled people, would have led to a somewhat different set
590 of findings, perhaps identifying additional needs. Finally, the interview sample was limited to
591 14 individuals. However, the mixed-methods design enhanced validity by offsetting some of
592 the limitations of each approach.

593 Second, the experimental results are based on a video simulation, which remains a proxy of
594 walking. Nevertheless, the use of such simulations is common in experimental research, the
595 results are consistent with field experiments (e.g., Johansson, Hartig, and Staats, 2011), and
596 research has shown that virtual simulations can trigger affective reactions (Johansson, Hartig,
597 and Staats, 2011; Laumann et al., 2003). In addition, the interview phase compensated any
598 limitations of the simulations in offering high ecological validity, also exploring the role of
599 previous experiences and familiarity with settings. Related to this, the findings correspond
600 with walks that took place in daylight; further research could explore the barriers to a positive
601 affective walking experience related to walking in the dark.

602 Third, due to the way the question was formulated, the experiment measured walking
603 intentions to walk more, but not to walk less or avoid walking, and this might have led to bias.
604 Future research should include questions on both intentions to walk and to avoid walking.

605 Finally, this study investigated the role of affect in walking intentions. However, other factors
606 that might influence intentions, such as attitudes or social factors (Triandis, 1977), were not
607 measured nor controlled for. Future research might consider the role of a wider range of
608 factors in the assessment of walking intentions.

609 Despite these limitations, the current study has developed a novel approach to understanding
610 the influence of built environments on the wellbeing outcomes of walking and walking
611 intentions, based on psychological theories on environments and behaviours (Russell, 2003;
612 Evans, 2003; Kaplan and Kaplan, 1989; Ulrich et al., 1983). This approach has emphasised the
613 importance of the pedestrian scale for a positive wellbeing experience of walking and has
614 highlighted the importance of micro-aspects of built environments that could be targeted to

improve wellbeing experiences of walking and walking intentions. Hence, the findings offer an important contribution to urban and transport planning for healthier and more sustainable cities through improving our understanding of what promotes attractive urban walking environments.

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