

1 **AFFECTIVE EXPERIENCES OF BUILT ENVIRONMENTS AND THE**
2 **PROMOTION OF URBAN WALKING**

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43 **ABSTRACT**

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

60 **1. Introduction**

61 Walking is a travel mode that has important health benefits (Robertson et al., 2012;
62 Warburton et al., 2006). These include improvements in short-term subjective wellbeing, e.g.
63 people's cognitive and affective evaluations of their lives (Diener, 2000, p. 34), for example
64 improvements in happiness and contentment (*hedonic tone*; Roe and Aspinall, 2011),
65 engagement (Johansson et al., 2011), relaxation and stress reduction (Roe and Aspinall, 2011,
66 Van den Berg et al., 2003), and positive affect (Hartig et al., 1991). However, environmental
67 settings vary in the extent to which they support particular activities, and the environments
68 in which walking is performed can moderate the benefits of walking (Frank et al., 2016;
69 Gatrell, 2013; Johansson et al., 2011). Considering that walking has generally declined in the
70 United States and Western Europe over the past four decades (DfT, 2017b; Buehler and
71 Pucher, 2012), understanding which environmental features limit individuals' walking
72 intentions is essential. The present paper contributes to this initiative by exploring how

73 affective experiences of walking influence intentions to walk in the future, focusing on
74 negative features of built settings that can limit intentions to walk. While in a previous study
75 we found that different settings were associated to different walking experiences (Author
76 hidden, 2018a), in the present study we explored how these experiences influence intentions
77 to walk. To this end, we employed ideas from the field of psychology on the influence of
78 environments on experiences and behaviours and explored these empirically with a mixed-
79 methods strategy involving a simulated experiment and photo-elicited interviews. In
80 psychology, some scholars argue that environmental affect is the key to understand
81 individuals' response to the physical environments (Russell, 2003). The main relevant theories
82 are summarised in the next section.

83 **1.1 Theoretical perspectives on environments, wellbeing, and behaviours**

84 Restorative environments theories (Kaplan and Kaplan, 1989; Ulrich. 1984, 1983) posit that
85 environments elicit affective and cognitive responses in individuals, and such responses
86 subsequently influence behaviours. Kaplan and Kaplan's Attention Restoration Theory (1989)
87 focuses on the effect of environments on cognitive demands, while Ulrich's Stress Recovery
88 Theory looks at the influence of environments on affect. According to Kaplan and Kaplan
89 (1989) and to Ulrich et al. (1991), it is exposure to natural settings that promotes greater
90 restoration than contacts with urban environments. One explanation proffered for this effect,
91 from an evolutionary perspective, is that individuals have an innate inclination towards
92 natural environments over built settings (Ulrich et al., 1991).

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

98 Finally, Russell's concept of environmental affect (Russell, 2003, 1980) theorises the influence
99 of environments on experiences and behaviours. Russell proposed that affect is crucial to
100 understanding responses to physical environments; the way individuals perceive physical
101 settings through affect influences reactions, activities, and behaviours. Affective state is
102 defined as "a neurophysiological state that is consciously accessible as a simple, non-reflective

103 feeling that is an integral blend of hedonic (pleasure–displeasure) and arousal (sleepy–
104 activated) values” (Russell, 2003, p. 145). Affective states are characterised by degrees of
105 valence (degree of pleasantness) and arousal (degree of intensity). Affective states vary in
106 intensity and pleasantness, but core affect is a flow that is always present. According to
107 Russell and Lanius (1984), positive affective experiences encourage behaviours and intentions
108 (*approach*), while negative ones elicit *avoidance*.

109 In the transport field, scholars have suggested that the affective travelling experience also
110 influences future behaviours and intentions, with individuals likely to choose the travel mode
111 that provides a positive experience (De Vos et al., 2018, 2016; De Vos and Witlox, 2017; Páez
112 and Whalen, 2010; Gatersleben and Uzzell, 2007). Similarly, the literature on travel
113 satisfaction highlights the long-term implications of immediate walking experiences. This
114 generally indicates that walking results in high levels of travel satisfaction (e.g., Zhu and Fan,
115 2018; Ye and Titheridge, 2017; De Vos et al., 2016; Mokhtarian et al., 2015; St-Louis et al.,
116 2014), including when it is combined with cycling (Friman et al., 2013; Olsson et al., 2013;
117 Paez and Whalen, 2010). In addition, satisfaction with walking trips is also associated with
118 higher life satisfaction (De Vos, 2018; St-Louis et al., 2014; Bergstad et al., 2011), longer-term
119 wellbeing (Martin et al., 2014) and satisfaction with leisure time (Chatterjee et al., 2017). As
120 noted by Gatersleben and Uzzell, affective appraisals of the travel experience produce
121 important implications for the promotion of sustainable transport and pedestrian mobility
122 specifically, as they provide “insight into the reasons that people prefer certain travel modes
123 to others” (2007, p. 417). However, scholars have given little attention to the role of physical
124 characteristics of settings in affecting walking benefits and associated behaviours.
125 Considering that built environment exposure will increase globally due to urbanisation (UN,
126 2014), it is crucial to explore the specific characteristics of current built environments restrict
127 the psychological benefits of walking and thus engagement in walking. While a growing body
128 of literature from environmental psychology has documented the positive wellbeing benefits
129 of walking in nature (Roe and Aspinall, 2011; Thompson Coon et al., 2011; Van den Berg et
130 al., 2003), the comparative influence of the urban environment is often identified as negative
131 (Johansson et al., 2011; Ulrich et al., 1991). Several experimental studies have found that
132 actual or simulated walks in urban settings were associated with negative affective outcomes
133 (Johansson et al., 2011; Ulrich et al., 1991). These included, for example, a commercial area

134 with heavy traffic (Johansson et al., 2011), an industrial area in urban outskirts (Hartig et al.,
135 2003), but also city centre environments such as a traffic-congested areas (Laumann et al.,
136 2003), and a busy urban road with shops (Tilley et al., 2017). However, the specific elements
137 that can contribute to these negative outcomes remain unclear.

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

154 **1.2 Aims**

155 Taking into account the limited literature on the features of built environments that can
156 influence affective experiences of walking and subsequent walking intentions, the present
157 paper advances this debate by examining the relationship between affective walking
158 experience, walking intentions, and characteristics of built environments. To this aim, it builds
159 on psychological theories of the influence of environments on wellbeing and behaviours
160 (Kaplan and Kaplan, 1989; Ulrich, 1984; Russell, 2003; Evans, 2003, 1984). Specifically, the
161 current study aimed to:

- 162 1. Empirically examine whether and, if so, how affective experiences of walking influence
163 intentions to walk in the future (Aim 1);

164 2. Propose a systematic, empirical characterisation of the barriers to positive affective
165 walking experiences from the pedestrian point of view (Aim 2).

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

167 **2. Methods**

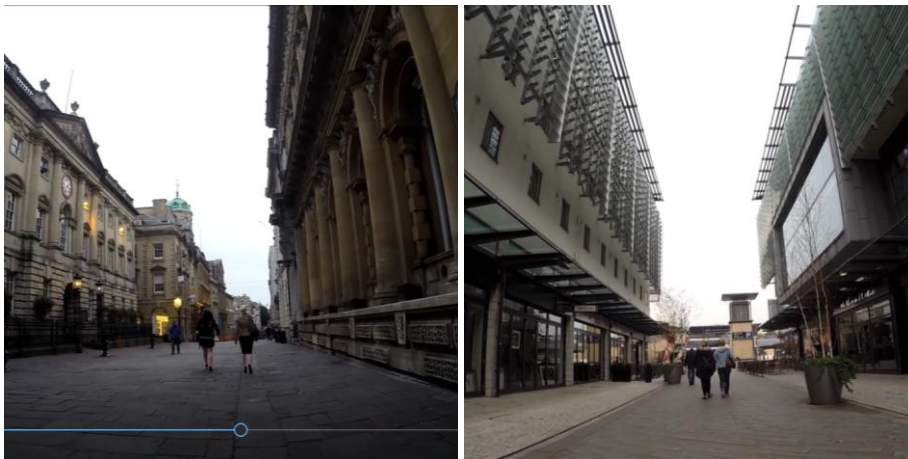
168 The current study was part of a larger, two-study mixed-methods research project
169 investigating the influence of built environments on the walking experience ([Author hidden]
170 2018). The present paper reports on those findings from both the quantitative phase of data
171 collection (simulated experiment) and the qualitative phase (photo-elicited interviews). In a
172 previous paper, we discussed how walking in built environments can support positive
173 affective perceptions (Author hidden, 2018b). The research project was approved by the
174 University Ethics Committee.

175 **2.1 Experimental phase**

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

185 The experiment employed a between-participants methodology involving a video and audio-
186 based virtual walk with five conditions, similarly to previous research (Ulrich et al., 1991;
187 Laumann et al., 2003). A one-minute video of a simulated walk was filmed for each
188 environment with a GoPro HERO 35 mm camera; videos reproduced the feeling of movement
189 and included sound in order to give a realistic representation of the walking experience.
190 Participants rated their affective states before and after watching the video. For more details
191 of the methodology, please refer to [Author hidden] (2018a).

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



202

203 *Figure 1: Pedestrianised Historic environment*

204 *Figure 2: Pedestrianised Modern environment*

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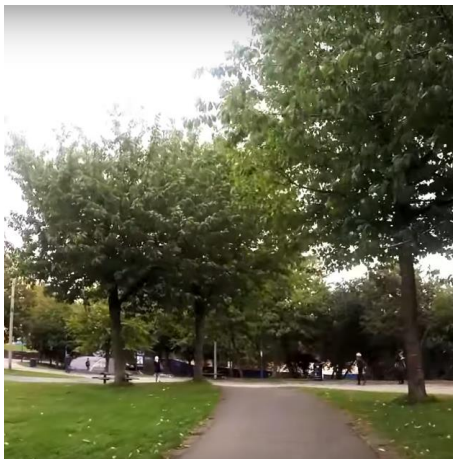
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208 *Figure 3: Pedestrianised Mixed environment*

209 *Figure 4: Commercial road with traffic*



210

211 *Figure 5: Park*

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

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

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

230 Other measures included: travel mode to work/place of study (*‘What is your main mode of*
231 *travelling to work/place of study?’*); walking habits (*‘How many days per week do you walk*
232 *for at least 30 minutes?’*); age and gender. The outcome, walking intentions, was measured
233 by the question: *‘If this kind of environment was on your way to work/university, to what*
234 *extent would you be more likely to walk to work/university more often?’*) using a 5-point scale
235 (1 = ‘definitely not’; 5 = ‘definitely yes’).

236 2.2 Photo-elicited interviews

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

Table 1: Participant characteristics (photo-elicited interviews)

Pseudonym	Walking habits	Urban orientation	Age range
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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

249

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

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

269 five videos used in the experimental stage were shown to each participant, as additional
 270 example environments, acting as a further aid to the discussion. Interviews lasted between
 271 35 and 90 minutes, and were recorded with a digital recorder. Data were analysed with
 272 thematic analysis (Braun and Clark, 2013) with a deductive approach building on
 273 environmental stress theory (Evans, 2003) and restorative environments theories (Kaplan and
 274 Kaplan, 1989; Ulrich, 1983).

275 3. Results

276 3.1 Quantitative results

277 3.1.1 Preliminary analysis

278 The analysis of individual factors indicated that 37% of participants walked to work/university
 279 and 48.3% walked daily for transport or leisure purposes (Table 2). Descriptive statistics for
 280 aesthetics, interestingness, and affective experiences are reported in Table 2. Aesthetics and
 281 interestingness had very good inter-item reliability (Chronbach alpha: $\alpha = .79$ and $\alpha = .84$
 282 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

283 3.1.2 Multiple linear regressions

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

	Model 1: Walking intentions				Model 2: Walking intentions with affective experiences			
	$F(6, 351) = 22.109, MSE = 132.651$ $p < .001, R^2_{adj} = .298$				$F(8, 206) = 11.113, MSE = 88.906$ $p < .001 R^2_{adj} = .350$			
Predictor variables	B	Std. Error	Beta	t	B	Std. Error	Beta	t
(Constant)	1.012	.281	-	3.599	1.633	.382	-	4.276
Δ stress	-	-	-	-	-.061	.025	-.172*	-2.407
Δ hedtone	-	-	-	-	.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.								

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

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

299 **2.2 Qualitative results**

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

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

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

311 *2.2.1 Motor traffic interferes with walking*

312 Motor traffic was one of the crucial elements associated with negative perceptions on the
313 affective walking experience and with walking intentions. For example, Sarah¹ explained that
314 heavy traffic is an influential element in her route choices and she generally prefers to avoid
315 situations like those she viewed in the video ‘commercial area with traffic’, due to the high
316 levels of congestion:

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

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

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

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

¹ Pseudonyms are used to guarantee anonymity and confidentiality.

329

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



330

331

Figure 6: Motor traffic represented by participants' photographs

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

338 *I'm thinking of how much of it gets into my lungs... the air pollution. I started to*
339 *think that maybe I should be wearing a mask. Sometimes you get a big lorry*
340 *passing you, and that air of the diesel is pretty foul. [...] That concerns me (Rachel,*
341 *34).*

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

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

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



356

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

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

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

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

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

373 Hence, while interrupting the walking flow and “the momentum” even for a few seconds can
374 be frustrating for pedestrians, it is challenging to find a balance between keeping the flow and
375 safety. In some cases, other than during road crossing, participants also felt threatened when
376 walking on the pavement, as a result of vehicular incursion into the space allocated to, or
377 perceived as reserved for, pedestrians². Related to this, it emerged that some interviewees
378 felt powerless towards cars. This idea was put into words by Julia:

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

381 These power dynamics can characterise pedestrians’ perceptions of cars, due to the fact that
382 cars dominate the road and have priority – e.g., “they win”.

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

388 *I do like being into places that are not near a road. Any opportunity to be off, away*
389 *from a road is good. [...] I think it is not being by the side, is the noise, the*
390 *movement, and also, you feel a bit more able to sort of move around really (James,*
391 *37).*

392 2.2.2 City busyness: ‘the city never seems to rest’

393 City busyness – e.g., the feeling that “the city never seems to rest” – was also perceived as a
394 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.

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

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

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

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

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

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

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

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



428

429 *Figure 8: Multitude of signs represent increased cognitive load*

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

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

437 Finally, scaffolding and construction sites that obstruct the pavement represented another
438 feature that made participants avoid certain routes. Some participants reported that they
439 “felt uncomfortable” when walking under scaffolding and that they preferred to avoid the
440 road. Construction sites and scaffolding could also be “noisy” as noted by one participant,
441 thus mirroring the negative auditory implications of traffic perceived by participants (Figure
442 9):

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



445

446

Figure 9: Construction work and related signs disturb the pedestrian

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

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

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

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

470 2.2.3 Poor aesthetics

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

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



478

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

480 Poor aesthetics also seemed to affect travel choices. Henry explained that he would “always
481 choose to walk where it is clean; that is much more inviting to walk, than all the rubbish and
482 stuff”. Poor aesthetics were often interpreted as perceived lack of care, and in some cases
483 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.

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

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

489 Similarly, it emerged that also abandoned buildings, litter, or illegal tagging (Figure 11) made
490 some people concerned and “on the edge” about the “wrong type of people” who may
491 frequent an area.



492

493

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

494 **3. Discussion**

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

501 **4.1 The urban pedestrian's needs for safety, comfort, and moderate stimulation**

502 Results from multiple regression analyses showed that affective experiences of stress and
503 hedonic tone have a direct impact on walking intentions. These findings confirm the
504 theoretical perspectives of psychology that affective experiences influence behaviours
505 (Russell and Lanius, 1984). These ideas were applied specifically to walking behaviours, thus
506 offering an important novel contribution to the limited literature. While previous studies
507 comparing satisfaction among travel modes found that a positive experience with a certain
508 mode increases the chance that the mode will be chosen for a future trip (De Vos et al., 2018,
509 2016; De Vos and Witlox, 2017), the current study adds that this is the case for walking trips
510 specifically. Results advanced findings by Johansson et al. (2016) that affective valence
511 influence intentions to avoid or to choose specific routes. While Johansson et al. (2016)
512 assessed affective walking experiences in terms of arousal (degree of activation) and valence
513 (degree of pleasantness), the current study considered the affective states of stress and
514 hedonic tone, and found that these influence walking intentions. By further examining the
515 affective walking experience with qualitative research employing psychological literature on
516 environments, wellbeing, and behaviours (Evans, 2003; Russell, 2003; Kaplan and Kaplan,
517 1989; Ulrich, 1984), it was possible to identify micro-aspects of built settings that represent
518 barriers to a positive affective walking experience and walking intentions. This approach
519 emphasises that it is potentially possible to mitigate individuals' negative perceptions of
520 traffic, city busyness, and poor aesthetics on psychological health, if one or more of these
521 micro-aspects are addressed (see policy implications in Section 4.2). First, it was illustrated
522 that motor traffic can discourage people from walking. The specific micro-features of traffic
523 that cause such an avoidance behaviour were identified as noise and air pollution,
524 interruptions to walking flow, and safety and power dynamics, thus partially reflecting the
525 framework of environmental stress (Evans, 2003, 1984). Previous research on environmental
526 affect has suggested that the auditory experience of motor traffic is negative (Benfield et al.,
527 2014; Payne, 2013); the current study showed that this is also the case specifically during
528 walking. Turning to air pollution, the direct health risks related to exposure to motor traffic
529 are well known (Barnes and Chatterton, 2017). However, the current study uncovers that
530 being exposed to traffic pollution also bears *indirect* health risks, as it triggered frustration
531 and concerns. The current findings also stress the importance of keeping a 'flow', a steady
532 progress, to walking, thus confirming ideas from Edensor (2010) and Crust (2011). Finally, it
533 also emerged that safety and power concerns are perceived as negative for the psychological

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

546 Second, city busyness – pedestrian density, noise and visual pollution – were described as
547 negative features of walking. Poor quality of pedestrian infrastructure and building height can
548 trigger negative affective outcomes such as frustration, stress, and concerns, thus supporting
549 ideas by Evans (2003). These results help to explain previous findings that low-quality
550 pedestrian infrastructures (Cain et al., 2017; Kerr et al., 2016) and building height (Cain et al.,
551 2017; Borst et al., 2008) were associated with negative self-reports. In addition, it was found
552 that visual pollution – advertisements, shops, and signboards – was also associated with
553 perceived negative affect. This topic seems to have received limited attention in the transport
554 literature, and further research on the impact of visual pollution on the affective walking
555 experience is warranted. On the other hand, it emerged that also a lack of variety in the
556 environment can have a perceived negative impact on the affective walking experience, and
557 ultimately discourage walking in some areas. This finding reflected the result from multiple
558 regression analyses that perceived interestingness had a direct impact on walking intentions.
559 The importance of interestingness is a novel and important finding. While the benefits of
560 walking in natural quiet spaces such as parks and rural areas are well-known (e.g. Van den
561 Berg et al., 2014; Crust et al., 2011), this study stresses the importance of a stimulating urban
562 environment as opposed to monotonous settings (see Authors, 2018b for a discussion on
563 engagement with place and psychological wellbeing benefits).

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

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

579 **4.2 Towards the healthy walking city: short and long-term implications for city and** 580 **transport planning**

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

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

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

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

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

625 experienced walkers could offer the best insights on the affective walking experience, hence
626 the analysis was 'rich and thick' (Braun and Clarke, 2013), thus respecting high quality
627 standards for qualitative research. In addition, research participants were relatively young
628 adults and over two-thirds were females. It is likely that a more varied group of participants,
629 for example including older or disabled people, would have led to a somewhat different set
630 of findings, perhaps identifying additional needs. Finally, the interview sample was limited to
631 14 individuals. However, the mixed-methods design enhanced validity by offsetting some of
632 the limitations of each approach.

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

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

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

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

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

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