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Exploring the use of Restorative Component Scale to Measure Street Restorative Expectations

Abstract: Contemporary high-density urban environments frequently have limited green resources, such as parks and woodlands, that are conventionally associated with psychological restoration. The restorative potential of everyday spaces such as urban streets, therefore, takes on heightened significance. Our study proposes that the delivery of streets for psychological restoration differs from that of wider urban open spaces. This is because streets serve functions not primarily associated with optional leisure activities. During the study, we used an online questionnaire (n=154) based on Restorative Component Scales (RCS) to assess peoples' restorative expectations on four different types of Shanghai street. We also adopted a scenario approach which asked participants to imagine and evaluate the ideal condition of each street type for providing them with restorative experiences. Our results show that users expected the highest restorative quality in the street scenario 'landscape and leisure', with the lowest expectations expressed for 'traffic-oriented' streets. People's expectations on 'commercial' and 'living and service' street scenarios were similar. These findings reveal clear design implications for the delivery of socially restorative streets, with special consideration on street typology and user expectations.

Keywords: restorative expectation; street typology; Restorative Component Scale; perceptive measurements.

Introduction

Streets are urban spaces that can vary in social and spatial complexity (Thwaites et al., 2020). Unlike other urban spaces, such as parks and plazas that are created specifically for recreational purposes, streets support a wide array of everyday activities including essential movement, commercial and social interaction (Mehta, 2013). Consequently, the restorative potential of streets needs to be approached differently from spaces that have previously been examined as restorative.

Restorative environments research has sought to develop an understanding of environmental characteristics that restore depleted psychological, physiological, and social well-being (Ulrich, 1983; Hartig, Mang and Evans, 1991). Seminal studies show that natural settings, such as forests (Valtchanov et al., 2010; Tyrväinen et al., 2014; Takayama et al., 2014), mountains (Hartig et al., 2003; Laumann, Gärling, and Stormark, 2001) and grasslands (Han, 2001), are restorative because they have certain, often green, characteristics that encourage a sense of *being away, fascination, extent, and compatibility* (Kaplan, 1995; Herzog, Maguire and Nebel, 2003). However, recent research has suggested that restorative characteristics do not only exist in natural environments (Karmanov and Hamel, 2008; Ivarsson and Hagerhall, 2008), with increasing research attention being given to the restorative potential of green or vegetated urban spaces, such as urban parks (Hartig, Mang and Evans, 1991; Hartig et al., 2003; Nordh et al., 2009), small pocket parks (Nordh et al., 2009) and roadside vegetation (Cackowski and Nasar, 2003).

With the uneven distribution between green spaces and population agglomerations becomes more common in contemporary high-density urban areas (Xu et al., 2019), some scholars have gradually turned their attention to exploring the restorative potential of non-natural urban spaces. Streets, as one of the most used public spaces in urban life (Mehta, 2013), have attracted extensive attention (Xu et al., 2007; Lindal and Hartig, 2013; Lindal and Hartig, 2015). Relevant research to date has mostly been focused on identifying whether certain streets or certain street elements can contribute to providing restorative benefits. For example, Xu et al. (2007) found that the green viewing rate and the openness of street interfaces have positive effects on restorative potential of streets. People's restorative experience in street environments has also been found to be correlated negatively with the

height of street-side buildings and the street's entropy value (describing the disorder of a street environment) (Lindal and Hartig, 2013). In contrast, it can be positively influenced by the quantity of street trees and planting beds (Lindal and Hartig, 2015; Yin et al, 2020). Such studies provide a precedent for examining the restorative influence of streetscapes in greater detail, but so far, no attention has been given to differentiating the restorative characteristics that exist between different street types.

Our research takes a step forward in broadening the scope of restorative street environment research through highlighting the difference between restorative streets and conventional restorative settings. Given the difference between streets and other leisure urban spaces, the delivery of street restorativeness should balance with its own functions and responsive characteristics, rather than simply pursuing an ideal that 'the more restorative the better'. An important aspect of restorative environment research linking with this is the focus on the relationship between restorative experiences and place meanings (Korpela; 1989; Montgomery, 1998; Korpela and Hartig, 1996), generally composed of their 'identity' (what a place is like) and 'image' (a combination of this identity with the perception of the place originating from the individual's feelings and expressions) (Montgomery, 1998). Previous studies have found that places holding a special meaning, such as museums (Kaplan et al., 1993), historic buildings (Scopelliti and Giuliani, 2004), monasteries (Ouellette et al., 2005) and zoo attractions (Pals et al., 2009) can also provide restorative experiences. Similarly, Hartig, Lindblom and Ovefelt (1998) found that females are less likely to have restoration at home compared to males, as home is the place they frequently have less time to relax. This shows how users' expectations are determined, or at least influenced, by their cognitions of former experiences in similar settings (Zajonc, 1980), combining their embedded feelings, images, and thoughts. Appleyard (1981) also highlighted that users' prior expectations and understanding could be essential in influencing their interactions with surrounding environments, saying *'when people expect traffic to be heavy, they tend to adapt to it and tolerate it. When they expect it to be safe, a hot-rodder can be especially dangerous.'* (p.15). Restorative expectations people have of different streets, therefore, have the potential to be formed according to street attributes such as locality, hierarchy, surrounding

land uses, landscape attributes, other streets connections and peoples' activities, which together influence the overall quality that a street possesses (SH-PLRAB, 2017).

Our research proposes that certain types of streets are expected to provide a higher level of restorative experience than others, as the emphasis of each street may vary depending on their defining characteristics. Based upon the foundation of research introduced, our study explores whether and how users' restorative expectations vary with street types. This is done whilst also assessing if users' individual background influences perceived restoration.

The Study

Our study was conducted in Shanghai, which is a typical high-density urban area with more than 24 million registered residents. Streets in Shanghai have been classified into five different types according to their functional and spatial characteristics (SPLRAB et al. 2017). This provides a good foundation for innovatively assessing how users' restorative expectations vary with street type. Restorative expectations of Shanghai street categories, generalised in the Shanghai Street Design Guidelines (SPLRAB et al. 2017), were investigated using an integrated method comprising a scenario approach and a questionnaire-based survey developed using a Restorative Component Scale (RCS). Given that this study intends to investigate people's expected the ideal restorative condition of a street, rather than its actual condition, this combined approach involving a scenario was appropriate. Scenario stimulation is widely used in environmental psychological studies using verbal, audio, or visual stimulations to trigger specific experiences of participants (Laumann, Gärling, and Stormark, 2001). The RCS-based questionnaire contained two parts with the first collecting participants' background information, followed by an assessment of participants' restorative expectations on different Shanghai street types. Participants were asked to imagine an ideal state on each type of street, according to verbal descriptions provided, as well as their personal experiences and impressions, then requested to describe their expectations by answering RCS questions.

Measurement – Restorative Component Scale (RCS)

Several attempts have been made to develop instruments for measuring people's subjective restorative experiences, including Perceived Restorativeness Scale (PRS; Korpela and Hartig, 1996; Hartig et al.,

1997; Hartig, Kaiser and Bowler, 1997), Restorative Component Scale (RCS; Laumann, Gärling and Stormark, 2003), Perceived Restorative Potential (PRP; Herzog, Maguire and Nebel, 2003) and Restoration Outcome Scale (ROS; Korpela et al., 2008). Many aspects of these are based upon Attention Restoration Theory (ART) and employ several aspects to respectively describe four components proposed in ART as contributors to users' restorative experiences (Kaplan and Kaplan, 1989). The first factor concerns opportunities for 'Being Away' from unwanted situations that consume directed attention. The second factor is 'Extent', defined by two essential properties: scope and connectedness (Kaplan and Kaplan, 1989). Scope refers to the environment that is extended in both time and space, while connectedness refers to the environment that is sufficiently connected to stimulate perception of a larger whole (Kaplan, 1983). Together, they promise opportunities to explore. The third factor, 'Fascination', which enables the rest of the inhibitory mechanism (Staats et al, 2004) allowing people to function without having to use directed attention. The last factor in forming a restorative environment is 'Compatibility', which refers to the match between one's goals and inclinations, and environmental affordance in support of those inclinations.

Recently, Yin et al., (2020) conducted a study similar to ours, and used RCS as an appropriate instrument in this study for measuring restorative expectation of different street types based on the following considerations. First, the factor structure of RCS appearing in later validation is more consistent with the four-factor structure of ART compared with other essential ART-based measurements. In addition, the feasibility of RCS has been validated on both real and imagining scenarios. Our research measures restorative expectations of streets and shares similarities with studies (Laumann, Gärling and Stormark, 2003) that devised and validated the RCS by evaluating restorative potential of places that participants recalled from memory. Additionally, the wording of RCS items describing four ART components remained consistent so that it is more understandable for people, especially non-specialists. The original version of the RCS (Laumann, Gärling and Stormark, 2003) incorporates 22 items, which was examined by Yin (2020) for adaptability in measuring street restorativeness based on the following considerations: 1) whether these items were relevant to street environments; 2) whether the items indicate similar meanings that might lead to misunderstandings,

especially after being translated into Chinese. A revised Chinese version of RCS (Yin, 2020) is used in this study, which consisted of 15 items with three of them describing the *being away*; four of them describing the *extent*; five of them describing the *fascination*; and four of them describing the *compatibility* (Table 1). Each item is formed by the responses on 6-point Likert Scales indicating participants' agreement.

Previous restorative environment research has found that weather (Zacharias et al., 2004; Thorsson et al., 2007; Hipp and Ogunseitan, 2011), setting size (Nordh et al., 2009), visit duration (Hansmann et al., 2007; Barton and Pretty, 2010), being alone or with company (Staats and Hartig, 2004; Korpela and Staats, 2014) and life stage (Kaplan, 1995; Scopelliti and Giuliani, 2004) can influence individuals' restorative perceptions. The former three are controlled in our experiment design and the last one explored in the analysis. Here, life stage information of participants was collected with two other background variables: gender and professional relevance in the background section of the questionnaire.

Table 1 The revised RCS (Yin, 2020) based on Laumann, Gärling, and Stormark's (2003).

ART *Components*	RCS *Statement*
B*eing away* (B)	B1 - When I am here I feel free from work and daily routine.
	B2 - When I am here I feel free from other peoples' demands and expectations.
	B3 - When I am here I do not need to think of my responsibility and obligations.
E*xtent* (E)	E1 - The elements here go together.
	E2 - The existing elements belong here.
	E3 - The surroundings are coherent.
F*ascination* (F)	F1 - There is plenty to discover here.
	F2 - This setting has many things that I wonder about.
	F3 - There are many objects here that attract my attention.
	F4 - There is plenty that I want to linger on here.
	F5 - I am absorbed in these surroundings.
C*ompatibility* (C)	C1 - The environment gives me the opportunity to do activities that I like.
	C2 - I can handle the kinds of problems that arise here.
	C3 – I can rapidly adapt to this setting.
	C4 - There is an accordance between what I like to do and this environment.

Stimuli

Shanghai streets have previously been classified into five types: Commercial Street, Living and Service Street, Landscape and Leisure Street, Traffic-oriented Street and Comprehensive Street (SPLRAB et al. 2017). A Comprehensive Street is also present in the classification. However, we excluded this during out study, due to it being a composite of the other four street types incorporating various sections that might fall into an independent category. Descriptions of each street type (Table 2, Figure 1) were used as stimuli to directly trigger users' imagination of a street they would expect to inhabit. To avoid bias caused by the researcher, only text descriptions were provided without any illustration nor specific street names.

Table 2 Street type definitions in Shanghai Street Design Guidelines. Source: SPLRAB et al. 2016.

Street types in Shanghai	**Definition and description**
Commercial *S*treet	This type of street is dominated by retail, food services, and other commercial businesses, with a certain level of service capability and industrial attributes.
Living and *S*ervice *S*treet	This type of street is dominated by residential services, small- and mid- scale retail, food services, and other businesses as well as public facilities.
Landscape and *L*eisure *S*treet	Characterised by waterfront, landscape, or historic-ness characteristics and equipped with leisure and entertainment facilities.
Traffic-oriented *S*treet	Dominated by traffic volume-function, with mostly closed frontages.
Comprehensive *S*treet	Street types and frontage types are highly mixed, or a street contains more than two types of characteristics.

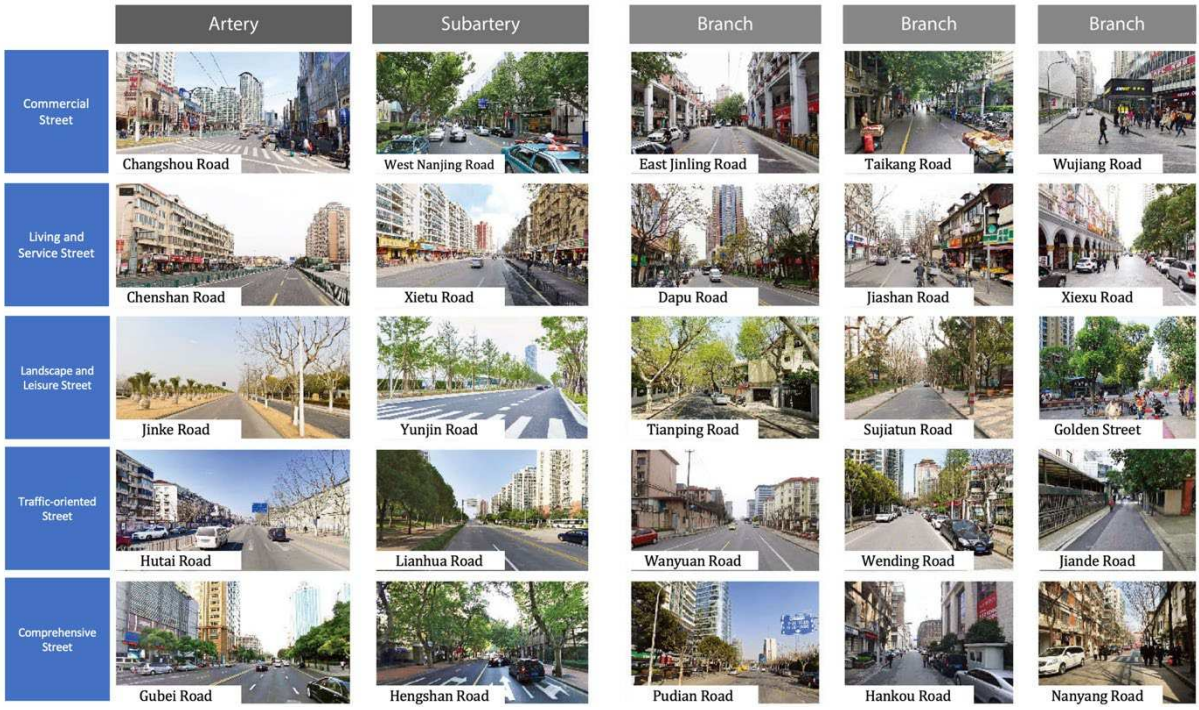

Figure 1 Shanghai Street Matrix. Source: SPLRAB et al., 2017.

Participants and procedure

An online questionnaire was used. This was an RCS-based questionnaire edited into an online version using the Wenjuanxing website (see https://www.wjx.cn/), an online open platform for designing, editing, and promoting questionnaires and surveys. The platform generates website links and QR codes that can be forwarded through different social platforms. These were published on personal websites and across social media groups, so that the questionnaire could be disperses across diverse social networks and accessed effectively by a large demographic of people with minimum time and economic costs. WeChat was used for spreading this survey online, based upon its wide application in previous studies (Qin, 2016; Xu et al., 2018) and its high user numbers in China with over 1.2 billion registered users (Giudice, 2020).

The online questionnaire began with a short explanation of the intention and the confidential nature of the survey. After participants showed their willingness to take part, they were directed to a page contains 15 RCS questions measuring four different street types. It was highlighted in the questions that participants are required to imagine an ideal state of the four street types according to the descriptions provided (Table 2) before giving out their ratings. For example: *"Please imagine an ideal state of a* ***Commercial Street****, which is dominated by retail, food services and other commercial businesses with a certain level of service capability and industrial attributes) and answer questions listed in the table"* (Table 1). The whole process took around 5-8 minutes for each participant.

The questionnaire was accessible online for 30 days, during which time 154 responses were collected (male = 71, female = 82). The age range of respondents was under 25 = 10, age 26-35 = 101, age 36-45 = 12, age 45-55 = 30. Around 15% of participants (24 participants) had a professional background in urban planning or associated areas of expertise.

Data Analysis

Data was analysed using SPSS V 25.0 and was examined for internal consistency with Cronbach's alpha (Hinton, 2014). Calculation of internal consistency using Cronbach's α is the preferred measure of inter-rater reliability when cases are rated in terms of interval variable or interval-like variable, such as the Likert scales used in this study. The α values of 4 ART components, b*eing away, extent,*

fascination, and compatibility, in the ratings of the four street types (Table 3) showed sufficient internal consistency (α value should be higher than 0.6) and hence, guaranteed the reliability of the obtained RCS ratings. Data was also tested for normality in SPSS, with the results indicating that all the data were normally distributed, and therefore reliable for further statistical analysis.

Table 3 Internal consistency results of the street restorative expectation survey.

Street Type	*Commercial Street*				*Landscape and Leisure Street*				*Living and Service Street*				*Traffic-oriented Street*			
ART components	B	E	F	C	B	E	F	C	B	E	F	C	B	E	F	C
Cronbach's α	.85	.91	.90	.84	.85	.90	.92	.88	.84	.89	.91	.86	.92	.88	.96	.87
No. of Participants	154				154				154				154			
No. of Items	3	3	5	4	3	3	5	4	3	3	5	4	3	3	5	4

* B=Being away; E=Extent; F=Fascination; C=Compatibility

In order to assess differentiation of restorative expectations within street types, we compared mean values and standard deviations between these four street types. General descriptions of the expected street restorativeness are included in Table 4. One-way ANOVA with LSD post-hoc test was then used to further examine whether there are any significant differences across street types in terms of each ART component, as outlined in the next section.

General descriptions of the RCS expectation results for comparing within participants' groups are concluded in Table 5 and Table 6. Perceptive differences between groups of participants with different background were also analysed using t-test and one-way ANOVA to ensure the accuracy of the expectation results.

Table 4 General descriptions of the RCS expectation results (N=154).

	B1-LL	***B2-LL***	***B3-LL***	***E1-LL***	***E2-LL***	***E3-LL***	***F1-LL***	***F2-LL***	***F3-LL***	***F4-LL***	***F5-LL***	***C1-LL***	***C2-LL***	***C3-LL***	***C4-LL***
Mean	5.71	5.67	5.29	5.39	5.56	5.48	5.50	5.44	5.67	5.88	5.79	5.53	5.48	5.54	5.48
Std. Deviation	1.28	1.29	1.50	1.33	1.26	1.32	1.40	1.45	1.27	1.31	1.18	1.37	1.40	1.31	1.38
	B1-TO	B2-TO	B3-TO	E1-TO	E2-TO	E3-TO	F1-TO	F2-TO	F3-TO	F4-TO	F5-TO	C1-TO	C2-TO	C3-TO	C4-TO
Mean	3.31	3.39	3.36	4.45	4.44	4.48	3.50	3.54	3.70	3.24	3.48	3.60	3.80	4.25	4.36
Std. Deviation	1.78	1.82	1.75	1.65	1.66	1.63	1.75	1.72	1.82	1.86	1.83	1.72	1.78	1.71	1.78
	B1-CM	B2-CM	B3-CM	E1-CM	E2-CM	E3-CM	F1-CM	F2-CM	F3-CM	F4-CM	F5-CM	C1-CM	C2-CM	C3-CM	C4-CM
Mean	4.60	4.40	4.18	5.03	4.92	4.98	5.07	5.08	5.10	4.84	4.57	4.60	4.54	4.76	5.10
Std. Deviation	1.54	1.51	1.68	1.34	1.40	1.37	1.42	1.48	1.39	1.44	1.56	1.56	1.51	1.44	1.30
	B1-LS	B2-LS	B3-LS	E1-LS	E2-LS	E3-LS	F1-LS	F2-LS	F3-LS	F4-LS	F5-LS	C1-LS	C2-LS	C3-LS	C4-LS
Mean	4.66	4.58	4.16	5.05	5.13	5.01	4.86	4.81	4.92	4.80	4.56	4.66	4.94	5.10	5.23
Std. Deviation	1.49	1.46	1.56	1.33	1.37	1.36	1.54	1.47	1.45	1.55	1.60	1.55	1.44	1.36	1.42

* B=Being away; E=Extent; F=Fascination; C=Compatibility. LL=Landscape and Leisure Street; LS=Living and Service Street; CM=Commercial Street; TO=Traffic-oriented Street

Table 5 General descriptions for comparing professional group (N=24) and lay group (N=129)

	Occupation	*N*	*Mean*	*Std. Dev*	*Std. Err*	*Mean*	*Std. Dev*	*Std. Err*	*Mean*	*Std. Dev*	*Std. Err*	*Mean*	*Std. Dev*	*Std. Err*
B1	Pro	24	5.208	1.250	0.255	2.250	1.422	0.290	4.458	1.532	0.313	4.208	1.318	0.269
	Lay	129	5.806	1.269	0.112	3.504	1.782	0.157	4.628	1.557	0.137	4.744	1.517	0.134
B2	Pro	24	5.292	1.042	0.213	2.292	1.398	0.285	4.000	1.560	0.319	4.000	1.319	0.269
	Lay	129	5.744	1.330	0.117	3.597	1.831	0.161	4.473	1.495	0.132	4.682	1.468	0.129
B3	Pro	24	4.750	1.648	0.336	2.292	1.517	0.310	3.875	1.872	0.382	3.833	1.523	0.311
	Lay	129	5.395	1.465	0.129	3.558	1.727	0.152	4.233	1.656	0.146	4.217	1.571	0.138
E1	Pro	24	5.042	1.429	0.292	3.708	1.706	0.348	4.917	1.381	0.282	4.792	0.977	0.199
	Lay	129	5.450	1.317	0.116	4.589	1.618	0.142	5.047	1.340	0.118	5.101	1.385	0.122
E2	Pro	24	5.250	1.225	0.250	3.625	1.740	0.355	4.875	1.541	0.315	4.958	1.268	0.259
	Lay	129	5.612	1.271	0.112	4.589	1.609	0.142	4.922	1.378	0.121	5.163	1.391	0.122
E3	Pro	24	4.875	1.484	0.303	3.667	1.606	0.328	4.958	1.546	0.316	4.875	1.361	0.278
	Lay	129	5.589	1.266	0.111	4.628	1.601	0.141	4.984	1.346	0.119	5.031	1.363	0.120
F1	Pro	24	4.917	1.816	0.371	2.500	1.383	0.282	5.042	1.367	0.279	4.792	1.414	0.289
	Lay	129	5.612	1.295	0.114	3.682	1.759	0.155	5.078	1.439	0.127	4.876	1.576	0.139
F2	Pro	24	4.833	1.606	0.328	2.667	1.404	0.287	5.333	1.435	0.293	5.000	1.383	0.282
	Lay	129	5.558	1.403	0.123	3.705	1.734	0.153	5.031	1.500	0.132	4.775	1.496	0.132
F3	Pro	24	5.083	1.558	0.318	2.625	1.439	0.294	4.917	1.613	0.329	4.833	1.465	0.299
	Lay	129	5.783	1.192	0.105	3.899	1.828	0.161	5.132	1.348	0.119	4.930	1.453	0.128
F4	Pro	24	5.583	1.381	0.282	2.208	1.285	0.262	5.125	1.676	0.342	4.958	1.601	0.327
	Lay	129	5.930	1.300	0.114	3.426	1.903	0.168	4.791	1.396	0.123	4.767	1.554	0.137
F5	Pro	24	5.417	1.139	0.232	3.083	1.932	0.394	4.792	1.560	0.318	4.625	1.313	0.268
	Lay	129	5.860	1.184	0.104	3.550	1.816	0.160	4.527	1.567	0.138	4.543	1.658	0.146
C1	Pro	24	5.083	1.248	0.255	3.125	1.296	0.265	4.708	1.517	0.310	4.875	1.154	0.236
	Lay	129	5.612	1.382	0.122	3.690	1.780	0.157	4.581	1.575	0.139	4.620	1.621	0.143
C2	Pro	24	5.083	1.283	0.262	3.583	1.586	0.324	4.708	1.083	0.221	5.208	1.021	0.208
	Lay	129	5.558	1.419	0.125	3.845	1.822	0.160	4.512	1.582	0.139	4.891	1.506	0.133
C3	Pro	24	5.250	1.113	0.227	3.833	1.685	0.344	4.625	1.245	0.254	5.125	1.191	0.243
	Lay	129	5.589	1.350	0.119	4.326	1.715	0.151	4.783	1.479	0.130	5.093	1.400	0.123
C4	Pro	24	4.708	1.517	0.310	3.542	1.865	0.381	5.250	1.189	0.243	5.250	1.073	0.219
	Lay	129	5.628	1.311	0.115	4.512	1.737	0.153	5.070	1.324	0.117	5.225	1.486	0.131

* B=Being away; E=Extent; F=Fascination; C=Compatibility; CM=Commercial Street, LL=Landscape and Leisure Street; LS=Living and Service Street; TO=Traffic-oriented Street

Table 6 General descriptions for comparing male group (N=71) and female group (N=82).

			LL-Street			*TO-Street*			*CM-Street*			*LS-Street*		
	Gender	N	Mean	Std. Dev	Std. Err	Mean	Std. Dev	Std. Err	Mean	Std. Dev	Std. Err	Mean	Std. Dev	Std. Err
B1	M	71	5.789	1.393	0.165	3.408	1.961	0.233	4.493	1.602	0.190	4.732	1.585	0.188
	F	82	5.646	1.180	0.130	3.220	1.626	0.180	4.695	1.505	0.166	4.598	1.422	0.157
B2	M	71	5.634	1.514	0.180	3.577	1.932	0.229	4.465	1.548	0.184	4.535	1.501	0.178
	F	82	5.707	1.083	0.120	3.232	1.731	0.191	4.341	1.484	0.164	4.610	1.438	0.159
B3	M	71	5.479	1.501	0.178	3.549	1.819	0.216	4.423	1.670	0.198	4.338	1.585	0.188
	F	82	5.134	1.505	0.166	3.195	1.688	0.186	3.963	1.688	0.186	4.000	1.540	0.170
E1	M	71	5.380	1.458	0.173	4.197	1.670	0.198	5.000	1.342	0.159	4.789	1.443	0.171
	F	82	5.390	1.235	0.136	4.671	1.626	0.180	5.049	1.351	0.149	5.280	1.189	0.131
E2	M	71	5.592	1.358	0.161	4.268	1.723	0.205	4.803	1.327	0.157	4.986	1.389	0.165
	F	82	5.524	1.189	0.131	4.585	1.602	0.177	5.012	1.461	0.161	5.256	1.350	0.149
E3	M	71	5.507	1.403	0.166	4.366	1.588	0.188	4.944	1.351	0.160	4.845	1.390	0.165
	F	82	5.451	1.259	0.139	4.573	1.678	0.185	5.012	1.401	0.155	5.146	1.325	0.146
F1	M	71	5.606	1.488	0.177	3.493	1.835	0.218	4.859	1.313	0.156	4.676	1.593	0.189
	F	82	5.415	1.333	0.147	3.500	1.694	0.187	5.256	1.497	0.165	5.024	1.499	0.166
F2	M	71	5.507	1.548	0.184	3.620	1.839	0.218	4.915	1.528	0.181	4.521	1.520	0.180
	F	82	5.390	1.377	0.152	3.476	1.627	0.180	5.220	1.449	0.160	5.061	1.400	0.155
F3	M	71	5.662	1.393	0.165	3.690	1.909	0.227	4.873	1.473	0.175	4.704	1.562	0.185
	F	82	5.683	1.175	0.130	3.707	1.767	0.195	5.293	1.291	0.143	5.098	1.330	0.147
F4	M	71	5.761	1.449	0.172	3.239	1.901	0.226	4.592	1.555	0.184	4.620	1.562	0.185
	F	82	5.976	1.186	0.131	3.232	1.855	0.205	5.061	1.309	0.145	4.951	1.547	0.171
F5	M	71	5.803	1.249	0.148	3.465	1.904	0.226	4.521	1.491	0.177	4.451	1.575	0.187
	F	82	5.780	1.133	0.125	3.488	1.786	0.197	4.610	1.631	0.180	4.646	1.636	0.181
C1	M	71	5.563	1.500	0.178	3.577	1.713	0.203	4.254	1.583	0.188	4.394	1.626	0.193
	F	82	5.500	1.260	0.139	3.622	1.740	0.192	4.902	1.487	0.164	4.890	1.466	0.162
C2	M	71	5.521	1.539	0.183	3.577	1.762	0.209	4.282	1.596	0.189	4.789	1.473	0.175
	F	82	5.451	1.288	0.142	4.000	1.792	0.198	4.768	1.408	0.155	5.073	1.412	0.156
C3	M	71	5.648	1.353	0.161	4.113	1.745	0.207	4.648	1.494	0.177	4.930	1.477	0.175
	F	82	5.439	1.287	0.142	4.366	1.689	0.187	4.854	1.398	0.154	5.244	1.253	0.138
C4	M	71	5.606	1.357	0.161	4.155	1.833	0.218	4.803	1.380	0.164	4.986	1.526	0.181
	F	82	5.378	1.402	0.155	4.537	1.737	0.192	5.354	1.180	0.130	5.439	1.306	0.144

* B=Being away; E=Extent; F=Fascination; C=Compatibility; CM=Commercial Street, LL=Landscape and Leisure Street; LS=Living and Service Street; TO=Traffic-oriented Street

Results

Descriptive results of restorative expectation differences

The results of the RCS rating (Figure 2) show that Landscape and Leisure Street was expected to have the highest level of restorativeness in terms of all the four ART components, and Traffic-oriented Street the lowest. The significant difference in restorative expectations identified between Landscape and Leisure Street and Traffic-oriented Street suggests that people's expectations do vary with their understandings of different street types. The RCS ratings of Living and Service Street and of Commercial Street were more similar with each other but with obvious differences appearing in

individual ART components. For example, Living and Service Street was rated relatively lower in the *fascination* and *being-away* components but higher in the *compatibility* and *extent*. (Figure 2).

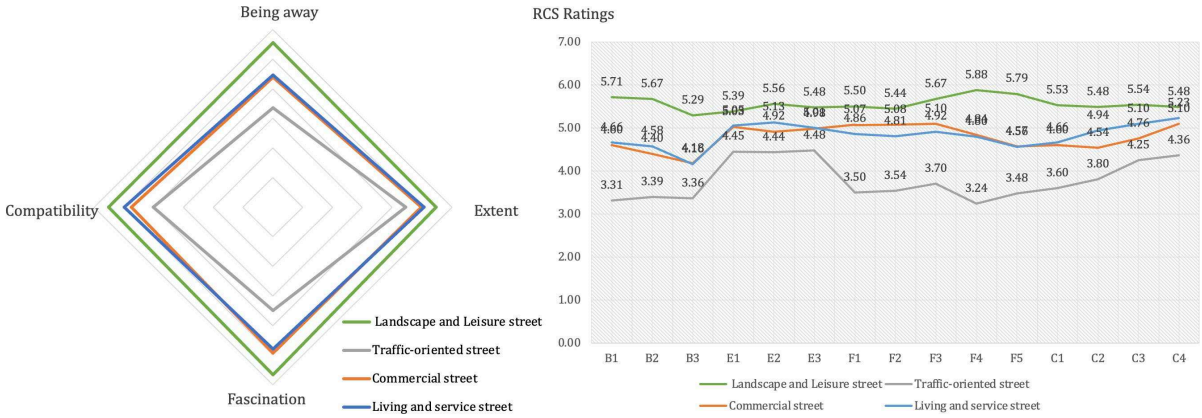

Figure 2 Overall mean rating results of restorative expectations for street types (N=154).

* B=being away; E=extent; F=Fascination; C=Compatibility

Comparison between street types

The ANOVA, which aimed to identify differences within the groups, showed significant differences across all the 15 RCS criteria (*Sig.=.000*).

The results in Table 7 show significant differences between Landscape and Leisure Street with Traffic-oriented Street, Living and Service Street with Traffic-oriented Street, Commercial Street with Traffic-oriented Street and Commercial Street with Landscape and Leisure Street. Results indicated that people's expectations of these street type pairs were different in each RCS item. However, there was little differentiation between Commercial Street and Living and Service Street, given that 13 RCS items showed no differences. Similarity was also observed in C4 ("There is an accordance between what I like to do and this environment") between Landscape and Leisure Street with Living and Service Street. Findings of the LSD post-hoc test suggest that people's expected restorativeness is different among street types and these differences could be clearly distinguished within most street types. The only exception was the restorative expectation of Commercial Street and Living and Service Street, with only slight differences existing in the *compatibility* component. This finding is in

accordance with the general description of RCS ratings, in which the ratings of these two street types are very similar with each other.

Table 7 Post-hoc results for comparing 15 RCS items within street types (Sig. <0.05).

	Being away			*Extent*			*Fascination*					*Compatibility*			
	B1	***B2***	***B3***	***E1***	***E2***	***E3***	***F1***	***F2***	***F3***	***F4***	***F5***	***C1***	***C2***	***C3***	***C4***
LL and CM	0.000	0.000	0.000	0.028	0.000	0.002	0.015	0.038	0.001	0.000	0.000	0.000	0.000	0.000	0.024
LL and LS	0.000	0.000	0.000	0.041	0.010	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.009	0.134
LL and TO	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CM and LS	0.738	0.316	0.916	0.873	0.188	0.873	0.235	0.129	0.287	0.798	0.942	0.741	0.024	0.043	0.442
CM and TO	0.000	0.000	0.000	0.000	0.004	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000
LS and TO	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

(* Value in bold show no difference in this item between street pairs. B=being away; E=extent; F=Fascination; C=Compatibility; CM=Commercial Street, LL=Landscape and Leisure Street; LS=Living and Service Street; TO=Traffic-oriented Street)

Perceptive differences between different participants groups

There was a consistency in restorative expectations across study participants with professional backgrounds and those without (Table 8). Significant differences between these two groups were only found in one item describing the being way component (B2) of Living and Service Street, and three items (F1, F2, F3) describing the *fascination* component of Landscape and Leisure Street. However, restorative expectations of people with professional background on Traffic-oriented Street was noticeable different from those without. The *being away, extent* and almost all items in *fascination* components were found to have significant differences. In respect to gender (Table 9), significant difference was only observed in one *compatibility* item of Commercial Street, while no significant difference was found in the Landscape and Leisure Street and Traffic-oriented Street expectation ratings. For Living and Service Street, different RCS items between gender groups were scattered with one in the *extent* component, one in *fascination* and two in the *compatibility* component. Slight differences were found within the four age groups on the RCS items (Table 10), with significant differences only observed in two items (B2 and F5) of Commercial Street and two items (B2 and F4) of Living and Service Street. However, significant differences again appeared on most of the RCS items of Traffic-oriented Street, especially in the component of *fascination* and *compatibility*.

Table 8 T-test results for comparing Pro-group and Lay-group using mean ratings (Sig. <.05).

	Being away			***Extent***			***Fascination***					***Compatibility***			
	B1	**B2**	**B3**	**E1**	**E2**	**E3**	**F1**	**F2**	**F3**	**F4**	**F5**	**C1**	**C2**	**C3**	**C4**
CM Street	.624	.160	.343	.665	.879	.932	.910	.363	.488	.299	.448	.716	.560	.624	.535
LS Street	.107	**.036**	.271	.298	.504	.607	.807	.495	.765	.583	.818	.463	.325	.917	.937
LL Street	.035	.117	.054	.171	.199	**.015**	**.025**	**.025**	**.013**	.236	.092	.083	.129	.248	**.002**
TO Street	**.001**	**.001**	**.001**	**.016**	**.009**	**.008**	**.002**	**.006**	**.002**	**.003**	.254	.141	.511	.197	**.014**

* B=Being away; E=Extent; F=Fascination; C=Compatibility; CM=Commercial Street, LL=Landscape and Leisure Street; LS=Living and Service Street; TO=Traffic-oriented Street

Table 9 ANOVA results for comparing gender groups using mean ratings (Sig. <.05).

	Being away			***Extent***			***Fascination***					***Compatibility***			
	B1	**B2**	**B3**	**E1**	**E2**	**E3**	**F1**	**F2**	**F3**	**F4**	**F5**	**C1**	**C2**	**C3**	**C4**
CM Street	.423	.616	.094	.823	.358	.759	.086	.209	.062	.044	.728	**.010**	.047	.380	.009
LS Street	.580	.754	.184	**.022**	.225	.172	.166	**.024**	.095	.190	.454	**.049**	.225	.156	.050
LL Street	.495	.728	.159	.964	.745	.796	.404	.622	.920	.314	.908	.777	.760	.330	.311
TO Street	.516	.245	.214	.078	.239	.437	.980	.608	.954	.980	.939	.874	.145	.364	.189

* B=Being away; E=Extent; F=Fascination; C=Compatibility; CM=Commercial Street, LL=Landscape and Leisure Street; LS=Living and Service Street; TO=Traffic-oriented Street

Table 10 ANOVA results for comparing age groups using mean ratings (Sig. <.05).

	Being away			Extent				Fascination				Compatibility			
	B1	B2	B3	E1	E2	E3	F1	F2	F3	F4	F5	C1	C2	C3	C4
CM Street	.528	.046	.156	.909	.690	.667	.937	.945	.513	.174	.042	.587	.220	.457	.497
LS Street	.053	.038	.023	.404	.946	.427	.423	.860	.327	.032	.092	.202	.936	.762	.379
LL Street	.135	.191	.160	.305	.509	.351	.432	.764	.444	.308	.322	.293	.224	.106	.591
TO Street	.012	.111	.140	.134	.438	.275	.001	.026	.007	.002	.002	.025	.034	.227	.388

* B=Being away; E=Extent; F=Fascination; C=Compatibility; CM=Commercial Street, LL=Landscape and Leisure Street; LS=Living and Service Street; TO=Traffic-oriented Street

Discussion

Two concepts: 'restorative expectation' and 'street typology' are introduced in this study to explore the appropriate way of designing streets to be restorative. It acknowledges that urban functional spaces should not sacrifice their other values in pursuit of being as restorative as possible because, in essence, they differ from natural places that are primarily designed for leisure and recreation. Therefore, people would expect different levels of restorative experiences when they walk in certain streets according to their previous experiences and cognitions. The actual street users are involved in this research to express how different types of streets should be improved to meet their restorative expectations. Investigating users' expectations revealed a way to begin designing restorative streets according to people's expectations so that street restorativeness, as one necessary street quality, can be achieved without jeopardising the other necessary qualities of urban streets.

The four ART components were initially proposed almost four decades ago (Kaplan, 1983). However, the development of measures for these components has only recently taken place. Measures of restorative qualities have long been regarded as useful for practical purposes since some have recognised the value of translating restorative environment theory into design options (Kaplan,

Kaplan and Ryan, 1998; Marcus and Barnes, 1999). They are also useful when assessing the restorative potential of existing and proposed settings, and in turn inform various kinds of design decision making (Hartig et al., 1996). Our study used an RCS-based online survey together with the scenario approach to investigate users' restorative expectations on four different Shanghai street types.

Findings from participant's restorative expectations support our assumption of making certain types of streets more restorative than others, since a clear ranking of restorative expectations on four other street types were observed, with the highest to the lowest being: Landscape and Leisure Street, Commercial Street, Living and Service Street and Traffic-oriented Street. Landscape and Leisure Streets are expected to have the highest restorative benefits, potentially due to their designated function of providing people with relaxations and entertainment, while the lowest ranking of Traffic-oriented Street could be due to a higher level of people's tolerance of their main functional as movement corridors. Furthermore, the higher *fascination* rating on Commercial Street can be explained by its anticipated frontages composed of various retailing shops. Normally, street-side shops, especially those with window frontages, provide strong attractions for people passing by. Also, an explanation of the higher compatibility rating on Living and Service Street could be related to users' expectations of having service functions along street sides and their daily needs being satisfied.

Our study investigated possible perceptive differences that have been analysed during previous research as influential factors to peoples' restorative experiences (Scopelliti and Giuliani, 2004; Berto, 2007; White et al., 2010). In general, there was no significant difference existing between gender groups. However, slight differences do exist between people with or without professional background and between people in different life stage, which were found in four rated street types, especially in Traffic-oriented Streets. One possible explanation might be because of the limited number of participants during the study.

Overall, our research findings provide opportunity to inform street design approaches. These include: 1) to design the Landscape and Leisure Street to be as restorative as possible and meet users' high-level of expectations; 2) to provide the Living and Service Street with various street-side functions for

making it compatible with users' daily needs; and 3) to make the Commercial Street more fascinating to street users through design interventions. Even though this is the case, a restorative standard can only offer a general direction implying how urban streets should be delivered to be restorative in relation to users' expectations. It will not be fully applicable in practical design until the relationship between restorative experiences and street design attributes are established more systematically. Whether, and how, these expectations of different levels of restorativeness can be realised in design practices still requires further exploration. Additionally, subjective perceptions can easily be affected by various factors, and these are relatively hard to control when the questionnaire-based survey is administered through an online platform.

Conclusion

Knowing peoples' restorative expectations are important in relation to urban street contexts, with these spaces no being conventionally see as restorative environments while serving multiple roles in urban outdoor life. In response to the limited exploration of the restorative qualities of streets, our study not only indicates that streets should be restorative, but that users expect to have different levels of restorative experiences while using streets with different characteristics.

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