



Greenery on residential buildings: Does it affect preferences and perceptions of beauty?

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ARTICLE INFO

Article history:

Available online 27 November 2010

Keywords:

Green roof
Green façade
Vegetation
Restoration
Beauty
Preference

ABSTRACT

Recently there has been a surge in the number of green roofs and façades (vegetation on the roofs & walls of a building) installed in the UK, with advocacy of their use by policy-makers and claims that they are aesthetically pleasing and promote restoration. But these claims rely on generalisations from different landscapes, raising concerns about validity. The present study examined whether houses with vegetation would be more preferred than those without, be perceived as more beautiful and restorative, and have a more positive affective quality. Differences between types of building-integrated vegetation were also examined. Two studies were conducted: an online survey in which participants ($N = 188$) rated photographs of houses with and without vegetation on each of these measures, and interviews ($N = 8$) which examined preference and installation concerns. Results showed that houses with (some types of) building-integrated vegetation were significantly more preferred, beautiful, restorative, and had a more positive affective quality than those without. The ivy façade and meadow roof rated highest on each. These findings are consistent with other areas of landscape research and the claims of those in the industry, and suggest that building-integrated vegetation would be a valuable addition to the urban environment.

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1. Introduction

The importance of greenery is increasingly being recognised by local authorities, architects, and urban planners in the regeneration of our cities (e.g. Thwaites, Porta, Romice, & Greaves, 2007). Previous landscape research has shown that natural scenes are generally more preferred and perceived as more beautiful and restorative than built ones (e.g. Kaplan & Kaplan, 1989; Van den Berg, Koole, & van den Wulp, 2003). The integration of nature in to urban areas can also improve perceptions of that area; Van den Berg, Hartig, and Staats (2007) suggest that greenery may be particularly desired within the urban environment since it has restorative properties that appear to combat stressors such as noise and crowding. In line with these ideas, there has been a recent push within the UK to incorporate green roofs and façades in to the urban landscape. For instance, in February 2008 the Mayor of London drafted a living roofs and walls policy for The London Plan, which stated that “the Mayor will and boroughs should expect major developments to incorporate living roofs and walls where feasible” (Greater London Authority, p. 8). Environmentalists

applaud the move, given the many documented environmental benefits of green roofs and façades (e.g. Grant, 2006). But problems arise in claims that vegetation is aesthetically pleasing and can promote restoration (e.g. Dunnett & Kingsbury, 2004; Greater London Authority, 2008), since they rely on generalisations from very different areas of landscape research, raising concerns about their validity.

In actual fact, there is some evidence to suggest that far from “improving... visual quality” (Dunnett & Kingsbury, 2004, p. 6), people actually have “concerns about the aesthetics of green roofs” (Smith, 2005, cited in Smith & Boyer, 2007, p. 49). In this study, Smith (2005, unpublished thesis) conducted semi-structured interviews with developers, contractors, and landscape architects working on new homes built to the EcoHomes Standard and/or badged as an Urban Village or Millennium Community (models typically associated with relatively high sustainable profiles). The study found that the inclusion of green roofs on to some of these homes was “dismissed by developers and designers as being visually inappropriate” (p. 276), and consultations with resident groups revealed that “residents can be wary of living in houses which do not meet their aspirations of a ‘standard’ house” (p. 277). This appears to contradict findings in similar areas of landscape perception research suggesting a desire for greenery. The present study therefore aims to assess the aesthetic impact and the level of

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perceived restoration (if any) that may be achieved by placing green roofs and façades on to homes.

1.1. Explaining green roofs and façades

Green roofs and façades are forms of *building-integrated vegetation*, where vegetation “has been deliberately seeded, planted or encouraged to establish itself on a built structure” (Grant, 2006, p. xi). Vegetation growing on a roof is called a *green roof*, and vegetation growing on the wall of the building is a *green façade* (Grant, 2006). One popular form of vegetation for a green roof is *Sedum*, which is widely used because it is easily installed and is drought-resistant, simply turning red/brown as it dries out (Grant, 2006). Another type, the brown roof, is often used to compensate for a potential loss of species at brownfield sites, being constructed using materials similar to those found on the site on which the building was developed, on which plants are generally allowed to self-colonise (Dunnett & Kingsbury, 2004; Grant, 2006). Dunnett and Kingsbury (2004) claim that brown roofs can “provide habitat for a range of invertebrates and birds” (p. 4), making them popular among conservation groups (e.g. Blackredstarts.org.uk, 2008). Other types of vegetation commonly used to create green roofs include turf, meadow, and succulents.

Green façades, also known as living walls, generally consist of climbing plants which are either planted at the base of the wall, or in to structures placed on to the wall (Greater London Authority, 2008). Traditionally, vegetation such as ivy, Virginia creeper, and clematis have been used to create green façades (Dunnett & Kingsbury, 2004; Grant, 2006).

1.2. Vegetation versus no vegetation

Research within the field of environmental psychology has shown that people generally respond to areas with vegetation and natural elements more positively than those without. Past research has produced four particularly interesting sets of findings, suggesting that natural and vegetated areas are a) preferred over built areas; b) more aesthetically beautiful; c) evoke more positive emotions; and d) are more restorative. These will be discussed in turn.

Preference can be defined as a tendency to choose one thing over another, and it has widely been found that people prefer natural landscapes over built ones (e.g. Van den Berg et al., 2003). Indeed, Ulrich (1983) writes that “one of the most clear-cut findings in the experimental literature on environmental studies is the consistency for North American and European groups to prefer natural scenes over the built view” (p. 110). Ulrich (1983) suggests that even the addition of some natural elements to an urban environment can improve preference for that landscape, something which may translate to the case of building-integrated vegetation.

Not only do people tend to prefer green environments, but research in to aesthetic appraisals also shows they tend to find them more beautiful (e.g. Van den Berg et al., 2003) and that these environments often evoke more positive emotional responses (affects). Korpela, Klemetilä, and Hietanen (2002), for example, found evidence suggesting that natural scenes evoke more positive affects (e.g. joy) and urban scenes evoke more negative affects (e.g. anger).

A restorative environment is one which can aid recovery from directed attention fatigue (Attention Restoration Theory; Kaplan & Kaplan, 1989; Kaplan, 1995) and stress (Van den Berg et al., 2003). Green and natural areas are often considered to be particularly effective in restoring attention (e.g. Hartig, Evans, Jamner, Davis, & Gärling, 2003; Hartig, Mang, & Evans, 1991; Herzog, Black, Fountaine, & Knotts, 1997).

2. Differences between vegetation types

Whilst there does appear to be consensus over the general preference and aesthetic, affective, and restorative qualities of greenery, there is a very complex pattern across different types of vegetation. After all, greenery encompasses many types of vegetation, kept in different styles, and it is unlikely that people will react in the same way to each.

Generally, studies have found that the more natural the landscape, the more it is preferred. For instance, Kaplan (2007) examined the preference for different environments surrounding the workplace, finding that the more natural, “prairie-like, less groomed areas” (p. 22), were preferred by workers in the area over “the large mowed areas” (p. 22). Similarly, Kaplan and Austin (2004) found that the view of nature from the home was the most important factor in choosing where to live, but the less natural, manicured/landscaped and mown areas did not impact upon satisfaction.

But the level of perceived naturalness can be broken down in to two distinct factors: the natural appearance and amount of vegetation; and the presence or absence of built/human elements. Özünger and Kendle (2006), for example, compared the perceptions of a more ‘manicured’ garden and a wilder park, finding that natural can be both described “as the ‘opposite of formal’ and as the ‘opposite of the built-up environment’” (p. 154). Ulrich (1983) similarly found that Americans believe a scene to be natural if it contains a) more vegetation, and b) fewer human-made elements. This highlights the unique position held by building-integrated vegetation, which is inherently of the built environment, as well as having vegetation which has clearly been placed or encouraged by human influence to establish itself on the building.

A clear distinction can also be made between undue human influence and good maintenance. Consistent with Kaplan (2007), researchers have found that attitudes are more negative towards areas such as large mown areas of grass and agricultural fields (e.g. Kaplan, Kaplan, & Brown, 1989) which may be considered as having been (unduly) influenced by humans. But areas which are perceived as being well-maintained are viewed in a more positive light. Özünger and Kendle (2006), for example, found that while participants preferred more natural landscapes, they wanted these to be well-kept. Similarly, Kuo, Bacaicoa, and Sullivan (1998) found that well-maintained grass was preferred over less well-maintained areas of grass, and Nassauer (1995) claimed that people find landscapes which contain cues indicating human attention and care more attractive. Talbot and Kaplan (1984) found that areas which were less well-maintained and had fewer built features were less preferred and associated with danger.

It is possible that the height and organisation of the vegetation may be an indicator of how maintained a landscape is, since unkept grass is generally tall and may be perceived as messy. Consistent with this idea, Todorova, Asakawa, and Aikoh (2004) found a preference for low-growing, ordered vegetation over taller more disordered planting, and Kaplan et al. (1989) showed that there was a preference for “smoothness”, defined as the “uniformity of and shortness of ground texture” (p. 518).

Not only level of maintenance, but the type and condition of vegetation may be relevant. Some researchers have found a preference for productive vegetation and a dislike for vegetation which appears to be in poor condition (e.g. Schroeder, 1982). Williams and Cary (2002) also found this when conducting follow-up interviews to understand the general preference for eucalyptal vegetation over non-eucalyptal vegetation. They found that participants ascribed their dislike for the non-eucalyptus species’ to the sparser, dry, and dead appearance of the vegetation, which was characteristic of a dry environment and which the participants believed (incorrectly)

was due to fire. They suggest that this fits in with an evolutionary explanation, in that “tree characteristics [can be used] to infer the productivity and safety of the landscape” (p. 271). Similarly, it has been shown that people dislike weedy fields and scrubland (Kaplan et al., 1989), which may be a sign of an unproductive landscape.

The presence of flowers in vegetation may also positively influence perceptions. Haviland-Jones, Rosario, Wilson, and McGuire (2005), for example, found that “flowers have immediate and long-term [positive] effects on emotional reactions, mood, social behaviours and even memory for both males and females” (p. 104), and Kaplan (2007) found that 50% of participants reported the desire for more flowers in the area surrounding their workplace. Todorova et al. (2004) also found a preference for flowers across different types of simulated vegetation growing along the streets of a Japanese city, with participants believing that the flowers positively contributed to psychological well-being and the aesthetic quality of the street.

3. The present studies

Building-integrated vegetation can consist of a variety of different types of vegetation, but given the lack of previous research, it is only possible to hypothesise the effects of various types based on similar research. It is unclear whether greenery on buildings is preferred over those without vegetation and whether residents may indeed be “ambivalent, or worse, actively against the inclusion of extensive green roofs in the residential landscape” (Smith, 2005, in Smith & Boyer, 2007, p. 49). It is unwise to assume then, as the policy-makers and those in the industry have, that the pattern of preference and restoration will be the same for this very different environment. Indeed, Kaplan et al. (1989) suggest that “certain types of predictors may only be effective in certain types of environments” (p. 528). It is important to determine whether people prefer vegetation over traditional built fabrics, as well as which type of vegetation is preferred, rather than simply advocating nature or greenery in general. This paper aims to address the lack of research in to the perceptions of building-integrated vegetation by presenting two studies: a questionnaire-based study; and an interview-based study.

The first study aims to compare the level of preference, perceived beauty, affective quality, and restorative properties of houses with various types of building-integrated vegetation to those without vegetation. Using this range of measures will create a broad understanding of the perceptions of building-integrated vegetation. We expect responses to be more positive for buildings with vegetation compared to those without vegetation, and to vary according to the type of vegetation. The second study will use interviews to: 1) obtain direct comparisons of preference across the same houses used in study I, since this cannot be achieved in the questionnaires, and to triangulate findings across methodologies; 2) provide reasons for the preference ratings obtained in the questionnaire; and 3) determine perceived barriers to placing vegetation on to the home, in light of evidence presented by Smith (2005).

4. Study I

4.1. Method

4.1.1. Design

The questionnaire was designed to assess participant responses to photographs of houses with various types of vegetation on them versus no vegetation on them. Participants were shown photographs of four different houses with various types of vegetation superimposed on to them. The houses were chosen to represent the current UK housing stock (semi-detached and detached,

Department for Communities and Local Government, 1996) and vary in age and rural/urban appearance.

The four original photographs were the basis for the no vegetation condition, with five further conditions created using different types of vegetation for each, to produce 24 photographs/conditions (Fig. 1). Each participant was therefore presented with 4 photographs showing one type of vegetation. The vegetation chosen was based on those currently readily available from green roof manufacturers for residential buildings:

- (1) Turf roof (short grass);
- (2) Flowering *Sedum* roof (red colour);
- (3) Tall flowering meadow roof;
- (4) Ivy façade;
- (5) Brown roof (varies in topography and colour).

4.1.2. Measures

Four measures were used to assess reactions to each of the houses presented in the questionnaire:

Preference. Two items were used to measure preference: “To what extent do you like the house?” (1 = dislike it a lot, 7 = like it a lot); and “To what extent do you agree with the statement: “I would love to live here?”” (1 = strongly disagree, 7 = strongly agree). The strongly disagree/strongly agree 7-point scale was utilised across Beauty, Affective Quality, and Restoration measures to keep question responses consistent, aiding completion and reducing participant confusion, as well as allowing comparability across scales in data analysis.

Beauty. Respondents rated the extent to which they agreed that the house was beautiful and pretty.

Affective Quality. Six items from the Russell and Lanius circumplex (1984) were used to measure the affective quality of the houses: pleasant, peaceful, boring, unpleasant, busy, and interesting. These items were chosen to give an overview of the aesthetic quality of the houses, given the need to keep the questionnaire within an acceptable length for the participant, and because many of the other items, such as “hectic”, “alive” and “slow” were not appropriate.

Perceived Restoration. Twelve of the most applicable items were chosen from the revised Perceived Restorativeness Scale (Hartig, Kaiser, & Bowler, 1997). Items such as “There are landmarks to help me get around” were, for example, removed because participants would not be able to relate them to the photographs of the houses. The wording of the introduction and some items were also modified to better fit the present study (e.g. “It is a place to get away from it all” was changed to “This is a good place to get away from it all”).

4.1.3. Participants

Participants were recruited in two ways: through the advertisement of the study in various forums on the internet (e.g. BBC television forums), on posters and leaflets around a town in the South East of the UK (Guildford), and in a newspaper serving the same area; and through a snowball sampling method, in which those acquainted with the authors but unfamiliar with the study were contacted by email. All respondents were given the opportunity to enter a competition to win a £50 voucher. It is not possible to compute the response rate since it is not known how many people viewed the recruitment information, but there were 251 visits to the forum pages and 63 people were contacted by email.

The sample consisted of 188 participants (79 male, 109 female), aged between 17 and 75 years ($M = 41.7$). Each vegetation was rated by approximately 30 respondents. About 21% of the participants lived alone, 41% with their partner, and 24% with their partner and



Fig. 1. The 24 conditions/photographs, displayed by house type and vegetation superimposed. Note. The original photographs were in full colour.

children. Approximately 62% were homeowners, and 23% worked outdoors, 12% worked with plants, and 9% worked with animals. Eighty-seven percent of respondents reported having either heard of or seen a green roof and 55% a green façade (although understanding of the concepts was not measured). The level of highest qualification in the sample was higher than the average levels for England in 2007: 69% of the sample had a university degree, compared to the English average of 31% with a degree or equivalent (Department for Innovation, Universities & Skills, 2008).

4.1.4. Materials

The 24 photographs were created by digital manipulation using Adobe Photoshop CS2. For each photograph, all obstructions in front of and around the house were removed, the sky and surroundings uniformed, and the size formatted to the same dimensions. This uniformity was done to try to reduce extraneous variables and increase experimental control. Vegetation was then cut from other photographs and superimposed on to the houses.

4.1.5. Procedure

Upon entering the website hosting the questionnaire, participants saw a welcome page describing the aim of the study, informing them of their anonymity, and asking for their consent to take part. When moving to the next page, one of six questionnaires was generated at random by the software, so that participants were randomly assigned one type of vegetation condition. Participants proceeded through the questionnaire by clicking on and filling in the appropriate boxes as instructed in the text, viewing one photograph at a time and rating it according to the measures below it.

5. Results

5.1. Data transformation

The photograph of House 3 with ivy was removed from all analyses due to a finding from study II which suggested that it was

problematic (described later). Given that every participant rated each of the four houses, with the exception of this photograph, 720 cases were used in analysis. Items which were negative were recoded, and new variables created for each measure for use in statistical analyses. Variables were created by taking the mean score of the items in each scale. Cronbach's alpha was used to check the internal consistency of measures, which was good for all (α for all scales was greater than 0.79). Five new variables were created to represent each scale: Preference (mean score of the two items measuring preference); Beauty (the two items from the beauty measure); Affective Quality (the six items from the affective quality scale); and Restoration (eight items from the restoration scale – the four items relating to complexity were removed because complexity was unrelated to the dependent variables).

5.2. The effects of vegetation type

Fig. 2 shows the mean ratings for each of the four measures by vegetation type. It shows a similar trend for each measure, with ivy being the most preferred condition, showing the highest ratings for Beauty, Affective Quality and Restoration. This is closely followed by meadow, which is also rated consistently high. The Sedum, turf and brown vegetations have slightly lower ratings, and the no vegetation condition has the lowest mean across the measures.

A series of univariate analyses of variance (ANOVAs; see Field, 2005) were performed to determine whether there were any significant differences in the responses on each measure (Preference, Beauty, Affective Quality, Restoration) according to the type of vegetation placed on to the building, and the type of house the vegetation was placed on to (four different houses were used). The analysis also examined whether house type interacted with vegetation type.

Significant differences were found on each scale according to vegetation type: Preference: $F(5, 719) = 4.16, p < 0.01, \text{Partial } \eta^2 = 0.03$. Beauty: $F(5, 718) = 6.22, p < 0.001, \text{Partial } \eta^2 = 0.04$. Affective Quality: $F(5, 329) = 6.86, p < 0.001, \text{Partial } \eta^2 = 0.04$. Restoration: $F(5, 719) = 5.25, p < 0.001, \text{Partial } \eta^2 = 0.04$. Effect sizes

were small, with vegetation type accounting for 3–4% of the variance across the four measures.

Games-Howell post-hoc tests were carried out on the data to compare each type of vegetation with every other vegetation (including no vegetation). For Preference, there were significant differences ($p < 0.05$) between ivy and the turf, Sedum, brown, and no vegetation conditions. For Beauty, there were significant differences ($p < 0.05$) between ivy and all the other conditions including the no vegetation condition. For Affective Quality, there were significant differences ($p < 0.01$) between ivy and the Sedum, brown, and no vegetation conditions, as well as between meadow and no vegetation ($p < 0.01$). And for Restoration, there were also significant differences ($p < 0.05$) between ivy and the Sedum, brown, and no vegetation conditions, as well as significant differences between the no vegetation condition and turf ($p < 0.05$) and meadow ($p < 0.01$). It should, however, be noted that whilst these differences are statistically significant, ratings on each of the four scales were not very high: for example, a rating of around 5 for ivy represents a slightly beautiful environment, whereas a rating of around 3 for the no vegetation condition represents slight disagreement with the statement that the house is beautiful.

House type also had a significant effect on each of the measures: Preference: $F(3, 697) = 43.44, p < 0.001, \text{Partial } \eta^2 = 0.16$. Beauty: $F(3, 696) = 43.11, p < 0.001, \text{Partial } \eta^2 = 0.16$. Affective Quality: $F(3, 697) = 51.27, p < 0.001, \text{Partial } \eta^2 = 0.18$. Restoration: $F(3, 697) = 39.45, p < 0.001, \text{Partial } \eta^2 = 0.15$.

There was a significant interaction between house type and vegetation type for Restoration $F(14, 697) = 1.71, p = 0.05, \text{Partial } \eta^2 = 0.03$ (Fig. 3). This indicates that whilst there was a general downward trend in perceived restoration from ivy to no vegetation, House 4 was rated consistently highly and was less affected by the presence of vegetation, with the exception of Sedum, which was considered more restorative (Fig. 4). Interactions between house type and vegetation type for Preference, $F(14, 697) = 0.91, p = 0.55, \text{Partial } \eta^2 = 0.02$, Beauty $F(14, 696) = 0.78, p = 0.69, \text{Partial } \eta^2 = 0.02$, and Affective Quality $F(14, 697) = 1.27, p = 0.22, \text{Partial } \eta^2 = 0.03$, were non-significant.

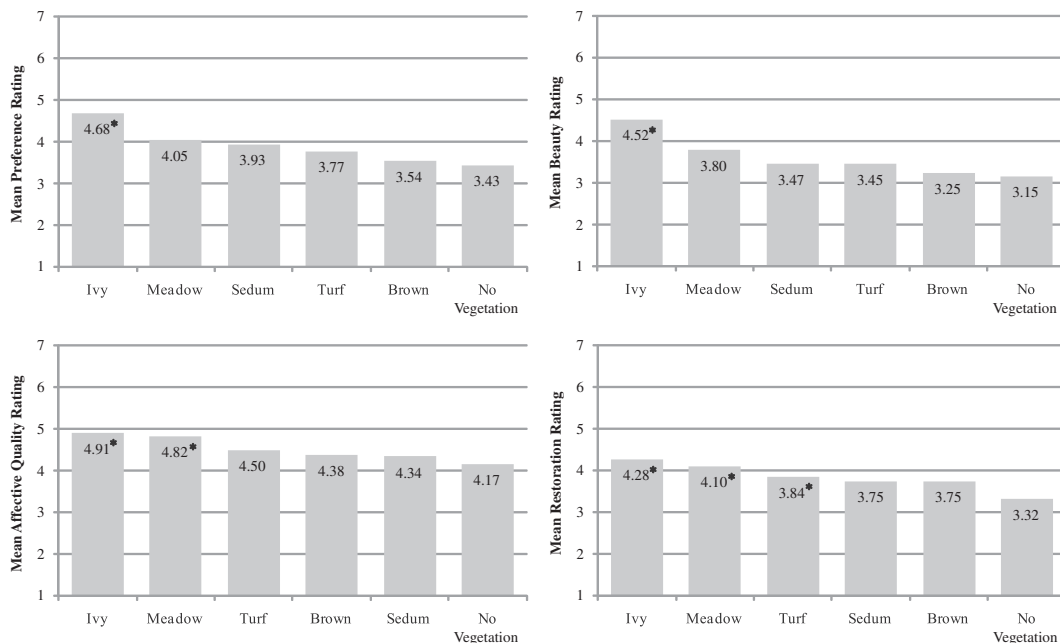


Fig. 2. Mean Preference, Beauty, Affective Quality, and Restoration ratings for each type of vegetation; Asterisks denote significant differences to the No Vegetation condition; Rating scale ranged from 1 to 7.

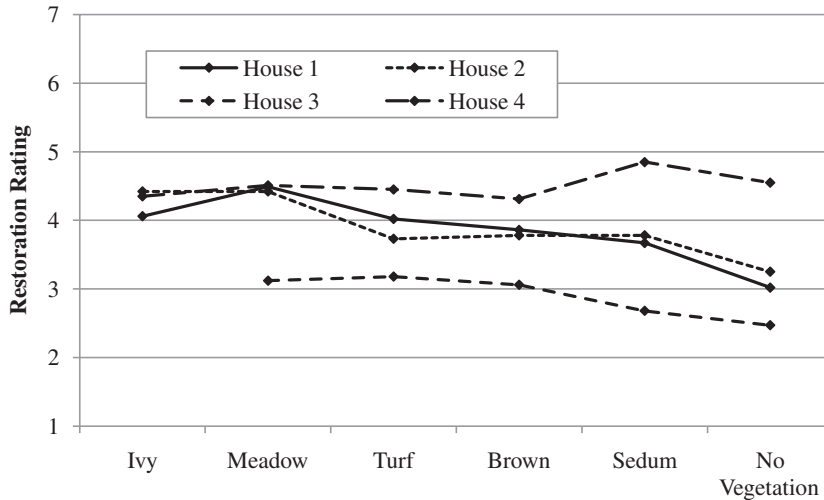


Fig. 3. Graphed interaction between house type and vegetation type for Restoration ratings.

The findings of Study I show that houses with ivy and meadow were generally more preferred, perceived to be more beautiful and restorative, and received more positive affective appraisals than houses with *Sedum*, turf and brown vegetations or without vegetation. Turf was also significantly more restorative than no vegetation. Additionally, there is a trend by which no vegetation received the lowest ratings across all measures.

6. Study II

6.1. Method

6.1.1. Participants

Eight participants aged between 22 and 67 ($M = 38.88$), four of whom were male, and four female, were obtained through opportunity sampling in a town in South-East England. Participants were recruited using poster advertisements placed at locations around the town, and by approaching people there. Three participants were homeowners, and five, tenants. Three worked full-time, four were students, and one was retired.

6.1.2. Procedure

Participants were asked to sort each of the 24 photographs on to five piles according to preference, thinking aloud as they did so and giving explanations for their decisions. Each photograph was

therefore rated on a scale of 1–5 according to: 1) how much they liked the house (1 = least liked; 5 = most liked); and 2) how much they would like to live there (1 = least like to live there; 5 = most like to live there).

6.2. Results

6.2.1. Differences in vegetation type

Each vegetation type received 32 ratings (8 participants rated the vegetation on 4 different houses). This enabled data to be analysed by ANOVA in order to determine whether there were significant differences in the two measures according to vegetation type, in a similar way to Study I. The photograph of House 3 with ivy was however removed from this analysis (as in Study I) because interviewees picked it out from other photographs as too bright a green and artificial-looking, impacting negatively upon the overall ivy and house 3 ratings: “it’s a bit too green, it looks like you’ve wallpapered on some ivy” (P2). For the second card sort task, one participant failed to complete the task, and so was removed. In total then, 184 cases were used in the analysis of the first card sort and 161 cases were used for the second card sort analysis.

For the first card sort task, mean preference ratings were highest for ivy, followed by meadow, no vegetation, turf, *Sedum*, and brown (Fig. 5). For the ANOVA examining Preference, the Welch F statistic was used because the assumption of homogeneity of variance was

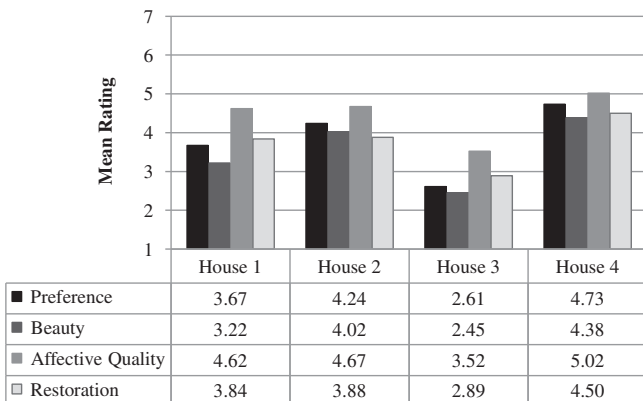


Fig. 4. Mean Preference, Beauty, Affective Quality, and Restoration ratings for each house; Rating scale ranged from 1 to 7.

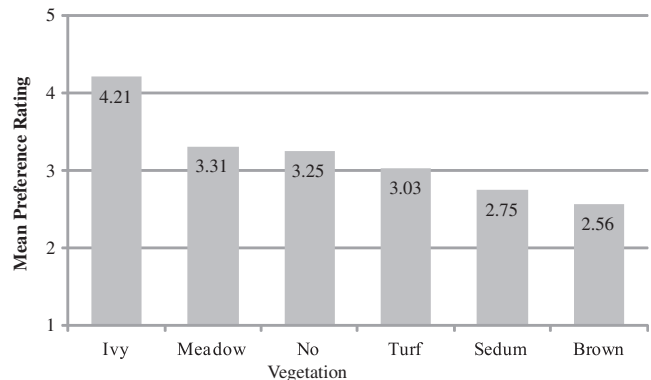


Fig. 5. Mean preference ratings for each vegetation type in Study II; Rating scale ranged from 1 to 5.

violated. This meant that interaction effects between vegetation type and house type for Preference could not be tested. Results showed a significant difference in preference across the vegetation types, $F(5, 71.83) = 4.25, p < 0.01, \eta^2 = 0.13$. Games-Howell post-hoc tests showed that there were significant differences between the highest rating vegetation, ivy, and each of the other types of vegetation, including the no vegetation condition ($p < 0.05$).

For the second sort task, the pattern was similar to the first, with participants reporting that they would most like to live in a house with ivy, followed by one with turf, no vegetation, meadow, *Sedum* and brown (Fig. 6). There was a significant difference in how much the participants would like to live there across the vegetation types, $F(5, 138) = 2.48, p < 0.05$, Partial $\eta^2 = 0.08$. Gabriel's post-hoc tests revealed significant differences between ivy and the lower rating *Sedum* and brown vegetations ($p < 0.05$). The interaction effect between vegetation type and house type was non-significant, $F(14, 138) = 0.24, p = 1.0$, Partial $\eta^2 = 0.02$.

6.2.2. Participant rationale for preference ratings

Thematic content analysis (Braun & Clarke, 2006) was performed to examine how different types of vegetation were described and provide insight in to the reasons behind differences in vegetation preferences. The descriptors/themes used to describe each type of vegetation were summarised and classified as either a positive or negative description (Table 1). Concerns regarding the installation of building-integrated vegetation were also examined, with the number of each type of concern counted to identify the greatest concerns. Informal member checks of the credibility of the content analysis (as in Lincoln & Guba, 1985) were carried out by discussing the findings of the analysis with two of the interviewees.

Participants appear to be largely considering factors such as the level of traditionality, the effect on nature, the overall effect on appearance, and how kept/natural the vegetation is, when classifying vegetation (Table 1). For example, participant 4 liked the ivy because it was traditional and made the house look older: "I like that [House 4, ivy] again it's that traditional look, same applies with the other ivy one [House 3, ivy]".

Colour was also consistently mentioned, in terms of the overall colour of vegetation, with green being a favourite: "I do find the green a lot more appealing than the mixed colours [turf versus *Sedum*]" (P7). Participant 5 showed a similar preference, but harmony between the roof and building colours was also desired: "I prefer the green colour [meadow, turf] to the red colour [*Sedum*] for the roof. But having said that, this one [House 4] looks like it fits in better with the red colour".

The amount of nature the vegetation attracts was also a consideration, with participant 6 liking a house which had

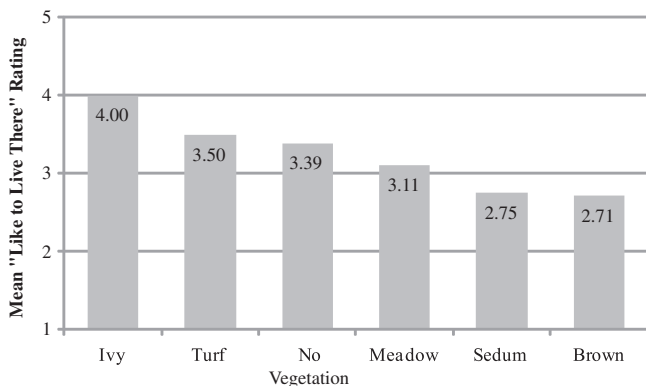


Fig. 6. Mean "I would like to live there" ratings for each vegetation type in Study II; Rating scale ranged from 1 to 5.

Table 1

A summary of positive and negative themes and descriptors used to describe each type of vegetation.

Vegetation type	Positive themes/descriptors	Negative themes/descriptors
Turf roof	Bright/very green/contrasts with house colours Traditional green roof Neat	Boring/mown/kept/less natural
<i>Sedum</i> roof		Colour combination is unattractive
Meadow roof	Has flowers/colourful Natural/wildlife-friendly Fun/cool/creative Fluffy/fuzzy Makes house look more rural	Untidy/messy Wild Weedy
Ivy façade	Makes house look older/grander Traditional Lots of green Highly attractive	Needs cutting
Brown roof	Colourful Makes house look more rural	Untidy Weedy Odd/weird
No vegetation	Conventional/traditional	Boring/plain/lacking in comparison to vegetation

previously been described as lacking in character based on the fact that with meadow on the roof "it's a bit more wildlife-friendly". There appears to be an overall preference for natural versus kept vegetation: "I don't like the, the er, turfed grass approach. I like something that looks a bit more natural, naturally occurring" (P2). But there also seems to be some polarisation between those who like the more natural, wild meadow, and those who like the more manicured, kept turf: Interviewees 2, 6, and 7 appeared to like the meadow and dislike the turf, whereas interviewees 3, 4, and 8 liked the opposite. Those who disliked the meadow described it as weedy and untidy, and liked the neatness of the turf. For example, commenting on meadow, participant 4 says "I don't like the weedy-looking ones". But those who liked the meadow described it as fun and natural, and thought the turf was "boring".

6.2.3. Barriers to installation

Five participants spontaneously volunteered reasons why they would be concerned at installing greenery on to their buildings. The remaining three were asked directly about any concerns at the end of the interview. Of the potential barriers to the installation of vegetation, maintenance was the greatest concern (Table 2). For example, participant 8 jokes "I would also only want to live there if I lived with a man who... was happy going up a long ladder to trim round the windows because otherwise it could get very overgrown"; and participant 7 says that "all of the greenery seem like they could be a bit more hard work, more up-keep... and I would think about how would you keep it trimmed, how would you cut this". A lack of understanding of the installation process also

Table 2

The number of mentions of a particular concern regarding the installation of building-integrated vegetation.

Concerns	Number of mentions
Maintenance	15
Installation	7
Ivy root damage	5
Leaks	3
Cost	2
Integrity of building	2
Attraction of insects	1
Longevity	1

appears to be a concern: “I don’t know if I could do it on my own, or if I could get someone else to do it, I don’t know if people do this kind of thing” (P2).

As with Study I then, preference and the desire to live in a house differed according to the vegetation placed on to the building, and was greatest for ivy. *Sedum*, turf and brown were not significantly different from no vegetation, and indeed no vegetation rated slightly higher than these types of vegetation. Study II enabled some of the reasoning behind these decisions and concerns regarding the installation of greenery to be identified.

7. Discussion

The results of study I show that photographs of houses with (certain types of) building-integrated vegetation were more preferred and considered more beautiful, aesthetically pleasing and restorative than those without vegetation. There were also differences between the various types of vegetation: ivy rated highest on each of these measures, followed by meadow, with *Sedum*, turf and brown vegetations rating lower and being more comparable to the no vegetation condition. It should, however, be noted that ratings were generally low on all scales and effect sizes were small.

Although a different methodology was employed for Study II, limiting comparability, the findings were generally supportive of those of Study I: ivy was significantly more preferred than no vegetation; meadow was rated highly; and the *Sedum*, turf and brown vegetations were less preferred. Some differences were found however, in that the no vegetation condition was rated more highly than the three lower rating vegetations, although these differences were not significant. Differences between the two studies may lie in the way in which participants compared the photographs; with participants viewing only one type of vegetation in Study I, and interviewees viewing all possible combinations in Study II; which is likely to have enhanced differences between photographs. Effect sizes were generally small, but there is a clear trend across the data, with several significant results. There was an interaction effect between the vegetation and house type presented to participants in Study I, whereby the most attractive house was less affected by the presence of vegetation, with the exception of *Sedum*, which was considered more restorative. One possible explanation comes from an interviewee who suggested that the red *Sedum* fit well with the colour of this house, indicating that a high level of coherence between roof and building colour is desired. Several reasons for the differences in preference were identified in Study II, with factors such as traditionality, the effects on wildlife and level of naturalness being considered by interviewees. Of the concerns at the integration of vegetation on to a home, maintenance and installation were the greatest.

7.1. Building-integrated vegetation versus no vegetation

The higher level of preference, perceived beauty, and affective quality shown for houses with vegetation compared to those with no vegetation is consistent with the findings of researchers such as Kaplan et al. (1989) and Van den Berg et al. (2003). It is also consistent with the suggestion made by Ulrich (1983) that introducing natural elements in to an urban environment can improve preference for that landscape. But it is inconsistent with the findings of Smith (2005, cited in Smith & Boyer, 2007) which suggested either ambivalence or resistance to building-integrated vegetation. The two studies have approached this question in very different ways however; with the present study focussing on various aspects of individual perception and preference, and the study by Smith (2005) examining residents groups (who may be inclined towards NIMBYism; see Kraft & Clary, 1991 for definition).

It would be interesting for future research to examine the perceived social norms towards building-integrated vegetation. The fact that perceived restoration in the present study was found to be significantly higher for houses with building-integrated vegetation compared to those without, is also consistent with research showing that green and natural areas are effective at restoring attention (e.g. Hartig et al., 2003; Hartig et al., 1991; Herzog et al., 1997).

7.2. Vegetation type

Significant differences in preference, beauty, affective quality, and restoration across vegetation type show that the type of vegetation used in the construction of a green roof or façade is not a superfluous one. Ivy and meadow rated higher on these factors, suggesting that these types of vegetation may be most beneficial to people. Indeed, turf, *Sedum*, and brown vegetations were generally not significantly different from the no vegetation condition.

In the interviews, meadow was often compared to turf by participants, with meadow being rated consistently highly in both questionnaires and interviews. In direct comparisons between the two, participants attributed this difference in preference to the level of naturalness exhibited by each. Turf was considered kept and less natural, whereas meadow was considered more natural and wildlife-friendly. This is consistent with the body of research in landscape preference which suggests that people prefer natural over kept vegetation. Specifically, Kaplan’s (2007) observation that “Prairie-like, less groomed areas” (p. 22) are preferred over mown areas appears to fit the present data particularly well.

Despite an overall preference for natural vegetation, the polarisation between those who particularly liked and disliked the meadow and turf roofs in Study II appears to mirror the individual differences in attitudes to nature described by Özünger and Kendle (2006), which they suggested may be due to familiarity with particular landscapes. In terms of familiarity, ivy has been used to green buildings for centuries (Grant, 2006), and is a common sight within the UK. In fact, interviewees reported liking ivy because it was traditional and made the house appear older. But concerns about the maintenance of ivy were raised in the interviews; questions of how to cut it and control it around windows. This concern could also have interesting implications for more complex green façades, which require good irrigation to maintain the plants. But it is worth noting that despite these concerns, this vegetation was perceived very positively by participants.

The presence of flowers in the meadow may have contributed to its favour over the non-flowering roof vegetations. This would be concordant with the results of Kaplan (2007) and Todorova et al. (2004) who suggested a preference and desire for flowers in vegetated areas. Similarly, it may have contributed to an increase in perceived restoration, akin to the way in which their participants believed flowers contributed to psychological well-being (Todorova et al., 2004). But the flowers in the meadow were tall, small and white, and the vegetation disordered, whereas according to Todorova et al. (2004), the preference is for low-growing, brightly-coloured, ordered vegetation. There was no comparison in the present study between tall and short or differently coloured flowers, and so perhaps such vegetation would be even more highly regarded by participants. But the difference in landscape studied is again salient in this respect, since the preference for low-growing vegetation found by Todorova et al. (2004) could be isolated to the Japanese roadside in which it was examined.

The finding that *Sedum* rated low on each of the measures, and that interviewees were generally not keen on the vegetation, is particularly relevant given its popularity in recent years. Research

has tended to be directed towards greener vegetation, and to the author's knowledge, no research has specifically examined the perceptions of *Sedum*. It should be noted however that there are many different *Sedum* species which could be used to create a green roof (Dunnett & Kingsbury, 2004), and the present study only focussed on one, at a time when the foliage was reddened. It is unlikely that participants will have been aware that *Sedum* can turn red under stress (Grant, 2006), but there may have been an intuitive awareness that the lack of green foliage meant suboptimal growing conditions. This would be consistent with the lower levels of preference for vegetation which appear drier, found by Williams and Cary (2002).

The brown roof also received several negative comments. Comments that it looked weedy fit well with the suggestion made by Kaplan et al. (1989) that people dislike weedy fields, and similarly, unproductive-looking landscapes (Schroeder, 1982). The lower rating for the brown roof is likely to be unwelcome news to environmentalists, who appreciate its potential to increase biodiversity, but it is important to place this finding in context; whilst there do not appear to be substantive psychological benefits to placing turf, *Sedum* or brown vegetations on to a house, neither were there significant differences between these vegetations and 'normal' houses without vegetation, and participants do not appear to actively dislike these vegetations. These findings do not damage the argument then for the installation of this type of vegetation.

7.3. Sampling and methodological issues

The sample used in the present study is not large enough to allow us to accurately represent more than the UK population. The use of the internet to collect data also excluded those who did not have internet access, something which is likely to have reduced the sample representativeness (Sturgis, 2006). Additionally, representativeness may have been reduced by the sampling methods and locations. The generalisability of the current findings is therefore limited, and caution must be placed on the conclusions which are drawn. This was, however, an exploratory study exploring an entirely novel area of landscape research, and there is great potential to build upon these findings with a larger, cross-cultural sample.

The artificiality of using digitally-manipulated photographs was also a concern, but was deemed necessary in order to achieve greater experimental control. It is likely to have had some effect, since replicating photographs of the same houses with different types of vegetation on made the manipulation visible to interviewees. But interviewees generally accepted the photographs; the photograph of House 3 with ivy being the exception, which was picked out as artificial in appearance. This problem was, however, controlled for by removing it from the analyses, and the attention it directed from interviewees does suggest that it was an isolated case.

Whilst steps were taken to ensure that the analysis of qualitative data in Study II was trustworthy, by for example informally discussing the conclusions of the analysis with two of the interviewees, future replication of this study could enhance the trustworthiness of the analysis. Lincoln and Guba (1985) suggest several additional ways in which to establish trustworthiness, and in particular the credibility of the findings and interpretations: 1) by prolonged engagement with the interviewees, persistent observations and triangulation; 2) through peer debriefing; 3) by negative case analysis, which involves "revising hypotheses with hindsight"; and 4) referential adequacy, by which recordings of interviews, such as those taken in the present study, are kept for later analysis and interpretation in order to test conclusions for adequacy (see Lincoln & Guba, 1985 for details).

7.4. Ideas for the future

The present study examined some of the most popular types of vegetation used for building-integrated vegetation. But there are many different types of vegetation suited to growing on roofs or façades, and many different subspecies of each, with varying heights, foliage and flower colours. It would be valuable to examine the various vegetative characteristics in order to establish a list of the most desired and restorative types of building-integrated vegetation. It would also be interesting to carry out a study which used real samples of vegetation, enabling participants to touch it and view it from various angles.

Several concerns were raised over the maintenance and installation of building-integrated vegetation, and participants indicated that these might affect whether or not they would be likely to put vegetation on their own home. Fact sheets explaining the process of installation, the costs, and maintenance issues, as well as the production of a regulated list of reputable suppliers and installers, could all help to alleviate some of these concerns. It might also be productive to examine the effect of education of the benefits of building-integrated vegetation on preference ratings.

8. Conclusions

The findings of this study were clear in their pattern, but should be considered as exploratory. Further research may serve to strengthen the conclusions that can be drawn from the study, but in the meantime caution should be given in their application. The present study suggests that houses with certain types of building-integrated vegetation are more liked, aesthetically pleasing, and restorative than houses without vegetation; providing some support for the claims of those within the green roof and façade industry and extending the body of literature which shows a preference for greened over purely urban scenes. Ivy and meadow rated highest on all of these measures, and were generally perceived more positively than houses without vegetation. The natural meadow roof was preferred over its more manicured counterpart, turf, a finding which is concordant with a preference for natural versus more well-kept, human-influenced vegetation. These differences were not large however. The turf, *Sedum*, and brown roofs were generally not perceived as significantly different from houses with no vegetation on these measures, suggesting that they may not carry the same level of benefit. Although these types of vegetation carry other economic and environmental benefits then, care should be taken in asserting that all green roofs are psychologically beneficial. In conclusion, the integration of vegetation on to homes appears to not only be valuable environmentally, but if the right type of vegetation is installed, they may also help to satisfy our human needs for aesthetics and restoration, and play an important role in the regeneration of our cities for the future.

Acknowledgements

I would like to thank Bauder and Alumasc for allowing me to use their photographs of green roofs, and the owners of the four houses who allowed me to use photographs of their homes. Thank you also to photographer, Tom White, who helped with the photograph manipulations.

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