Of Streets and Squares

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CADOGAN
CREATE streets

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Which public places do people want to be in and why?

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Foreword

Cadogan is here for the long-term, seeking to protect and enhance the character and vitality of one of London's best known neighbourhoods. We are committed to the area's success, preserving the rich heritage and identity that make Chelsea, we believe, a very special place. To do that, we invest significantly in the environment and work closely with the local community – from the bohemian King's Road and sleek Sloane Street, to the creation of Duke of York Square and, more recently, the thriving artisan community on Pavilion Road. We place great emphasis on creating a balance of small and large, old and new to maintain the attractiveness of each location and the vitality of the area. Successful neighbourhoods are much more than the sum of their parts, created by 'layering' to evoke a strong sense of place; from the architecture and public realm, to culture, curation of retail, food and drink – together, this contributes to a thriving community that draws people through its rounded experience.

But how do we interrogate the success of a place and truly understand the impact of our investment? What it is that makes public spaces tick at the most fundamental human level - is it lucky happenstance, an art or are there elements that can be analysed for us all to learn from? We have always believed that many of the decisions we make reflect wider themes about how people like to behave in city streets, shops and squares be they living, working, shopping or just passing through. What elements of our history should shape our actions today? What needs to change? What is merely passing whim? What is necessary for the long term? This important empirical study by Create Streets looks in depth into the types of streets and squares in which people truly like to be and in which they thrive, feel at ease, socialise and prosper. It brings a quality of evidence into the discussion that is, I believe, unique and important as we all strive to make our towns and neighbourhoods better places to be.

For these reasons, we have been delighted to support the highly able team from Create Streets in this academic study. We hope that not just other landowners but also local councils, developers, community groups, planners, architects and wider society will find it useful as they strive to make public spaces where people are comfortable and happy. It will give, I hope, readers new confidence in some of the things they thought they knew but also pause for thought on a few they may not have considered. I hope that *Of Streets and Squares* will help its readers think about how to learn from the best of the present and the best of the past, as we all try to build a better future.

Hugh Seaborn, Chief Executive, Cadogan

'Streets and their sidewalks,
the main public spaces of a city,
are its most vital organs.' Jane Jacobs

'The art of architecture studies not structure in itself,
but the effect of structure on the human spirit. Geoffrey Scott

'Most of the wonderful places in the world
were not made by architects but by the people.' Christopher Alexander

Acknowledgments

'If you want to go far, go together.' We hope that this book marks an important step in the research on what makes for good and popular places. It has certainly been a collective effort. Above all, we would like to thank the Cadogan Estate for so generously sponsoring our research and their Chief Executive (Hugh Seaborn), Head of Building Surveying (Jane Henshaw, Head of Marketing and Communication (Caroline Jennings) and Jilly Maiklem for their supremely kind intellectual and practical support to the project.

The growing global network of Create Streets fellows has been essential to this research. Create Streets Fellow, Dr Alessandro Venerandi, was very generous with his time, in helping frame the overall research, and also advised on the variables of urban form. Our conversation on beauty and place, with Sophie Pringle, Create Streets Fellow and researcher and consultant at Queensland University of Technology, Brisbane, was particularly stimulating. Ann Sussmann very kindly reviewed and commented on our work. Finally, we were very lucky to be able to benefit from the long practical experience of John Massengale, Board member of the Congress for the New Urbanism and member of Create Streets America.

Beyond Create Streets, we are very grateful to Ben Page and Ben Marshall of Ipsos MORI, for their long experience and wise advice in helping frame our polling with Ipsos MORI. Dr Stephen Law, researcher at the Turing Institute, was very generous with his advice on analytical techniques. Charles Montgomery of the excellent Happy City, Professor Nikos Salingaros, provided very welcome expert reviews and comments, for which we're very grateful, and Dr Matteo Barbone, researcher at Technische Universität München, for stimulating discussions on analytical technique. In the Create Streets office in London, Yasmin Lennon-Chong helped run the online visual preference surveys, produce the images and draft the text on results. Kieran Toms helped frame and interpret our visual preference surveys. Nothing would have been possible without Constance de Montigny, who keeps the wheels on the bus and the show on the street.

Executive Summary

What turns space that is public into a public space? Why are some streets and squares valued, yet others shunned? Why do people tend to prefer some places rather than others? How does this affect their behaviour? This study summarises existing research into why people like some squares and streets and avoid others. It also sets out important new primary research (the most far-reaching ever conducted) with a review of 18,966 streets and squares in six British cities: London, Manchester, Birmingham, Milton Keynes, Canterbury and Cambridge.

Using this evidence, we set our Ten Steps that developers, architects, planning authorities and landowners should normally follow, if they wish to design places that are popular with more people more of the time. They are:

1. Gentle density is your friend – but 'fine grain' it! The best and most beautiful streets and squares are typically in areas of 'gentle density', half way between the extremes of tower block and extended suburbia They are rarely more than three to seven storeys high, with a land-use coverage between 45 and 65 per cent and dwelling density of between 50 and 150 homes per hectare. Squares between 80 and 100 metres wide and blocks between 50 and 150 metres long (depending on centrality) are normally best.

2. When it comes to greenery, little and often is normally best. People like being in green places. Urban greenery is associated with increased physical and mental wellbeing, as long as it is used. You can maximise this by 'spreading it around', with frequent green spaces inter-weaved into streets and squares. Street trees are normally a no-brainer. However, greenery on its own does not normally 'do it', if most other things are wrong. Squares can be lovely, popular, relaxing places, without a blade of grass in sight – above all, if the buildings are beautiful and the micro-climate is neither too hot, nor too cold.

3. Benches and statues should be structured, not randomised. Where seating is matters. Horizontal infrastructure, with a bit of structure, helps humans play the right roles: benches that face a fountain; an arcade that faces a square, with a statue or a podium in it. Brownian motion should not apply to the horizontal infrastructure. You cannot put 'bench wash' on an ugly and windy chasm or art wash on a traffic island. Or, you can, but most people will still avoid them. The best squares typically have an average of sitting area of between 6 and 10 per cent of the total open space.

4. Beauty really really matters. The most popular places with a predictable 70-90 per cent of the population have a strong sense of place and 'could not be anywhere.' They have 'active facades' that 'live' and have variety in a pattern. They have streets that bend and flex with the contours of the landscape. They are not designed by committee. More finely-grained developments also tend to be more long-lasting and resilient, better able to adapt to changing needs. Their organised complexity attracts, interests and reassures at different scales. A square or street, with many plots, can see its buildings upgraded, enlarged, improved, even replaced, but still somehow remain the same, or at any rate a similar, place. Most beautiful cities are intense, coherent and rich in architectural detail. Health correlates more with 'scenic-ness' than greenery.

5. Mix it up! Places with a textured mix of different land uses, and active façades, are nearly always more successful. They attract more people and generate more diverse and engaging environments. They can work for longer portions of the day, by mixing people at work, people at lunch, people at home and people at play. Mixed land use is also more walkable and is associated with lower car use, as it is possible to combine trips more easily. In King County, Washington, residents in mixed-use neighbourhoods don't use their car 12 per cent of the time, compared to 4 per cent of trips in single-use areas. Our Place Beauty Analysis found that 'richness of land uses' influenced the perceived 'scenic-ness' of a street of square almost 60 per cent more than the average of all urban elements studied.

6. Edges attract and protect. The edges of streets and squares attract us. This is partly-lived experience. (It is where we are used to pavements going, even when a street is pedestrianised). But it is also sensory. There is more to look at (shop fronts, cafés) and (in a square) edges allow us to step back and either watch the world go past, or sample the space. 8 out of 10 people, in our sample, preferred to sit with their back against the wall and face to the court.

7. People like to feel enclosed... up to a point. Most people like to spend time in places that are enclosed and human scale, without feeling too claustrophobic. There is a necessary moment for views that open up as you round a corner, for grand vistas, for open parks, but many of the most popular streets surrounding and linking such views and vistas are surprisingly human-scale. Few of the most popular streets are wider than 30 metres or narrower than 11 metres. Popular wider streets (Paseo de Gracia or Champs-Elysees) normally 'break up' their width with avenues of trees. Many of the most popular squares and public spaces are between 50 and 100

metres in width. Street height-to-width ratio is normally best between 0.75 to 1.5. Most successful urban squares or plazas have a 1:3 to 1:2 height-to-width ratio.

8. It's not what you spend, it's where and how you spend it. Investing money in improving carriageways, pavements and horizontal infrastructure often works. Our Place Beauty Analysis found that investment in public realm was associated with increasing 'scenic-ness.' Normally, you should invest in places where the 'intrinsic' quality of urban form and design are good, but poor maintenance, or poor quality public realm, is needlessly letting them down. Also find tactical ways of improving streets, without big budget expenditure, and support community-led initiatives wherever possible. On average, in our sample, investment resulted in 'scenic-ness' increases of 0.46 or just under 14 per cent.

9. Walkability works but does not quite mean maximising space to walk. Compact, walkable and 'bikeable' environments are good for you. People walk in them more and are healthier and happier. This in turn drives higher values for investors. A complex array of elements encourages or discourages people walking or cycling rather than jumping in the car. More walking is encouraged by beautiful engaging façades, regularly spaced trees, and frequent small parks, the presence of resting places, arcades or colonnades at the edge of busy squares, outside cafes, sufficiently wide pavements and cycling lanes. Huge pavements with everything else wrong won't necessarily be very attractive. Our Place Beauty Analysis found that the 'Presence of footways' influences 'scenic-ness' by almost 20 per cent more than the average of all urban elements studied. Normally you should design residential streets with a speed limit of 20 mph, continuous walkable environments that are more than 400 metres long and plant trees every 8 to 15 metres, depending on the street type.

10. Do people say they like it? And do they mean it? Design is not rocket science. We all spend time in towns, in streets and squares. People are very good at judging what they like and where they want to be. And it is increasingly easy to use technology to map where people do spend time, or to understand this not by asking simplistic questions, but by performing proper visual preference surveys. Doing this can correct for the 'design disconnect' (the measurable difference between the design preferences of design professionals and everyone else) and help crowdsource making better places, which people really like.

Introduction

Sometimes the most basic questions are the most important. What, when you come to think of it, is a public space? Lots of spaces in towns and cities are freely accessible to the public: pavements, plazas, parking lots and pedestrian underpasses are all public spaces of a sort. And yet, most parking lots don't function as civic squares and most pedestrian underpasses are not places in which to relax. What turns space that is public into a public space? And which public spaces are most valued? Or shunned? Why do people tend to prefer some places rather than others? And how does this affect their behaviour? What are the patterns? It can't be just the presence of seats. Some seats on streets or squares sit un-used, gathering moss or pigeon poo for month after month.

Seats alone do not make a public space…

It can't be just the presence of grass to relax on or a tree to sit under. Some grass remains un-sat on week in, week out. And some trees cast their soothing shade over paving stones but never people.

……but nor do trees or grass.

Nor is it simply the presence of people. People walk five minutes to sit in some places. And hurry through others to get there.

Why do people sit here (left) but not here (right)?

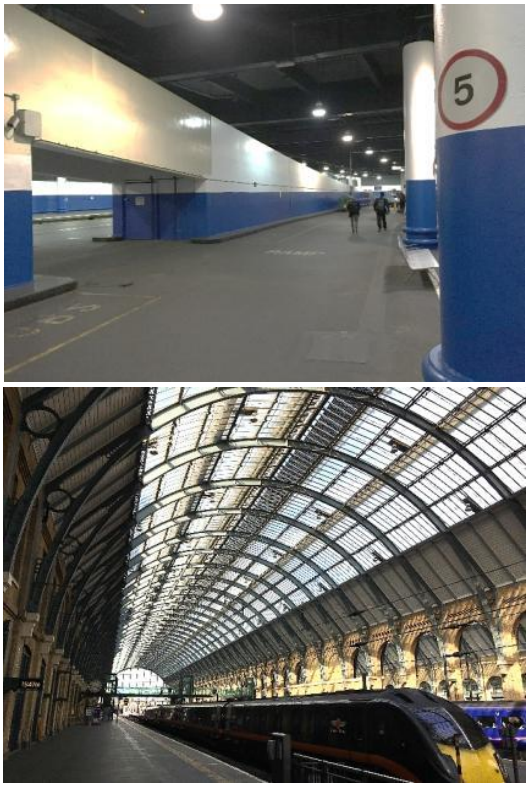
Traffic clearly makes some places unpleasant. But it doesn't always. People pause and preen and sit and

stroll on the Champs d'Elysee but 84,000 vehicles pass per day.

Traffic does not always ruin public places.

Nor is it just things to do or things to buy. Some streets with shops also serve as public places. People go there to buy, but they also go there to be. Other streets remain purely transactional: arrive, purchase, leave; arrive, purchase, leave. When does form add to function? When does it detract from it? The platforms at King's Cross Station and Euston Station, in London perform the same role. But one invites us to stand and look up at the heavens. The other encourages us to scuttle homewards as fast as we can. Are these the same type of place or fundamentally different ones?

And so, we come back to our question: why do people tend to prefer some places rather than others? In common parlance, there is a simple answer to this complex question. Some places are 'nice'. Others are not. If a place is really good, it might even be beautiful. And yet, nearly all design and planning professionals would reject this as ignorant and un-tutored.



Euston Station and King's Cross Station.

Good is subjective. As Lucretius put it: '*Ut quod ali cibus est aliis fuat acre venenum*'[1]. One man's meat is another man's poison. The highly-lauded architect, Sir Terry Farrell, publicly rejects the very concept of

beauty, as a way of judging what you should build, as one that is inescapably biased.[2]

Is 'nice' a nonsense concept, hopelessly shot-through with subjectivity and personal bias? Or, can we define it and predict it, at least up to a point? Presumably, there is no one perfect answer that always works for all people in all places. Different public spaces work in different ways, and with different amalgams of qualities and comforts. But can we predict what combinations tend to work and tend to fail? There may be no one magic recipe. But are there half a dozen very good ones? What are the relationships between what a place looks like, where it is, its wider urban form, and its popularity as a place to live, work, shop or spend time? This report is an attempt to give newly solid answers, to these hitherto nebulous questions, into what makes for good streets and squares, plazas and places. Firstly, we have carried out (we think) the widest ever review of existing research. And we have been brutal: are there numbers? Is there evidence either of greater use, of greater popularity, or of greater value associated with some public spaces versus others? Or is this just personal opinion and observation? Other than to give us hypotheses to test, we are not interested in what famous designers or developers think as individuals. However, we are very interested in how thousands upon thousands of their fellow humans act and feel. If this makes for populist beauty, so be it.

Secondly, we have conducted important new research. We have analysed nearly 19,000 streets and squares, passageways and plazas, courtyards and carriageways, in six British cities, measuring how much people want to be there and cross-referencing this with 11 elements of their 'urban form' and quality. We have used the largest available datasets freely accessible online. In total, these have millions of 'datapoints.' They encompass data on a wide range of urban characteristics, such as the presence of historic buildings, different land uses, amount of greenery and density of the built-up area. We have also conducted five visual preference surveys, four via social media and one with Ipsos MORI. Our aim has been to compare how a place looks, and feels, with its physical characteristics. We are attempting to distinguish not just between good places and bad places, but also to identify why, among the good ones, some are better than others, by analysing and categorising places, based on their features and function. Finally, we conclude by making practical suggestions about how we should design, build, manage and regulate public spaces. Of course, we are not the first to explore this territory. People have always thought and written about their physical environments, responding to the challenges of their age and helping set perceptions for the future. Our views of Victorian cities are still strongly hued by Charles Dickens' descriptions of the filth of coal-fired industry.

'In the hardest working part of Coketown; in the innermost fortifications of that ugly citadel, where Nature was as strongly bricked out as killing airs and gases were bricked in; at the heart of the labyrinth of narrow courts upon courts, and close streets upon streets, which had come into existence piecemeal, every piece in a violent hurry for some one man's purpose, and the whole an unnatural family, shouldering, and trampling, and pressing one another to death; in the last close nook of this great exhausted receiver, where the chimneys, for want of air to make a draught, were built in an immense variety of stunted and crooked shapes, as though every house put out a sign of the kind of people who might be expected to be born in it.'[3]

In fact, by the 1920s, improved sanitation had largely solved the 'urban penalty' of Victorian cities, but that has not prevented generations of architects theorising confidently about what made for good places, in reaction to the smog and sanitary challenges of Victorian cities.[4] Principles have been ubiquitous; actual evidence rather rarer. As Howard Frumkin put it in *Healthy Places: Exploring the Evidence*, the difficulty of 'how to design good places' is not due to the scarcity of guidelines, but rather due to the way research has been conducted so far.[5] Most design recommendations have their basis in personal interpretation and judgment, not data, and in qualitative observational studies, not quantitative empirical ones. And, sadly, much research to date is imperfect.

Protest led by Jane Jacobs against demolition of New York's Penn Station in 1963.

Research into the quality of public spaces only really began in the 1960s, in reaction to modernism and the wholesale destruction of acres of walkable, if coal-encrusted, city streets, swept away in favour of a new utopia of gleaming towers, shining plazas and city parks. Most famously, Jane Jacobs, probably the most influential urbanist and activist, advocated a community-led approach to city planning, in her seminal book *The Death and Life of Great American Cities*. She introduced ground-breaking ideas that cities need to be understood in relation to human behaviour and interaction. She argued for the importance of self-organisation and organic development in understanding how cities develop

and grow. Not everything could be planned from on high:

> *'The more successfully a city mingles everyday diversity of uses and users in its everyday streets, the more successfully, casually (and economically) its people thereby enliven and support well-located parks that can thus give back grace and delight to their neighbourhoods instead of vacuity."*[6]

Fine stuff, but was she right? What evidence did she have? Jane Jacob's analysis of Greenwich Village, New York, was mainly based on observations made during walks along streets, visits to shops and personal experience of the neighbourhood's urban life. She got some things intuitively right. But she got other things wrong. For example, she theorised that economic growth and employment are stimulated by technological spillovers. More empirical recent economic studies suggest otherwise.[7]

Today, research can go beyond qualitative observations and provide increasingly robust evidence, based on empirical data. Over the last 20 years, a new generation of urban researchers has been able to shift their focus from telling individual stories to mapping behavioural patterns. This is partly because they wanted to. It is also because they can. There is just more data available and better technology to assess it. Researchers have counted passers-by, mapped desire lines, measured traffic and tabulated neighbourhood knowledge networks. American pioneers in environmental psychology, Rachel Kaplan and Stephen Kaplan, have run stated preference studies, by showing people photographs of different types of places and getting them rated.[8]

Probably the best-known proponent of a people-based approach to designing places is the Danish architect and urbanist, Jan Gehl. Jan Gehl has been conducting research on the form and use of public spaces since 1966. In the late 1970s, especially thanks to his wife's contributions, Professor Gehl became something of an icon to the current generation of urban architects and designers. His recent book (with Birgitte Svarre) *How to Study Public Life* provides professionals, academics and city planners with a series of tools and methods to design better places that encourage city life.

Researchers have reached agreement on quite a few issues. Green areas and trees can contribute to healthy environments. People tend to prefer places that are 'coherent' and 'spatially defined.' However, research has very imperfectly influenced practice. And much formal 'guidance' has been surprisingly opinion-led. Strip away the confident assertions and, sometimes, the emperor is more than a little naked. Certainly something is not working. Despite the confident language of place-making, as we shall see, we continue to make things that are not places. Either the research is not fully believed, or it is not getting

through. Or both. We believe that by taking advantage of previous research, and also by taking advantage (for the first time in such research) of Artificial Intelligence techniques and national polling, it is possible to start being more confident. In total (and in addition to reviewing existing work), this study is based on 18,966 places, within London and five other British cities. With such a rich treasure trove of data, our aim is to measure and model the morphological characteristics, and fundamental structure, of the most beautiful and successful places in British towns and cities. This allows us to see which, of the many competing theories of public space, actually 'add up.' It allows us to make use, with increased confidence of some of the insights emerging from the disciplines of neuroscience and environmental psychology. It also permits us to set more confident guidelines on how to design better and more popular places. These won't be right everywhere and every time. All places need to be just a little bit unique. But, based on 30 years of research, and our 19,000 case studies, they will tend to be true.

Greenery keeps us physically and mentally healthy.

[1] Lucretius, *De Rerum Natura*. Book IV, line 637.
[2] At his lecture when being awarded the RTPI Gold Medal in July 2017, Terry Farrell rejected the concept of beauty as a way of judging what should or should not be built within a city.
[3] Dickens, C. (1966). *Hard times (1854)*. (p. 74).
[4] In 1880, urban areas of the US had 50 per cent higher mortality than rural areas. By 1920, this gap had gone. Sternberg, E. (2009), *The Science of place and wellbeing*. (p.253-4).
[5] Frumkin, H. (2003). *Healthy places: exploring the evidence*.
[6] Jacobs, J. (1961). *The death and life of American cities.* (p.111).
[7] Glaeser, E. L., Kallal, H. D., Scheinkman, J. A., & Shleifer, A. (1992). *Growth in cities.*
[8] Kaplan, R., & Kaplan, S. (1989). *The experience of nature: A psychological perspective*. & Kaplan, R., Kaplan, S., & Ryan, R. (1998). *With people in mind: Design and management of everyday nature*.

'The street … is the river of life of the city, the place where we come together, the pathway to the centre. It is the primary place.' William W Whyte.

Structuring our research review: what questions do we need to ask? The behaviour of people in public spaces has mainly been investigated by asking how people interact with each other, how they play, entertain and are entertained, and how they observe, walk, sit and stand.[9] However, with some very important exceptions (the effect of walkability and greenery on behaviour is increasingly well-studied), 'hard' evidence is surprisingly scarce. We need numbers, as well as words, and data, as well as opinions. We have set out the numerical evidence we have been able to find from asking seven key questions.

Chapter one: why do people spend time in public spaces? Why do people spend time in particular public spaces? What do they do there? What are the stated and conscious decision factors? What are the trade-offs (as best we can judge) between location versus perceived quality? Why are some streets places to be, as well as places to pass through?

Chapter two: What are the best sizes and shapes, edges and paths? What are the links between the size, nature and form of a public space, with what people do and how they use a public space? What types of public space, size, shape and street width to height ratios encourage the human ballet of watching and doing? And which shapes and sizes discourage it? And why? Does this vary in different climates?

Chapter three: does walkability work? Walkability has become the buzz word of all urban regeneration development schemes. Does the evidence support the importance placed on it? What effect does traffic have upon how a street or square functions, how much time we spend there and how we talk to, or hurry past, our fellow humans? Can you pedestrianise badly?

Chapter four: does it matter what objects you have in a public space and where? Which elements in the built environment attract or repel us? Which objects stimulate or impede social interaction and the use of public spaces? What enhances (or undermines) a place's perceived security? This might include street furniture, such as lighting or benches, but also arcades, parked cars, or other landmarks.

Chapter five: is greenery essential or just a 'neat trick'? There has been lots of research in the last 20 years on the (normally though not always) positive impact of greenery on mental and physical wellbeing. But is greenery essential to the most successful public spaces? And when is it not helpful? And why?

Chapter six: do we need to bother about beauty? If the shape of the public space matters, and what is physically in it matters, does what buildings look like matter? If benches and paving, traffic and trees, might be described as horizontal infrastructure, does

what one might term the vertical infrastructure (i.e. the buildings) matter too? Oddly many architects and urbanists seem to think not, other than having 'active facades' on the ground floor. However, the evidence is beginning to suggest that it does. Our sixth category explores the hypothesis that more detailed intricate design – such as articulated façades with more of a 'sense of place' – are often associated with more popular public spaces.

Chapter seven: what might be the underpinning reasons for these trends? Our final category changes focus and, instead of analysing the relationships between spaces with human behaviour, tries to understand why these elements matter. Does neuroscience or environmental psychology have the answer? We are learning more about human responses to the physical environment. Why do different components of the physical world help people feel better or worse? And how can this knowledge help design places that are better for us, or more popular?

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[9] Hall, E. T. (1966). *The hidden dimension*. & Stevens, Q. (2007). *The ludic city: exploring the potential of public spaces*. & Gehl, J. (1980). *The residential street environment*.

First of all, we have categorised the quite limited evidence on why people spend time in particularly public spaces. What are the stated and conscious decision factors? The evidence is not copious, but suggests that:

(1) Spaces on the way to somewhere almost always do better than ones which aren't;
(2) Quality matters, as well as location; and
(3) We seek each other out. Good places to meet and mingle are more popular.

1.1 What do people do?

There are surprisingly few numerical studies on what activities people actually like to do in public spaces. The influential Danish architect and urbanist, Jan Gehl, has classified activity types.[10] Based on observations of people's behaviour, on an ordinary street, on an ordinary weekday in several cities around the world (Sydney, Melbourne, Paris and Bilbao) he categorised them into three main groups:

- Necessary activities: going to work, or school, or waiting for a bus. These activities happen regardless of other conditions (above all weather – we need to go to work in the rain);
- Optional activities: sitting, sunbathing or going for a walk. These activities strongly depend on weather conditions (we don't sunbathe in the rain);
- Social activities: communal activities, children playing, greeting someone, or sitting with friends. These activities depend on the presence of other people in the public space (we might still play football in the rain).

This seems (intuitively) very sensible and is based on a lifetime's observations. How is it reflected in more precise studies of particular places? One 1984 study was of two different public spaces in the centre of San Francisco: a city plaza (Justin Herman Plaza) and a park (the TransAmerica Redwood Park).[11] It sought to outline and explain different uses, based on a public space's nature and location. Justin Herman Plaza was visited by a wide variety of infrequent users, due to its proximity to shops, hotels and workplaces. Redwood Park, however, was primarily occupied by frequent users and nearby office workers, having lunch or going there to relax in the greenery.

The difference in use appeared to be driven by both location and the nature of the place (table below). One theme does emerge from the study. Meeting people played a much more important role for visitors to the town square. Enjoying being outdoors, even alone, played a more important role for visitors

to the park. What is the wider evidence on why people choose particular places?

Justin Herman Plaza (left) and TransAmerica Redwood Park (above), San Francisco.

Reason for using public spaces	City Plaza: Justin Hermann Plaza	Park: TransAmerica Redwood Park
Eat lunch	23%	23%
Pass through	14%	15%
Spend time or sit	14%	6%
Meet someone or wait	14%	6%
Work nearby	9%	21%
Curiosity	7%	10%
Outdoor / fresh air	5%	19%
Like physical space	2%	8%
Comes to sit 'often'	52%	79%
Feels comfortable being there alone	89%	98%
Works in downtown San Francisco	59%	85%

Different reasons people use two places in San Francisco (1984).

1.2 Going somewhere? The importance of making connections.

One thing is certain: location really matters. As the San Francisco study implied, where a public space is, and how it connects, is vital to how many people are likely to visit it. The London-based firm, Space Syntax has calculated that 60-80 per cent of usage of

streets is due to spatial accessibility.[a] In short, more accessible public places do get more people. This creates value. In central London, 80 per cent of shops are located in the 20 per cent most spatially accessible streets.[12] People create shops where they know people will come. A correlation between spatial accessibility and rateable value per square metre finds a correlation of 88 per cent.[13]

One recent example of a new, and very successful, well-connected pedestrian street is More London Riverside, within a wider office-led development near City Hall and Tower Bridge in London. More London Riverside opens up a marvellous new link with London Bridge Station, at one end, and City Hall and Tower Bridge at the other. Lined by cafés, it is a busy and successful pedestrian street. However, the development also illustrates that connectivity is not everything. Half a dozen other new pedestrian streets also link elements of the wider development. They may not be quite as powerfully-useful a new connection, but they are still impressively located between the Thames, major office blocks and London Bridge station. However, with their blank facades and their utter lack of ground floor activity, they are normally windy and deserted, other than people scuttling through them to get from A to B. They are streets to pass through, not streets to be, unpleasant, almost scary. Connectivity may be crucial, but it is not everything.

Both these new streets are well connected but more is needed to succeed. More London.

Connectivity also has disadvantages. High levels of traffic, pollution and noise negatively affect residents' quality of life and increase stress levels. One example is the 24 acres regeneration project near Cambridge Station. Residents have paid a price for the site's high accessibility. The Great Northern Road, now the main thoroughfare to Cambridge Station, and which runs parallel to Station Road, was opened to the traffic after residents moved in. Now

[a] Or, put mathematically, when you perform regression analysis of spatial accessibility against pedestrian and vehicular movement, R-squared equals 0.589 and 0.702 respectively.

the serious noise levels (66 decibels during the day and 61 decibels during the night[b]), together with the heavy traffic, taking and picking up people from the train station, have (reportedly) largely prevented residents from using their large balconies or the communal gardens. They are not profiting from so much accessibility.[14]

A neighbourhood for people or for cars?

According to a 2010 report, by the Health Protection Agency, prolonged exposure to excessive noise can have adverse cardiovascular, physiological and mental health effects, impair hearing and undermine learning.[15]

[b] The UK Government's Environmental Noise Regulations suggested threshold for residential areas is 50 decibels.

1.3 Why do people visit particular public spaces?

A 1991 study led by Tridib Banerjee and Anastasia Loukaitou-Sideris compared seven plazas in Los Angeles and San Francisco.[16] Sixty people were interviewed and surveyed in each place. The most common reason people visited all but one of the plazas was to 'eat lunch'. The only exception had no food shops nearby. Other reasons were to 'sit and relax', 'meet friends' or, less frequently, 'to shop.' The main stated reasons for choosing one particular plaza over another were ease of access and proximity to a place of work – in other words, its location more than its quality. Features like food shops and kiosks, water and fountains, outdoor sitting, landscaping and sunny environments were most appreciated by users. Average time spent by users in plazas was between fifteen minutes and one hour. On average, they visited once or twice per week.

Terrance Purcell and Ross Thorne conducted a study, in 1976, looking at the use of three plazas and one small urban park in Sydney. They investigated why people visited certain spaces. Disappointingly, the total size of the sample was not recorded. This survey found that both proximity and the ability to relax were crucial: quality and location.[17]

Reason for spending time in open spaces	Per cent
Proximity to workplace	69%
Relaxation	62%
Eating	22%
Walking	10%

Reasons for spending time in public spaces.

1.4 What do people say would make places better?

Two studies have also considered how and why users say they would modify a space to help it better suit their needs. Both, however, were based on a restricted sample of case studies. The first focused on a detailed user-evaluation of a large, very well-used central square in Chicago; First National Bank Plaza, over one full day. What did people like about the plaza? This one-day observation was replicated in a public square in Seattle, with similar results. Terrance Purcell and Ross Thorne's 1976 Sydney study (cited above) also asked what people liked, and did not like, and what improvements people would like to the way the plazas and park were designed. They found that:

- 21 per cent of the interviewees wanted more places to sit;
- 21 per cent wanted more entertainment (street performances and general activities); and
- 15 per cent wanted more greenery.

Attraction	Percentage citing it as primary attraction
Entertainment (street performances and general activities	26%
Fountain	19%
Watching people	12%
Atmosphere	11%
Opposite sex	10%
Isolation	8%
Appearance	6%
Sun	5%
Location	3%

Summary of what people liked about First National Bank Plaza.

One third of respondents felt the square could be most improved by more 'entertainments' such as concerts and events; 20 per cent felt tables and umbrellas were most important; and only 14 per cent prioritised more greenery and flowers. Food concessions – café, bars, take away – and movable chairs were considered less important. However, it should be noted that the 80 per cent of the

participants were young – under thirty years old.[18] Greenery does matter, but it is not pre-eminent. People want things to do and places to sit.

1.5 Meeting and mingling

People go to public spaces to meet as well as to relax. More popular public spaces do not just have a higher number but also a higher *proportion* of slightly larger groups of people. William H. Whyte concluded from his research, 40 years ago, that the most successful public spaces are those with the highest percentage of social mingling and interaction.[19] In the 1970s, he observed five of the most-used plazas in New York, through time-lapse filming. He found that the most-used plazas were also the most diverse in their appeal. They had a higher proportion of women, couples and groups. The percentage of groups in five of the most-used plazas was 45 per cent, while in the least-used ones it was only 32 per cent. The most popular squares also had an above average proportion of women and were more likely to be intentionally-chosen, and agreed upon, as meeting places. They were consciously preferred, but to what degree this was due to their location or inherent quality was not clear. Both were important. A subsequent study analysed the distribution of groups of people in public spaces, and the frequency of clustering, in 12 plazas across the US. It studied different group sizes (2, 3, and 4 or more people) sitting together over a period of two years. It found reasonably consistent distribution patterns, especially for groups made of three people. More popular public spaces did not just have a higher number of people. They also had higher proportion of slightly larger groups. The table below summarises the results. Again, this explains why connectivity matters. A place needs to be easy to reach to be a popular meeting or mingling point. But it also suggested that good public places need to be designed to encourage interaction, whether it is for 'close friends', 'friends', 'acquaintances', 'chance contacts' or 'passive contacts.'[20] Successful public spaces normally offer a combination of different degrees of engagement, as well as the possibility to disengage from everyone else and be alone. People can readily move together and apart as they need. But what does this mean in practice, in design terms?

Group size	All 12 Plazas	Seagram's Plaza (the most popular)
2 people	67 %	60 %
3 people	21 %	21 %
4 people / more	12 %	19 %

Different spread of groups' sizes in the most popular plazas versus all plazas.

[10] Gehl, J. (1971). *Life between buildings: using public space*.
[11] Cranz, G. (1984). Public attitudes. *Tall buildings: Tight spaces. A research project for Kaplan*.
[12] Hillier, B. and Hanson, J. (1984). *The social logic of space.*
[13] Presentation made by Tim Stonor on 8th March 2011 and 26th April 2012. Available at: www.slideboom.com.
[14] https://www.cambridge-news.co.uk/news/cambridge-news/cb1-cambridge-station-traffic-noise-14380499.
[15] Health Protection Agency (2010), Environmental Noise and Health in the UK.
[16] Banerjee, T., & Loukaitou-Sideris, A. (1992). *Private production of downtown public open space: Experiences of Los Angeles and San Francisco*.
[17] Purcell, T., & Thorne, R. (1976). *Spaces for pedestrian use in the city of Sydney: A pilot study of city office and shop workers' attitudes and requirements for open space to be used in their lunch break*.
[18] Purcell, T., & Thorne, R. (1976). *Spaces for pedestrian use in the city of Sydney: A pilot study of city office and shop workers' attitudes and requirements for open space to be used in their lunch break*.
[19] Whyte, W. H. (1980). *The social life of small urban spaces*.
[20] Carmona, M., Heath, T., Oc, T., & Tiesdell, S. (2012). *Public Places-Urban Spaces.* (p. 167).

How does the overall nature, size and shape of a public space, its size, its underpinning arrangement and its interaction with surrounding streets and buildings influence how a public space is used or not used? Why do people sit in or enjoy some spaces, or bits of spaces, and not others? We have found evidence of very varying quality, on these crucial questions. There is certainly more work to do. However, the evidence we can find suggests slightly smaller places, with a reassuring 'sense of enclosure' and attractive and busy edges are normally best:

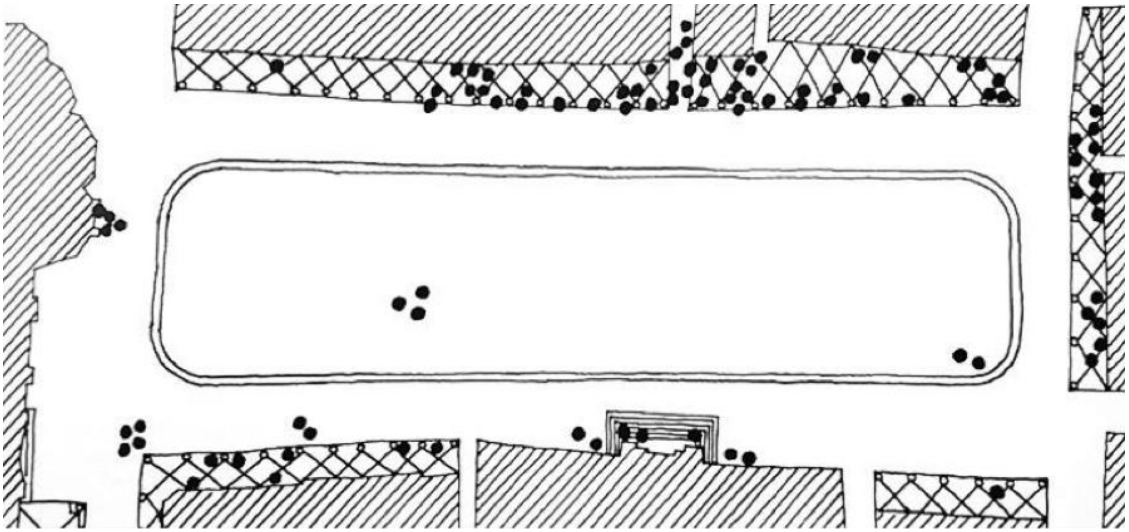
(1) Edges really matter. People often cluster by them, particularly when they are more comfortable and complex;
(2) However, people also like to be able to get directly from A to B, within a space – often cutting diagonally across it;
(3) Corners are crucial, where the 'direct line' and the 'edge effect' reinforce each other;
(4) People need some personal space in a square, but not as much as you might think; and
(5) It is probably true, but not yet fully-proven, that more enclosed spaces are more successful than less enclosed spaces.

2.1 Edges really matter

The edges of streets and squares attract us. This is partly from experience. (It is where we are used to pavements going, even when a street is pedestrianised). But it is also sensory. There is more to look at (shop fronts, cafés) and (in a square) edges allow us to step back from the masses and watch the world go by. Edges permit us, if we wish, simultaneously to enjoy solitude and to do so in a crowd. Public spaces cannot go on for ever and appear to be weaker when they stretch too far. Big is not always best. At least, that is what the theory says. The tendency of 'people to gravitate towards the edges in the public spaces of coastlands, forests and restaurants' has been discussed by many theorists and designers. Most famously, Christopher Alexander wrote that '*If the edge fails, then the space never becomes lively… The success of urban space depends on what can occur along its boundaries*.'[21] The phenomenon was first termed 'the edge effect' by the sociologist Derk De Jonge in the late 1970s.[22] But, is it actually true? If you actually study how people behave, do they cluster at edges?

The best-known study is a behavioural mapping exercise conducted by Jan Gehl, in Piazza del Popolo, in Ascoli Piceno, Italy, in 1965. This demonstrated that people do tend to sit and stand at the edges of spaces. They often only stop in the centre for short, casual conversations, perhaps if they meet someone on their way.[23]

He observed 206 people on a cold December day, between 5.30 pm and 5.40 pm. Of these, 105 were crossing the square in the middle, while 101 were standing at the edge. Favourite places to stand were very clearly by the columns of the arcades, under the arcades and along the buildings' façades.



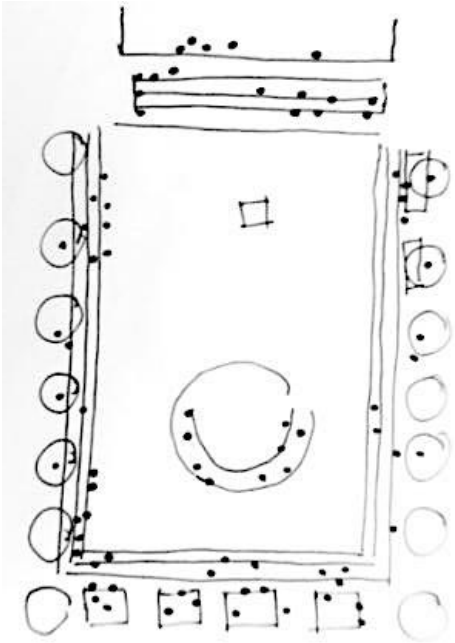
Where do people spend time in squares? The 'edge effect' in action, Piazza del Popolo

Quentin Stevens conducted a similar study in Melbourne, in 2007.[24] It examined the role of frequent front door steps, window ledges and loggias, in providing comfortable places to sit watching street shows in the shade and shelter. Professor Stevens observed and photographed two street performers on two streets and 21 passers-by.

If true on a wider scale, this might help explain why most people appear to sit at the edge of public squares not their centres. It gives you something to look at. And maybe it avoids too much embarrassing eye contact with strangers, as you watch the world go by. But is this finding replicated elsewhere? Though the conclusions are credible, it is not clear

how many people were observed, or for how long. Certainly, many new public spaces continue to put benches in the middle, implying no consensus on the issue. Based on studies such as these and her own un-quantified observations, the landscape architect, Catherine Dee, has defined edges as 'interlocking forms or places of transition that enclose and separate different spaces.'[25] She has argued that individuals tend to spend time along the edges of spaces, or anywhere where there is a physical element, such as benches, trees, or steps.

Does 'the edge' matter? New benches in Cambridge between road and pavement.



Sketch of 'edge effect', representative of where people are more likely to sit and stand.

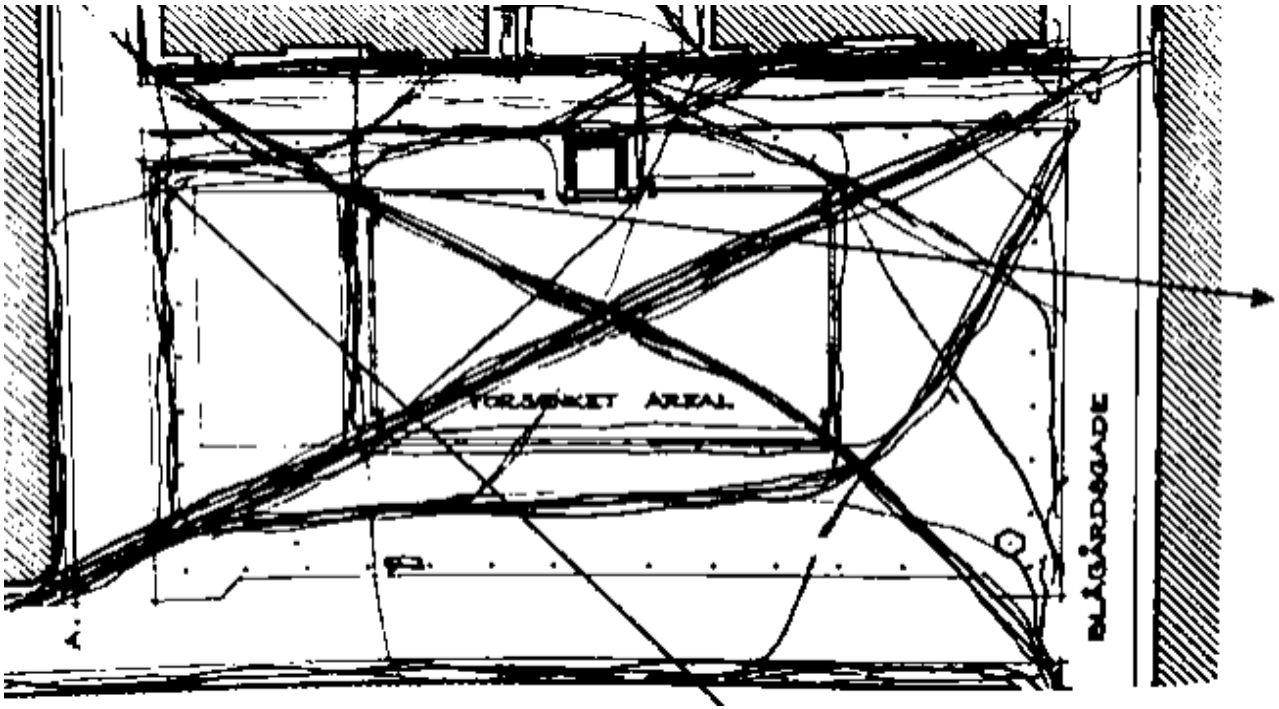
Similarly, even when entire roads are pedestrianised, many people continue to walk near the edges. Perhaps, this is sometimes force of habit. But maybe it is also that there is more to see and it is more psychologically comforting. When Madison Avenue in New York was pedestrianised for two weeks, in 1972, between noon and 2pm, 60 per cent of pedestrians still walked along the pavements.[26]

2.2 How do people get around in public spaces?

If edges seem to matter, so does the ability to get about. People want to be able to cut from A to B. And that means using a direct path. A well-known study by Jan Gehl on pedestrian movements, showed that, when walking, people tend to choose the simplest and most direct route, regardless of the type of street typology.[27] He observed people walking and crossing Blågårds Square in Copenhagen.

The study was conducted between 4 pm and 4.30 pm and then for another half an hour, in the evening, in May 1968. The study was replicated on a winter's day, in 2013. The outcome was the same: almost all people tend to cross the square by the shortest path in daylight and along its edges at night. In this at least, millennials are like their parents. Perhaps some urban behaviour patterns are as old as cities.

Since Jane Jacobs' first argued that city design should be more clearly based on how people actually move



Mapping of people crossing Plan of Blågårds Square in Copenhagen.

around, research has also focused on informal 'desire paths.' These are informal paths that develop over time as a result of individuals bypassing built paths, or pavements, to get where they want to be more quickly or more easily.

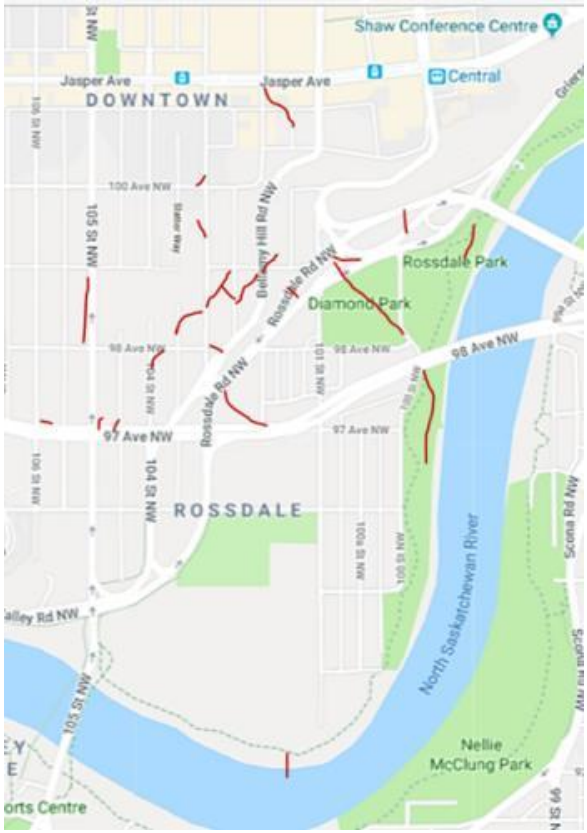
> Analytical approach: the technique used to collect empirical data for this study was a tracing and mapping tool. Unobtrusive observations of people's behaviour were made for thirty minutes. One hundred people were randomly selected (every fifth person entering the test area was chosen) and their pathways mapped. Observations were made from a window on the second floor.

As there tend to be predictable patterns to how people move about ('I need to get to the train station as quickly as possible' or 'this links to that gate') the accumulated effect of years can be to create new paths.[28] City authorities might frown ('Keep off the grass').

However, some smart institutions make use of them. At Michigan State University, Ohio State University and Reed College Cornell University, paths were only marked down after watching where students and professors actually walked.[29]

Examples of successful use of desire lines in Michigan State University (top) and Ohio State University (bottom).

A fascinating study by Erika Luckert, of a one-square kilometre area in central Edmonton, Canada, mapped and documented 20 desire lines, from May to August 2012. She walked, photographed and hand drew maps of each desire path, using Scribble Maps (a tool that 'allows freeform annotation over a Google Maps base layer').



Mapping desire lines in Edmonton.

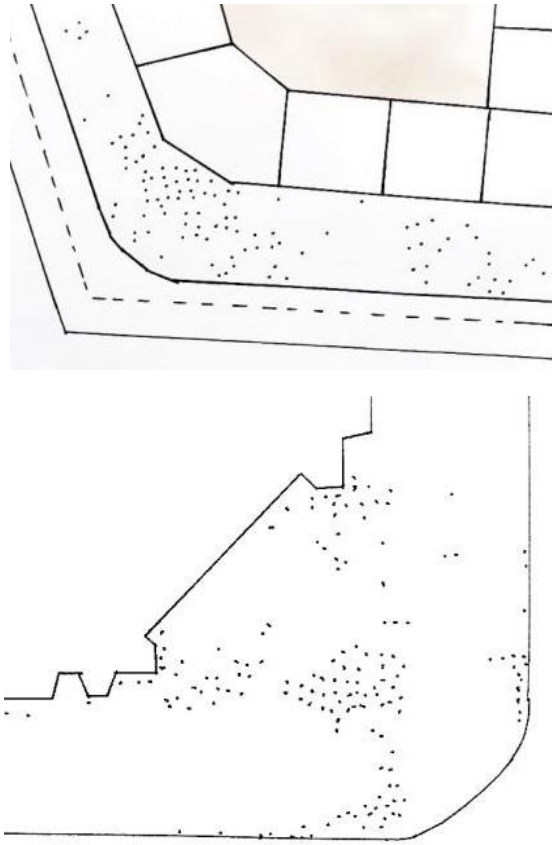
She observed that desire paths:

- Tend to cut corners - people look for the shortest distance;
- Continue where the footway ends - people wish to walk further;
- Often run parallel to other roads or separate from them; and
- Appear to reflect people's preference for a softer surface when walking or running - paths in the grass.[30]

Another good example of the usefulness of desire paths comes from Finland, where planners usually visit parks immediately after snowfall, keep records of people's chosen routes and integrate the data into the official design guidelines.[31]

2.3 Corners are crucial

Perhaps not surprisingly, given our natural desire to get from A to B as quickly as possible, and the apparent attraction of edges as places to observe shop fronts, or watch people, corners can be crucial. They are places we meet, wait, even do business. Of 133 conversations mapped on a New York crossroads, by William H. Whyte and his team 30 years ago, 57 per cent happened in the highest-traffic locations, most on the actual corner itself. A similar pattern emerged at a department store entrance, or even in a study of prostitution.[32]



Location of street conversations lasting two minutes or more.

2.4 Space and interpersonal distance

Research suggests that people do need space but not too much. A growing number of studies have focused on the effect of physical distance on the way in which unknown people interact with one another. For example, an early study of the anthropology of space, conducted by Edward Hall in the United States, attempted to explain behaviour via 'careful observation over a long period of time in a wide variety of situations, making note of each small shift in information received'.[33]

He focused on a restricted sample of local, healthy, middle-class adults. He concluded by classifying distances between people into four categories, based on observations of people's behaviour. These were:

- Intimate distance (15 to 20 cm): the presence of the other person is unambiguous and might be disturbing;
- Personal distance (0.5 to 0.8 m): people perceive a sense of closeness and are aware of the possibility of touching each other;
- Arm's length (0.8 to 1.2 m): people interaction is based on agreement. They can touch each other's arm if they want to; and
- Beyond: interaction must be voluntarily sought.

Following on from Hall's findings, William Whyte observed, in 1980, that in the most active squares in New York city, people tended to sit at arm's length distance of about 0.8m. In other words, for every 100m of sitting space, between 108 and 125 people can be seated.[34] These findings were based on 48-hours' observation of people's actions in squares,

through time-lapse filming. A photograph was taken from every half-second to every 10 minutes, depending on the level of activity.[35]

People may tend to go where other people are – but they also keep their distance.

'From a 1,200 metres distance, a human figure can be recognised, from a 120-150 metres distance it is possible to recognise whether the figure is a woman, or a man, and distinguish their gestures, from a 22-24 metres distance a person can be recognised, at 14 metres distance it is possible to see clearly the other's face, and between 1 -and 3 metres there is direct social interaction. For this reason, open public spaces of between 1 -and 3 metres length are generally too small, they are intimate when 12 metres long, and at human-scale when 24 metres long, as they allow to distinguish people's faces. Most beautiful traditional squares are almost never larger than 137 metres, as they tend to appear too large and with no clear definition of space'.[36]

One metre seems too small. And 137 metres is surely false precision. More recently, Jan Gehl has agreed, arguing that 100 metres is the maximum social field of vision. Beyond this distance, he has written, the image of other people becomes blurred, and it is harder to feel part of the same social group.[37]

2.5 Building height and street enclosure

Some designers have argued that the success of a street is determined by size and proportion. Can you see the sky? Does it feel dark and overwhelming, or dull and too stretched out? A street might be nicely wide. However, if surrounded by buildings which are too high, or too boring, it might feel shadowy or unpleasantly cavernous.

On the other hand, it might have beautifully articulated façades, which are so low compared to its width, that it feels more like a pretty race track than a place to be. Medium-rise buildings, it has been argued, can imbue a street with a pleasing sense of enclosure, with dynamism and spatial continuity.

The architectural writer, Christopher Alexander, has argued that well-enclosed public spaces make us comfortable and that we are biologically programmed to seek the edge;

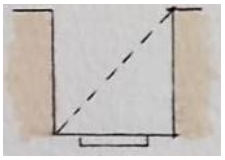
'The success of urban space depends on what can occur along its boundaries. A space will be lively only if there are pockets of activity all around its inner edges.'[38]

A key metric for thinking about this is the street's height-to-width ratio. This is defined as the proportion of the width of the street to the height of the building. It is a measure of sense of 'enclosure'.

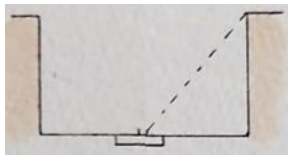
A good ratio positively influences human perception of the space – helping it feel safe and naturally constrained. A bad ratio might create a sense of claustrophobia (if too high) or dispersion (if too low). A British academic, Matthew Carmona, has suggested the following possible guidelines:

- A height-to-width ratio of 1:4 or above: more sky is visible than buildings so there is very little sense of 'enclosure';
- A height-to-width ratio of between 1:2 and 1:2.5: the portion of sky and buildings visible are about equal leading to a reasonable sense of enclosure;
- A height-to-width ratio of 1:1 or below: means that it is not possible to have a comprehensive view of the buildings without looking up. This reduces light levels and, it has been argued, can induce feelings of claustrophobia. A ratio of 1:1 'is often considered the minimum for comfortable urban roads.'[39]

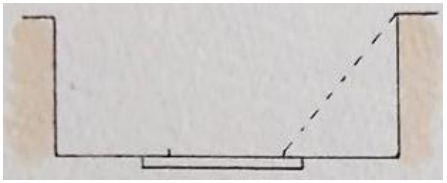
This argument is based on studies of environmental perception, which have shown that the human field of view generally has a peripheral angle of view of 180 degrees horizontally and 150 degrees vertically, with a clear field of view of 27 degrees height and 45 degrees width. These angles decrease as the speed increases.[40] We can see more broadly when we are standing still, least widely when we're zooming past.



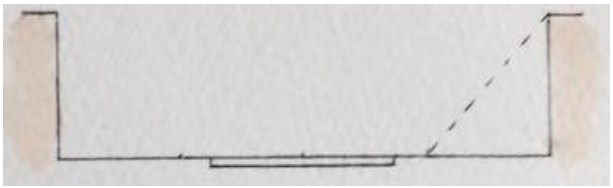
1:1 h/w ratio



1:2 h/w ratio



1:3 h/w ratio



1:4 h/w ratio

Examples of strong, medium and low spatial enclosure.

A 1974 environmental perception study, by Professor Samuel Franklin and Scott Hayward, was the most robust we've been able to find. It concluded that a sense of enclosure did not depend on the size of space, but was determined by its height-to-width ratio. They randomly selected 20 undergraduate students. Observers were given twelve drawings of architectural spaces, four images of small size places (3x3m), four images of medium size places (6x6m) and four images of large size places (12x12m). For each set of images, four different height-to-width ratios were depicted: 1:1, 1:2, 1:3 and 1:4.

Observers were asked to judge levels of enclosure on a ten-point scale, where 1 indicated minimum enclosure and 11 indicated maximum enclosure. The study found that:

- Increased height-to-width ratios corresponded to increased perception of enclosure. On the 1 to 11 scale, a 1:1 height-to-width ratio corresponded to an 8.6 mean rating of enclosure. While a 1:4 height-to-width ratio corresponded to a 4.0 mean rating of enclosure;
- However, there was no significant influence of size on perception of enclosure, with only 0.9 points of difference between small and large places, 0.6 between large and medium, and 0.3 between medium and small ones.[41]

Mean ratings of enclosure (scale of 1 to 11)					
Size	1:4	1:3	1:2	1:1	Average enclosure rating per size
Small (3x3m)	3.6	4.2	5.7	8.6	5.5
Medium (6x6m)	3.8	4.7	6.2	8.6	5.8
Large (12x12m)	4.6	5.7	7.1	8.5	6.5
Average enclosure rating per ratio	4.0	4.9	6.3	8.6	

Mean 'enclosure scores' on a scale from 1 to 11.

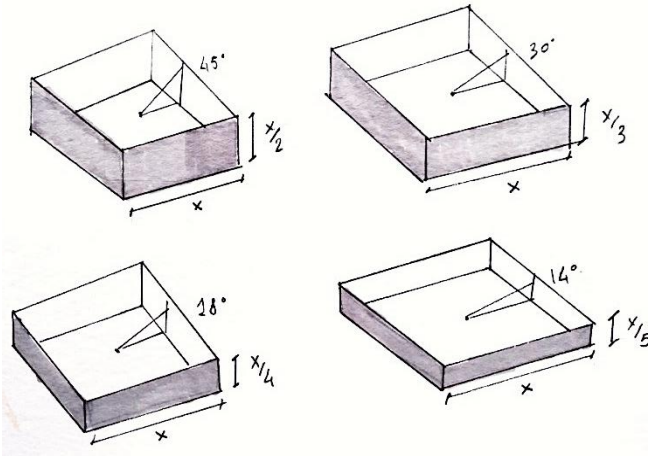
This positive association between higher height-to-width ratios and increased sense of enclosure was explained by the American architect and planner, Paul Spreiregen, in 1965:

> *'when a facade height equals the distance we stand from a building (a 1:1 relationship) the cornice is at a 45-degree angle from the line of our forward horizontal sight. Since the building is considerably*

higher than the upper field of forward view (30 degrees), we feel well enclosed."[42]

But does this matter? Is it actually reflected in the reality of how streets 'feel' and how popular they are? Certainly, many clearly very popular streets have a ratio of between 1:1 and 1:1.5. In other words, the buildings are as high as the street is wide, or the street is not more than 50 per cent wider.

For example, John Massengale has argued that one of the key reasons that Manhattan's 70th Street, between Park Avenue and Lexington Avenue, is so attractive is due to its height-to-width ratio.[43] The street is just over 18m wide. The buildings are 4.5 to 5 storeys (about 16m) high. In other words, the ratio is very nearly 1:1.



Sense of enclosure and human field of view.

In his excellent book, *Great Streets*, Allan Jacobs surveyed 15 of the 30 streets he personally judged to be the most beautiful in the world. He found that most of them were in the range of 1:1.1 to 1:2.5 height-to-width ratio, with a building height of less than 30.5 metres.

Some streets had lower ratios, such as Via del Corso and Via dei Greci, in Rome, with 1:0.5 and 1:0.3 height-to-width ratios respectively. And some of them had higher ratios, such as the Champs-Elysees or the Paseo de Gracia, with height-to-width ratios of 1:3 and 1:5 respectively. Jacobs also argued that one reason why we often perceive a fine sense of enclosure, in a very wide street or boulevard, is the presence of one to four rows of closely-planted trees. These help visually to define the space.[44] Terraces also appear to help.

As well as trees, Allan Jacobs has argued that a terraced street, or buildings, with only minimal distances between them, increases the sense of enclosure. For example, some seven metres wide residential Streets, off Fairmount Boulevard in Ohio, have a strong sense of enclosure, as the buildings are nearly terraced with only 3 to 6 metres between them. They also have a row of regularly spaced trees on both sides.

In contrast, East and West streets in Litchfield, Connecticut, which are the same width, have much

less sense of enclosure, as the buildings are 60 metres apart and trees are more scattered. Is that really as far as you can go without streets feeling overwhelming? Climate certainly matters. Successful streets in hotter climates are often very narrow, protecting pedestrians from a sun whose heat is less welcome, for example, in Marrakesh than in Manchester. Interestingly, wider streets in hotter climates were often built by colonial authorities, whose residents did not expect to spend much time on them, or by modern developers who perhaps expect people to zoom about the city in cars.

70th Street, New York.

On the other hand, many urban squares and piazzas have a ratio of 1:3 and yet are still pleasant and comfortable spaces. The height of the buildings are one third of the piazza's width. For example, Plaça Sant Jaume in Barcelona is surrounded by buildings of 5 to 6 storeys and has sides of 63 and 35 metres length. Similarly, Campo di Ghetto Nuovo, in Venice, has buildings between 5 and 6 storeys and a maximum square width of 50 metres. Their height-to-width ratios are approximately 1:28 and 1:36. What 'feels right' in a public square is clearly not the same as in a street.

A street in the Medina and in the Ville Nouvelle, Marrakesh.

Champs-Elysées, Paris
Street width: 70 metres
Building height: 23 metres
Height-to-width ratio: 1:3

Via del Corso, Rome
Street width: 11 metres
Building height: 21 metres
Height-to-width ratio: 1:0.5

Great streets can break rules!

Campo di Ghetto Nuovo, Venice.

Plaça Sant Jaume, Barcelona.

[21] Alexander C (1977), *A Pattern Language: towns, buildings, construction.* (p.600).
[22] Thwaites, K., Mathers, A., & Simkins, I. (2013). *Socially restorative urbanism: the theory, process and practice of experiemics*. & De Jonge, D. (1962*). Images of urban areas their structure and psychological foundations*.
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[30] Luckert, E. (2013). *Drawings we have lived: Mapping desire lines in Edmonton*.
[31] https://www.rbkc.gov.uk/idoxWAM/doc/Other-777167.pdf?extension=.pdf&id=777167&location=VOLUME2&contentType=application/pdf&pageCount=1
[32] Whyte, W. (1988), *City, Rediscovering the Centre*, (p.54, p.96).
[33] Hall, E. T. (1966). *The hidden dimension*. (p. 115).
[34] Whyte, *The social life of small urban spaces*.
[35] Researchers also interviewed people to discover were they lived and worked, their frequency of visits and their view of the public space. No information on sample size is provided in the write ups.
[36] Lynch, K. (1958). *Site Planning,* 1962. Especially Chapter Five *Visual Forms,* and Chapter Eight *The Process of Site Planning*. & Hosken, F. P. (1968). *The language of cities,* in Rapoport, A. (2016). *Human aspects of urban form: towards a man—environment approach to urban form and design*.
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[39] Carmona, M., Heath, T., Oc, T., & Tiesdell, S. (2012). *Public Places-Urban spaces*.
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[42] Spreiregen, P. D. (1965). *The architecture of towns and cities*. (p. 75).
[43] Dover, V., & Massengale, J. (2013). *Street design: the secret to great cities and towns*.
[44] Jacobs, A. B. (1993). *Great streets*.

Walkability (and its less attractive sister, connectivity) has become the *phrase du jour* of pretty much any urban regeneration, or architect-led design. Does the evidence support the importance placed on it? Unlike several of the issues so far, this is one area where quite a lot of work has been done. And the evidence is empathic: walkability does work:

(1) When people can walk more they normally do;
(2) More walking is associated with better physical and mental health;
(3) More walking is associated with higher land values. Everyone wins;
(4) More traffic is associated with speaking to fewer neighbours and a less attractive place in which to 'mingle';
(5) Wider pavements and pedestrianisation of streets and squares normally lead to more walking, more shopping and more popular and better-used spaces;
(6) However, not everyone always gains from pedestrianisation, it can lead to side effects and drive-to-pedestrianisation has a very patchy history;
(7) Pedestrianising an area does not work if it is not very nice, or not very easy to get to; and
(8) All distance is not equal. Different types of urban form and façade patterns appear to be more attractive to walkers than others.

3.1 When people can walk more they do

The evidence that people walk more in traditional street grids, with mixed use, seems hard to argue with. One of the first comparisons (in 1995) between walking levels in a traditional and a typical lower-density suburban neighbourhood, in San Francisco, found that the residents of the traditional neighbourhood made 10 per cent more non-work trips, even taking account of income levels and available public transport.[45]

Another 1995 study, in San Francisco corroborated this, although the phenomenon was found to be less strongly true in Southern California, where there was simply less to walk for.[46] Since then, a range of American studies have built up a remarkably consistent picture.

A study, which rated high walkability by greater land use mix, higher street connectivity and high population density, found that residents took the equivalent of an additional one to two 13-15 minute walks per week.[47] Another study found that 37 per cent of residents, in the most walkable neighbourhoods, met the recommended minimum of at least 30 minutes of physical activity, compared to only 18 per cent of those who lived in the least-walkable neighbourhoods. Residents of the most-walkable neighbourhoods were nearly two and a half

times more likely to get sufficient physical activity than residents of the least walkable.[48]

3.2 Does walking keep you fit and mentally healthy?

Over the last decade, a range of largely US studies have also shown that such conventional walkable neighbourhoods are meaningfully correlated with lower rates of obesity, diabetes, heart disease and high blood pressure. Two recent studies have been particularly emphatic.[49] One recent literature review also found that 50 out of 64 relevant studies found an association between compact walkable neighbourhoods and positive health outcomes. The remainder were unclear. None showed a reverse correlation.[50] It is important to state that the evidence on the relationship between greater walkability, and better mental health is not ubiquitous. For example, a study conducted in King County, Washington, between 2001 and 2003, found significant relationships between levels of walkability, within a neighbourhood, and depression symptoms – but only for men. The researchers interviewed 740 people, who had lived in King County for at least two years, with a certain minimum health level. They then measured symptoms of depression,[c] and probability of walking at least 150 minutes per week, within three buffer areas around each participant's home of 100, 500 and 1,000 metres radius. They found that 'greater neighbourhood walkability was inversely associated with depressive symptoms in older men'. However, the same was not shown for women.[51] Another study conducted between 2001 and 2005, investigated the relationship between environmental characteristics, neighbourhood satisfaction and self-rated mental health. The researchers interviewed 2,194 people, aged between 20 and 65, from 50 random addresses within 32 neighbourhoods (16 with high and 16 with low walkability rates), in Seattle and Baltimore.[d] They measured average daily minutes of; moderate and vigorous physical activity, walking for transport, walking for leisure, body mass index and mental quality of life. They found that people living in high-walkable neighbourhoods:

- Did nearly 6 more minutes of moderate and vigorous physical activity than those in low-walkable neighbourhoods;

[c] To measure depression symptoms, they used the Centre for Epidemiologic Studies Depression Scale (CES-D), a 20-questions survey according to which a person with a score of 16 or more is classified as having depressive symptomatology.

[d] They assessed 13 environmental characteristics by rating them on a four-point scale from 'strongly disagree' to 'strongly agree'. Neighbourhood satisfaction was measured asking the participants 'How satisfied are you with…' 17 physical and social environment items were measured on a scale from 0 (strongly dissatisfied) to 5 (strongly satisfied). Mental health was measured using what is known as the 'SF-12 score' which permits the calculation of a mental health composite score ranging from 0 (poor) to 100 (good).

- Walked on average 31.5 minutes more per week than people in low-walkable neighbourhoods, to reach transport;
- Walked for leisure an average of 4.3 minutes more per week, than people in low-walkable neighbourhoods; and
- Were 35 per cent less obese than people in low-walkable neighbourhoods.

However, people living in higher walkability neighbourhoods:

- Were slightly more depressed than people in low-walkable neighbourhoods. On a scale of 0 to 10 (where 10 indicates highest level of depression), residents of higher-walkable neighbourhoods had a score of 9.9 compared to 8.9 for lower-walkable neighbourhoods; and
- Had slightly lower mental health than people in low-walkable neighbourhoods. On a scale of 0 to 100 (where 100 indicates better health), residents of higher-walkable neighbourhoods had an average score of 49.7 compared to 50.7. No positive correlation was found between mental health and walkability.[52]

In short, walking more is good for your physical health beyond doubt. It is probably good for your mental health too. But not quite always and not quite everywhere. Other factors can be more important.

3.3 People must like walkability because they will pay for it

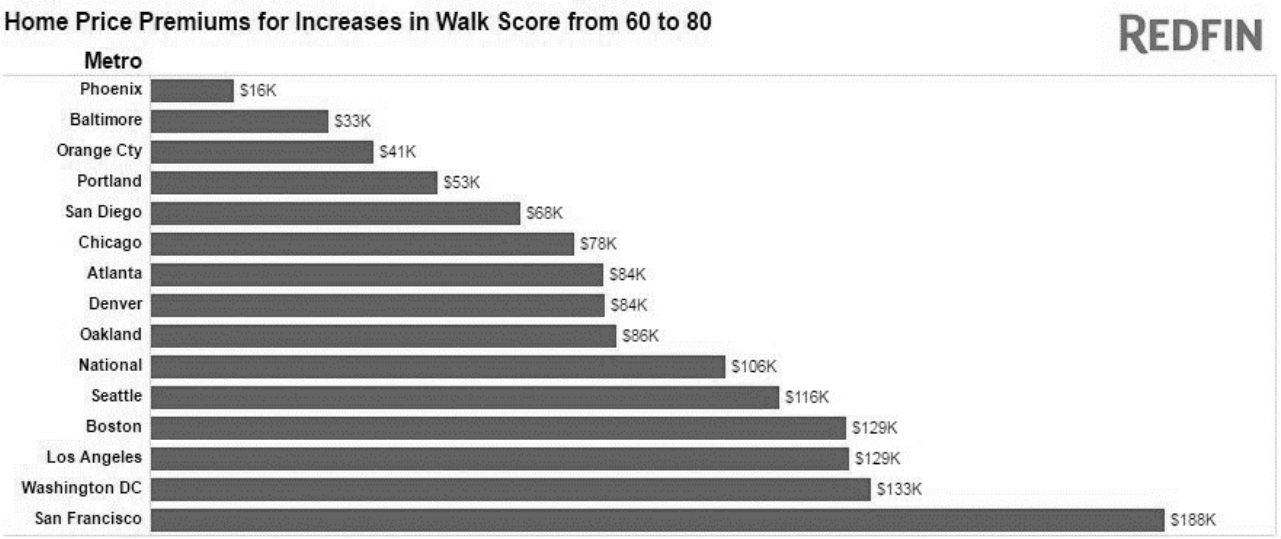
There is growing evidence that shops, and some other types of commercial activity, perform better commercially in places with higher walkability, rather than in car-dominated environments.[53] Of the nine studies we have considered, all have found correlations between high levels of commercial activity and high levels of pedestrian traffic.[54] It is difficult to isolate walkability as a variable, as it is consequent on a range of other design choices (street grid, street design, nature of green space, speed limits etc.). There are various organisations and tools for measuring walkability, such as Walk Score, Walkonomics, RateMyStreet and Walkability Mobile App.[55] All these indices can be discussed at length and are hard to 'get completely right.' Nevertheless, most have been assembled in a well-researched way and studies that research property values in relation to these walkability indices do seem to tell a fairly clear story of the value impact of walkability. For example, in 2012, the US Brookings Institute published a study that compared 201 places by their 'walkability', which is worth citing fully. They found that:

- 'Places with higher walkability perform better commercially. A place with good walkability, on average, commands $8.88/sq. ft. per year more in

office rents, $6.92/sq. ft. per year higher retail rents, and generates 80 per cent more in retail sales as compared to the place with fair walkability, holding household income levels constant;

- Places with higher walkability have higher housing values. For example, a place with good walkability, on average, commands $301.76 per month more in residential rents and has for-sale residential property values of $81.54/sq. ft. more, relative to a place with fair walkability, holding household income levels constant; and
- Capitalization rates are lower in places that qualify as walkable urban places, than in those that do not, especially in the period after the Great Recession of 2008. Development in places with higher walkability has lower capitalization rates. The underlying value of real estate assets in walkable places is higher, facilitating private market financing. On average, before the recession (2000 to 2007), retail and office space in walkable urban places had a 23 per cent premium per square foot valuation. During the recession (2008 to 2010) that premium nearly doubled to 44.3 per cent.'[56]

More recently, in 2016, researchers at the Seattle-based real estate firm, Redfin, used hedonic regression to find out how much residents, of various American cities, valued walkable neighbourhoods.[57] They examined over 1 million homes sales in the USA, and accounted for various elements of American homes, including size, age, number of bedrooms and bathrooms, and neighbourhood characteristics including average income. They also looked at the property's 'Walk Score.' This is an 'algorithm that estimates the walkability of every address in the United States, on a scale of 0 to 100, based on its proximity to a number of common destinations like schools, stores, coffee shops, parks and restaurants.'[58] Their findings showed that increased walkability is reliably associated with higher home values, across the country. They found that a one-point increase in a house's 'Walk Score', was associated, on average, with a $3,000 increase in the home's market value.



House price premiums for increase in Walk Score from 60 to 80.

A very different study of a single street found consistent findings. A 2009 study analysed the price effects of the replacement of the Embarcadero and Central freeways in San Francisco (damaged in the 1989 Loma Prieta earthquake), by a surface boulevard with slower traffic, high levels of pedestrian access and a re-instated tram.[59] In both cases, the effect was strongly positive, with the benefit being around $118,000 per home, by the former Embarcadero freeway and around $116,000, by the former Central freeway. A less robust study into the impact of the replacement of Boston's Central Artery freeway, with an underground facility, and the transformation of the surface to a linear parkway and boulevard, also found strongly positive price impacts.[60] Another study looked at the effects of walkability on the market value and investment returns of over 4,200 office, apartment, retail and industrial properties, from 2001 to 2008, in the United States.[61] Researchers found that the value of offices, shops and apartments in areas with higher walkability rates were higher. On a scale from 1 to 100, an increase of 10 points in the walkability rate, increased values between one and nine per cent depending on the property type.

From Embarcadero Freeway to Boulevard led to a value increase of about $118,000 per unit.

3.4 More traffic, less chatting

If a street is going to function as a place to be, as well as a place to pass through, common sense would suggest that pavements need to be wide enough to feel safe, to permit conversation with fellow pedestrians, and (ideally) for children to play, not just trudge along umbilically attached to their parents' hands. The evidence of cars' circulation after snowfall certainly suggests that this need is both latent and achievable. An example is an observation made by Clarence Eckerson, director of StreetFilms, which documented pedestrian and cycle-friendly streets, in New York, after an intense 2014 snowfall.

He observed that the snow created natural kerb extenders: 'protrusions of pavement that give pedestrians a safe place to stand as they wait to cross the street and make street crossing easier'. He noticed that;

- 'Snow-ploughing creates narrowed roads, illustrating possible space for parking, pedestrians or bike lanes; and
- Curved snowbanks create wider pavements and indicate how much road space cars need when turning.[62]

'In nive veritas'. How much road and how much pavement do we need?

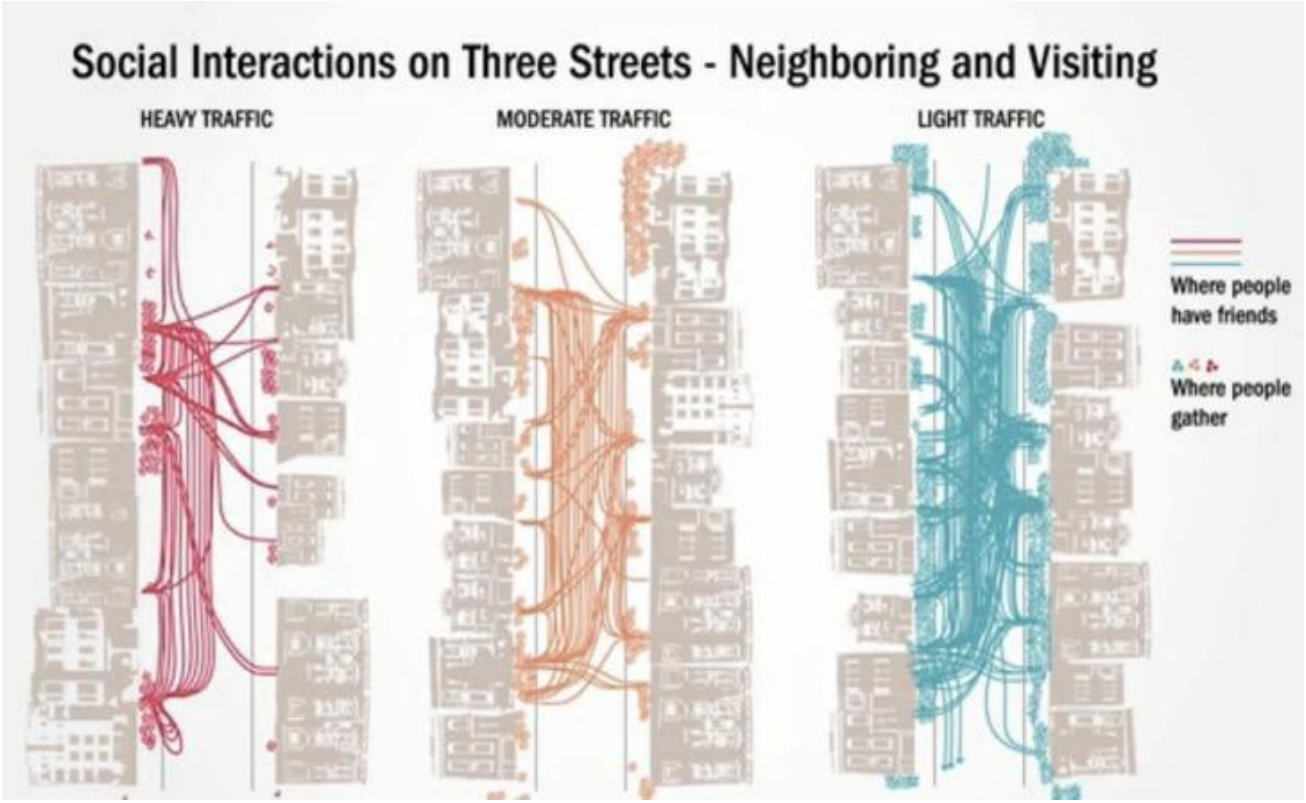
The evidence agrees. People do feel safer in streets where traffic is reduced, children play more, and adults spend more time standing by the doorsteps watching or having conversations with the neighbours. Heavy vehicular traffic has a malign impact on social connectivity and neighbourliness – both of which we know to be associated with wellbeing.

The best-known study (by Donald Appleyard and Mark Lintell as long ago as 1972) into the impact of traffic, on neighbourliness, is far from perfect due to very material differences in social demographics and length of tenure. These are not controlled for. Nevertheless, its findings are intuitively compelling. People living on lightly trafficked streets (2,000 vehicles per hour) were friends with three times as many people on their street as those living on the 'heavy street' (15,750 vehicles per hour). They also knew twice as many people and far more people on the opposite side of the street.[63]

Put simply, on busy vehicular streets, people know far fewer of their neighbours, particularly from the other side of the carriageway. This must be, in part, due to differing lengths of residence. However, the researchers' notes on their interviews with residents are fairly convincing - that traffic plays a far more than incidental role. They wrote of the lightly trafficked street: 'Front steps were used for sitting and chatting, sidewalks by children for playing, and by adults for standing and passing the time of day (especially around the corner store).' However, the heavy street had 'little or no sidewalk activity and was used solely as a corridor between the sanctuary of individual homes and the outside world. Residents kept very much to themselves so there was no feeling of community at all.'

In spring 2008, Joshua Hart and Graham Parkhurst replicated this study, in Bristol, in the UK.[64] They took three streets, with different levels of traffic, and compared the average number of friends and acquaintances, that people had on each street type. Then they compared the results with the mean values in San Francisco. The table below summarises the findings for both cities, showing the average number of friends and acquaintances in relation to

the traffic volume for each street type. Both studies show that people living on streets with heavy vehicular traffic tend to have fewer friends on their street and not many acquaintances. Those living on lightly trafficked streets appear to have three or four times as many friends and twice as many acquaintances. Lots of cars make for bad neighbours.



Lines show residents' movements to/from friends and neighbours.

Study area	San Francisco (1972)			Bristol (2008)		
Street	Low	Medium	High	Low	Medium	High
Traffic volume	2,000	8,000	16,000	140	8,420	21,130
Avg. no friends	3	1.3	0.9	5.4	2.5	1.2
Avg. no acquaintances	6.3	4.1	3.1	6.1	3.7	2.8
Mean length of residence	8.0	9.2	16.3		-	
Percentage of renters	50	67	92		-	

Average number of friends and acquaintances in Appleyard's original study in San Francisco, and in 2008 Bristol study.

3.5 Wider pavements are associated with more mingling

The same logic would appear to hold for successful public spaces. Recall that more people like to go where they can readily mingle with others and where it is at least conceivable to meet in slightly larger groups. The noise, pollution and potential danger of cars is not conducive to this. Importantly, there is evidence that reduction of traffic in public spaces does lead to more pedestrians and increased social mingling.

An important recent example is Times Square in New York, where the temporary closure to traffic of a three kilometres stretch of Broadway, from Union Square to the Flatiron building, was so successful that part pedestrianisation was made permanent. Since the changes, Times Square is widely seen as becoming safer and more enjoyable;[65]

- Taxi traffic and car crashes were reduced by 63 per cent;
- Pedestrian accidents were reduced by 35 per cent;

- There were 80 per cent fewer people walking in the carriageway and 11 per cent more people walking in Times Square;
- Speed of motorised journeys decreased by 2 per cent for cars and 13 per cent for buses;
- According to a Times Square Alliance's survey, around 74 per cent of New Yorkers agreed that the area had 'improved dramatically' in the last few years;
- The Transport Commissioned observed that 'commercial activities were booming', converting Times Square into one of 'the top 10 most desirable retail locations in the world.'
- There was a 71 per cent increase in revenue by businesses; and
- Rents of the shops around Times Square have increased by 180 per cent.

A parallel project was the remodelling of Trafalgar Square in London, in 2003. Pedestrian mobility and walking pattern studies showed that Londoners tended to avoid the centre of the square while tourists' journeys from Parliament Square to Trafalgar Square were made impossible by the dense traffic.[66] The response was to close the north side to traffic and to insert a major staircase linking the square to the newly pedestrianised north and directly to the National Gallery. This has led to;

- 'A 250 per cent increase in pedestrian activity;
- A 900 per cent increase in its use as a pedestrian through-route (13 times more as before); and
- Transformed public perceptions of Trafalgar Square as a destination'. People now enjoy improved seating and lighting, as well as urban amenities, such as a café with outdoor seats, improved flooring and a generally safer environment.[67]

Similarly, a review by Jan Gehl of the effects of widespread pedestrianisation in Melbourne, Australia, was hard to argue with. He concluded that:

- There was a 39 per cent increase in the number of pedestrians from 1993 and people spent three times more in the city;
- Pedestrians' use of the city at night had doubled; and
- Activity in the city during the week had tripled.[68]

Pedestrianisation does not just work in global cities, however. For example, in the late 1990s, authorities in Kajaani, a small Finnish town of fewer than 40,000 people, pedestrianised the main square and part of the main street. The results were clear and measurable. After the pedestrianisation:

- 20 per cent more inhabitants said Kajaani was a good place to live;
- 13 per cent more inhabitants found the city centre beautiful;

- 55 per cent of them wanted a larger pedestrian area; and
- 52 per cent of shops and business said they had benefited.

Pedestrianisation is also normally good for the air that we breathe. The pedestrianisation of Nuremberg's historic centre was associated with a traffic reduction of 25 per cent, a fall in carbon monoxide emissions of 30 per cent and of particulate matter by 15 per cent.[69]

3.6 However, pedestrianisation is not always good for everyone

Of course, the process is not simple. Pedestrianised areas tend to become more prosperous, with higher rents and changing tenants. There are measurable selection effects, in where people chose to, or can afford to live, shop and work. This means that one person's improvement might be another person's loss of a home, shop or neighbourhood. While pedestrianisation has a positive impact on overall retail business, it also leads to higher rents. A review of the literature, for the Living Streets charity, concluded that 'retail and commercial rates increase in the range of 10-30 per cent.'[70] Examples cited ranged from a 17 per cent increase in Hong Kong to a 25 per cent increase in London. Other estimates are even higher. Property consultants Erdman Lewis estimated that, 'pedestrianising a site means an instant rental premium of as much as 50 per cent over comparable vehicle-access sites.' But there are unavoidable losers from this process as well as winners. The report concluded that, 'with margins constrained, it tends to be the larger retail chains that are best suited to move in and take advantage.'[71] Sometimes, pedestrianisation might homogenise more than everyone would like.

3.7 Pedestrianisation can create difficult 'trade-offs' and you can do it badly

Success can create other problems, such as overcrowding, noise and rubbish. In many Italian historic city centres (for example Venice, Trieste, Sienna), residents complain of the size, noise and general disruption of the crowds of visitors attracted by the walkable and beautiful urban perfection of medieval Italian cities. Some of their neighbours may benefit from the visitors. But not everyone does.

Similarly, a 48-hours study into peak noise levels in Soho, London, registered levels over 90 decibels (the maximum level permitted in nightclubs) between 11 pm and 3 am.[72] Hardly surprisingly, many residents complained about noise, waste and social disorder. One could respond that they had chosen to live there, but the point is merely that pedestrianisation is not always an unmitigated benefit for everyone. Nor is pedestrianisation a panacea in all situations, if everything else is wrong, if the urban form is too distended, or if you can't get to the walkable area. This is a crucial point. For example, it is now widely

forgotten that what now seems like the obsessive over-design of post-war development (the elevated walkways, the segregated roads and 'pedways') were well-intentioned attempts to separate the pedestrian from the car in an era when road accidents were increasing rapidly. The American mall, in rebuilt 1960s and 1970s American city centres, was one such response: a fully-pedestrian (often internal) 'street' lined with shop-fronts but, often accessed by car and surrounded by vast car parks. The quintessential North American mall might be described as 'drive-to walkability.' Initially built in American suburbs, they soon spread to town and city centres, with the creation of about 200 'downtown' malls.

> *'The pedestrian mall took several architectural and landscape elements from the suburban shopping center such as fountains, lighting, etc. It also aimed to provide the shopper with an "enclosed" experience, cut off from the area around it, with design elements included to provide a pleasant environment where the shopper would want to stay, meander and shop more.'*[73]

However, they clearly have not worked. According to a comprehensive 2013 study, about 89 per cent have failed, or been redeveloped as more mixed developments of only partially-pedestrianised high streets ('main streets' in American English). Doing so, unlike the examples cited above, has led to more activity and more commercial success, not less. About 90 per cent of them have experienced 'significant improvements in occupancy rates, retail sales, property values, and private sector investment, in the downtown area, when streets were restored.' This was the case in Baltimore, Chicago, Philadelphia and Pittsburgh, where an 'isolated suburban pedestrian mall' had replaced streets, in an urban centre which was subsequently restored. Pedestrianisation, to mix metaphor and reality, is not a one-way street. Those American 'downtown pedestrian malls' that did work tended to be easier to get to, or benefited from lots of people living or working nearby. Successful malls were in smaller towns, had good bus links, were smaller, or benefited from a nearby mix of land use, or a large institutional user (a hospital or university), or lots of tourists. In short, traffic matters and discourages knowing your fellow man. But it does not follow that pedestrianising is always a silver bullet. Pedestrianising an area (creating a 'pedestrianised mall') does not work if it is not very nice, or not very easy to get to. Form and connectivity still matter.

3.8 All distance is not equal

Urban form and character may can influence people's propensity to walk in other ways too. It is not just a question of the presence or absence of traffic. Research suggests that two paths of the same length are perceived as shorter, or longer, based on the urban structure and the walker's experience of the

surrounding environment. For example, in his study of the perception of distance walked, Peter Bosselmann compared a 350-metre-long street in Venice, which he travelled in four minutes on foot, with 14 road or streets segments of 350 metres, in eight world cities in England, Italy, United States, Canada, France, Denmark, Japan and Spain. The study's aim was to understand how architecture and enclosure influenced perceptions of the distance walked. His personal experience was that the denser, richer streets felt like a longer route. He argued that we calculate our lengths in terms of 'rhythmic spacing', based on our visual and spatial experience. For example, the Venetian walk had more variety in its rhythm and texture: 39 unequal spaces, 11 turns (instead of one), 2 small squares, 6 narrow alleys and 3 bridges. In contrast, those with monotonous, blind facades were perceived as shorter to travel. He concluded that:

> *'thirty-nine drawings of unequal spacing were needed to explain the four-minute walk in Venice; far fewer drawings could explain most of the other walks. Successive acts of apperception and recognition influence one's sense of time.'* [74]

It is a fascinating study. It feels intuitively correct. But it is based on only one observer's experience. It is hardly robust to put it politely. We need more data to be less subjective. Fortunately, Raymond Isaacs has conducted a broader-based study on the relationship between perceptions of the urban environment and the physical space of streets. Forty-two students were divided in two groups and were asked to walk three different 500m paths in the city centre of Dresden (the first path was different for each):

- a late 20th century pedestrian and spaced out mall with no turns and just one change of direction (for the first group);
- a Baroque alley (for the second group),
- an irregular pre-industrial neighbourhood, with five turns and smaller dimensions (for both groups); and
- a 19th century quarter with an irregular grid and small spatial dimensions (for both groups).

Participants estimated the duration of their walks. These estimates were compared to their actual duration. Both groups gave similar results. The more complex pre-industrial neighbourhood and the irregular nineteenth century grid were on average felt by pedestrians to be two to four minutes *longer* than the simpler pedestrian mall or simple alley. The table below shows the estimated time to walk four 500 metre street segments.

A 350-metre walk in Venice is perceived as longer than a 350-metre walk in San Francisco.

Estimated walking time	Group one		Group two	
	Actual time	Participants' estimated time	Actual time	Participants' estimated time
Late C20th pedestrian mall (0 turns)	8.5 minutes	9.7 minutes	-	-
Baroque alley (0 turns)	-	-	6.5 minutes	7.3 minutes
Pre-industrial neighbourhood (5 turns)	7.8 minutes	13.8 minutes	6.5 minutes	9.7 minutes
C19th irregular grid (2 turns)	8.8 minutes	13.1 minutes	6.5 minutes	9.8 minutes

Estimated walking time on four 500 metre street segments.

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[46] Cervero, R., & Gorham, R. (1995). *Commuting in transit versus automobile neighborhoods*.
[47] Sallis, J. F., et al., (2004). *Active transportation and physical activity: opportunities for collaboration on transportation and public health research*.
[48] Frank, L. D., et al., (2005). *Linking objectively measured physical activity with objectively measured urban form: findings from SMARTRAQ*.
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[53] Alfonzo, M. and Leinb erger, C. (2012), *Walk this way.* (p. 9). & Poyner (1994): *Lessons from Lisson Green: an evaluation of walkway demolition on a British housing estate,* in Clarke, R.V, Newman (1996): *Creating Defensible Space*.
[54] Hoel, L. A. (1968). *Pedestrian travel rates in central business districts*. (*p.* 10-13). & Zacharias, J. (2001). *Pedestrian behavior and perception in urban walking environments*.
[55] For more information see http://www.walkonomics.com/; http://www.ratemystreet.co.uk/; https://walkabilityasia.org/2012/10/03/walkability-mobile-app/.
[56] Leinberger, C., Alfonzo, M. (2012). *Walk this way: The economic promise of walkable places in metropolitan Washington, DC*. (p. 9). & Poyner, B. (1994). *Lessons from Lisson Green: An evaluation of walkway demolition on a British housing estate*. & Newman, O. (1966). *Creating defensible space*.
[57] Bokhari, S. (2016). *How Much is a Point of Walk Score Worth?*
[58] Walk Score measures the walkability of an address using a 'patented system.' It analyses hundreds of routes to nearby amenities and awards points based on the walking-distance to these amenities. The scores range from 90-100 out of 100, named walker's Paradise, which means that 'Daily errands do not require a car,' down to 0-24, 'Car Dependant' where almost all errands require a car. More at https://www.walkscore.com/
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[72] Interview with environmental health officer, Westminster City Council as part of the Soho study.
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Which physical elements of the built environment can help stimulate social interaction and the use of public spaces, by making them more attractive, or enhancing their security? We have found evidence, of varying quality, in at least five areas:

(1) Benches are great and are probably better placed longitudinally at the edge of public spaces;
(2) Street lighting is good, but you can probably have too much light;
(3) Arcades make a busy public place more attractive and livelier, but can make a quieter, or purely residential area feel less safe;
(4) Too much parking (like faster cars) means you are less likely to know your neighbours; and
(5) Public art is probably a good thing (though the evidence is thin).

4.1 Where should benches go?

As we've seen, and as common sense would suggest, people want to relax in public places. Places to sit are therefore good things. People need them and seek them out. The evidence bears this out. William Whyte conducted direct observation of 18 public places (14 squares and 4 parks) in New York, over one hour (12.30-1.30pm), on a sunny day.

William Whyte conducted interviews and used time-lapse photography, leading to the 1970 film: *The Social Life of Small Urban Places*. Among other things, he found that the more benches there were in a square, the higher the number of people sitting and thus the more populated the square.[75] He found that, in the most popular public squares, sitting space occupied between 6 and 10 per cent of the total open space. Most of the time, squares with more places to sit had more people. For example, 77 Water Street had 274 metres of benches and 160 people sitting on them. 280 Park had 146 metres of benches, but only 17 people using them.

But when do more benches become too many? And where should they go? Some have argued that seating longitudinal to the flow of people is more successful. This permits observation, whilst avoiding eye contact.[76] This has been referred to as 'passive engagement' - also encouraged by street performances, public art, fountains, statues and so forth. People certainly are picky about where they sit. Quality matters. In one rare study in this area, Jan Gehl has studied sitting behaviour in Stockholm on a sunny day. He found that poor quality benches are simply less used. Quality was judged based on four aspects:

- 'Pleasant microclimate;
- Suitable location (preferably on the edge of an urban space) with an unobstructed view;
- Noise level that does not interfere with conversation and no pollution; and
- Landscape features (trees, flowers, beautiful scenery and good quality architecture).'[77]

If there are benches, people normally use them. Holborn Circus attracted dozens of people once new benches were installed.

He found a positive correlation between the quality of benches and their level of use. Benches that did not meet the above criteria had an occupation rate of only 7 to 12 per cent. Some were barely used. In contrast, benches with a combination of the four aspects had an occupation rate of 61 to 72 per cent. Around 12 pm, benches with a view in Sergels Torg were unoccupied for an average of only 22 seconds between one person and the other. People wish to sit on comfortable, well-located and quiet benches.

When it comes to benches comfy is better.

Jan Gehl also measured the activity levels in two newly-built public spaces, Kay Fiskers Plads in Copenhagen and Bryggetorvet Square in Oslo during a summer day in 2007 between 12 and 4pm. Activity was 10 times higher in Bryggetorvet Square. He observed 224 people using the square in Oslo and only 21 in Copenhagen. 95 per cent of those using Kay Fiskers Plads were standing and chatting, next to the fountain, or sitting on benches, or on the terraces

of many cafes; only 25 per cent did in Bryggetorvet Square. Kay Fiskers Plads is a poor quality monotonous public space, tarmac-dominated and with blind façades. It is at the city's periphery and works as a major transport hub where metro stations and buses of all kind meet, and hundreds of commuters drop their bikes, to jump on the bus or train. Brygetorvet Square is a real urban square, with limited car speed, (some) greenery and cafes with outdoor sitting places, so that it encouraged people both to walk through it and to stay and enjoy it. Kay Fiskers Plads merely told people to pass through to reach the metro station.[78] Of course, these two public spaces have very different functions. A metro station does not necessarily need to be a place to sit. However, its design could make the unavoidable waiting of travel less unpleasant. And this must be a good thing? Absent these few studies, writers have mainly used individual photographs to demonstrate their views. More systematic research is needed on the role of benches in the urban environment, to understand their optimal use and positioning, in creating more stimulating and successful places.

Bryggetorvet Square in Oslo.

Kay Fiskers Plads in Copenhagen.

4.2 More street lighting is normally better, but possibly only up to a point

Despite the shortage of studies on the role of lighting, in both indoor and outdoor environments, and their sometimes-contradictory nature, environmental psychologists have found that most people, most of the time, seem to prefer walking along well-illuminated streets and squares – certainly

at night.[79] Improved lighting certainly brings more pedestrians onto the streets in the evening. The highest formal level of lighting set in the UK is known as British Standard BS5489. This is a minimum of 5 lux and an average of 10 lux. (Five lux is broadly equivalent to the light at sunset). A 1996 study of three streets in London showed an increase in pedestrian footfall, when lighting was improved;

- 64 per cent on a pedestrian footpath and 69 per cent on a road in Edmonton;
- 72 per cent on a road in Tower Hamlets; and
- 54 per cent on a road in Hammersmith and Fulham.[80]

Better lighting is also associated with lower crime. A systematic review on the impact of street lighting on crime was conducted by a British Home Office Research Study, in 2002, in 13 areas in the United States and Britain.[81] They found that eight American cases showed a 7 per cent decrease in crime after lighting improvements. Five British studies showed a 30 per cent reduction. A meta-analysis, of the 13 experimental areas together, showed an overall reduction in crime of 20 per cent, after street light improvements. However, it does not follow that more light is always better. Too much light, particularly at night, can adversely impact health. For example, exposure to incandescent lighting for less than one hour can have a 50 per cent decrease in levels of melatonin circulation.[82] This has a negative effect on sleep quality, altering the 'sleep-wake' cycle, and on the body's ability to regulate body temperature, blood pressure and glucose levels.

Studies have also shown a positive correlation between night shifts at work (during which people are exposed to bright light at the 'wrong' time of day) and the risk of breast cancer. Among 78,562 women doing rotating night shifts at least three nights per month, over 30 years, there were 206 cases of breast cancer (36 per cent more than you would expect).'[83] This is particularly pertinent as, in urban areas, nearly 20 per cent of workers do alternative shifts at work.[84] Recent research suggests that, in London, this figure is as high as 30 per cent.[85] Perhaps an urban environment can be over-lit as well as under-lit. This is certainly true when taking into account energy usage. A balance is necessary between the needs of public safety and the needs of longer-term public health.

4.3 Arcades are 'no-brainers' when you have enough people

Arcades are covered walkways, normally at a building's edge, that are simultaneously within a building and outside. They can provide shelter from rain or sun. They emphasise the role of the edge of the square, or the retail excitement that lies within. Certainly, some of the most famous public places in the world, from Piazza San Marco in Venice to Rue de Rivoli in Paris, have arcades. So, did Greek stoa and

Roman fora. Several writers have argued that arcades, thanks to their convenience, scale and focus, stimulate social interaction and enhance the sense of security.[86] But is there any evidence? As we have seen, Jan Gehl's study of standing and sitting preferences, in Piazza del Popolo, suggests that this might be true.[87] It showed a measurable human preference for standing under arcades, or near their columns. Of 101 people he observed, standing at the edges of the square, 69 were sitting or standing below the arcades. Another ten were standing next to them.

There does not appear to be wider evidence on this point but, if it is true, why is it true? Some have argued that arcades provide variety in a pattern, rhythm without monotony.[88] They are the ultimate 'active ground floor.' The colonnade of Piazza San Pietro, in Rome, for example, has 284 columns, 88 pilasters and 140 statues. Blank façade it certainly is not. However, arcades have practical benefits as well. The benefits of arcades might consist of:

- Easy and sheltered access to shops;
- Wide and safe pedestrian footways along main streets;
- Places to meet;
- Sheltered entrances to public buildings; and
- Places to sit and rest, out of the sun or the rain.

'Point' an 'arcade' away from the street, or edge of the square, and inside an urban block and it essentially becomes a 'mini mall.' Many of the best shopping 'streets' in European cities are essentially re-directed arcades, 'mini-malls': examples include Galleria Vittorio Emanuele II, in Milan ('the place to see and be seen'), Galleries Royales St. Hubert in Brussels, Madlerpassage Arcade in Leipzig, Burlington Arcade in London, or Victoria Quarter in Leeds.[89] These are places to go to, as well as to stay.

Example of social interaction under the arcades in via Santo Stefano, Bologna.

But, as we are learning, success in some locations, does not guarantee success in all situations. Just because arcades work along busy square edges, or as 'mini-malls', it does not mean they can work anywhere or everywhere. Above all, when they are

ugly, or in lower footfall areas, when they don't properly define the edge of a space, or fail to align with the direction people need to go, then arcades cease to be arcades and can become frightening places, with poor natural surveillance. When does an arcade become something else?

A 1980s study of 52 modernist post-war residential housing blocks, in non-traditional street patterns, found that those raised on pilotis and above ground floor garages, were more likely to suffer from graffiti, general damage, public urination and sexual attacks.[90] In all of these, around 3 per cent of the variation could be statistically explained by the presence of pilotis. (Or, put statistically, there were standardised coefficients between 0.0282 and 0.0349).

4.4 Space to park?

Many have claimed that parked cars spoil the appeal and utility of public spaces. They take up space and 'spread everything out', as Jane Jacobs put it.[91]. They don't look nice. They drain the life and joy out of a square. Some have argued that small parking places, of up to six cars, are better than large ones. They reduce, it is claimed, the depressing effect, typical of car-dominated environments and are even better if surrounded by trees.[92] However, is this always true? Looked at purely superficially, not all streets with car parking seemed ruined by the fact.

A quiet, beautiful residential street in Amsterdam, yet with car parking on the sides.

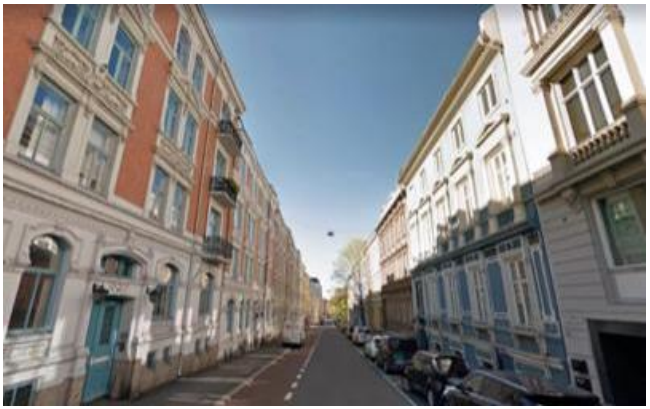
A fascinating study by Daniel Sauter and Marco Huettenmoser investigated the effects of street design and traffic on social interaction within a lively and diverse residential neighbourhood in Basel, Switzerland.[93] They looked at three different street types, distinguished by car speed limits:

- a single-carriageway street with a 50 km/hr speed limit and parking on both sides;
- a 30 km/hr speed limit street with parking on both sides; and
- three streets with 20 km/hr speed limits, an encounter zone, (pedestrian priority zones, where pedestrians have priority over all others), with some parking along the street, and two *woonerven* (Dutch for 'living streets', where

devices have been installed to reduce cars' speed limit and calm traffic), with no parking places at all.

They assessed nine features of the built environment: places to sit, footways' width, number of parking spaces, number of cars, cyclists and pedestrians; age of buildings, rents and house prices as well as residents' socio-demographic status. Sauter and Huettenmoser then ran a questionnaire on 425 residents' perceptions of social interaction.

Finally, they performed a regression analysis to evaluate the influence of environmental features on residents' perceptions. In a very important result, they found, with statistical confidence, that streets with limited parking spaces and reduced traffic measurably increased neighbourly social interaction. There was a reduction of around 1.7 per cent of interaction per km/hr increase in the speed limit. The table below shows the number of neighbours known on each street type. Streets appear to be better places to spend time on, when there is less traffic. Almost 25 per cent of the residents of the 50km/hr street said they 'occasionally' spent time on their street. This rose to 33 per cent for residents of the 30km/hr, and between 50 to 75 per cent for residents of the encounter zones. In short, traffic treatment could have a threefold impact on residents' use of their streets as a 'place to be' in their community. Why was this? One principle reason was that limited car speeds contributed to an enhanced sense of security on the street. 85 per cent of residents felt insecure on the 50 km/hr street. This fell to 51 per cent on the 30 km/hr street and to 24 per cent on the 20 km/hr street.



Example of parking lots' replacement with cycling lanes in Huitfeldts Gate, Oslo.

Street type	Total neighbours known personally	Neighbours known in own building or same side of the street	Neighbours known on opposite side of the street	Proportion of neighbours known on opposite side of the street (%)
50 km/hr street	11.1	9.5	1.7	18%
30 km/hr street	24.6	21.7	2.9	14%
20 km/hr street	22.8	15.2	7.5	50%
Encounter zone 1	17.8	12.1	5.7	48%
Encounter zone 2	22.3	16.1	6.2	39%
Encounter zone 3	32.6	19.5	13.1	67%

Street separating effect. Social mingling increases when the speed limit decreases.

4.5 Does public art make for better public places?

If the arrangement of benches can influence people's experience of a public space, can the nature or positioning of public art, be it a monument, statue, wall decoration, flower display, or street artist? Perhaps, too often, we walk past these, our conscious senses numbed by familiarity. But, maybe they are influencing our mood? When public art is more assertive, can it help stimulate social interaction? ('Gosh. What do you think of that?')[94] This is what William Whyte has called 'triangulation': 'the process by which some external stimulus provides a linkage between people and prompts strangers to talk to other strangers as if they knew each other.' For example, sculptures placed in the middle of Chase Manhattan Plaza, or in Federal Plaza in Chicago, in 1972, stimulated strangers to interact with each other. 'People are drawn to the sculpture, and drawn through it: they stand under it, beside it; they touch it. They talk about it.'[95] Street performers can also bring people together. William Whyte observed that people, in audiences he observed, were more attracted to other people in the crowd

than the musician, comedian or actor. For example, he cited the example of the young magician, whose tricks were so predictable that people preferred a conversation with their neighbour instead.

Are street performers a good excuse to start a conversation with your neighbour or just annoying?

Interview-based research has suggested that 'for each of the art forms, whether community or stylised murals, sculpture, monuments, or even graffiti, there is evidence that there is a public appetite for outdoor art.' [96] If the art is any good, then a 2009 survey by Ipsos MORI indicates that this is probably popular. To the question 'in which of the following have you experienced beauty?', 47 per cent of participants answered, 'through art'. This was higher than through buildings and parks (41 per cent), but lower than in natural environments (65 per cent).[97] However, what proportion of this might be through public art (in squares underneath pigeons, not in galleries underneath roof lights) is unknown. Similarly, what role (if any) public art or performance plays in mental health is unclear.

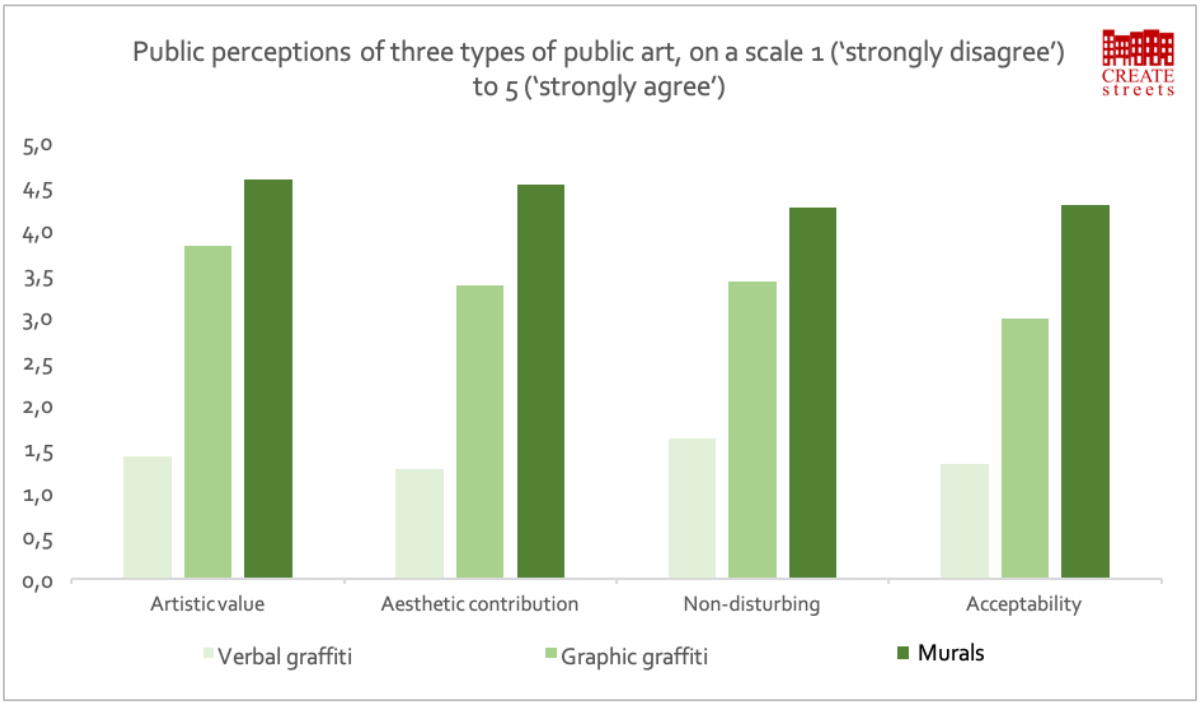
Analysis, using data from the 2001 Scottish Household Survey of nearly 10,000 people found a positive relationship between participation in the arts and mental health and wellbeing. It found, for example, that, 'those who attended a cultural place or event were almost 60 per cent more likely to report good health compared to those who did not attend.' Similarly, 'those who participated in a creative or cultural activity were 38 per cent more likely to report good health compared to those who did not participate in any cultural activity in the previous 12 months.'[98] However, as these figures do not control for socio-economic status and there is likely to be a demographic distinction between the

two groups they are, sadly, not very compelling. We need more data. Does the public perceive and respond to different types of art differently? There is some research, but not much. A study of perception of public art in Yogyakarta, Indonesia, found that murals painted on walls were considerably more popular than either verbal or graphic graffiti. Perhaps art that is 'not too challenging' is more popular with the public, even if it less popular with artists. Murals were between 23 and 68 per cent more popular than graffiti.[99] They were felt to have a positive impact on public space: on a scale of 1 to 5 (where 1 was very negative and 5 very positive) they were considered a good aesthetic addition to the public realm (4.5 points) with high artistic value (4.6 points).' The figure below shows city users and stakeholders' perception of Graffiti and Mural art.

Graffiti and murals considered for the study.

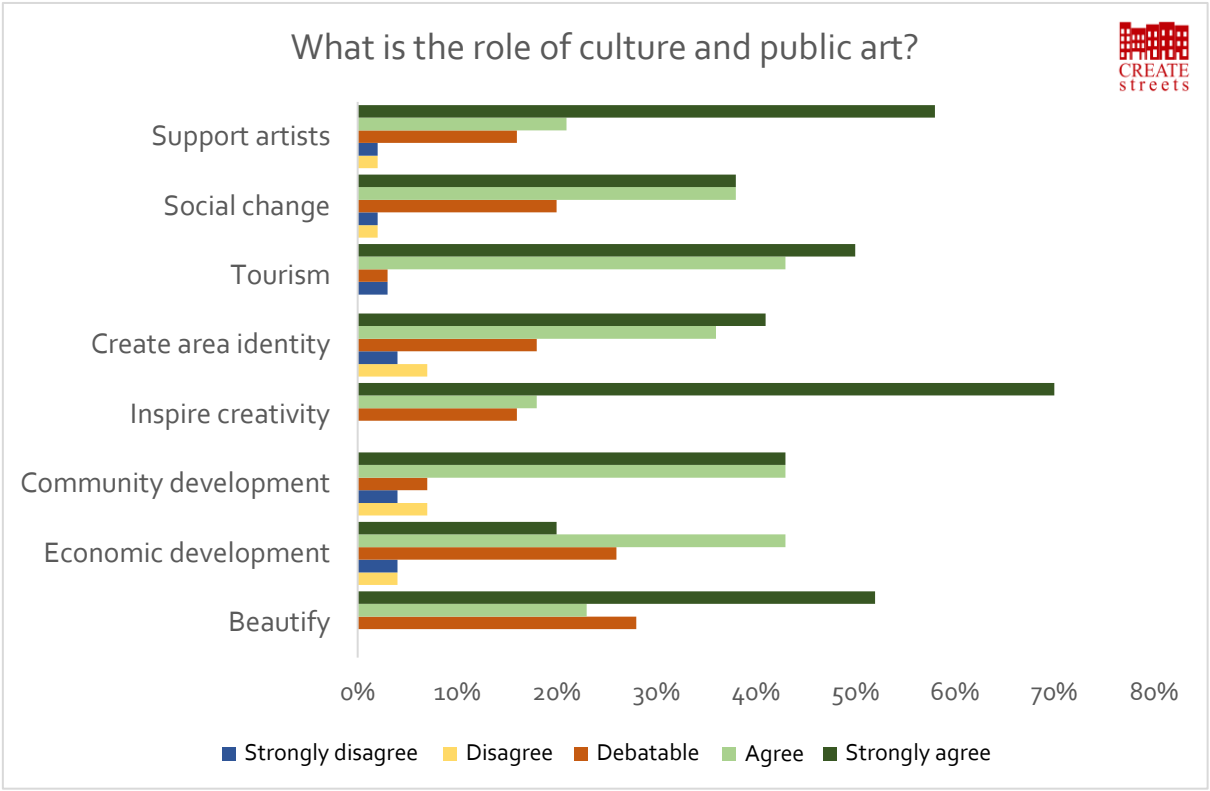
Analytical approach: the technique used was a combination of qualitative (desk study, literature and documentary review) and quantitative analysis (fieldwork, questionnaires and in-depth interviews). 124 city users were asked to fill in a questionnaire on a scale from one to five, where one corresponded to 'strongly disagree' and five to 'strongly agree'. The completion rate was 83 per cent. There were also in depth-interviews with nine different groups: artists, four local authorities, one urban expert and two local communities.

A 2017 study into the role of public art in new urban environments, interviewed several dozen passers-by, including tourists, artists and citizens in Katara Cultural Village, a neighbourhood in Doha, Qatar. Katara Cultural Village is a huge project designed by the government to attract investment and tourists. It includes large and small sculptures, murals and monuments. The study found that 70 per cent of respondents believed that the art on display inspired creativity, 55 per cent felt that it beautified public places and 50 per cent felt that it encouraged tourism and bolstered communities.[100]



City users and stakeholders' perception of Graffiti and Mural art.

Sculptures, Murals and statues in Katara Cultural Village, Doha.



Results of a street survey on the role of Katara Cultural Village's public art.

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(1) Urban greenery is good for us;
(2) We pay more for urban greenery, especially, when it is close to us or scarce;
(3) The best approach to urban greenery is little and often; and
(4) Greenery is great, but it is not enough.

5.1 Urban greenery is good for us

Greenery has normally had positive connotations.[101] From the garden, from which we are all exiled, to the Rose Gardens of Blandings Castle; from William Blake's concerns about the satanic perversion of rural England, to the representation of the same in the 2012 Olympics, a delight in greenery is axiomatic in much literature and in much modernist and late Victorian urban planning. Port Sunlight, Welwyn Garden City and mid-twentieth century towers in the park, were both (opposite) responses to the perceived need to introduce more greenery into quotidian lives.[102] Certainly, the presence of greenery in the urban environment tends to have a positive impact on our mental and even our physical health. This has been widely demonstrated and is both a psychological and a physical phenomenon. Researchers, such as Jun Yang and David Nowak, have found that the presence of greenery can help in keeping down pollutants.[103] Rome-based Anna Chiesura, and the Swedish researchers Anita Gidlöf-Gunnarsson and Evy Öhrström, found that greenery can reduce noise pollution.[104] It can also induce more physical activity – as shown by Billie Giles-Corti and Melvyn Hillsdon and their teams.[105]

A 2002 study, by the British Urban Green Spaces Taskforce, found that 46 per cent, out of 515 respondents, used green spaces more than once per week.[106] Greenery seems also to positively impact the psychophysical status of city dwellers by lowering levels of stress.[107] At least ten studies have now shown a link between regularly looking out at an attractive green environment and mood, stress, recovery from mental fatigue and wellbeing.[108] Though not strictly a matter of public space, the most well-known (and one of the first) studies was carried out by Roger Ulrich in 1984:

> *'Records on recovery after cholecystectomy of patients in a suburban Pennsylvania hospital between 1972 and 1981 were examined to determine whether assignment to a room with a window view of a natural setting might have restorative influences. Twenty-three surgical patients assigned to rooms with windows looking out on a natural scene had shorter postoperative hospital stays, received fewer negative evaluative*

comments in nurses' notes, and took fewer potent analgesics than 23 matched patients in similar rooms with windows facing a brick building wall."[109]

These benefits carry through into the measurable wellbeing of residents. There is excellent recent evidence that (at least in prosperous areas) well managed communal gardens can be positively associated with high levels of neighbourliness, activity and community awareness.[110] And at least eight studies have shown some level of vegetation, near to buildings, can be associated with lower levels of expected crime, fear of crime or with lower levels of residents' violence. More strikingly, a study of one of the US's poorest districts (98 apartment buildings, in the 1940s Ida B. Wells public housing development in Chicago) showed how buildings, without trees and greenery around them, suffered from predictably more crime than buildings with trees and vegetation. This was true even when building height and size were controlled for. Levels of vegetation explained as much as 7-8 per cent of variance in crime block to block. Academics believe that this is due both to the calming effect of greenery and to its association with greater outdoor use of spaces.[111]

5.2 We pay more for urban greenery, especially when it is close to us, or scarce

People are normally more rational than they are given credit for. Other things being equal, most of us will normally pay more for a property that has a small garden, or easy access to a town square or park. One of the most comprehensive of the many studies into the relationship between greenery and value, was carried out by the American researchers Keith Bartholomew and Reid Ewing. They undertook a wide literature review, encompassing several factors in different geographic contexts, affecting property prices.[112] They concluded that price premiums were normally associated with properties located close to protected open spaces and that the size of the monetary benefits partially depended on the size of the open space, on its proximity to central areas and on the density of its surrounding neighbourhood. Denser neighbourhoods valued it more and proximity was often more important than size.

Another extensive literature review, by Henrik Lönnqvist, published in 2015, generally confirmed Bartholomew and Ewing's overview, though stressed that there were exceptions when greenery was associated with anti-social behaviour or congestion.[113] It found that fully-grown trees located within the curtilage of a property had positive effects on house prices. Distance really matters. Walking to greenery is best of all. The study found that recreational areas provided monetary benefits, if they were located within walking distance of a dwelling. Views of natural amenities predictably increased house prices. To cite just one example, of the importance of proximity over size, Benjamin Bolitzer and Noelwah Netusil carried out an analysis

of 16,402 transactions, from 1990 to 1992, in Portland, Oregon, US, using hedonic regression.[114] They found that proximity mattered more than size. On average, homes located within 1,500 feet of any open space sold for 3.2 per cent more than houses located beyond this threshold. The size of these open spaces was found to have a predictable though very modest, impact on house prices. Every one hectare increase only corresponded to an additional premium of 0.04 per cent.

5.3 The best approach to urban greenery is little and often

And yet, of course, it is not as simple as this. The first problem is that greenery that is *too* thick, or which might potentially harbour criminals waiting to pounce, can frighten, create stress and indeed correlate with higher crime. At least eight studies have shown high levels of general fear, or fear of crime, associated with denser vegetation, specifically in parks, and more generally. To cite one summary of the evidence;

> *'In safety ratings for 180 scenes of parking lots, the more a photo was covered by vegetation, the lower the perceived security. And in research examining fear of crime on a university campus, dense understories that reduced views into areas where criminals might hide were associated with fear of crime. In these and other studies, view distance seems to be an important factor. Fear of crime is higher where vegetation blocks views.'*[115]

This would appear, at least on occasions, to be rational.

> *'Not only has dense vegetation been linked to general fears and to fear of crime in particular, but two studies have pointed more directly at a facilitative role of vegetation in crime. In the first study, park managers and park police indicated that dense vegetation is regularly used by criminals to conceal their activities … In the second, … automobile burglars described how they used dense vegetation in a variety of ways, including to conceal their selection of a target and their escape from the scene, to shield their examination of stolen goods, and finally, in the disposal of unwanted goods …The clear theme in all these studies is that dense vegetation provides potential cover for criminal activities, possibly increasing the likelihood of crime and certainly increasing the fear of crime. Large shrubs, underbrush and dense woods all substantially diminish visibility and therefore are capable of supporting criminal activity.'*[116]

As the Chicago Ida B. Wells study showed, this is not always true, but it clearly *can* be true. In a telling illustration of the capacity of vegetation to be threatening, as well as restorative, when a resident was shot in a communal garden, on the South

London Aylesbury Estate, his body lay undiscovered for 24 hours.[117]

A second problem is that managing greenery can be expensive. When the Ida B. Wells development, discussed above, was first built, *all* the courtyards had trees and grass, but 'over time, many of these green spaces have been paved in an effort to keep dust down and maintenance costs low; this paving has killed many of the original trees.'[118] There is evidence that green space is degrading into hard, paving for reasons of economy, in the UK at present.[119] Clearly, designing beautiful green space only for it to grow into potentially threatening vegetation, or be cut down to barren paving, is not much of a success. But, certainly communally, the type of biologically complex, parkland or mini-parkland that seems to optimise both what people like, and in which they best relax, is not necessarily cheap to manage. No one can honestly guarantee that there will be a budget, or the social capital, for the management of a given portion of green space indefinitely. Private developments can be mismanaged. Public budgets can be cut. Communal gardening schemes can wither and die.

Thirdly, even if well-maintained, green space clearly needs to be *used* and *seen* to be effective. This is not just a matter of landscape management and the need for well-maintained not overly-dense vegetation. It also a matter of urban form and town-planning. Greenery that is too big, too rare and too far from the home may not be used. An indicative survey of dozens of New Yorkers found that none of them had been to Central Park in the previous week.[120] By contrast, there is some evidence that the actual experience of gardening, of physically engaging with the soil, brings the most benefits.[121]

UK focus group research, by Ipsos MORI, also shows that, given the choice, most people would rather have access to modest private gardens, that they can use effortlessly every day and which seem to work better in managing family stress and wellbeing. Ipsos MORI found that 'private gardens were preferred to shared gardens' and that typical British apartment block residents 'appreciated that the properties were set in a natural area, [but] they felt that this space was difficult to use as a personal outdoor area, as sharing the area with others did not tend to work well.'[122] Parents had the strongest preference for private gardens. One interviewee commented: 'I would like my living space to lead onto my garden. At the moment I'm upstairs and the garden's down. My son is a terror, he needs space to run but I don't always want to be out in the garden.'[123]

The implication of this is that the way to maximise the positive impact of greenery is to see it, even feel it, as regularly as possible. This is a natural consequence of, and corollary to, maximising the number of houses and modest, but frequent open

spaces. Many of the flats that have been found to be meaningfully associated with less good mental health outcomes had no private gardens.[124]

One study found that looking out on greenery, from your window, rather than other people's walls or windows, sharply increases the perception of space and privacy.[125] Large parks are great for those who live by them, have to pass through them, or have the leisure to visit them. They are not so helpful for everyone else. Evidence suggests that people will frequently go to an open space, if it is less than 2-3 blocks away (about 225m), but very sharply less frequently if it is further away than that.[126] For maximum impact, public green space needs to be frequent, close and modest in size. As we have seen, in Ipsos MORI focus groups, many (particularly parents) would trade off maximum green space in favour of immediate access to private green spaces.[127] The evidence also suggests that streets' trees are a 'no regrets' move. Over many years, a combination of poor maintenance, pollution or traffic engineers' concern over safety, killed off older trees and prevented newer ones being planted. We could not have got it more wrong. To take the point on safety first, the key determinant to how fast we drive is *not* the speed limit but how safe we feel. The rational response to obstacles on an urban street - such as trees - is to drive more slowly. This is precisely what we do. One study found that the presence of trees, on an otherwise similar stretch of urban street, reduced speeds by 7 to 8 miles per hour.

This makes streets safer. A study of five arterial roadways, in central Toronto, found that mid–block car crashes declined by between 5 and 20 per cent, in areas where there were features, such as trees or concrete planters, along the road. Similarly, urban 'village' areas in New Hampshire, containing 'on–street parking and pedestrian-friendly roadside treatments', were 'two times less likely to experience a crash' than the supposedly safer roadways preferred by most transport engineers. Several other American studies corroborate this.[128]

But the benign impact of street trees on public wellbeing appears to be much more profound than this. Urban trees improve air quality.[129] They moderate heating and cooling energy use.[130] And people aesthetically prefer streets with trees.[131] Above all, and perhaps astonishingly in the complexity of human life, street trees have a measurable effect on human health even taking into account income, age and education. One recent Canadian study is incredibly compelling. It was able to map the precise location of 530,000 Toronto trees and compared them to the health, records of 30,000 Toronto residents. They found that 'people who live in areas with higher street-tree density reported better health perception and fewer cardio-metabolic

conditions compared with their peers living in areas with lower street-tree density.'[132]

The comparison took account of age, income and education levels and was able to quantify the impact:

> *'Having 10 more trees in a city block, on average, improves health perception in ways comparable to an increase in annual personal income of $10,000 and moving to a neighbourhood with $10,000 higher median income or being 7 years younger."*[133]

An equally recent London study found an association between the density of streets-trees and the rates of anti-depressant prescribing:

> *'After adjustment for potential confounders … we find an inverse association, with a decrease of 1.18 prescriptions per thousand population per unit increase in trees per km of street (95% credible interval 0.00, 2.45). This study suggests that street trees may be a positive urban asset to decrease the risk of negative mental health outcomes."*[134]

In short, at multiple levels, the evidence for regular green spaces and for street streets would appear to be highly compelling. But what about the buildings that go round them?

5.4 Greenery is great, but it is not enough

In one important recent British project, Chanuki Seresinhe at the University of Warwick (and a Create Streets fellow and contributor to this study) has taken advantage of the power of crowdsourcing to gauge 1.5 million ratings of the 'scenic-ness' of 212,000 pictures. These findings were then compared to self-reported health, from the 2011 census. Importantly, they found that the 'differences in reports of health can be better explained by the 'scenic-ness' of the local environment than by measurements of green space.'[147] Dr Seresinhe commented;

> *'This is a fascinating finding. Just because a place is green does not compel us to feel better on its own. It seems to be that the beauty of the environment, as measured by 'scenic-ness', is of crucial importance. Our results suggest that the beauty of our everyday environment might have more practical importance than was previously believed. In order to ensure the wellbeing of local inhabitants, urban planners and policy-makers might find it valuable to consider the aesthetics of the environment when embarking upon large projects to build new parks, housing developments or highways. Our findings imply that simply introducing greenery, without considering the beauty of the resulting environment, might not be enough."*[148]

The research team also performed a colour analysis on the photographs. Again, the findings of this study, of 1.5 million individual judgements, strongly implied

that beauty and attractive aesthetics are not just a matter of fields and trees:

> *'Our colour analysis also reveals that 'scenic-ness' does not simply constitute large areas of green. Indeed, we find that the most scenic areas do not contain the most green, but rather contain high proportions of blue, grey and brown.'*[149]

Other, recent research has also highlighted that greenery is not the only, or necessarily even the most consistent, aspect of a view that people find scenic or beautiful. It is the quality that matters. A pilot study by a Create Streets Fellow, Sofie Pringle, at the Queensland University of Technology, has used images from Instagram to find out the 'parameters of urban happiness.'[135] Through this 'thematic analysis of images', she was able to identify the design elements that were most likely to make people happy. Natural spaces with parks, gardens and areas with trees, or water, significantly contributed to people's happiness. She then asked 30 Brisbane residents and workers to fill in a detailed online questionnaire. She found that, despite the different cultural and experiential backgrounds of the respondents, the two tests gave similar results. Participants classified three main categories as those that made them feel happier (from most important to least important):

- 'Open space': 86 per cent of respondents;
- 'Natural lighting': 81 per cent of respondents; and
- 'Heritage buildings': 72 per cent of respondents.

In short, greenery matters. But so do beautiful buildings.

Sample of images used for the study.

[101] This chapter is largely based on previous Create Streets research published in *Heart in the Right Street* and *Beyond Location*.

[102] Port Sunlight is doubly influential. Not just did it physically point the way to the garden city movement and to the suburbanisation of British design. Its patron, Lord Leverhulme also funded the world's first school of town planning, The Department of Civic Design, at Liverpool University in 1909 with funds won in a libel action from *The Daily Mail.*

[103] Yang, J., McBride, J., Zhou, J., & Sun, Z. (2005). *The urban forest in Beijing and its role in air pollution reduction*. & Nowak, D. J., Crane, D. E., & Stevens, J. C. (2006). *Air pollution removal by urban trees and shrubs in the United States*.

[104] Chiesura, A. (2004). T*he role of urban parks for the sustainable city*. & Gidlöf-Gunnarsson, A., & Öhrström, E. (2007). *Noise and well-being in urban residential environments: The potential role of perceived availability to nearby green areas*.
[105] Giles-Corti, B., Broomhall, M. H., Knuiman, M., Collins, C., Douglas, K., Ng, K., ... & Donovan, R. J. (2005). *Increasing walking: how important is distance to, attractiveness, and size of public open space?* & Hillsdon, M., Panter, J., Foster, C., & Jones, A. (2006). *The relationship between access and quality of urban green space with population physical activity*.
[106] Dunnett, N., Swanwick, C., & Woolley, H. (2002). *Improving urban parks, play areas and green spaces*. London: Department for transport, local government and the regions. (p. 35).
[107] Hartig, T., Mang, M., & Evans, G. W. (1991). *Restorative effects of natural environment experiences.* & Conway, H. (2000). *Parks and people: the social functions*. *The regeneration of public parks*.
[108] For a more extensive discussion of the evidence linking greenery and mental wellbeing see, Kuo, F. E., & Sullivan, W. C. (2001). *Environment and crime in the inner city: Does vegetation reduce crime*
[109] Ulirch, R (1984), *View through a window may influence recovery from surgery*. This is a brilliant piece of research which carefully chose 23 pairs of patients controlling for their condition, lifestyle and even nurse so that their windows remained the main variable.
[110] Andersson, J. (2015), *"Living in a communal garden" associated with wellbeing while reducing urban sprawl by 40%: a mixed-methods cross-sectional study.*
[111] Kuo, F., Sullivan, W. (2001), *Environment and Crime in the Inner City: does Vegetation reduce crime?*
[112] Bartholomew, K. and Ewing, R. (2011*). Hedonic price effects of pedestrian-and transit-oriented development*.
[113] Lönnqvist, H. (2015). *On the Effects of Urban Natural Amenities, Architectural Quality and Accessibility to Workplaces on Housing Prices–an Empirical Study on the Helsinki Metropolitan Area.*
[114] Bolitzer, B., & Netusil, N. R. (2000). *The impact of open spaces on property values in Portland, Oregon*.
[115] Kuo, F., Sullivan, W. (2001*), Environment and Crime in the Inner City: does Vegetation reduce crime?* The studies being summarised are: Schroeder, H., & Anderson, L. (1984). *Perception of personal safety in urban recreation sites.* & Nasar, J. & Fisher, B. (1993). *"Hot spots" of fear and crime: A multi-method investigation.*
[116] Kuo, F., Sullivan, W. (2001), *Environment and Crime in the Inner City: does Vegetation reduce crime?* (p.345).
[117] Boys Smith, N., Morton A. (2013), Create Streets. (p. 41).
[118] Kuo, F., Sullivan, W. (2001), *'Environment and Crime in the Inner City: does Vegetation reduce crime?*
[119] Jones, M. (2012) *High density housing – the impact on tenants*.
[120] Montgomery, C. (2013), *Happy City.* (p.121). This evidence is less robust than most of the sources cited in this survey.
[121] Guitart D., Pickering C., Byrne J. (2012), *Past results and future directions in urban community gardens research. Urban Form, Urban Green.* & Pillmer, K., Fuller-Rowell, T., Reid, M, Wells, N. (2010), *Environmental outcomes and volunteering over a twenty year period.*
[122] RIBA (2012), *The way we live now*. (p. 49, p. 52). This evidence is less robust than most of the sources cited in this survey.
[123] RIBA (2012), *The way we live now.* (p. 53).
[124] For example, see, Weich S, Blanchard M, Prince M, Burton E, Erens B, & Sproston, K. (2002). *Mental Health and the Built Environment: Cross-sectional Survey of Individual and Contextual Risk Factors for Depression*.
[125] Day, L. (2000), *Choosing a House: the relationship between dwelling type, perception of privacy and residential satisfaction*.
[126] In a 1971 California study trips per week to a small local part fell from over 19 a week at one block's distance, to an average of barely more than zero per week at more than four blocks' distance. Alexander, C. (1977), *A Pattern Language* (p. 305-308).
[127] RIBA (2012), *The way we live now*. (p. 49-53).
[128] Dumbaugh, E. (2006), *Safe Streets, Liveable Streets.*
[129] Nowak, D. J., Crane, D. E. & Stevens, J. C., (2006). *Air pollution removal by urban trees and shrubs in the United States, Urban forestry & urban green*. & Nowak, D. J., Hirabayashi, S., Bodine, A. & Greenfield, E., (2014). T*ree and forest effects on air quality and human health in the United States*.
[130] Akbari, H., Pomerantz, M. & Taha, H., (2001). *Cool surfaces and shade trees to reduce energy use and improve air quality in urban areas*.
[131] Smardon, R. C., (1988). *Perception and aesthetics of the urban-environment - review of the role of vegetation.*
[132] Kardan, O. *et al*., (2015). *Neighborhood greenspace and health in a large urban cente*r.

[133] 'Scientists have discovered that living near trees is good for your health', *Washington Post,* 9 July 2015.
[134] Taylor, M. Wheeler, B., White, M., Economou, T., Osborne, N. (2015) Research note: Urban street tree density and antidepressant prescription rates—A cross-sectional study in London. (p. 174–179).
[135] Pringle, S., & Guaralda, M. (2018). *Images of urban happiness: A pilot study in the self-representation of happiness in urban spaces.* (p. 97-122).

If the size, shape, contents, volume of traffic and amount of greenery matters, in understanding the quality and popularity of public spaces, what about the architecture? It is a truism, among many architects, that design preferences are entirely subjective, or even immaterial alongside issues of urban design or social equity. But is this true? Urban form and horizontal infrastructure (what is physically in a public space) certainly *do* matter. Does the vertical infrastructure matter as well? Do we need to worry about what the buildings actually look like? Does beauty matter? Indeed, is there such a thing as beauty or merely an infinite variety of human preferences? In fact, (though still far from perfect) the evidence we have been able to find seems to show that which buildings people like (or don't like) is fairly predictable, and does matter, for people's mental health and behaviour. We have found that:

(1) What most people like, most of the time, is fairly predictable;
(2) Living in places that you find attractive is good for your mental health;
(3) Façades should 'live' and have variety in a pattern;
(4) Some façade complexity is good, but not too much. Coherence matters too;
(5) Some colour is nice; and
(6) People seem to prefer some symmetry in their facades.

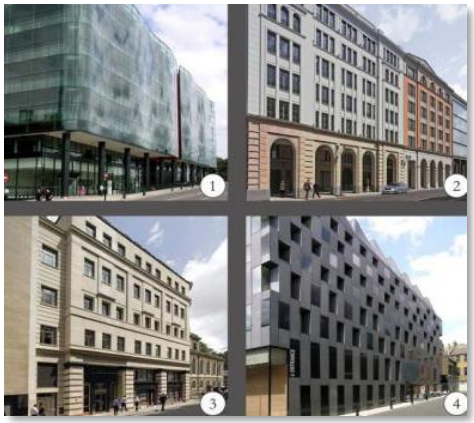
6.1 What most people like, most of the time, is fairly predictable

It's a commonplace belief among designers that style is purely a matter of unknowable personal taste, with the sophisticate's preference for burnished steel as valid as (indeed more valid than) the petit-bourgeois liking for sash windows or red bricks. When receiving his 2017 Royal Town Planners Institute Medal in 2017, the well-known British architect, Sir Terry Farrell, dismissed the concept of 'beauty' as an appropriate theme for considering the future of London. Purely statistically, this would appear to be incorrect.

What most people like, architecturally, is remarkably predictable. For example, in every survey of British preferences that we have conducted, or have been able to find, there is either a strong, very strong or overwhelming preference for what might be termed 'a more visually complex and historically-referenced' style. People seem to care far more about a 'sense of place' (buildings should fit in with their surroundings) than a 'sense of time' (buildings must stand for today's zeitgeist). Starting with indicative evidence, back in 1989, 99 per cent of letters sent to the Prince

of Wales, in response to his anti-modernist television programme, Vision of Britain, were supportive.[136] A 2001 BBC list of 'Britain's worst buildings' was entirely composed of modernist, or post-modernist, tower and slab blocks, dating from the 1960s to the present day.[137] A 2004 list of the ten worst and ten best buildings in Britain, spontaneously given by a sample of 2,000, also listed no recent building in the 'Best Buildings' list and named exclusively recent buildings among the ten worst buildings list.[138] A 2005 survey had very similar findings. [139]

This evidence is obviously strongly indicative, rather than robust, but it is backed up by other data sources over many years. Research, from 1994, found that 67 per cent would 'prefer an older looking property or copy of an older design.' In 1997, the Halifax Building Society interviewed a sample of 302 intending and recent house buyers. Only 12 per cent wanted to buy a 'more innovative and up-to-date in appearance' new house. In 1998, a survey asked if 'Old styles are right for new houses' and 'New houses should not imitate old houses.' 63.5 per cent thought old styles were right for new houses: 15.5 per cent did not. 54 per cent thought new houses should imitate old houses: 25 per cent did not. None of these questions, or surveys, had any visual prompts so different respondents will have interpreted them differently. Nevertheless, they paint a not inconsistent picture of between 60-80 per cent support for a less self-consciously assertive approach to design. The only way of overcoming uncertainties in use of vocabulary is to use pictures. There remains a risk of bias, via choice of images, but choosing images from the same angle and distance, in the same weather conditions, and with equal presence of trees or parked cars, should take account of that. At least five pieces of recent research have used fairly selected visual material, to assess architectural preferences, with consistent results.[140]



Stylistic preference for commercial buildings was 77 per cent (2 and 3) vs. 23 per cent (1 and 4).

To cite only the most recent two, in 2005, a YouGov survey sought to determine whether the British public prefers traditional or contemporary buildings for non-residential buildings, 77 per cent of respondents who selected a design, from a choice of 4, chose traditional architecture over contemporary styles. Only 23 per cent chose contemporary buildings. The survey asked 1,042 respondents to

select a preferred building from a choice of four, in answer to the question; 'Please imagine a new building is planned to be built near where you live. Four different designs are proposed. Please look at the designs below. Which one would you most like to be built near you?' The illustrations showed new buildings of a similar height, size and orientation to the street. Some of the most recent evidence is from an Ipsos MORI poll, commissioned by Create Streets in 2015.It asked respondents if, in principle, they supported the building of new homes on brownfield land (previously developed but now vacant), near where they lived. The poll found that 64 per cent of adults supported the building of new homes, locally on brownfield land, and 14 per cent opposed. Respondents were then shown five photos illustrating different types of housing (figure below).

For each, they were asked if they would support or oppose the building of 10 similar-style homes, in their local area. The most conventional in form, style, and materials won 75 per cent and 73 per cent support. (Of these, one might be termed 'modern vernacular' and one is what architects might condemn as 'pastiche.' But both have a complex and yet coherent pattern). Blander facades won 23 per cent and 34 per cent support. Designs that respond to people's preferences can materially change support for new homes. Among the 14 per cent who opposed building "in principle," half changed their mind for the most popular design option.[141]

Impact of design on support for new building.

Perhaps underpinning much of this research is a desire, in an international world, for home as a place of refuge. Research Create Streets conducted in 2014 for the Prince's Foundation for Building Community, based on participants in British community engagement projects over 15 years, implied strongly that most of us crave a 'sense of place' that, many feel, most contemporary housing just fails to provide.[142] Though it is not the focus of this study, pricing data widely corroborates this polling.[143] So does our own work running dozens of visual preference surveys for, and with, neighbourhood and community groups up and down the country.

6.2 Living in places you find attractive is good for your mental health

But does any of this matter? Even if we can predict what most people will like, does it actually have any impact on their propensity to use space or to feel good using it. In fact, the potential importance of the beauty of urban areas, on health and happiness, is now starting to emerge from a growing list of metadata studies. As we have seen, an important recent British project, by Dr Chanuki Seresinhe, has used 1.5 million ratings of the 'scenic-ness' of 212,000 pictures, compared to self-reported health, to understand the relationship between how attractive a place is and physical and mental health:

> *'It seems to be that the beauty of the environment, as measured by 'scenic-ness', is of crucial importance. Our results suggest that the beauty of our everyday environment might have more practical importance than was previously believed.'*[148]

The team's colour analysis bore this out, finding that most scenic areas do not contain the most green, but rather high proportions of blue, grey and brown.'[149] This measurable emotional attachment to beautiful places would appear to have consequences. A 2011 survey, of 27,000 respondents in ten US cities, found stronger correlations between a place's physical beauty and people's satisfaction with their communities than any other attributes. It had, for example, a correlation of 0.56 with overall place happiness, 0.53 with city satisfaction and 0.51 on recommending a city as a place to live for family and friends. Factors such as 'overall economic security' came nowhere close.[144]

A 2008-2010 Gallup survey, of 43,000 people in 26 cities, agreed. It found that residents' ratings of the aesthetic attraction of their cities and green spaces correlated significantly with their attachment to their city. This, in turn, correlated with GDP growth. In this survey, aesthetic attraction to their city came third in the pecking order behind 'Social Offerings' (what there was to do) and 'Open-ness' (perception of open-ness to different types of resident) as a predictor of attachment. However, it still ranked above education, basic services or safety.[145] A third study also found that a perception of beauty is significantly associated with community satisfaction and significantly more important than individual demographic characteristics.[151] The 2001 Survey of English Housing found a strong relationship between place satisfaction and 'visual quality.' Those living in areas judged by an independent surveyor as having the best visual quality in England were the most satisfied with their area. Those living in areas with the worst visual quality where the most dissatisfied. 77 per cent of those living in the highest visual quality areas were satisfied with their area. In contrast, only 29 per cent of those living in the worst visual quality areas were satisfied with their area. Finally, a well-

controlled 2015 Ipsos MORI survey found indicative associations between levels of perceived beauty, in residential areas, and physical and mental health.[152] From the evidence to date on popularity, environmental psychology and 'scenic-ness', health and emotions, it is hard not to conclude that architecture and perceptions of beauty matter. However, this only begs the question: what elements of buildings do people find attractive and why?

6.3 Facades should have variety in a pattern

As long ago as 1961, the American urbanist Jane Jacobs argued that busy street facades with multiple uses, openings, variety and forms would attract more activity and encourage the sort of neighbourly interactions that strengthen social ties and provide increased natural surveillance.[146] Jan Gehl has used the distinction of 'walking architecture' versus 'driving architecture' to encapsulate this. 'Walking architecture' is readily appreciated at pedestrian speed or at eye level. It tends to be fine-grained urban and rich in details. 'Driving architecture' is characterised by simpler design, which offers unambiguous signals to those driving at speed. Subsequent research is justifying these concepts.

Jan Gehl has conducted the best-known studies and found that the 'treatment of the city's edges, particularly the lower floors of buildings, has a decisive influence on life in city space.' In many cities around the world, the most attractive shopping centres all share the same rhythms: 15 to 20 shops per 100 metres of street, which corresponds to new experiences for pedestrians every four to five seconds.[147]

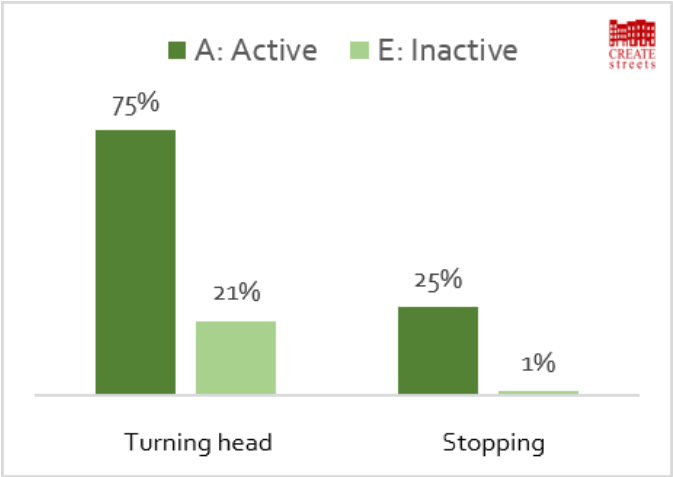
'The best courtyards have many entry points, a view to the streets beyond, and enclosing walls that are fenestrated, not blank. These are used most often."[148]

The evidence certainly seems clear that active, interesting facades promote street life, neighbourliness and even enhanced social support, and (in some cases) better physical health. For example, in one Copenhagen study, two very different types of façade were compared. The first, the active façade, featured 'varied facades with many doors, visual contact between outside and inside and various functions.' The second, the more passive

façade, was composed of 'uniform facades with few doors, blind or no windows and few or no functions.' Gehl's team then compared the number of people passing, their speed and the number of people who stopped, or turned their heads, on a series of summer days and autumn evenings. They found that:

- Pedestrian traffic was 13 per cent slower along the interesting facades;
- 75 per cent of people turned their heads, along the interesting facades, compared to only 21 per cent along the less interesting facades; and
- 25 per cent of pedestrians stopped in front of the interesting facades, compared to only 1 per cent in front of the sterile facades.

The chart below shows the results of the observations.



Percentage of people turning their head towards, and stopping in front of, the Active façade (A) and Inactive façade (E).

'Walking' (left) vs. 'Driving' (right) façade types.

Examples of active (left) and inactive (right) façade types.

In aggregate, Gehl's team calculated that there was around seven times as much activity in front of the active facades as the passive. Other studies, in Madrid, Melbourne and Stockholm had similar findings.[149] It isn't just that people stop more either. Sterile 'edges' have actually been proven to affect levels of sociability and helpful behaviour – all meaningfully correlated with wellbeing. A recent experiment, led by Charles Montgomery in Seattle, selected two facades in the same neighbourhood. One was highly 'active', with 'a high concentration of small businesses, opportunities for pedestrians and a high level of visual interest.' The other, a 'block-long blank warehouse wall was highly 'inactive.' Volunteers posed as lost tourists at both locations.

They stood on the pavement, looking confused and with an open map. The 'lost tourists' did not approach anyone. They waited for random passers-by to offer help.

> *'The results were remarkable. Pedestrians at the active façade site were nearly five times more likely to offer assistance than at the inactive façade site: 10 per cent of passers-by offered assistance at the active site versus 2.2 per cent at the inactive site. Of those who helped, seven times as many at the active site offered to let our 'tourist' use their phone (7 per cent versus 1 per cent). Four times as many offered to actually lead our tourist to their destination (4 per cent vs 1 per cent).'*[150]

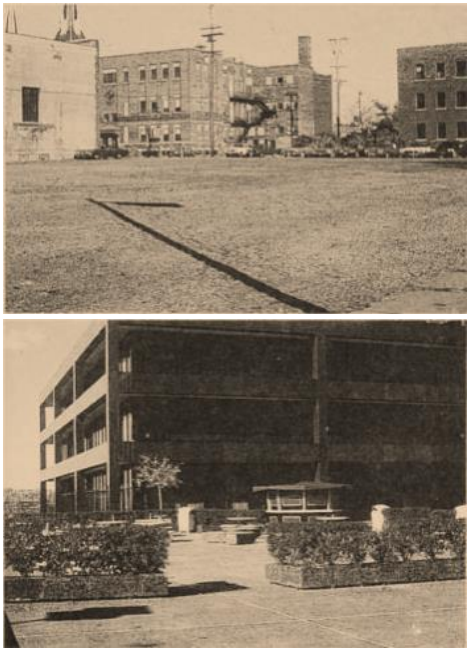
Active (top) and inactive (bottom) facades led to different behaviour from pedestrian behaviour.

Recent academic research is starting to explain why. A study of 29 shopping areas, in Maastricht, was conducted by Harmen Oppewal and Harry Timmermans, to determine which public areas people preferred to visit. 214 participants were asked to rate 128 images of places, based on a list of 10 attributes of appearance, layout and furnishing of shopping centres. They found that the four most important variables, that mostly influenced people's choices, were; maintenance levels, shop-front appearance and presence of activities and cafes with the presence of green areas a little way behind. Maintenance levels, attractive large shop windows, the number of street activities and the number of cafes all had what statisticians call p-values of 0.000 or 0.001. This means that there is almost 100 per cent probability that the appearance of the place depends on these factors. The amount of greenery also had a positive relationship, but with a p-value of 0.010 – still important, but suggesting an almost 100 per cent probability that the appearance of the place depends on the amount of greenery.[151]

6.4 Some façade complexity is good, but not too much

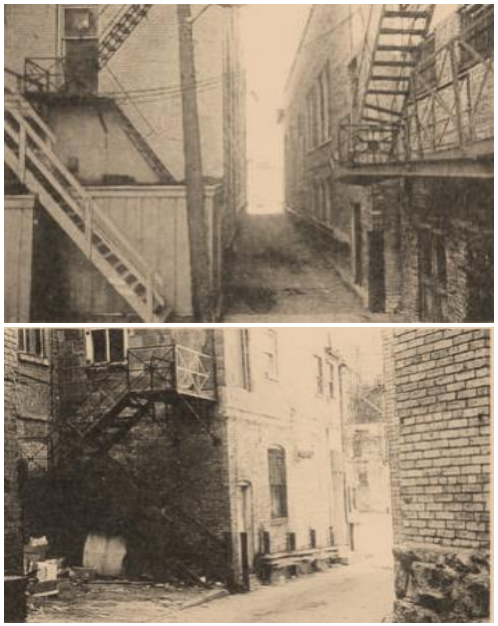
Researchers are starting to find that 'people consistently prefer moderate levels of visual complexity, but also tend to like inherent order'.[152] For example, in 1992, Thomas Herzog conducted an important 1992 cognitive analysis on which urban spaces students preferred at Grand Valley State University. 326 undergraduate students were shown 70 colour slides of urban settings (with no people). They showed four categories of urban spaces: eight were open or un-defined; 19 were spacious, but well structured; 11 were enclosed; and eight had blocked views. Examples are shown below. Participants were

asked to rate how much they liked each space, based on a scale of 1 to 5, where 1 was 'not at all' and 5 was 'a great deal'.



Open/undefined spaces and well-structured spaces.

Space with a blocked view.



Enclosed spaces.

They found that nine predictor indicators explained 87 per cent of the variances in people's preferences. The key ones were 'coherence', 'legibility', 'complexity' and 'mystery'. They also found that well-structured spaces were the most favoured images. They were;

- Preferred with a rating of 3.4 out of 5, (compared to an overall average of 2.2);
- Judged as more 'coherent', with a rating of 3.7 out of 5 (compared to an overall average of 3.0); and
- Judged as more 'legible', with a rating of 3.5 out

of 5 (compared to an overall average of 3.2).

This seems to confirm an older 1972 study, by Stephen Kaplan, which found that we seem to prefer scenes that have a moderate level of complexity. They seem to hold our interest for longer.[153] Based on the ratings, of 88 participants, of 56 images of urban and rural spaces, Professor Kaplan found that complexity;

- Had a positive relationship with preference of urban spaces, with a standardized coefficient of 0.78, which means that complexity explains 61 per cent of the variance in preference for urban spaces; and
- Had a positive relationship with preference of rural spaces, with a standardised coefficient of 0.69, which means that complexity explains 48 per cent of the variance in preference for rural spaces.

Can too much complexity be a 'bad thing'? There is some analogous research, on modern paintings, that too much confusing information to process can overwhelm the visual system, become harder to process and lead to less popular images.[154] For example, a 1980 study into art preferences found that very ambiguous paintings, were judged by most people as less pleasant because they could not easily 'read' them. 43 undergraduate students from the University of New Brunswick, Canada, were shown 20 slides of Cubist paintings, with a 'fairly broad range of ambiguity' and had to rate each painting on a scale 1 to 10, where 1 was 'not interesting' and 'not pleasant' and 10 was 'very interesting' and 'very pleasant'.

Cubist painting with highest subjective ambiguity (Braque, left) and lowest subjective ambiguity (Picasso, right).

A measure of *subjective ambiguity* was earlier attributed to each painting. This was calculated using a diversity index. It ranged from a minimum of 3.7 (low) to a maximum average of 5.1 (high). It turned out that the more ambiguous paintings were, the less popular they were. For example, Braque's painting *The Portuguese*, with a high subjective ambiguity value of 4.6, was the painting with the lowest pleasantness rating (5.0). It was hard to understand and the least popular. In contrast, Picasso's *Still Life with Gourd*, was easier to understand. It had a low subjective ambiguity of 3.1. It was also more popular

- receiving a rating of 7.1. Picasso's painting was rated as more pleasant, because it had fewer components and clearer shapes. Statistically, 32 per cent of the variance in preferences was determined by each painting's level of ambiguity.[155] Might the same be true of streets?

6.5 Some colour is nice

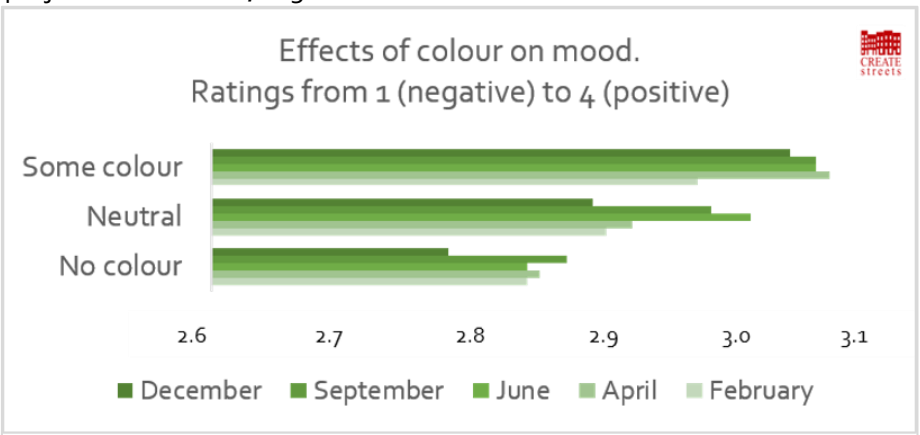
There is some anecdotal and case study evidence that people prefer streets with colour in them. On the Venetian island of Burano, no-one lives in a house of the same colour as their neighbour. Originally painted by fishermen, so that they could see their homes in the Adriatic fog, residents must make a formal request before they paint their houses. Is this overly onerous? Certainly, it is popular with tourists. The photographer Lumi Toma recalled;

'with the very first steps on the island I immediately felt a burst of positive energy. My brain started reacting to what my eyes were seeing, and a feeling of happiness overpowered me.'[156]

Burano Island, Venice.

Santa Marta, Rio de Janeiro.

In 2010, architects Jeroen Koolhaas and Dre Urhahn launched a project called 'Praça Cantão', in Rio de Janeiro, Brazil. Intended to challenge the negative connotation generally attributed to favelas (or slums), the architects trained 300 residents to paint 34 houses in Santa Marta, a hillside slum in the heart of Rio de Janeiro. They argued that the whole neighbourhood had benefited from this rainbow treatment. 'It gives the community life', said Edimar Marcelinho Franco, a favela resident who helped with the painting and subsequently obtained a professional painting qualification. He added, 'people who come to the favela today say, "Wow, how pretty." It doesn't have that image of an ugly favela'. Carlos Piazza, AkzoNobel's communication director for Latin America, agreed; 'colours bring status'. Tigrao, or Big Tiger, was a drug dealer before he took part in the project. He declared, 'it gave me a different outlook on life, showing me that an honest job can be a good thing'.[157] However, these are just anecdotes. Can we be sure that colour really improves our mood and emotional state? In 2006, a cross-cultural research project was conducted, on the impact of light and colour on psychological mood, in indoor working environments. 899 people in four very different countries (UK, Sweden, Saudi Arabia and Argentina), each with different light and climatic conditions, filled in surveys over a four-month period from September to December. This was compared to local lighting and colour conditions. Those who were in the most colourful settings had a visible mood improvement.[158] The figure above shows the relationship between colour and participants' mood. Consistently, those living in more colourful environments felt better.

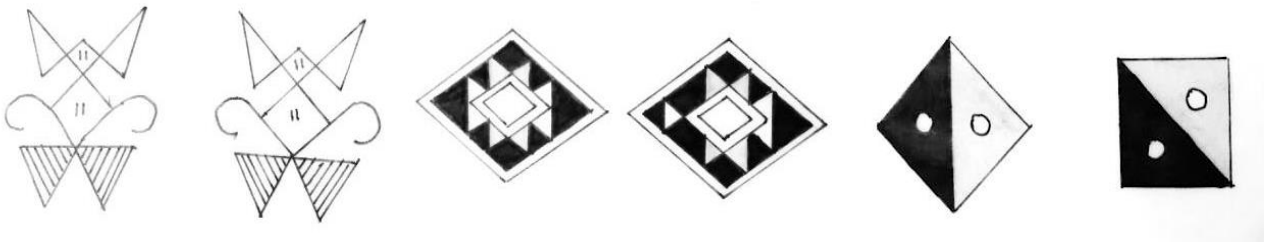


Colour has beneficial effects on mood, on a scale 1 (negative) to 4 (positive).

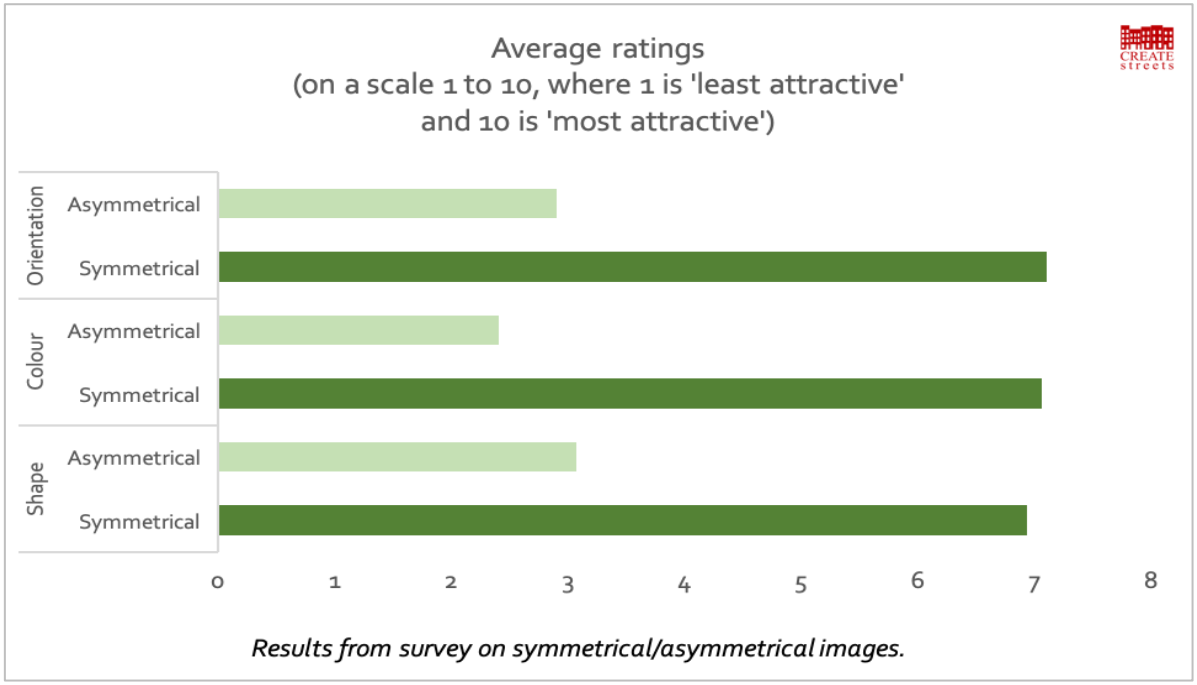
6.6 People seem to prefer some symmetry in their facades

Research is increasingly demonstrating that humans tend to prefer symmetrical design. A 2004 psychology study was conducted on people's design preferences, by comparing symmetric and non-symmetric images. 40 undergraduate students were shown 10 pairs of un-familiar geometric images. They were asked to choose the most attractive from each pair. Each pair contained images that were symmetrical and asymmetrical by colour, or by shape, or had images that were orientated with, or without, vertical symmetry. The findings were startling. Symmetry won three times out of three. On a scale of 1 to 10, 'designs with symmetrical shape were judged to be more attractive than designs with asymmetrical shape (6.9 versus 3.1). Symmetrically-coloured designs were judged to be more attractive than asymmetrical coloured designs (7.1 versus 2.4).

Designs with a vertical axis of symmetry were chosen as more attractive than designs with a non-vertical axis of symmetry (7.1 versus 2.9). Without ambiguity or cavil, people like their symmetry.[159] The chart below shows the average ratings, on a scale 1 to 5, where 1 is 'least attractive' and 5 is 'most attractive'. Symmetry, or near symmetry, is everywhere: not only in popular 'traditional' architecture, from the colonnade of St. Peter's Square in Rome, to the Schönbrunn Palace in Vienna, but in many of the most popular streets and towns around the world. Symmetry is certainly a way of creating a façade which 'lives' and which is both coherent and complex. Our appreciation for some streets over others might be due to this. Create Streets' 2015 Ipsos MORI poll arguably found that the most nearly-symmetrical streets, with the most rhythm, were the most popular.



Geometric images shown to participants: symmetric shape, symmetric/asymmetric colour and vertical/horizontal symmetry.



Results from survey on symmetrical/asymmetrical images.

[136] Charles, Prince of Wales, (1989), *A Vision of Britain*. (p. 9). Of the remaining 1% half were qualified in their support and half were opposed.
[137] Boys Smith, N. (2013), *Create Streets*. (p. 28).
[138] Adam, R. (2005), *Architectural preferences in the UK – a digest of the evidence.* (p.1).
[139] Hanley, L. (2007), *Estates – an intimate history*. (p.118).
[140] See Boys Smith, N. (2016), *Heart in the Right Street*, Section 9.8 for information on the other three. There is a sixth survey in Airey (2018), *Building More, Building Beautiful*. This supports the thrust of the wider evidence though the images are not as controlled so it is not cited here.
[141] Ipsos MORI interviewed 1,000 adults aged 15+ across Britain, face-to-face, in-home in May 2015. Data is weighted to the known population profile. *www.ipsos-mori.com/researchpublications/researcharchive/3586/Design-influences-public-support-for-new-build-homes.aspx*
[142] See Prince's Foundation (2014), *What People Want*.
[143] Boys Smith, N., Venerandi, A., Toms, K. (2017), *Beyond Location*. (p. 82-87).
[144] Leyden, K. et al (2011), *Understanding the Pursuit of Happiness in Ten Major Cities*.
[145] Soul of the Community Project, (2010), *Soul of the Community 2010 Overall Findings*. (p.9). Available at www.knightfoundation.org/sotc/overall-findings/
[146] Jacobs, J. (1961), *The Death and Life of Great American Cities.*
[147] Gehl J., (2010), *Cities for People*. (p.75, 76).
[148] Alexander, C. (1977). *A pattern language: towns, buildings, construction*. (Pattern 115. P. 561).
[149] Gehl, J. (2006), *Close encounters with buildings*. (p.29-47).

[150] Edible Urbanism Project, *Happy Seattle*, www.thehappycity.com/wp-content/uploads/2015/03/Editable-Urbanism-Report.pdf. In addition to these findings, people at the active façade reported a significantly higher level of trust in strangers (5.1 vs. 4.8 out of 10), walked more slowly and lingered more.

[151] Oppewal, H., & Timmermans, H. (1999). *Modeling consumer perception of public space in shopping centers*.

[152] Zacharias, J. (2001*). Pedestrian behavior and perception in urban walking environments*. (p.11).

[153] Kaplan, S., Kaplan, R., & Wendt, J. S. (1972). *Rated preference and complexity for natural and urban visual material*.

[154] Reber, R., Schwarz, N., & Winkielman, P. (2004). *Processing fluency and aesthetic pleasure: Is beauty in the perceiver's processing experience?*

[155] Nicki, R. M., et al. (1981). *Ambiguity, cubist works of art, and preference*.

[156] https://www.dailymail.co.uk/travel/travel_news/article-3062423/A-town-technicolour-Venetian-island-Burano-house-painted-different-shade-rainbow-want-make-change-need-government-permission.html.

[157]http://edition.cnn.com/2010/WORLD/americas/11/17/brazil.beautiful.favela/index.html.

[158] Küller, R., Ballal, S., Laike, T., Mikellides, B., & Tonello, G. (2006), *The impact of light and colour on psychological mood: a cross-cultural study of indoor work environments.*

[159] Cárdenas, R. A., & Harris, L. J. (2006). *Symmetrical decorations enhance the attractiveness of faces and abstract designs*.

A complex, not yet entirely proven, but hopefully reasonably coherent picture is emerging. The most popular urban streets and squares are not over-sized and have a reasonable sense of enclosure. They probably have some greenery. They are not necessarily car-free, but traffic almost certainly is taking second place to pedestrians. They have sufficient places to sit and relax. Their buildings are varied and attractive to the majority of people.

Is this just the chaos of creation, or are there underpinning reasons for these preferences? Are we being randomly-biased or deeply rational? The good news is that small, but growing teams of environmental psychologists, neuroscientists and cognitive scientists are trying to understand why different elements of our physical environments induce or discourage happiness, comfort, frustration and stress. It is far too soon to say that we fully understand the interactions between humans and the built environment. It is also important to be a little cynical. Just because someone writes 'neuroscience' at the start of a sentence, or a conference title, does not make it correct.

However, the new emerging evidence, does seem to be largely aligning with the wider evidence on how people behave in different types of places. Perhaps we can design, with growing confidence, for 'public places which provide 'psychological reassurance' to users?'[160]

(1) People like variety that is not too complex because they can understand it more easily;
(2) We like symmetry because we recognise ourselves in it;
(3) People may like coloured streets because they make them happier;
(4) Edges are reassuring to us because they allow us to see and not be seen;
(5) Enclosure is also reassuringly protective – up to a point;
(6) Beyond 100 metres everything is blurred;
(7) We need enough light for healthy bodies and healing minds;
(8) Place is emotional not just rational – we like memories and meaning; and
(9) We find greenery and some façades attractive as they combine coherence and complexity.

7.1 People like variety that is not too complex, because they can understand it more easily

'Order alone is monotony', yet 'complexity alone is chaos.'[161] We love to explore and engage with buildings and urban settings that are varied, but we need to be able to 'read' them. The neuroscientist

and urban psychologist, Colin Ellard, has argued that 'varied facades contain more information, they satisfy our craving to learn more about our environment, much more than those long, boring homogeneous facades do.'[162]

We also seem to find it easier to find our way around. A 2000 study, into the links between the local environment and the behaviour of patients with Alzheimer's disease, found that monotonous interior architecture could reduce patients' ability to navigate a space. In contrast, a simple, yet 'articulated' environment, with frequent visual reference points, improved their navigational abilities.

How do you know which door is yours?

Four out of the six participants experienced difficulties, in finding their own room, when corridors and doors all looked similar. Simple, but not monotonous, circulation routes seem to reinforce people's spatial cognition and mental-mapping abilities. Researchers argued that 'labyrinths are disorienting because of their repeated same-ness.'[163]

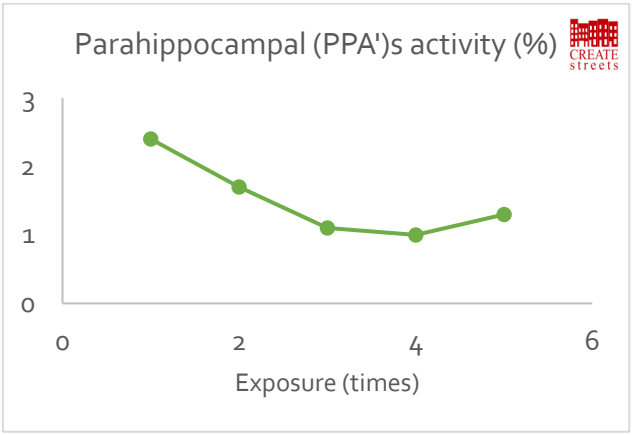
As confusion and memory challenges are common in dementia, and Alzheimer's patients, a 1950's street, Memory Lane, was built in Bingley, West Yorkshire, between two old people's homes, 'to help its residents to feel more comfortable.'[164] On Memory Lane, patients walked past varied and traditional facades and old-fashioned advertisements, to help them find their way around and recall their past. Variety is not just helpful for dementia sufferers however.

A 2006 neuroscience study also demonstrated a wider neuronal preference for some level of visual novelty. When we are repeatedly exposed to the same images, brain activity in the parahippocampal gyrus and the fusiform gyrus decreases.[165] The parahippocampal is 'a cortical region in the medial temporal lobe that surrounds the hippocampus and plays an important role in both spatial memory and navigation'. [166]

Memory Lane, West Yorkshire.

The fusiform gyrus is 'a large region in the inferior temporal cortex that plays important roles in object and face recognition.'[167] In other words, our ability to remember and navigate is higher in a varied and engaging environment, lower in a monotonous space.

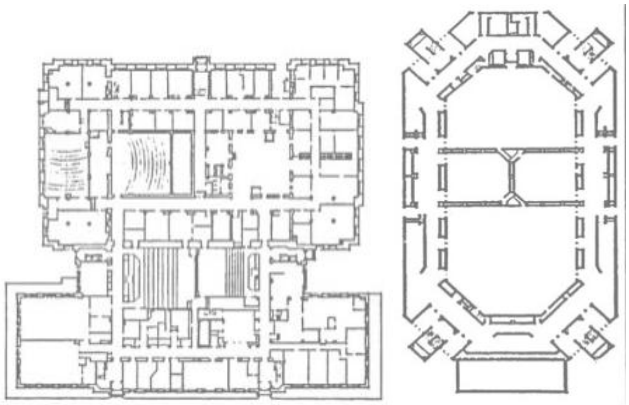
The emerging field of neuroaesthetics, which links the neurobiological underpinnings, of aesthetic experiences of beauty and art, to the neuroscience of architecture, has found that the parahippocampal responds specifically to environmental scenes, such as landscapes, interior architecture, buildings and streets.[168] The figure below shows that activity in the Parahippocampal (PPA) decreases, from 2.4 to 1.3 per cent, as the number of times an image is shown to an observer increases.[169] Too much repetition breeds boredom. Variety seems to be a good thing.



We prefer novelty. By the third time we look at an image, we are already bored!

However, complexity can go too far. For example, a 1981 study, into the relationship between humans and their environments, compared 73 students' ability to navigate in two buildings at Michigan University. Participants' ability to comprehend and navigate interior spaces was enhanced by regular geometric shapes.

- While almost 40 per cent of students said they got lost in the Chemistry Building (first image below);
- Only 13 per cent experienced the same in the Modern Languages Building (second image below).[170]



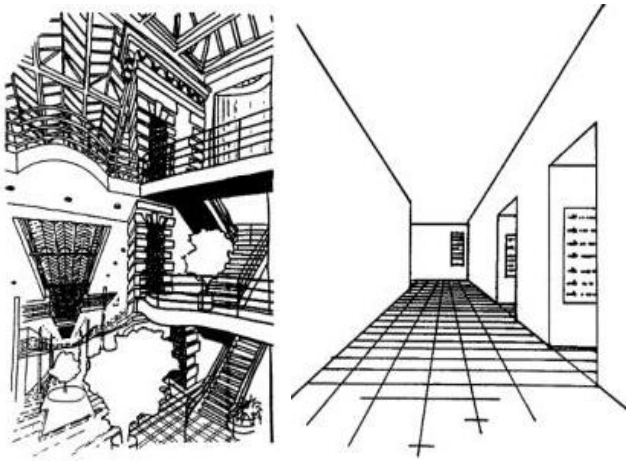
Chemistry (left) and Modern Languages (right) Building, Michigan University.

More tentatively, our preference for ordered variety may also explain our natural inclination to like hierarchical, or legible images. For instance, most of the objects in both natural and built environments tend to be tripartite, as is the human body (with head, body and feet). The reason for this may be that it is easier to understand when we look at it. Places that are not legible, or easy to navigate, may be a cause of stress. Thus, coherence and legibility are important to reducing stress for those moving in the built environment.[171]

For example, 'a building with a clear roofline, middle section, and articulated base, looks complete, resolved, familiar, much like an articulated or simply-rendered figure or face.'[172] Our appreciation for hierarchical scenes may have a biological explanation. The way our visual system processes images is hierarchical, from top to bottom. Some have argued that we like ordered scenes because they are simple to understand and require little effort. The psychologist Jürgen Eysenck observed that,

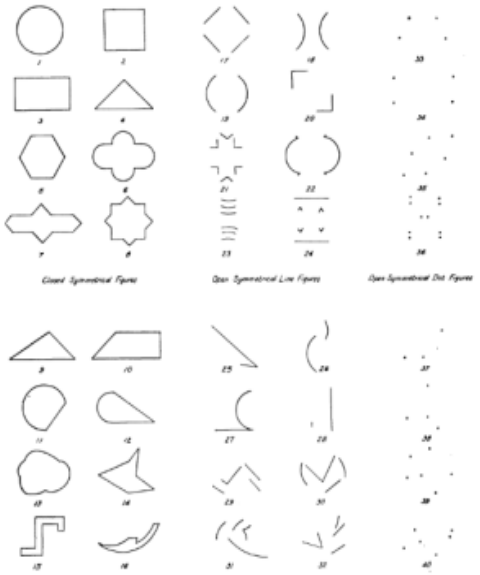
> *'the pleasure derived from a percept as such is directly proportional to the decrease of energy capable of doing work in the total nervous system, as compared with the original state of the whole system.'*[173]

Put simply, we like most what is easiest for our eyes to observe and for our brain to compute.



Ambiguous and illegible spaces may cause stress, whether they are extremely complex and disordered or monotonous and too homogeneous.

A 1940 study conducted by the psychologist, Marian Hubbell, on people's preferences for the configuration of images, tried to demonstrate this. 40 geometrical figures were shown to 40 students. Half of the images were symmetrical on one or more axes. The other half were asymmetrical.



Original figures used for the experiment. Closed figures (left) and open figures (right).

Participants were asked to look at the figures and modify them to make them 'good' or pleasing. Professor Hubbell found that figures were normally changed toward greater differentiation and more simplification. In particular;

- 37 per cent of the changes simplified the figures;
- 44 per cent of all open figures were modified to increase coherence and unity; while
- Only 9 per cent of the closed symmetrical figures were modified. They were already perceived as pleasingly simple and coherent.[174]

When people are given the opportunity to choose, they seem to prefer clear, enclosed and coherent images. In short, we seem to like what we can readily understand.

7.2 People like symmetry because we recognise ourselves in it

If hierarchy, some pattern for the variety to fit in is helpful to most of us, so, it seems, is symmetry. A branch of research has focussed on the relationship between humans and nature and has tried to explain humans' preference for natural environments. One of the most common features, among all living species, is symmetry. Just as humans' anatomy is ordered and symmetrical, so is that of the wider natural world. According to biologists, '99 per cent of modern animals are members of the evolutionary group Bilateria', including humans.[175] This means that their biological design is bilaterally symmetric along the vertical axis. Evidence is now emerging that our brains are particularly good at recognising symmetry and that predictably our brains like it.

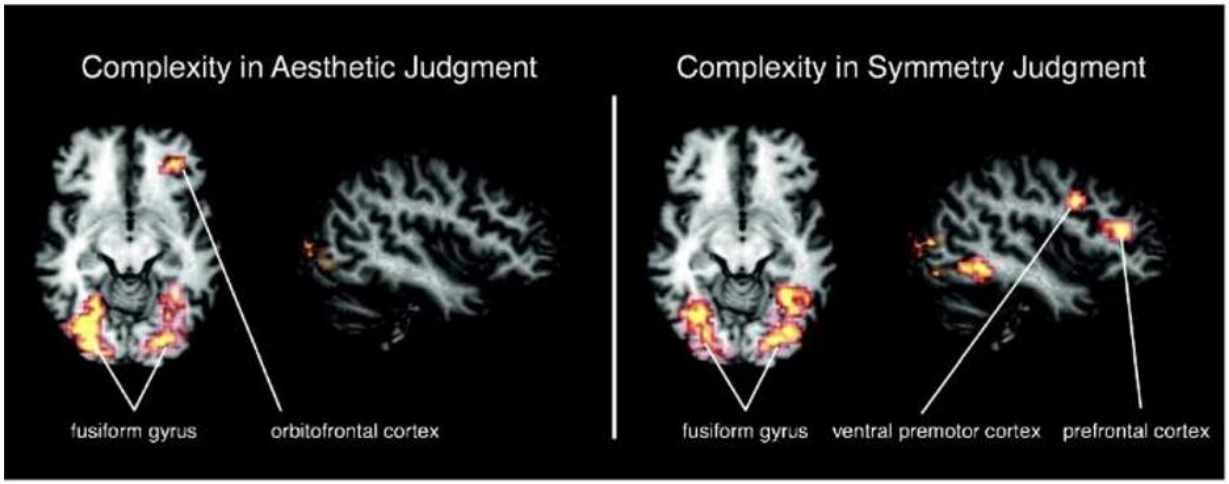
There is certainly consistent evidence that most of us find symmetrical faces more attractive than non-symmetrical faces. A 2004 study investigated people's preference for symmetric and asymmetric faces and for faces painted symmetrically or asymmetrically. The study asked 40 participants to rate the attractiveness of 36 faces, on a scale from 0 (not attractive) to 8 (very attractive).[e] It found that symmetric faces, with symmetric paint, were consistently the most attractive. Symmetrical faces, painted symmetrically, had an average score of 5.5. Asymmetric faces, painted asymmetrically, had an averages score of 2.6.[176] However, our preference for symmetry goes beyond human faces.

A 2006 study, in cognitive science and neurology, used functional MRI to investigate the relationship between symmetry and aesthetic preferences. Functional MRI is a non-invasive test that uses strong magnetic fields, and radio waves, to investigate activity in the brain, by measuring changes in the blood flow. The study demonstrated a clear positive relationship between symmetry and aesthetic preferences. Fifteen participants were asked to judge 220 black and white images, on a 5-points scale, as 'beautiful/symmetrical' (+2) or 'not beautiful/not symmetrical' (-2). Both metabolic and behavioural findings showed that 66 per cent of the symmetric items were judged to be beautiful. In contrast, only 42 per cent of the non-symmetric items were judged as beautiful. The research concluded that 'symmetry guides aesthetic judgments of beauty'.[177] The image below shows which areas of the brain were more engaged, when participants judged an image to be beautiful. For both conditions, increasing complexity in the images caused significant activation within the fusiform gyri, which helps us with object and face recognition. The implication is that if we want to develop urban environments that people will love, new buildings should have a certain degree of symmetry and complexity.

In the light of such evidence, the neuroscientist, Eric Kandel argued in this 2012 book, *The Age of Insight,* that our preference for symmetry in the built environment is derived from humans' inclination to find comfort in any approximation of the human face: 'face perception has evolved to occupy more space in the brain than any other figural representation'. Around 50 per cent of our brain is focussed on processing visual images, of which potentially 80 per cent is focussed on face

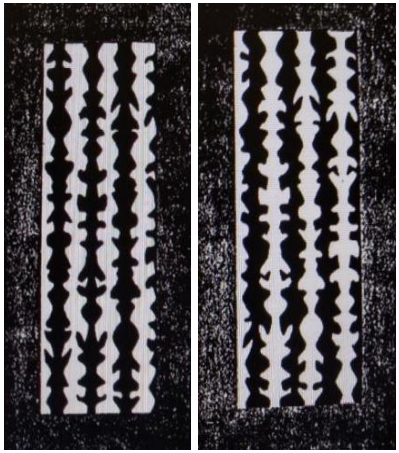
[e] Three other conditions were tested and showed the same trend: Asymmetrical faces with symmetrical paint, with standardised mean rating of 4.75 versus Symmetrical face with asymmetrical paint, with a standardised mean rating of 3.25. Asymmetrical face with symmetrical paint, with a standardised mean rating of 4.34 versus Asymmetrical face with symmetrical paint, with a standardised mean rating of 3.57. Symmetrical face with no paint, with a standardised mean rating of 5.27, versus Asymmetrical face with no paint, with a standardised mean rating of 2.73.

perception. This is why we so readily see 'faces in things', from Martian hills to tractor facades.[178] It may also explain why buildings with predictable, largely symmetrical, façade patterns of windows and doors are so easy for us to live with and love. Even when they don't look precisely like human faces, their complexity and near symmetry feels very familiar. The opposite is true of a blank façade, or an overly aggressive and alien form or shape. Not only do we seem to prefer symmetry. We also seem to recognise symmetric images and patterns faster than asymmetric ones. A 1992 Nature study by the Department of Psychology at Cambridge University, on symmetry perception showed that, while we interpret symmetrical areas or scenes as figures in the *foreground*, we see asymmetrical ones as *background*.[179] In a series of images consisting of red and green patterns, one symmetrical and the other not, 80 per cent of the time observers saw the symmetrical pattern first. This confirmed a much older 1928 experiment in which two black and white images containing two similar, but opposite vertical patterns were shown to 64 people. In the first image the black pattern was symmetrical, and the white was asymmetrical. In the second image, the symmetry was reversed. In both cases the symmetrical patterns were seen 89 per cent of the times, while the asymmetrical patterns were only seen once. Our brain's visual system seems able to read symmetrical scenes faster.[180]



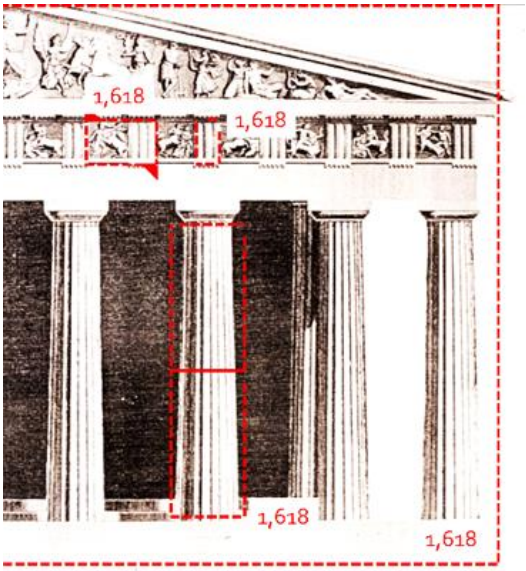
Fusiform gyri's activation during judgments of beauty and symmetry.

Human, humanoid and anti-human architecture? Certainly our brains instinctively think so.



Images with vertical patterns used for the 1928 experiment.

Professor Kandel has also argued that our instinct for facial recognition can help explain the popularity of buildings deploying the so-called 'golden rectangle' rule. The 'golden rectangle' is a rectangle with an approximate 8:5 length-to-width ratio. It has been discussed for centuries. Leonardo da Vinci called it 'divine proportion', in 1509. Consciously or not, much ancient and classical architecture was also built according to this principle. It can be found in the Egyptian Pyramids. The Parthenon in Athens (image below) can also be read as a large golden rectangle, made of smaller golden rectangles, whose length-to-height ratio is consistently 1:1.618.



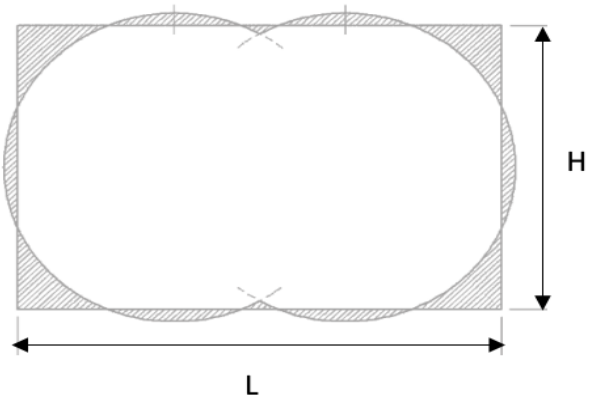
The Parthenon was built according to the golden ratio (1.618).

So why do designers keep coming back to these types of ratios? Professor Kandel has argued that what is crucial to recall is that humans have binocular vision: when we watch with two eyes, our fields of vision overlap. In the image below, each circle represents the area that each eye can see. This corresponds to a rectangle approximately three sections wide for every section that it is high. (In fact, it is a ratio of 1:1.47, which is very similar to the 'golden rectangle' of about 1:1.61.) Shapes of about this proportion therefore seem to be shapes that our eyes and brain can 'compute' very speedily and lazily: very similar to the golden rectangle.

Professor of Mechanical Engineering, Adrian Bejan, has set out how the brain 'reads' these shapes particularly speedily. The way we understand an image is by reading it horizontally and vertically. Some neurons in the brain are specialized to read vertical lines and some are specialized to read horizontal ones. While we read horizontal images faster than vertical ones, the golden ratio allows us to read the vertical axis as fast as the horizontal one. Humans tend to save energy in any action. (For example, studies have shown that, when given the choice between the stairs and the lift, 97 per cent of the people would take the lift. 93 per cent of them would still choose the lift, even if they are reminded of the beneficial health effects of taking the stairs). Perhaps our brain follows the same principle in the way it is attracted to, or repulsed by, certain shapes and scenes. As Berkeley Professors of Mechanical Engineering, Allan Lichtenberg and Michael Lieberman, concluded, 'The golden rectangle is like a key that fits the specific lock of our visual field and energy-conserving habit.'[181]

Following the writing of Christopher Alexander, an important thinker on design patterns, Professor Nikos Salingaros of the University of Texas, disagrees. He has argued that the ratio of the golden rectangle is unimportant. Buildings as diverse as Le Corbusier's Villa Stein and the United Nationals building can also be said to exhibit it, with very different reactions from most observers. Nor is it

even clear (from a 1992 study) that people actually do prefer rectangles with this ratio. What is important is that the golden rectangle helps to establish 'natural fractal scaling in built forms', with 'a scaling hierarchy' from a building's largest components (height or width), to its smallest (detail or ornament that 'feels right' - see section 7.9).[182]



Rectangle with length (L) to height (H) ratio of 1:1.47.

At any rate, what is clear is that we like images and scenes that are symmetrical and fairly, but not overly, complex. We read faces, or face-like facades, particularly easily and efficiently – we have evolved to. Some shapes and ratios (about 1:1.5) may also be easier for us to read more efficiently. And our brains like to be efficient. Things we can process efficiently tend to be more attractive to us. This is why symmetrical, or near symmetrical, variety in a pattern is so often so pleasing to us.

7.3 People may like coloured streets because they make them happier

Environmental psychologists have conducted research on the psychological effects of colour. Most have agreed that it can have a significant impact on people's mood. They found that blue is generally a calming colour, while red and yellow tend to stimulate the brain.[183] A 1973 review by the psychologists, Francis Adams and Charles Osgood, of 86 studies of the effect of colours on human mood, concluded;

> *'Black is bad, strong and passive. Grey is bad, weak and passive, white is good and weak, colour is good and active, red is strong and active, yellow is weak and blue and green are good.'*[184]

Professors Adams and Osgood conducted a study on 23 groups of 40 secondary school students, from 20 different cities around the world, to assess the 'mood music' of colour. The study found that, on a scale from 0 (low) to 7 (high), blue was preferred and associated with positive feelings (such as familiarity). Blue had an average rating of 5 while red and yellow had average ratings of 0.1 and 0 respectively. By contrast, red was the highest rated in terms of activity, with an average rating of 4. Our brains find red exciting and arousing. They find blue relaxing. This may explain why people love the Moroccan city of Chefchaouen, also known as the 'blue city.' Locals,

if their brains are like everyone else's, will find their blue walls and homes relaxing and restful. But it does not have to be blue! One very robust study conducted at the Department of Psychology, at Berkeley University in 2010, found that bright red, blue and green were the most highly rated colours. They were preferred by most to gentler hues. Colours, in general, can have strong emotional effects on human beings. Research has shown that exposure to colours can produce positive emotional, cognitive and psychological effects. A 1997 study, by the psychologist Rebecca Jeanes, of children with reading difficulties, found that 53 per cent of the 93 secondary school participants who were shown text, with 29 overlaid colours, improved their reading speed by an average of 8 per cent. A possible explanation to our appreciation of bright colours is offered by the Ecological Valence Theory, which argues that people tend to 'like colours strongly associated with objects they like (e.g. blues, with clear skies and clean water) and dislike colours strongly associated with objects they dislike ((e.g. browns with faeces and rotten food).' Others have argued that our biological system is naturally

Chefchaouen, the 'blue city'.

programmed to be exposed to varying visual stimuli and that monotony reduces our ability to see and respond to these stimuli. So, colour seems to be beneficial for our mental and emotional wellbeing. Certainly, this seems to reflect reality. While ancient towns made intense use of colours, modern and contemporary cities have progressively become monochromatic. However, some towns' most popular streets are still making striking use of colour: Clifton in Bristol, Nettleton Road in Gloucester, Hillgate Place and Farmer Street in Notting Hill, London or Kinsale in County Cork. Though indicative, not scientific, there is certainly some evidence that such streets are correlated with livelier neighbourhoods and an enhanced sense of community. Residents of Gloucester's Nettleton Road, for example, said they had become friendlier with each other after they had all agreed to paint their homes bright colours. A 22-year-old student argued that 'it's brought a new dynamic to the street and neighbours are chatty, friendly and help each other out'.

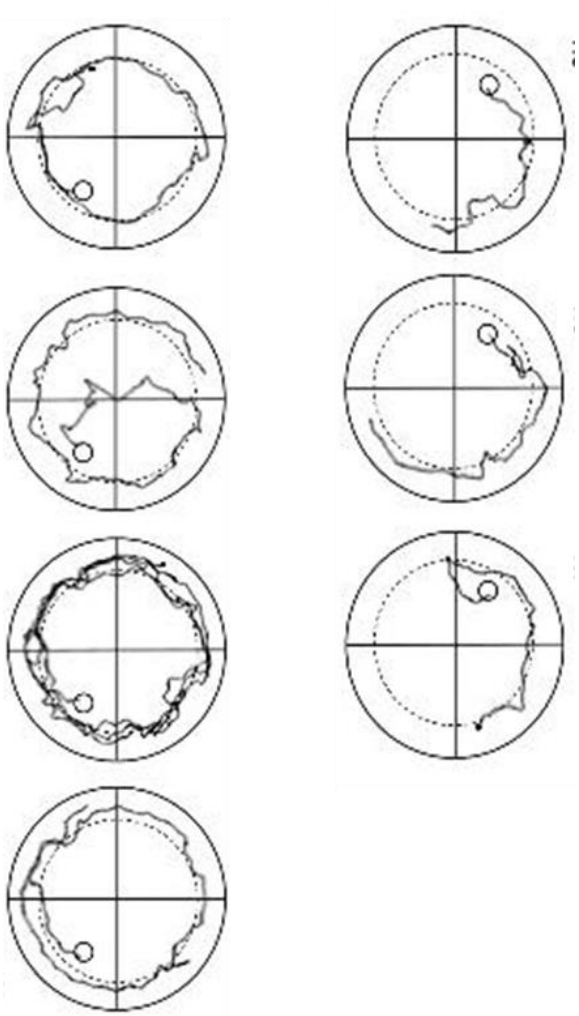
7.4 Edges are reassuring to us because they allow us 'to see and not be seen'

As we have seen, edges matter. Often people appear to prefer to walk, stand or sit along the wall of a public space, not in its middle. Some researchers (for example, Jay Appleton with his 'Prospect and Refuge Theory') have speculated as to why. But what is the evidence? Some cognitive researchers have started to explain this through the concept of thigmotaxis, or the tendency to explore environments from their edges.

> *'Humans are thigmotactic, a 'wall-hugging-species. We are innately self-protective and tend to avoid the centre of places. We are a social species, visually attuned to take in other people, and specifically interpret their faces quickly. We tend to favour symmetrical shapes, curving forms, and visual complexity'.*

A study of humans' cognition ran a series of psychological questionnaires, on 106 people, to assess fear, anxiety and cognitive abilities. Participants, with different levels of fear and anxiety, had to locate a target in a circular computer-generated area (6 m wide and 2 m high) on a computer, with a joystick, and find it as quickly as possible. The experiment found participants, who were affected by anxiety, tended to keep their cursors around the sides of the area. And this could be measured and predicted. The more nervous the participant's disposition, the more they avoided the centre with a standardised coefficient r ranging between 0.22 and 0.26. This means that 5 to 7 per cent of the tendency to move along the edges could be explained by their above-average anxiety. This may not sound very much but it implies that people

do find the clear definition of edges useful in learning how to get about a place.



Human experience of thigmotaxis. Circular Computer-Generated Area, with the small circle representing the target and the continuous line the path to reach it.

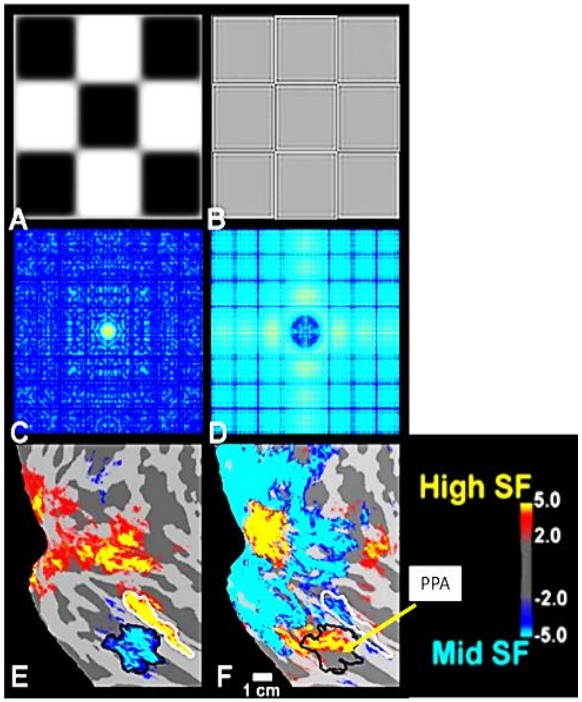
7.5 Enclosure is also reassuringly protective – up to a point

As we have seen, it is probably true that more enclosed spaces are more popular than less enclosed spaces. Christopher Alexander argued that the best squares have

> *'a width of approximately 60 feet. Their length can vary. The walls enclosing the space, whether partially or wholly surrounding it, should make us feel as if we are in a large open public room'.*[185]

Why is this? Cognitive researchers are starting to conduct research which might provide an answer. As we have seen, the parahippocampal (PPA) is an area the temporal lobe of the brain that is concerned with complicated processing of visual information about objects. Experiments have found that its cells are extremely responsive to enclosure. For example, in one study, seven adults were asked to look at the image of a checkerboard, with edges that were either clear or obscure (or as they put it, with high or low spatial frequency). People were measurably more stimulated when they were looking at images with clearer edges, which they found more pleasant. The figure below shows that activity in the PPA was higher, (shown in E) when participants were exposed to the image of the checkerboard with clear edges, (shown in B) than blurred edges (shown in A). In the image with clear edges, activity in the PPA is more

intense (red-yellow), with values between 2 and 5 (F). In the image with blurred edges, activity in the PPA is less intense (blue-cyan), with values between -5.0 and -2.0 (shown in E).



Perceived pleasantness of scenes with low and high spatial frequency.

A 2013 doctoral thesis, by Deltcho Valtchanov at the University of Waterloo, Canada, in behavioural and cognitive neuroscience found that we are attracted by images with clearer edges. On a scale of 1 to 5, where 1 is low and 5 is high, Dr Valtchanov found that urban and natural scenes, with the clearest edges, were, on average, rated as 4.1. By contrast, those with the least-clear edges were rated, on average, as 2.2. The figure below shows some of the images.[186]

Images used for the experiment: least clear edges (top) and clearest edges (bottom).

We look, it seems, for clearly-defined edges. Of course, in the blurred image above, contours are barely distinguishable, while, in the sharp image

below, edges are clear and visible. This theory seems to have strong biological credibility. Many cells in our visual systems are primarily involved with clear edges. As Colin Ellard put it;

> *'As it turns out, our visual systems are replete with neural circuitry that is designed to work out these kinds of details. Cells at all levels of the visual system from the retina to the upper reaches of visual cortex are specifically tuned to be looking for a particular size resolution of contours, and the mix of such specifically tuned cells can vary from one area to another.'*[187]

In other words, in our brains' visual system there are neural circuits that are designed to read this kind of detail. Our brain cells naturally seek edges in an image. In chapter 7.1, we reviewed an experiment by the psychologist Marian Hubbell on the configurational properties of images that people like the most. The study asked people to make any changes, to 40 images, so that they would find them pleasing. It found that '60 per cent of all changes enhanced closure, while only 2 per cent detracted from it.' 81 per cent of the open figures (both symmetrical and asymmetrical) were made more enclosed. Once more, this demonstrates that we seem to prefer enclosed images to open images. We certainly find them more attractive: potentially they feel safer.[188]

So, enclosure protects and reassure us. However, you can have too much enclosure. As we have seen in chapter two open spaces with a height-to-width ratio of less than 1:1 may be less pleasant to most of us. However, more empirical evidence is needed to confirm this. Christopher Alexander has concluded;

> *'Courtyards should never be perfectly enclosed by the rooms which surround it, but should give at least a glimpse of some other space beyond.'*[189]

7.6 Beyond 100 metres, everything is blurred

As we have seen in chapter one, people go to public spaces because they like to see other people. The human eyes can distinguish particularly well, up to a100 metre distance. Researchers found that widely-lauded public spaces often have a longest dimension of 100 metres or less. Cognitive scientists have named this the 'Social Field of Vision.' And this 100 metre field of vision has further consequences. Professor Bejan has demonstrated that our vision is mostly horizontal. Since we cannot see farther than 100 to 120 degrees, in both vertical and horizontal directions, without lifting or moving our head, our view therefore has a rectangular shape and has a length-to-height ratio of 1.5. Thus, again, we are meeting the 'golden ratio.' The biological explanation for this is that it requires less effort to see.

Place des Vosges, Paris. 1612

St. Peter's Square, Rome. 1667

Taj Mahal Garden, Agra. 1632

Many (though not all) of the world's most iconic urban squares are less than 100-metres long or wide.

7.7 However, we need enough light for healthy bodies and healing minds

Urban design is about optimising trade-offs, not maximising any one variable at the expense of others. So, while we have seen that a sense of enclosure may be neurologically reassuring, there are limits. Where height-to-width ratios rise to more than around 1:0.8, then spaces seem to get less popular (and certainly darker). Is this because we need the light that the walls are shutting out?

Maximising available internal or external light has certainly been a core belief in modern architecture. Think of the Guggenheim Museum in Bilbao, or the Gherkin in London, entirely made of glass. And unlike many modernist beliefs on town planning (which have turned out to be flawed), there is evidence that light is good for you. Sunlight is the major source of vitamin D. 'Vitamin D deficiency causes muscle weakness, increasing the risk of falling and fractures and has other serious consequences on overall health and wellbeing.'[190]

The World Health Organisation has reported that, worldwide, low levels of ultraviolet light exposure might be responsible for around 3.3 billion years of what are known as disability-adjusted life years. Put in plain English, this means that up to 3.3 billion years of human lives are being led with disability that more ultraviolet light exposure might help prevent.[191] Similarly, a 2014 study, of built environment and

wellbeing, found a relationship between low levels of light during the day and higher levels of sleep disorders.[192]

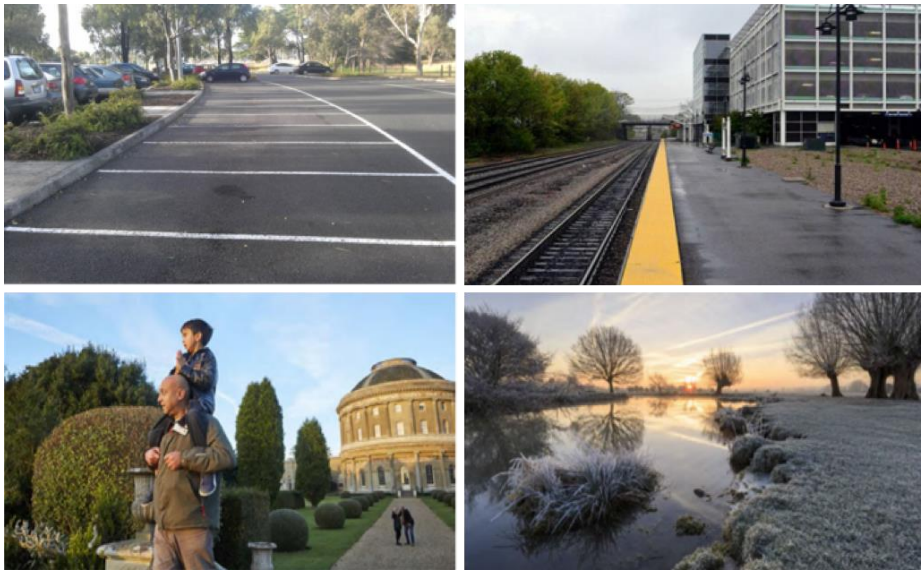
The same seems to be true of mental health. A fascinating study compared the recovery times of two sets of depressed patients, in very different climates and seasons. One set of patients were in Edmonton, Canada. Edmonton's climate has very low winter temperatures (minus 25 degrees), with external light amplified by the snow for over four months of the year. The second set of patients were in Milan, Italy where morning sun can lead to light intensities comparable to more than 15,000 lux on summer mornings. (Normal artificial light is between 2,500 – 5,000 lux). In both cases, half of the patients were in bright rooms and half were in rooms with low natural light. Results showed that patients in brighter rooms recovered more quickly and 'left the hospital more than two and a half days sooner' than those who had lower light in the room.[193] Light is good for you. Of course, that does not necessarily mean that maximising exposure to natural daylight is the right thing to do everywhere, or always. Some places are too hot (walls in desert towns are higher and streets are narrower). Nor does it mean that focussing entirely on maximising exposure to natural light always leads to good overall street patterns. It does not particularly if it results in a failure to distinguish between private and public spaces.

7.8 Place is emotional not just rational – we like memories and meaning

We go to places that make us feel well and are good for our spirit. This behaviour has been named *Topophilia*, from the Greek *topos* 'place' and *philia* 'love of', the love for a place. The bond between person and place might be intense or fleeting. It might be positive. It might be negative. But it does seem to be real. [194] For example, fascinating recent work commissioned by Britain's National Trust from Dr Andy Myers at research consultancy Walnut, makes this point starkly. It sought to understand the power and motivation of people's emotional connection with places. Can we measure the love of place?[195] Twenty people were shown three different types of images;

- ten meaningful places to them such as woodlands, coastal areas, buildings and historic sites (42 per cent were urban and 21 per cent were natural areas);
- ordinary everyday places such as streets, bus stops, train stations, fields and office buildings; and
- what are known as International Affective Picture System Images. These are images which have been previously proven to provoke a strong response from the Amygdala (which is the area of the brain which identifies emotions and the need to respond).

While they were being shown these images, participants' brains were being monitored by an fMRI scanner, which was able to track 'regional changes' within each area of the brain that are associated with emotional processing. The results were fascinating. When participants were looking at meaningful places, researchers observed deep emotional processing in the Amygdala. They also observed higher activity in the Medial Prefrontal Cortex. This is an area, in the frontal lobe of the brain, that evaluates whether it is a positive or negative situation. Researchers found that 78 per cent of participants reacted more strongly to meaningful places, which were linked to childhood memories, friends or the present, than to unknown ones. Of these, 42 per cent of the places were urban and 21 per cent were natural areas. 86 per cent of the participants said their meaningful place was 'part of them.' 58 per cent felt like they belonged to it, when visiting the place. Topophilia, it seems, can be measured in the brain. (And it should hardly be surprising, therefore, that people often oppose new development which may unsettle imperfect but emotionally settling neighbourhoods).



Examples of ordinary (top) and meaningful (bottom) places.

7.9 We find greenery and some façades attractive, as they combine coherence and complexity

As we have seen, greenery can be good for us (as long as we don't fear that someone is going to jump out of it at us). There is now plenty of evidence on the potential beneficial effects of greenery, in the built environment, on physical, psychological and mental health. For example, it can reduce stress.[196] And this can, yet again, be tracked in the brain and in our physical reactions to greenery.

A 2015 Stanford-led study, published in *Proceedings of the National Academy of Science*, found that a 90-minute walk in a natural setting, as opposed to an urban setting, was associated with a 'decreased activity in a region of the brain associated with a key factor in depression.'[197]

The psychologists Rachel and Stephen Kaplan also observed that when we view natural scenes, our eyes move faster. [198] But where does our appreciation for nature come from? Different writers have advanced different theories. All seem tempting. None are fully proven or disproven. Colin Ellard has argued that our preference for natural landscape may be linked to our tendency to like curvilinear shapes. This has a biological reason. 'We have many more cortical cells devoted to the analysis of the nuances of a curved surface than of a sharply-angled one.'[199]

A 2013 behavioural study, on people's willingness to accept (positive reaction), or reject (negative reaction) a series of stimuli, found that 10 per cent more participants had a positive reaction to round shapes than square ones, in open and enclosed interiors. It also found that, when participants were looking at round images of interior architecture, rather than rectilinear ones, activity in the calcarine gyrus and in the visual cortex was higher.[200] These are two areas in the occipital lobe (the bottom back part of the brain) that understands what the eyes see and process visual information. Because nature is mostly made up of rounded, rather than square shapes, this may also explain why we tend to prefer natural landscapes over urban settings. The biologist Edward Osborne Wilson, has argued that we have a 'tendency to focus on life and life-like processes.' He named this inclination *Biophilia,* from the Greek *bio,* life and *philia,* 'love of'. He defined it as 'the urge to affiliate with other forms of life.' In other words, we are evolutionarily 'hard-wired to find particular scenes of nature calming and restorative'.[201] Some have argued that biophilic theories explain why we tend to prefer historic buildings. Many are embedded with natural shapes, or symbolic vegetation. For example, the structural and ornamental elements of Antoni Gaudi's unfinished Barcelona cathedral, Sagrada Familia, it has been argued, remind us of real natural features, such as trees and flowers.[202]

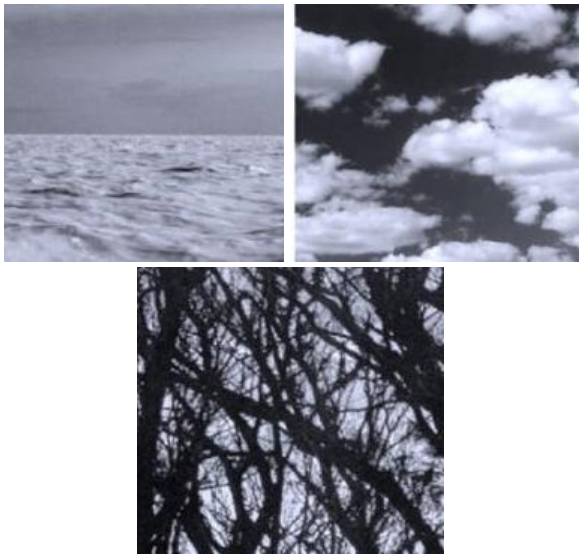
Interior of the Sagrada Familia, Barcelona.

Others have argued that our liking of natural images is due to their fractal nature. Fractal geometry is a statistical index of complexity. Specifically, fractal shapes are those that possess repeating patterns, when viewed at increasingly fine magnifications. Their complexity goes on for ever – or, at any rate, for a long time! [203] Many complex natural shapes are fractal. Think of fern fronds or snowflakes. We certainly do seem to like fractal patterns. A 1998 study, by the physicist Richard Taylor, found that more than 90 per cent, of a group of 120 students, preferred fractal over non-fractal patterns.[204]

We also seem particularly to like fractal patterns when they approximate the level of 'fractality' typically found in nature. Scientists normally measure the level of 'fractality' by the variable they term 'D'. The more complex the shape, the higher the measure of 'D'. A line has a D of 1. A plane has a D of 2 and a sphere has a D of 3.[205] The level of 'fractality' in most natural objects is apparently between 1.3 and 1.5.

Fascinatingly, a multi-disciplinary academic study, conducted by psychologists and physicists, in 1993, found that people usually prefer images and scenes that have broadly this same level of 'fractality' (of 'D'). Eight participants were asked to rate 7,500 fractal images, on a scale from 1 (not aesthetically pleasant) to 5 (very aesthetically pleasant). The average 'D' score of 'fractality', of the 443 images rated 5 by all eight observers, was 1.3 – similar to the typical level found in natural images.[206]

Our appreciation for fractal geometry may also explain why most of us tend to prefer older neighbourhoods. Nikos Salingaros has argued that natural landscapes and older streets are mostly shaped according to fractal geometry. They are detailed at many scales. Most modern buildings are not. He has argued that contemporary urban landscapes are set by Euclidean geometry. Buildings and shapes are bi-dimensional and devoid of ornaments, details or colour. Shapes are copied *ad nauseam,* but not adapted and evolved. Patterns do not 'live'.[207] We recognise, he has argued, 'monotonously repeating forms as un-natural.'[208]



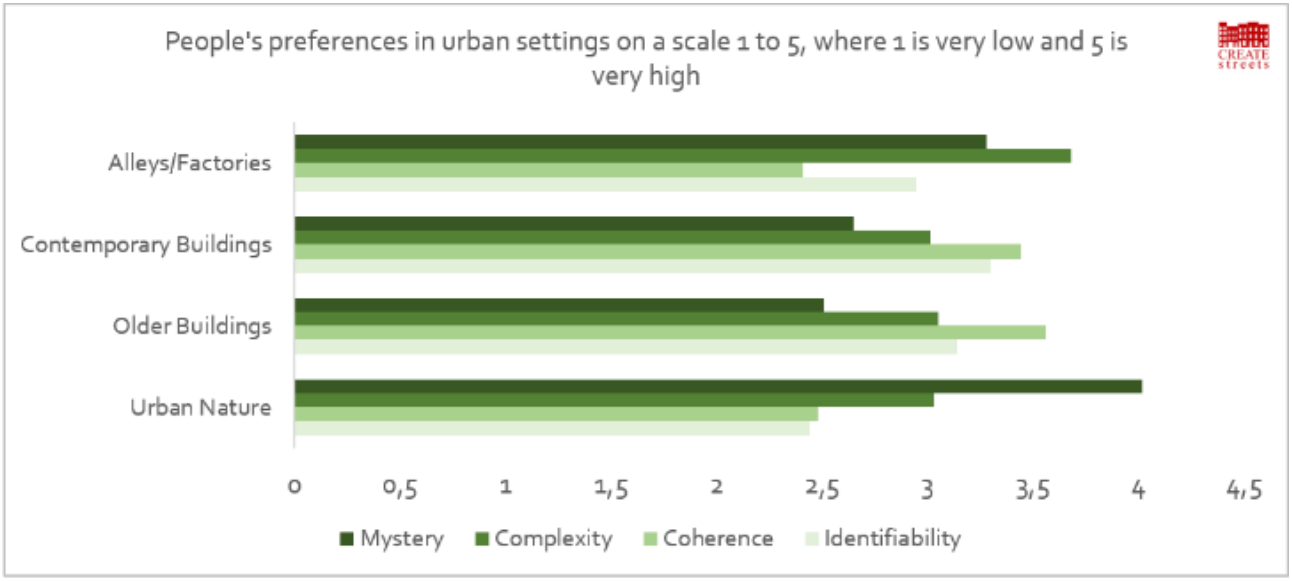
The more complex, the higher the fractal dimension: D = 1.0, D = 1.3, D = 1.9.

This is seen in startling 'starchitecture', such as MVRDV's Market Hall in Rotterdam, which, even its admirers would admit, has no relationship with its surroundings and does not attempt to mirror neighbouring buildings' geometry or proportions. But it is also true of hundreds of thousands of less totemic buildings. However, if we tend to reject a lack of ornament, we also need that ornament to be coherent and not chaotic. Professor Salingaros has gone on to argue that,

> *'human beings prefer ordered complexity and not randomness in their environment, a result of our perceptual system evolving to interpret natural forms.*

MVRDV's Market Hall, Rotterdam.

The human mind is built to read organised complexity and to reject disorganised complexity. We are attracted by the coherent and ordered. We tend to dislike what appears incoherent and chaotic. For example, the Alhambra of Granada, is composed of millions of elements which are all organised, coherent and inter-connected. This makes it appealing to the human eye, rather than confusing. It does not matter how much you increase the complexity of a façade, as long as it is coherently organised and inter-connected. Does this argument relate to the evidence on why we prefer the urban places that we do? It would appear to. Research by psychologists, Rachel and Stephen Kaplan, measured people's preferences for buildings, in order to test four predictor variables;



People feel happier and more excited in an environment with varied facades and diverse activities.

- '*Coherence*: the extent to which a scene contains factors that allow us to predict from one portion of a scene to another;
- *Complexity*: the extent to which a scene contains many elements, regardless of their arrangement;
- *Identifiability*: how easily one can tell what is being depicted; and
- *Mystery*: the extent to which a scene promises further information, to encourage the observer to 'walk' deeper into the scene. '[209]

The experiment found that human beings appreciate coherence in old buildings, mystery in urban nature and identifiability in contemporary buildings, while they do not appreciate the complexity and lack of coherence of alleys and factories. The chart above shows participants' ratings for each urban setting based on the four predictor variables. Research conducted by Colin Ellard, with the BMW-Guggenheim Laboratory in New York, found that we quickly get bored when we are surrounded by monotonous and blind architecture.[210]

Between August and October 2011, 134 people spent time in two distinct, but proximate, parts of the city of New York. They wore bracelets to measure their excitement levels based on their 'galvanic skin response' which is a measurable change in the electrical resistance of the skin caused by emotional stress. Half of the group was in front of the long blank façade of a supermarket (the Whole Food Market). The other half was less than a block away, in front of a restaurant (Macondo) in the middle of a lively area, surrounded by other restaurants and stores. The second area had frequent facades and open windows and doors. The first had none. The results were predictable. Based on participants' reactions and their bracelet's physiological measurements;

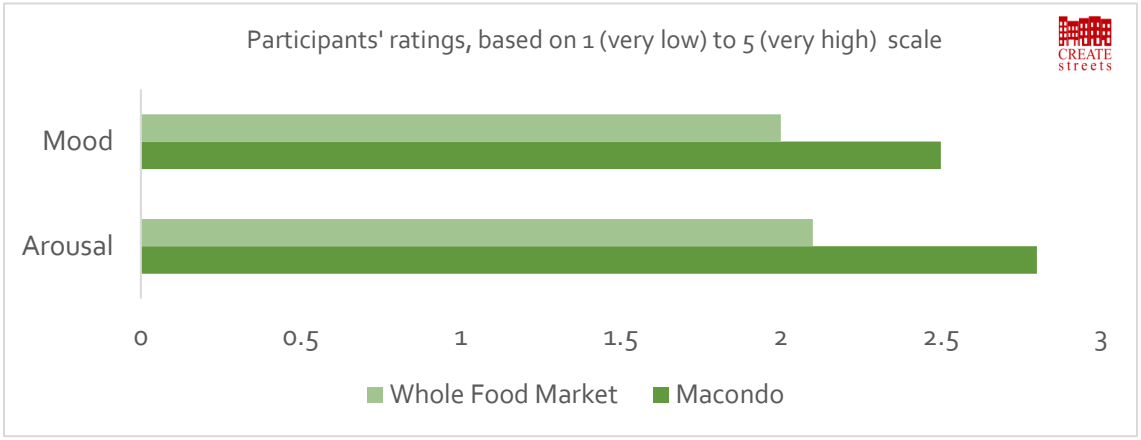
- In front of the Whole Food Market, people were 'bored and unhappy.' They described the place as bland, monotonous, and passionless. On a scale 1 (lowest) to 5 (highest), their average rating of mood was 2 and excitement was 2.1; while
- In front of the restaurant, people were 'lively and engaged' and their levels of excitement were high. They described the place as mixed, lively, busy and good for socialising. On a scale 1 (lowest) to 5 (highest), their average rating of mood was 2.5 and their excitement was 2.8.

The chart below shows the participants' ratings, based on a scale from 1 to 5, where 1 is 'very low' and 5 is 'very high'. In conclusion, humans appear to be attracted to nature, because we have evolved to be. We are biophilic. And we are visual beings, strongly sensitive to the symmetries and coherent complexity, not just of plants and trees, but also of some types of urban form and building. We look for varied and engaging urban environments. We get bored in monotonous or dull places. Our deeper emotional brains influence our preferences. So do our memories. It has always been so and probably always will.

That is why Sir Osbert Lancaster was deeply correct when he wrote that, 'the conception of a house as une machine à habiter presupposes a barrenness of spirit to which, despite every indication of its ultimate achievement, we have not yet quite attained.' We have still not escaped our native selves.

Colour can make us happy. Curves are attractive. Symmetry is helpful. Complexity appeals to us and allows us to respond to the same building at different distances. Coherence allows us to process and enjoy the complexity. We like variety. But we like it in a pattern. We are, after all, only human.

Blank and lively façade.



People feel happier and more excited in an environment with varied facades and diverse activities.

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Conclusion: what do we know, what do we think we know?

What can we posit, with reasonable confidence, that we know about what makes for successful public spaces? What distinguishes a street, or a square, from a place where people want to be, to one where people merely hurry through, on the way to somewhere more useful or more pleasant. A fair list of what we can say we know would seem to include;

- The best public spaces allow people to relax but also actively meet people;
- Slightly smaller spaces with a reassuring 'sense of enclosure' and attractive and busy edges are normally best;
- Readily walkable places are more popular, more valuable and encourage more walking – which is good for physical and mental health;
- The most popular and best-used public spaces makes use of places to sit and arcades and are not overwhelmed by parked cars and traffic;
- Greenery and street trees improve public spaces (as long as they are maintained and do not create fear of crime);
- We need to bother about beauty. More 'active' and textured facades, with more of a sense of place, are more popular than 'blank' facades; and
- We are beginning to understand why these factors are truly predictable. Variety that is not too complex, some level of symmetry, a sense of enclosure, edges and colours, are more readily comprehensible to us, more reassuring and seem to make us happier. Place is emotional not just rational – we like memories and meaning and good development recognises this.

What seems likely but has not been proven? What don't we know at all? A list of what is still uncertain would seem to include;

- The relative importance of the 'edge effect';
- The importance of placing benches around the edge;
- The optimum size of public squares;
- The optimum width of streets and alleys;
- The relative importance of the sense of enclosure and the presence of people;
- The relative importance of the surrounding urban 'form', versus the quality of the public space; and
- The relative importance of the quality of the façade, versus the quality of the public space.

As best we can, in part two of this study, we have focussed on this second list, so that we can set, with more confidence than ever, as convincing a 'menu' as possible for effective public spaces.

SECTION TWO: NEW RESEARCH - WHERE DO PEOPLE WANT TO BE?

'It turns out that those "gut feelings"…that we sometimes use to guide decision-making, and which are more often right than wrong, are actually born in our deeper, emotional brains and they constitute important pathways by which we can make sensible goals and plans.' Colin Ellard







As we have seen, research has advanced some strong hypotheses and proved some things (traffic is pretty definitely a bad thing for the quality of public life). However, much remains unproven. To understand which places are considered most beautiful, where people most want to be and why, we have used a range of research techniques to try to 'harden up' our understanding of what humans like any why. We have investigated 17 specific aspects of the built environment, grouped into the six questions we set out at the beginning of this book:

1. Why do people spend time in public spaces?
2. What are the best shapes and sizes, edges and paths?
3. Does walkability work?
4. Does it matter what objects you have in a public space and where?
5. Is greenery essential, or just a 'neat trick'?
6. Do we need to bother about beauty?

Cutting across all of these is a desire to understand the relative importance of horizontal infrastructure (trees and benches, presence of traffic) versus vertical infrastructure (façade quality of the surrounding buildings).

Our principle research, which we have termed our Place Beauty Analysis, uses 'big data' and has combined machine-learning technology developed by Create Streets' Fellow (and researcher in data science at the University of Warwick and the Turing Institute), Dr Chanuki Seresinhe, with Create Streets analysis of GIS software. We have brought these tools together (for the first time ever), to quantify and compare the 'beauty' and urban form of 18,966 specific public places, in six cities across the UK. To research categories that this analysis could not tease out, we have also run a range of visual preference surveys (online, and in combination with Ipsos MORI) and conducted on-site observations and measurements. The table below shows the full list of categories and the methodology we used to measure each issue.

	What	Category	How
1	Why do people spend time in public spaces?	Mixed commercial vs. single commercial use	• AI-algorithm + urban form metric + regression analysis
2		Mixed land use vs. single land use	• AI-algorithm + urban form metric + regression analysis
3		People vs. no people	• CGI + online polling
4	What are the best shapes and sizes, edges and connections?	Enclosed vs. open spaces	• AI-algorithm + urban form metric + regression analysis
5		Different size square in the same city/style	• CGI + online polling
6		Different width streets in the same city/style	• CGI + online polling
7	Does walkability work?	Footway vs. carriageway proportion	• AI-algorithm + urban form metric + regression analysis
8	Does it matter what objects you have in a public space and where?	Urban furniture provision	• AI-algorithm + urban form metric + regression analysis
9		Cycle lanes vs. no cycle lanes	• AI-algorithm + urban form metric + regression analysis
10		Seats vs. no seats	• AI-algorithm + urban form metric + regression analysis
11		'Edge effect': Seats at side of public spaces vs. in middle of spaces	• CGI + online polling
12		'Edge effect': Seats away from traffic vs. with back to the traffic	• CGI + online polling
13	Is greenery essential or just a 'neat trick'?	Street trees vs. no street trees	• AI-algorithm + urban form metric + regression analysis
14	Do we need to bother about beauty?	Buildings with textured materials and regular fenestration vs. buildings without	• AI-algorithm + urban form metric + regression analysis
15		Buildings with 'walking architecture' (vertically articulated every few metres) vs. 'driving architecture' (limited or no vertical articulation)	• AI-algorithm + urban form metric + regression analysis
16		Recently invested in public realm vs. not invested in	• AI-algorithm
17	What is the relative importance of horizontal vs. vertical infrastructure?	Nice vertical infrastructure vs. nasty vertical infrastructure; Nice architecture with horizontal infrastructure vs. nasty architecture with horizontal infrastructure	• CGI + MORI survey

The Place Beauty analysis is a method for measuring which places people find to be aesthetically pleasing (or 'scenic') and for relating this analysis to an area's 'morphological features, (for example, its street pattern, building height or the presence of street trees). It has two main components:

- Firstly, a deep-learning algorithm that rates the 'scenic-ness' of different places. This was developed by Create Streets fellow, Dr Chanuki Seresinhe.[211] This algorithm can rate the beauty, or 'scenic-ness' of images of the outdoor environment.[f] This learning algorithm has learnt to recognise outdoor beauty by being trained on over 200,000 images of Great Britain, that have been rated over 1.5 million times, by over 20,000 people. It is able to predict, with a high degree of accuracy, which environments most people prefer, due to their appearance;

- Secondly, we have performed a regression analysis, linking the findings of this algorithm to the actual form, nature, age and shape of the immediately surrounding city. Among the key criteria we have used are: how dense in built-up area a place is; the proportion of historic buildings; the distance from historic buildings; the richness of land uses and of commercial activities; and the presence of urban furniture, like benches, trees and fountains. Our data is sourced from Ordnance Survey (OS), Historic England (HE), Consumer Data Research Centre (CDRC) and OpenStreetMap (OSM) websites.[212] More details of the data, methodology and precise assumptions made are set out in the appendix.

8.1 About six British cities

We analysed public spaces in six English cities.[g] We wanted to look at a range of city types and sizes, from the global and the larger metropolitan, to new towns and conventional historic cities. We therefore looked at: Greater London, two metropolitan cities (Manchester and Birmingham), the new-town Milton Keynes and two historic cities (Cambridge and Canterbury). For each place we downloaded four images, to permit a 360-degree view, and computed the average score. These cities are intended to represent a range of places. The two metropolitan cities are broadly comparable in size and nature. So

[f] Deep learning algorithms are the type of algorithms behind recent dramatic advances in artificial intelligence tasks, such as facial recognition and speech recognition

[g] It was necessary for all cities to be English to ensure data comparability.

are the two historic cities. London obviously stands alone, within the UK, as a global city. So (within our sample) does the new town of Milton Keynes, garden city of grass verges and countless roundabouts. For each city, we have identified a 'rural-to-urban transect.'[h] A transect can be thought of as a 'slice of the city', from the beating heart of the centre, to the restful countryside beyond the city limits. The term comes from environmental studies and is used to describe changes in habitat.[213] Over the last decade, it has been increasingly used to analyse the concentric circles of a city and how their use and character changes with location, centrality and connectivity.[214] The figure below shows a transect sequence proposed by Andres Duany in 2002.

Example of a rural-urban transect.

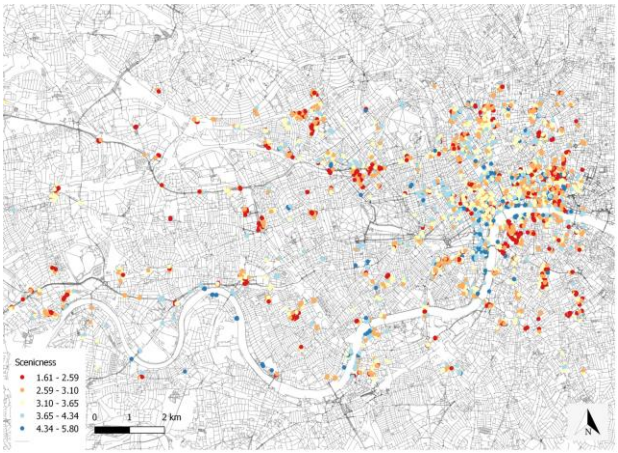
[h] Sections of urban areas are often used in urban studies to give a representative sample of the city fabric.

Case study	Categorization	Population in 2017[215]	Predominant building age range[216]	Overall density (people /hectare)[217]
London	Global	8,825,001	1967-1972	52
Manchester	Metropolitan	2,798,799	pre 1900	43.5
Birmingham	Metropolitan	1,137,123	1930-1939	40.1
Milton Keynes	New town	267,521	1973-1982	37.6
Canterbury	Conventional	164,100	pre 1990	42.8
Cambridge	Conventional	124,919	pre 1990	38.8

Cities studied.

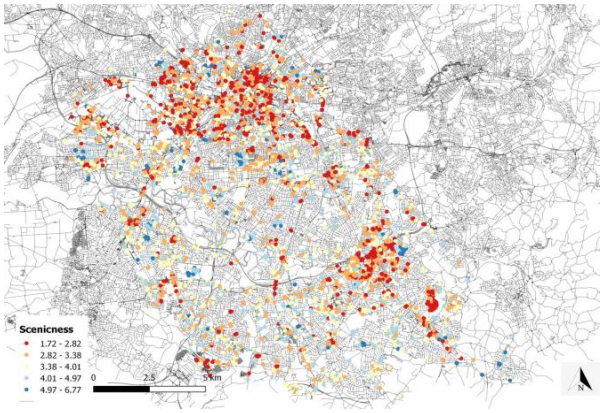
London transect.

Greater London. The transect of London, that we have considered, crosses some of the main central areas, like Covent Garden, Westminster, Chelsea and Kensington. It extends west to Harlington. It intercepts very diverse places, with many different urban patterns, from high-density Victorian terraces and Edwardian mansion blocks, to medium-density suburban neighborhoods. The figure below shows the places we considered.[i]



London places with 'scenic-ness' scores from most (blue) to least beautiful (red).

Greater Manchester. Manchester demonstrates, probably better than anywhere else, the revolutionary consequences of the industrial revolution on some British towns and cities. We took a section from the neighbourhood of Strangeways heading south, reaching the Victorian middle-class suburb of Didsbury to beyond Stockport. The city centre mixes some modern, high-rise developments, with many more Victorian textile warehouses. Many of these have now been refurbished and converted into flats, or re-used as offices. The figure below shows the places we considered.

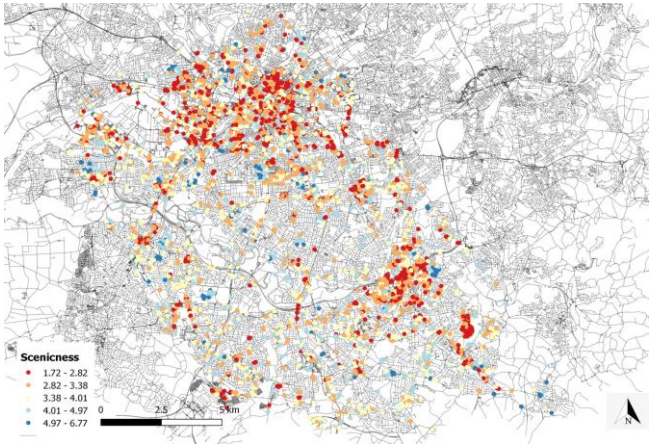


Manchester places with 'scenic-ness' scores from most (blue) to least beautiful (red).

Birmingham. Regeneration and large-scale development characterise Britain's second largest city. Our Birmingham section runs from Aston (in the north) to Moseley (in the south), crossing the Jewellery Quarter in the centre (historic home of small manufacturing), and the prosperous suburb of

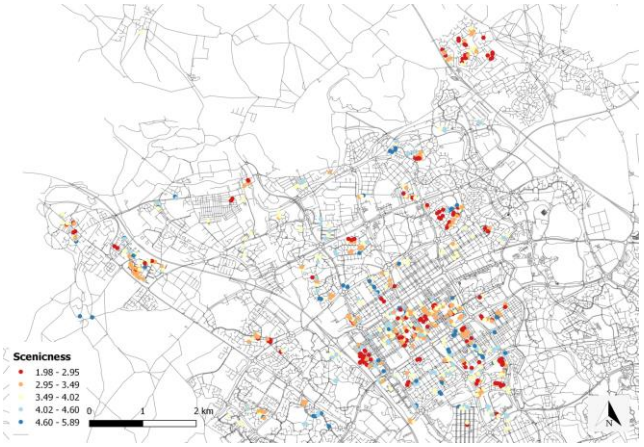
[i] Places are represented as function of the 'scenic-ness' and classified according to the 'Natural Breaks' classification in GIS into five classes. From the most scenic (blue) to the least scenic (red).

Edgbaston and reaching to the village of Wordsley. This section intersects large-block urban schemes, the city's business and leisure districts (which are a mix of modern buildings and recently refurbished Victorian buildings), some low-density areas (with high-rise, low-quality constructions) and a tangled network of streets. It ends in the peripheral villages around the city, composed of very low-density residential areas, with red-brick detached homes and much surrounding greenery. The figure below shows the places we considered.



Birmingham places with 'scenic-ness' scores from most (blue) to least beautiful (red).

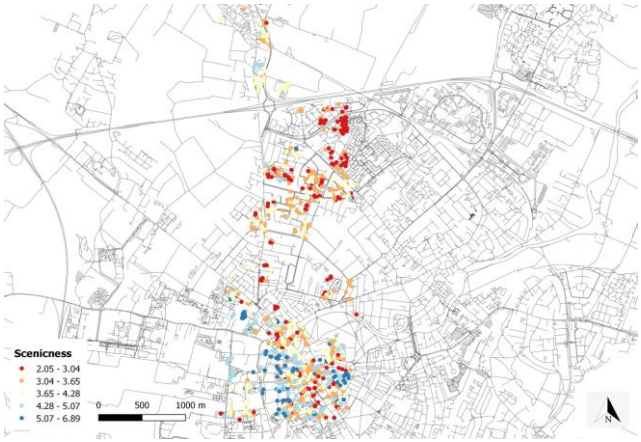
Milton Keynes. The largest of the British new towns, Milton Keynes, was designed and developed from 1967, on farm land. It was created by a top-down decision-making model, that generated an urban form both reliant on the car, but with homes often cut off from streets and public highways. We examined a section from Eaglestone West, south of the town centre, towards the north, up to Newport Pagnell. This transect intercepts different urban patterns, from low-density residential neighbourhoods, dominated by single houses with private gardens and many cul-de-sacs; to a commercial district made of large blocks of commercial boxes, separated by a grid-iron layout of urban highways. The figure below shows the places we considered.



Milton Keynes places with 'scenic-ness' scores from most (blue) to least beautiful (red).

Cambridge. Home to one of the two world-famous British universities, Cambridge University, founded in 1209, Cambridge's city-centre is not just thronged

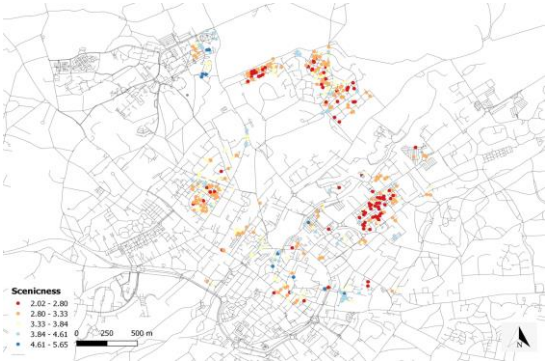
with students ,in term time, but with tourists drawn to its history, architecture and largely medieval street patterns. We selected a transect from the historic town centre, in Market Square, which tourists know well, running north, up to Orchard Park, crossing some of the more modest sections of the city, such as Arbury which tourists certainly don't frequent. The centre intercepts some of the most lavish and eclectic university buildings - above all the world-famous King's Chapel. In contrast, the suburbs are characterized by very low-density, semi-detached houses with private gardens, parking spaces and lots of greenery.



Cambridge places with 'scenic-ness' scores from most (blue) to least beautiful (red).

Central does not always mean historic in Cambridge, however. Recent 'international style' shopping centres, for instance, could as easily be in Connecticut as Cambridge. The figure above shows the places we considered.

Canterbury. We have taken a section running from the town centre, outside the original city walls, and Lower Bridge Street, running north-east to Hales Place. As in Cambridge, the centre is made up of both historic and more modern buildings, with commercial uses. In the suburbs, there are many cul-de-sac and detached houses. The figure below shows the places we considered.



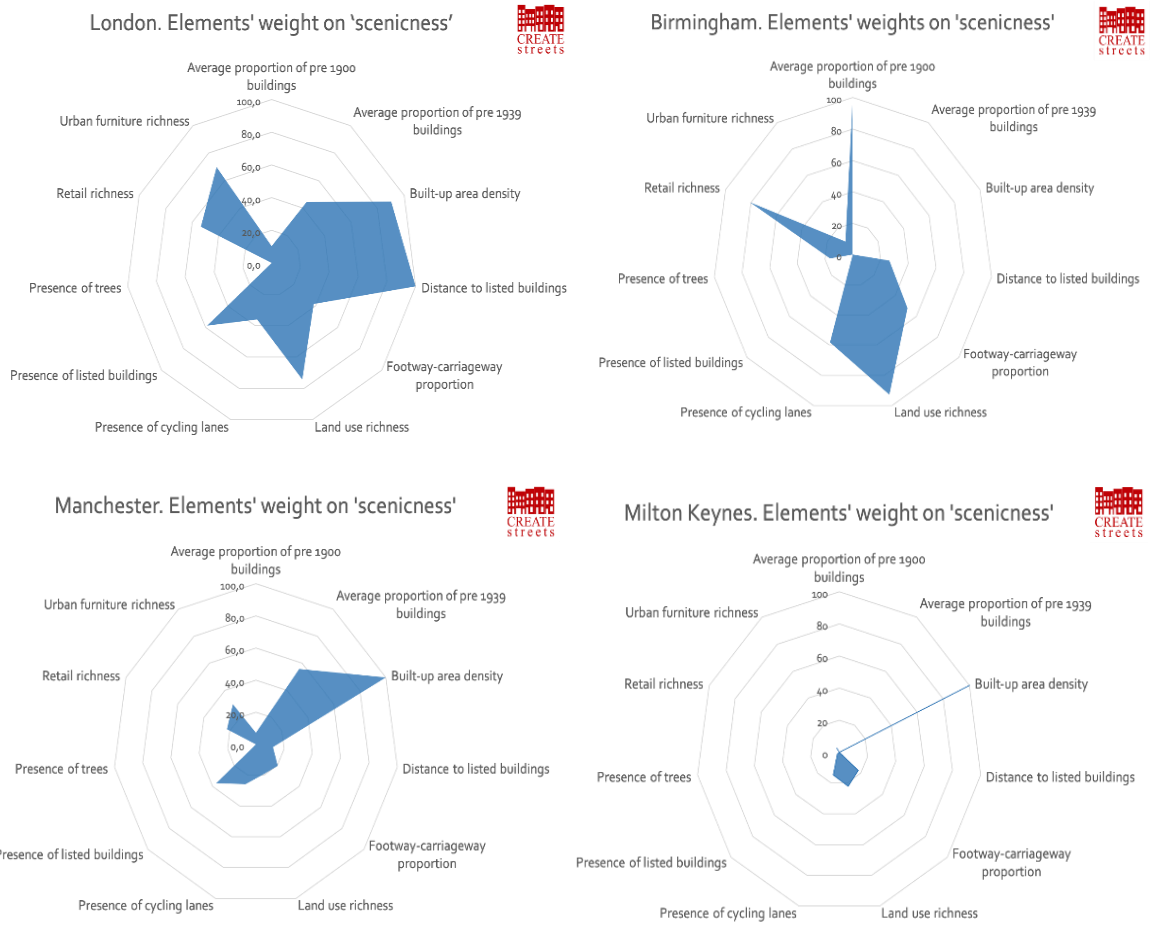
Canterbury places with 'scenic-ness' scores from most (blue) to least beautiful (red).

8.2 What we found: beautiful places are dense, mixed in use and rich in architectural details

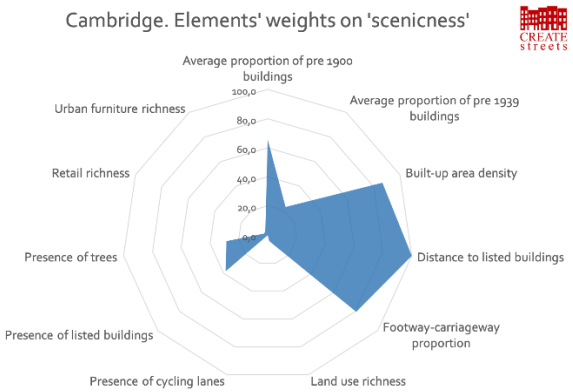
We used our Place Score analysis to test how well scenic predictions correlate (or do not) with certain elements of urban form. This permitted us to

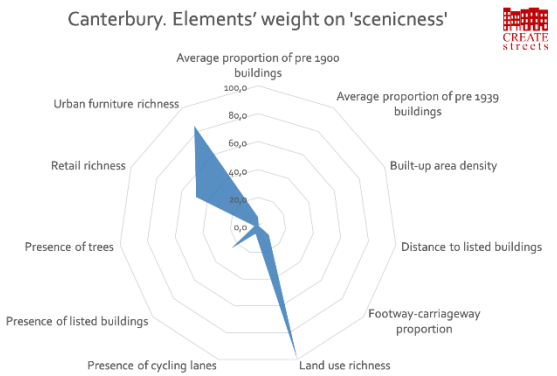
understand which elements were correlated with (and arguably often constitute) 'scenic-ness'. We ran the analysis, firstly, city-by city and, secondly, across large cities and small cities separately.

City-by-city. Firstly, we ran the analysis city by city. The series of figures below represents the weight, or importance, of each element of urban form, on a scale from 0 (least) to 100 (most important), in determining the 'scenic-ness', or beauty, of a place. The analysis was run for each city, on the full dataset.



Degree to which different elements of urban form predict 'scenic-ness'.





Milton Keynes has very weird results. This may be due to its highly segregated and mono-functional urban structure. Everything happens in the centre. The commercial and leisure district has an extremely high mix of land uses and commercial activities, and some scattered sitting places and trees. The outer areas are residential only, with no shops, yet with lots of greenery. The most consistent predictors of 'scenic-ness' in the city-by-city analysis, which are above overall average, in at least in three cities, are: Built-up area density (i.e. the amount of land that is built on);

- Average proportion of pre-1939 buildings;
- Richness of land uses;
- Presence of listed buildings; and
- Richness of commercial activities.[j]

[j] The overall average is calculated across all elements of all cities and it is equal to 33.3 over 100.

In short, in our city-by-city analysis, the presence of older buildings, of a high ground cover by buildings and a diversity of land use, were all associated most consistently with greater 'scenic-ness.'

All-large-cities vs. all-small-cities combined. Secondly, as big cities are very different from smaller cities, we analysed all the large cities together (London, Manchester and Birmingham) together and all the small cities (Cambridge, Canterbury and Milton Keynes). This was a 'check' for our city by city analysis. If we consider the overall mean value of all elements, for both large and small cities (44.2 and 21.7 respectively), four elements seem most important in determining the 'scenic-ness' of places in big cities and three elements in small cities.[k]

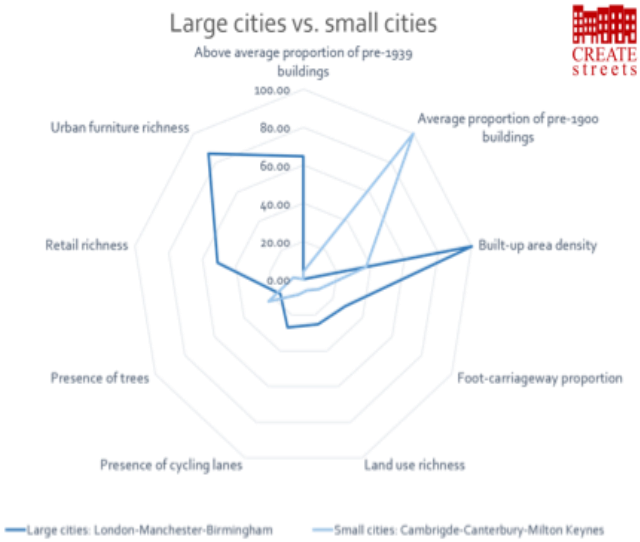
[k] The difference may be due to the lack of data in the smaller-size cities.

The tables below rank these from the most to the least important, on a scale from 0 to 100.

Elements of urban form	Large cities
Built-up area density	100
Urban furniture richness	86
Above average proportion of pre-1939 buildings	65
Richness of commercial activities	51

Elements of urban form	Small cities
Above average proportion of pre-1939 buildings	100
Built-up area density	37
Presence of trees	23

Elements determining 'scenic-ness'.



Degree to which different elements of urban form predict 'scenic-ness'.

Cities compared. Of course, no one city is the same.[I] Considering the overall average value (33.3), we found the following. Elements are listed from the most important to the least. The most beautiful or scenic places are determined by:

[I] Variance across cities may be due to several biases. These include; a) the varying samples due to different sizes (London and Manchester have a far greater number of observations than all other cities. This could skew the total); b) the possible lack of explanatory elements missing from the model that could explain 'scenic-ness'; c) the skewed-ness of elements after symmetrisation. This could be an issue when interpreting the significance between the associations of the independent and the dependent variable; and d) the redundancy of some elements of urban form. 'Presence and Distance to a listed building', 'Above average proportion of pre-1900 and of pre-1939 buildings' and 'Built-up area density', all measure similar things: how old a place is. However, they all represent different categories in this analysis and therefore we believe it is important to include them all. Also, the elastic net analysis works well with instances where there are several highly correlated elements.

In London:

- distance to a listed building: 100;
- high built-up area density:91;
- richness of land uses: 74;
- richness of urban furniture: 70;
- the immediate presence of a listed building: 59;
- richness of commercial activities: 53;
- average proportion of pre-1939 buildings: 45;
- proportion between footways and carriageways: 38.

In Manchester:

- high built-up area density: 100;
- average proportion of pre-1939 buildings: 56;
- presence of listed buildings: 37.

In Birmingham:

- average proportion of pre-1900 buildings: 100;
- richness of land uses: 93;
- richness of commercial activities: 81;
- presence of cycling lanes: 58;
- footways vs. carriageways proportion: 52.

In Cambridge:

- distance to a listed building: 100;
- high built-up area density: 87;
- footways vs. carriageways proportion: 81;
- average proportion of pre-1900 buildings: 66;
- presence of listed buildings: 38.
-

In Canterbury:

- richness of land uses: 100;
- richness of urban furniture: 85; and
- richness of commercial activities: 49.

In Milton Keynes:

- high built-up area density: 100.

The table below shows the importance of elements, per city, in determining the 'scenic-ness' of a place. Weights are set on a scale from 0 (least) to 100 (most important) and are represented with a gradient from darkest red (most important) to lightest red (least important).[m] While the elastic net model predicts eight elements, out of 11, that most determine the 'scenic-ness' of places in London, for the other cities it is not the same. This is due to the far greater and more detailed data available for London than for the other cities, combined with a larger number of observations.[n] Nevertheless, we have found some fairly consistent themes, which are reflected by the all-cities analysis. Across all (or nearly all) cities, the best-rated places tend to have certain key characteristics. As above, numbers represent each element's weight on 'scenic-ness' on a scale from 0

[m] Weights (named elastic net coefficients) represent the extent to which elements predict 'scenic-ness'.

[n] Some of our data come from Open Street Map, which has more accurately mapped London. For more details see the Appendix.

(least) to 100 (most important). They are weighted on the overall average of 33.3). These are;

- A high built-up area density. In almost all cities 'scenic-ness' tends to be determined by more densely-built areas – above 86.7. However, Canterbury and Birmingham are exceptions. The former accounts for 4.2, while the latter 23.2. This may be due to the scarcity of data on buildings. In the case of Canterbury, and due to its small size, this may also be due to the high number of observations in suburban and rural areas;
- A rich mix of land uses. Except for Cambridge, richness of land-uses appears to be crucial. This is especially in Canterbury (100), London (74.3), and Birmingham (45.4). The reason for Cambridge's exception may be the high presence of university buildings that are mainly college accommodation. Only a small area around the city centre has a mix of different functions;
- Listed buildings immediately present. This is very important in predicting 'scenic-ness'. This is a common pattern across cities and ranges from 38.1, in Cambridge, to 58.2 in London. The exceptions are Milton Keynes (due to the near total lack of historic buildings and their location in very low-density areas), and Birmingham due to (we think) the poor state of many older buildings;[o]
- An above average diversity of shop types; with three out of six cities, with values largely above the mean (49 in Canterbury, 53 in London and 81 in Birmingham). Cambridge and Milton Keynes score extremely low, 3 and 0 respectively. Although in different ways, shops in both cities are only clustered in very central areas.

[o] Some older buildings do exist within Milton Keyes however they are former village buildings swallowed up by the new town and not situated centrally as with most towns.

Elements of urban form	London	Manchester	Birmingham	Cambridge	Canterbury	Milton Keynes
Distance to listed buildings	100.0	12.1	26.4	100.0	0.0	0.0
Built-up area density	90.4	100.0	0.0	86.7	4.2	100.0
Land use richness	74.4	19.4	93.0	4.4	100.0	22.2
Urban furniture richness	69.9	29.6	10.0	3.1	84.8	3.0
Presence of listed buildings	58.6	36.9	0.0	38.1	25.5	1.9
Retail richness	53.4	22.3	80.8	2.6	48.7	0.0
Above average proportion of pre-1939 buildings	44.5	55.9	0.0	22.9	0.7	0.0
Footway-carriageway proportion	38.2	20.4	51.8	80.6	10.4	17.5
Above average proportion of pre-1900 buildings	10.3	7.2	100.0	65.8	5.8	0.0
Presence of cycling lanes	10.3	25.8	58.2	0.0	6.3	14.7
Presence of trees	0.0	0.0	16.5	28.6	2.6	0.0
Average per city	50.0	30.0	39.7	39.4	26.3	14.5
Overall average	**33.3**					

Importance of elements per city in predicting 'scenic-ness', on a scale from 0 (least) to 100 (most important).

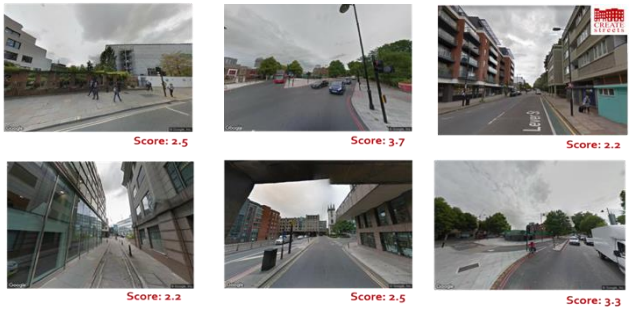
8.3 No matter how many trees, if the façade is ugly

Against our expectations, our model did not find that the presence of trees is a primary driver of 'scenic-ness'. This surprised us. The presence of street trees is quite robustly associated with many good health and wellbeing outcomes (including slower cars, fewer accidents, more walking and better mental health)[218]. We also know that purely rural areas tend to score very highly due to their natural landscape features, such as trees, water and hills.[219]

So why no strong association with street trees? There seem to be two associated main reasons – and one possible limitation with the data. First of all, while trees are very nice, it would seem that the beauty of urban areas is mainly (or can be) a function of what their buildings look like and the urban patterns. Façades that are beautiful, engaging and rich in detail, make beautiful places. Think of the world's great public spaces from St Mark's Venice to the Grande Place in Brussels, and this is clearly true. An example within our analysis, is Sussex Street in

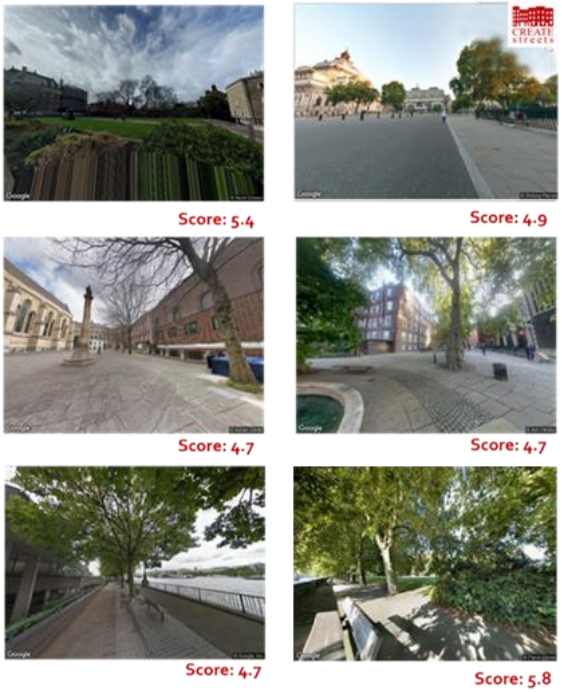
Cambridge. In contrast, Kings Square Gardens in Clerkenwell, London, has many trees within its immediate surroundings, but its overall score is very low (2.2). This may be due to the ugly, modernist buildings that surround it. Trees are great but they are simply not enough if nothing else is right.

In addition, we have found some trees missing from the database which is leading to some false (or at any rate incomplete) readings.[p]



Examples of low scoring places with a high number of trees.

For example, in Victoria Tower Gardens in London, the score is 5.8, because it is by the river, in a small park and with many benches. However, the trees have not been mapped in OSM, so the 'Presence of trees' is not influencing the score. The figures below show some examples of low scoring places, despite the high proportion of trees (left). Kings Square Gardens is the top right. Of high scoring places with no data for trees (right). Victoria Tower Gardens is the top right.



Examples of high scoring places with no data for trees.

[p] The database of the trees (gis_osm_natural_free_1.shp) comes from the Open Street Maps archive and contains only trees that have been mapped, rather than all existing trees. We estimate it has about 70 per cent coverage. Potentially, picture were taken in winter which would reduce trees' prominence in images. For more details, see Appendix.

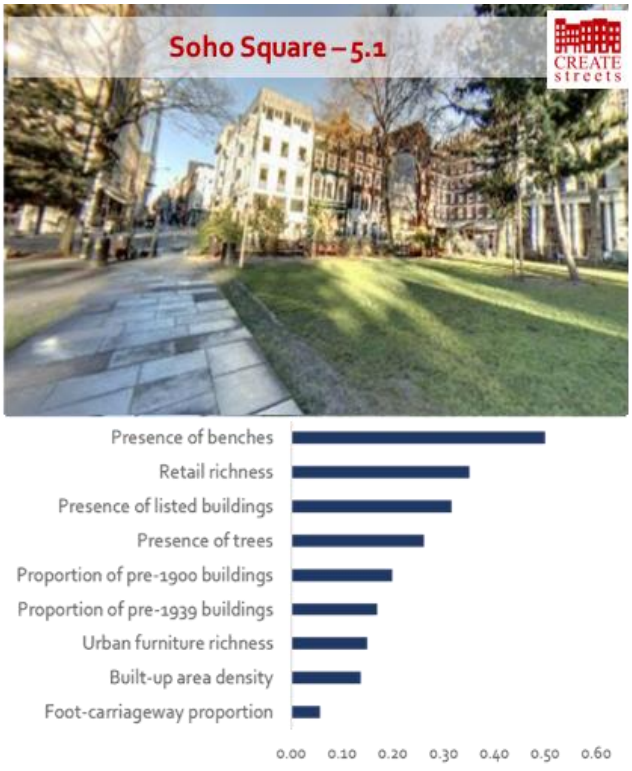
8.4 What are some of the best scoring places in London?

Based on our findings, the most popular places tend to be parks, or enclosed small squares, with a variety of urban furniture, surrounded by historic buildings, or façades rich in detail. We intentionally chose four different types of spaces which have scored highly: a medium-size square, in a very dense, central borough (St. James's Square), a famous, medium-size square in a very lively neighbourhood (Soho Square), a smaller, less-known square (Old Square), and a much-debated recently pedestrianized boulevard (Exhibition Road). The figures below summarise the morphological characteristics of each place. Bar charts show the elements of urban form that most influence their success, from the most to the least important. Data is normalized among the eight case studies (best- and worst-scoring places) for visual comparison.[q]

St James's Square. St James's Square is the best scoring place (6.2) in all of London, from the most urban to the most rural. The square benefits from being green and having an historic highly textured frontage of buildings. The dense urban context, with a high proportion of pedestrian over vehicular use and a balanced mix of urban furniture (above all benches) probably also helps.

Soho Square. Soho Square's high score (5.1) reflects the variety of urban amenities (there are many benches and trees), and of commercial activities. Its high built-up area density, together with its proximity to several listed and pre-1900 buildings, also contributes to its beauty.

[q] For each place we downloaded four images to allow for a 360 degrees view and each image was rated by at least three people.

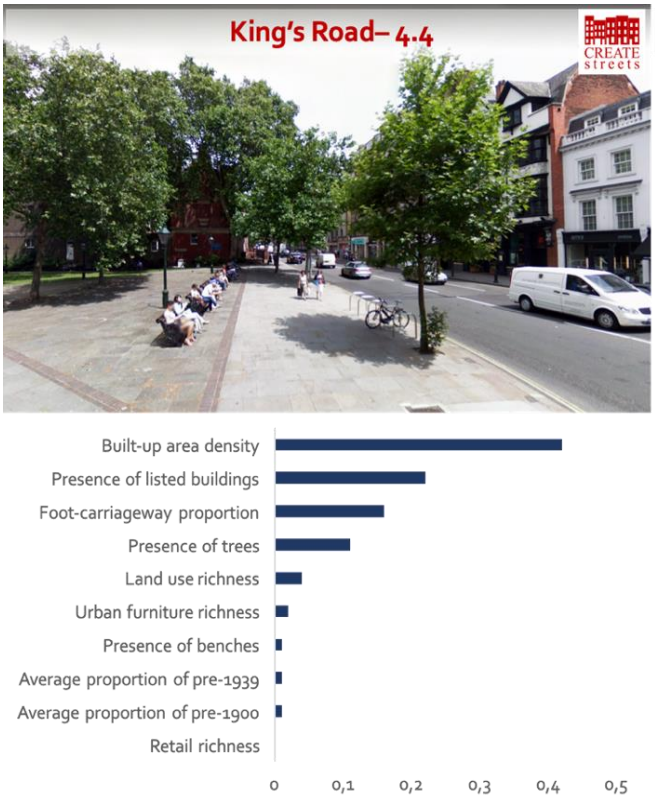


Old Square. Old Square also scores very highly (5.1). Its success comes from its combination of a well-balanced ratio between footways and vehicular use, a high built-up area density and the proximity to historic buildings. Again, the high proportion of pre-1900 and pre-1939 buildings, in its immediate surroundings, influences the overall score. Its score is increased by the presence of good urban furniture, such as trees and benches.

Exhibition Road. Exhibition Road, now a fully-pedestrian boulevard at its southern end, with a good mix of different shops, cafes and restaurants at its southern end, turned out to be one of the most successful places in London (4.4). The right balance between its articulated façades, the high proportion of sitting places and trees and the proximity to some impressive historic buildings, make Exhibition Road an enjoyable, safe and engaging space.

King's Road and Sloane Square. Other high scoring places included the King's Road and Sloane Square both on the Cadogan Estate in Chelsea which scored 4.4 and 4.3 respectively. Their high scores are associated, above all, with an appropriately high built up area density, with many listed buildings rich in detail and texture, with wide pavements, street trees and a great diversity of uses. Their score represent reality – that they are good places in which to be and spend time.

The locations selected on the King's Road actually had slightly less diversity of shops in the immediate vicinity than most of the street due to its immediate proximity to a fire station and a small park. This means that the 100m-radius circle did not intercept as many shops as it would in another position. This reduced the score for retail richness.



Similarly, the 'scenic-ness' score for Sloane Square (4.3) will have been reduced by the fact that the location was in the middle of the carriageway not the middle of the square itself. However, this is not entirely unfair as Sloane Square is in parts dominated

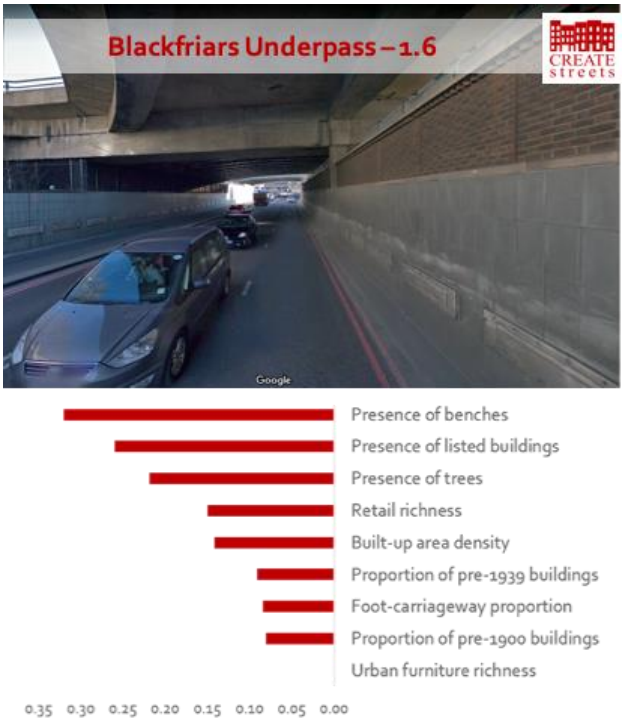
by quite heavy vehicular traffic. This does reduce its quality as a place to be.[r]

8.5 What are some of the worst scoring places in London?

Based on our findings, the worst places tend to be dark alleys, parking spaces and crossroads. They are generally surrounded by ugly, boring, and grey façades. We intentionally chose four different types of spaces: a central main thoroughfare (Blackfriars Underpass), a less central, 'service' road (Mepham Street), a residential cul-de-sac (Northchurch), and a narrow alley in a modern setting (White Hart Street). The figure below summarises the morphological characteristics of the selected low-scoring places. Bar charts show the elements of urban form that are missing, and thus most needed, for improvement. Elements are represented from the most- to the least-needed.[s] Data is normalized among the eight case studies (best- and worst-scoring places) for visual comparison.

[r] King's Road and Sloane Square were computed separately from the previous four case studies and this may have also caused lower scores than expected.

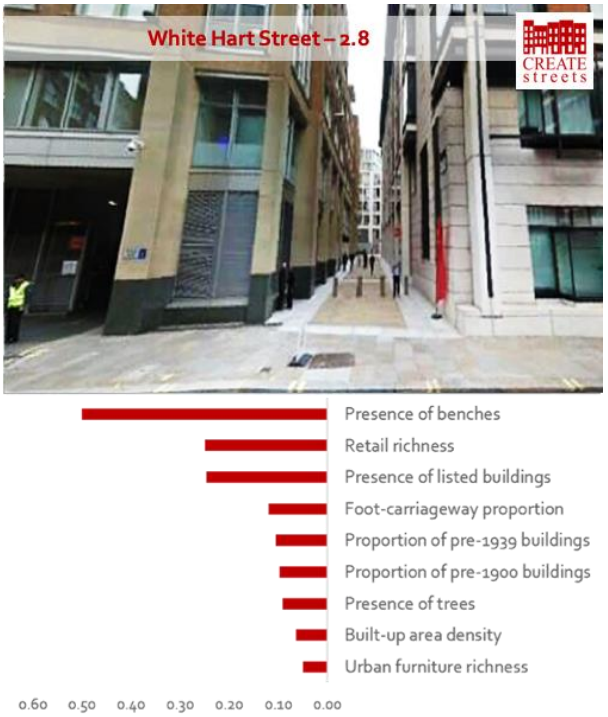
[s] The values were calculated as the difference from the maximum value across the eight case studies of that element.



Blackfriars Underpass. Blackfriars Underpass, a three-lane street along the Thames, is the lowest scoring place in all of London (1.6). Despite the relatively high-density of the built-up area around Blackfriars station (normally a good thing) and the presence of some good elements nearby, (the Neoclassical Art Deco Unilever building and Queen Victoria statue), the amorphous and depressing blank tunnel facades make for a horrid place. There is no urban furniture, nowhere to sit, fast traffic and no trees.

Mepham Street. Mepham Street, outside Waterloo station, is nearly as bad and is one of the lowest scoring places in London (1.8). Despite its high density (normally a good thing), many footways and the presence of a listed building in the immediate surroundings, the complete lack of urban furniture, benches and trees, the lack of commercial activity and the monotonous blank facades make Mepham Street an unpopular and isolated place.

Northchurch. Northchurch is a residential cul-de-sac in Southwark. It has parking lots on both sides, surrounded by poorly-detailed modernist buildings. This appears to drive the very low score (2.0). Its high built-up area density and the presence of scattered trees in the neighbouring streets, are not enough to increase its beauty. There are no seats. There is no mix of land use or commercial activities. The poor performance is particularly driven by the lack of what most would consider to be beautiful or engaging architecture.



White Hart Street. White Hart Street, an alley off Warwick Lane in the City, has a slightly higher score (2.8), possibly due to the presence of a better urban framework and a slightly higher proportion of pre-1900 and pre-1939 buildings in the immediate surroundings. However, it's high height-to-width ratio and lack of visible amenities, such as seats or shops, make for an un-interesting area which scores lowly.

8.6 What is the impact of investment on public space?

We ran another analysis to see whether investment in public space had an impact on the perception of places. We selected 17 streets in London that have recently seen material public realm investment.[t] We downloaded multiple images of each place from Google Street View.[u] We ran the images through the 'machine-learning' algorithm and obtained scores for before and after investment. The table below shows the 'scenic-ness' score before and after investment. Streets are sorted according to the score's percentage increase. What conclusions can we draw? On average, there has been a 13.8 per cent increase in scores after investment. Unsurprisingly, where more money was invested, places benefited more. For example, Exhibition Road was significantly improved by a £29 millions investment (40 per cent increase). A wide pedestrian boulevard has replaced two busy carriageways and is now populated with many active shops and restaurants with homes and offices above. By contrast, a £1.75 million investment in Aldwych was focused on the paving of the pedestrian crossing and did not have such a big impact on surroundings (0.5 per cent increase). An interesting case is Van Gogh Walk (37 per cent increase). Despite limited funds, this residential street, (named after the painter's brief residence in the area in the 1870s), has become a much more peaceful and safer space after community-led pedestrianisation and landscaping.[220] The figures below show Van Gogh Walk, Exhibition Road and Aldwych before and after investment.

2008

Scenicness Score: 3.21

2017

Scenicness Score: 4.40

Van Gogh Walk before and after investment.

[t] Case studies were selected from: *Better Streets Delivered, (2013)* and *Better Streets Delivered 2*, (2017). Both were published by Urban Design London.

[u] We used Google historic script to retrieve historic images of each street. However, we had to consider the lack of systematic distribution of historic sampling: time frames are not equal across all places nor is their frequency. Weather conditions may also vary from image to image.

2008

Scenicness Score: 3.12

2008

Scenicness Score: 4.25

2015

Scenicness Score: 4.37

Exhibition Road before and after investment.

2017

Scenicness Score: 4.27

Aldwych before and after investment.

Street	Investment (in millions)	Completion date	Score before investment	Score after investment	Percentage increase
Exhibition Road	£29	December 2011	3.12	4.37	40 per cent
Van Gogh Walk	£0.4	2013	3.21	4.40	37 per cent
Herne Hill	£1.704	July 2010	2.87	3.59	25 per cent
Windrush Square	£8.7	February 2010	4.04	4.96	23 per cent
Malet Street	£1.1	Summer 2011	3.52	4.33	23 per cent
Venn Street	£0.4	September 2011	2.96	3.44	16 per cent
Kingsland High Street	£2.58	April 2002	2.79	3.15	13 per cent
Montague Place	£1.15	Summer 2011	3.63	4.11	13 per cent
Royal College street	£0.6	August 2013	3.60	4.00	11 per cent
Lancaster Place	£1.75	2013	3.60	3.96	10 per cent
Euston Circus	£4.5	December 2013	2.86	3.13	9 per cent
Piccadilly two-way	£12.5	June 2012	4.41	4.58	4 per cent
Leyton High Road	£2.4	2012	3.93	4.07	3.5 per cent
Britannia Junction	£1.1	July 2012	4.58	4.74	3 per cent
Clapham Junction-Brighton Yard	£1.9	April 2011	3.10	3.14	1 per cent
Great Russell Street	£0.8	Summer 2011	4.57	4.60	0.6 per cent
Aldwych	£1.75	2013	4.25	4.27	0.5 per cent

'Scenic-ness' score before and after investment.

[211] Seresinhe, C. I., Preis, T., & Moat, H. S. (2017). *Using Deep Learning to Quantify the Beauty of Outdoor Places.* & Law, S., Seresinhe, C. I., Shen, Y. & Gutierrez-Roig, M. Street-Frontage-Net: *Street-level Knowledge Discovery using Deep Convolutional Neural Networks.*

[212] https://www.ordnancesurvey.co.uk/.https://services.historicengland.org.uk/NMRDataDownload/. https://www.cdrc.ac.uk/. https://www.openstreetmap.org/. http://tools.geofabrik.de/map/.

[213] Interview with A. Duany in https://www.cnu.org/publicsquare/2017/04/13/great-idea-rural-urban-transect

[214] Duany, A., & Talen, E. (2002). *Transect planning.* American Planning Association.

[215] https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/bulletins/annualmidyearpopulationestimates/mid2017.

[216] Source:https://maps.cdrc.ac.uk/#/metrics/dwellingage/default/BTTTFFT/12/-2.2300/53.4700/.

[217] https://www.nomisweb.co.uk/reports/localarea?compare=1119885113.

[218] Boys Smith, (2016), *Heat in the Right Street*.

[219] Seresinhe, C. I., Preis, T., & Moat, H. S. (2017). *Using deep learning to quantify the beauty of outdoor places.*

[220] http://www.vangoghwalk.org/

9.1 Where do people like to sit?

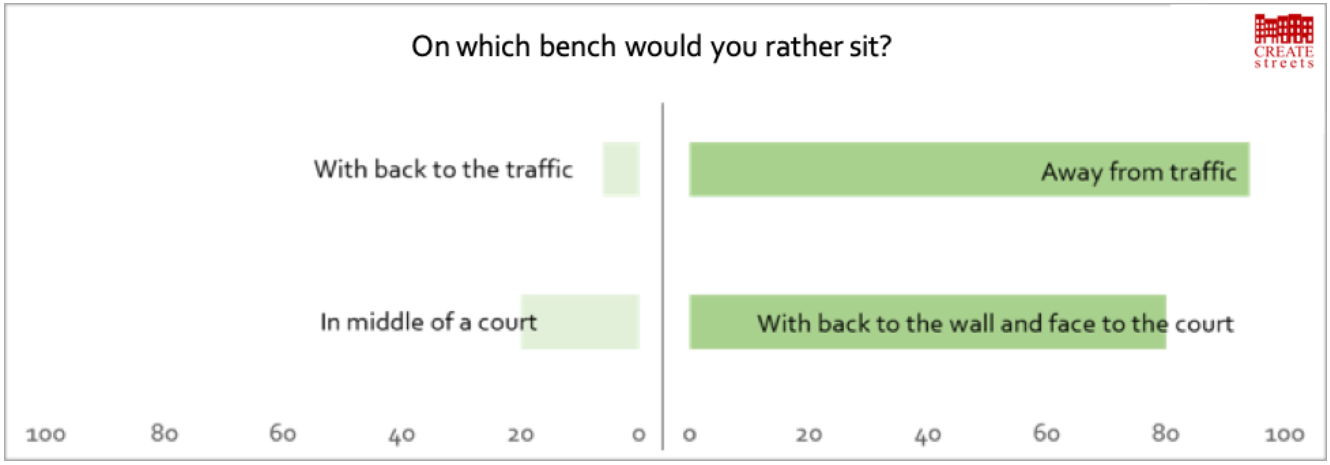
Between the 21st July and 24th September 2018, we ran an online visual preference survey via social media. In total, 768 people visited the site. Of these, 687 took part in the survey (a 90 per cent completion rate).[v] The survey used computer-generated images to insert benches (and people) in different places, in an otherwise identical public space.[w] The aim was to gauge people's immediate preferences for where in a public space a bench should go. Research so far, although mainly theoretical, has shown that people tend to gravitate toward the edges of places, rather than sitting in the middle. This pattern, also known as the 'edge effect', has been explained by cognitive architects as 'thigmotaxis': the subconscious movement of an organism towards, or away from, a physical object.[x] The figure below shows the images used for the survey. Images were presented in a random order. 91 per cent of the respondents said that they would prefer to sit with their back against a wall, instead of in the middle of the pavement. 94 per cent would sit away from the traffic rather than with their back to the traffic. In a courtyard, 74.5 per cent of the participants preferred to sit facing the centre, rather than in the centre. In short, there are nuances. Sitting in the middle of a leafy courtyard appears to be less unattractive to most of us than sitting in the middle of a pavement, or with your back to passing traffic. Nevertheless, we can say with reasonable confidence, that the edge effect is real. Based on our survey, people would rather sit and watch the world go by, than sit in the middle of it.

The figure below summarises the results. Results from survey questions 1,3 and 4, all referring to sitting at the side vs. in the middle of public spaces, were amalgamated.

[v] To be clear we cannot and are not claiming that this is a representative sample of the British population. However, our previous online surveys have been fairly close to national opinion polls we have run with Ipsos MORI.

[w] In this and subsequent surveys, we believe our methodology is solid and results are convincing. Firstly, by using CGI we were able to contrast images where the *only* variable was the object of the survey only (the bench and people sitting on it). Secondly, we chose existing places (images were downloaded from Google Street View) rather than unrealistic or invented environments. Thirdly, we kept questions simple to encourage participation. Average time to complete (on this survey) was 2 mins and 33 seconds. (It was longer on some others). By sharing it through multiple social media accounts such as Twitter and Facebook, and via different accounts, we were able to reach a wide range by sex, age, culture and geography.

[x] See chapter 7.4.



Results of visual preference survey on the position of benches in a public space.

Visual preference survey ran on the position of benches in a public space.

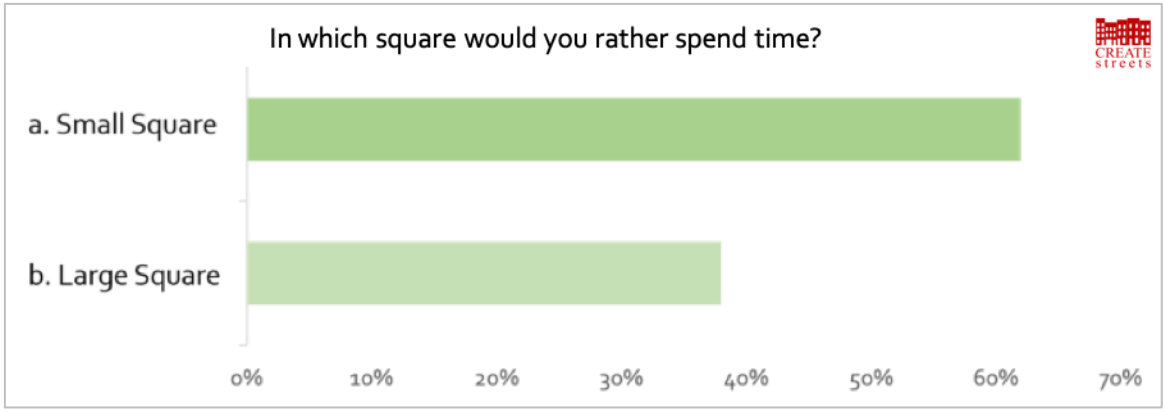
9.2 Do people prefer big squares or little squares?

Between 3rd and 24th September 2018, we ran a second online visual preference survey, that we shared via social media. A total of 798 people visited the site, with 721 people proceeding to participate in the survey (a 90 per cent completion rate). The survey used sourced imagery, sourced via Google Street View, of two public squares contrasting in scale within the same city. This was a means of avoiding bias to varying architectural styles. The aim of the survey was to establish whether, and to what degree, the size of a public square might influence the desire to spend time in each place, whilst also providing insight into people's sense of enclosure, spatial experience and overall perception of their surroundings. 62 per cent of the respondents said that they would prefer to spend time in the smaller public square (image a) over the larger one (image b), whilst the remaining 38 per cent said that they would rather spend time in the large square.

The square in image a (Plaça Saint Jaume in Barcelona) has a height-to-width ratio of around 1:3. The square in image b (Plaça del Pi in Barcelona) has a height-to-width ratio of around 1:1. These findings suggest that there is a sense of enclosure, though it may not be as strong as some other phenomena (or maybe it 'kicks in' more with bigger less-pleasing spaces).

Other variables such as people, furniture, presence of trees and difference in architectural facades may alter or have an impact on these preferences. Further research might take account of these elements. Nonetheless, it still appears very likely that smaller public squares offer a greater sense of enclosure, that most people appear to find preferable and in which they would rather spend time. The figure below summarises the results.

Visual preference survey ran on the size of public squares.



Visual preference survey on the size of public squares.

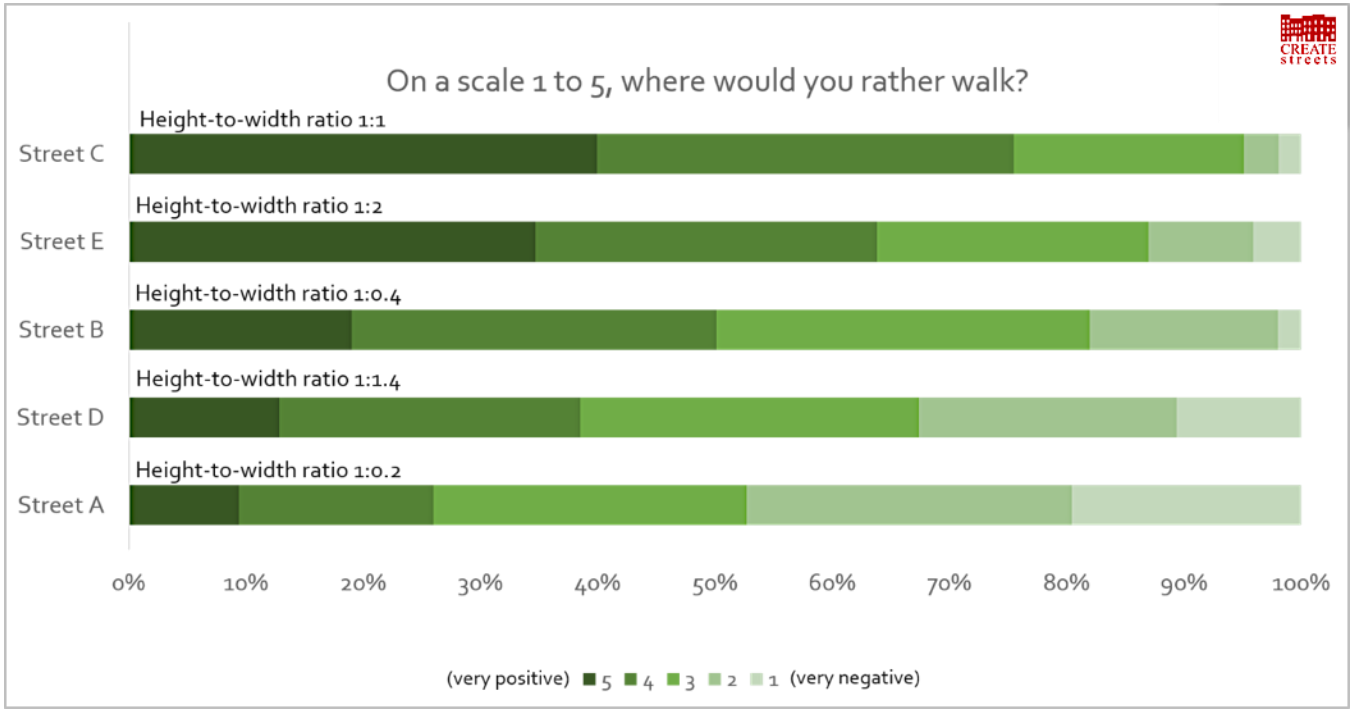
9.3 Do people prefer narrow, medium or wide streets?

Between 2nd and 29th October 2018, we ran a third online visual preference survey, that we shared via social media. A total of 490 people visited the site, with 419 people proceeding to participate in the survey (an 86 per cent completion rate).[y] The survey used imagery, sourced via Google Street View, of five pedestrian streets different in width but similar in architectural style, within the same city (Venice). This was a means of avoiding architectural preferences influencing the results. The aim of the survey was to establish whether, and to what degree, the size of a street might impact on the desire to spend time in each, whilst also providing insight into people's sense of enclosure, spatial experience and overall perception of their surroundings. We considered streets with the following dimensions;

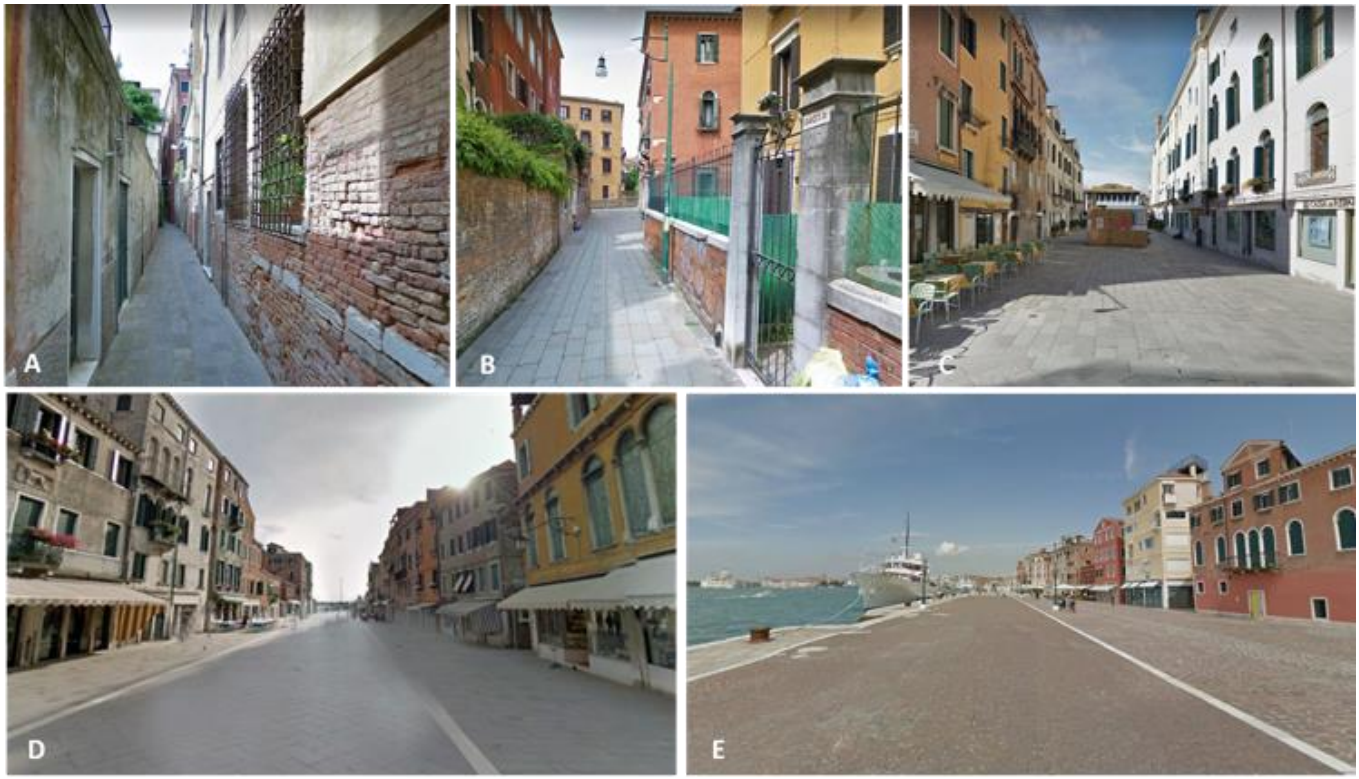
- A: less than 1-metre-wide and with a height-to-width ratio of about 1:0.2;
- B: between 3 and 5 metres wide and with a height-to-width ratio of about 1:0.4;
- C: between 10 and 15 metres wide and with a height-to-width ratio of about 1:1;
- D: between 17 and 25 metres wide and with a height-to-width ratio of about 1:1.4; and

[y] Out of 419, 404 people answered the first question, 405 answered the second, 408 answered the third, 405 answered the fourth and 415 answered the fifth question.

- E: more than 25 metres wide and with a height-to-width ratio of about 1:2 (which also had sea on one side). We asked: 'On a scale 1 to 5, where would you rather walk?' where 1 is very negative and 5 is very positive. The figure below summarises the results.



Where would you rather walk? Results of visual preference survey on the sense of enclosure in pedestrian streets.



Visual preference survey ran on the dimension of pedestrian streets.

The most popular street was between 10 and 15 metres wide (image C). 40 per cent felt very positive about walking along this street. The next most popular was the airy open boulevard, about 25 metres wide (image E). 35 per cent felt very positive about walking along this. The least popular was the 1-metre-wide alley (image A). Only 10 cent felt very positive about this and 20 per cent felt very negative.

These findings strongly suggest that people like to feel enclosed, though only up to a point. The most popular street had a height-to-width ratio of around 1:1. While they prefer medium-width streets, people would rather walk on an airy and monumental boulevard than a narrow alley, despite its rich architectural detail. (However, it is possible that the water in image E might have made it more popular).

9.4 What is more important – sense of enclosure or the presence of people?

Our survey, of senses of enclosure in squares, indicated (not surprisingly) that factors other than scale influence spatial preferences. We therefore carried out a fourth survey, between 30th October and 3rd December 2018. How does the presence of people influence the relative attractions of two squares as a place to spend time?

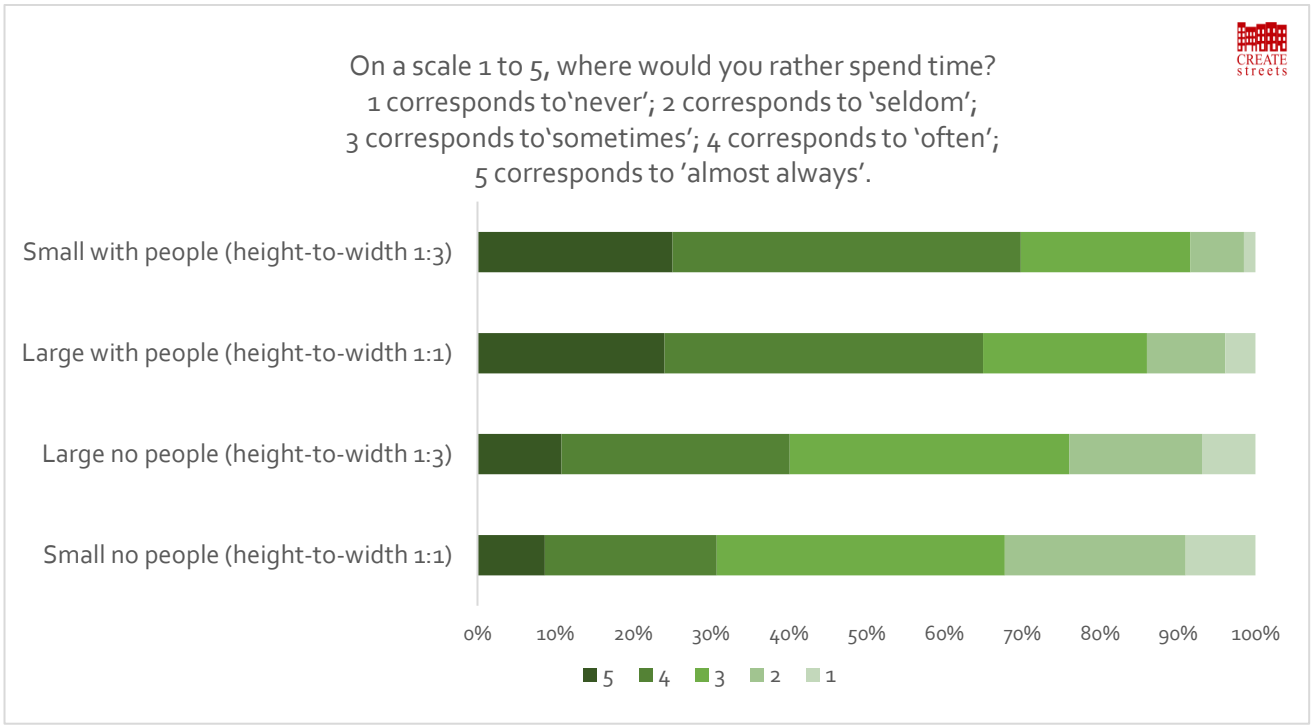
We created visuals of the same two public squares (with height-to-width ratios of 1:1 and 1:3) with two variants of each – one with people and one without. A total of 435 people visited the site, with 341 people proceeding to participate in the survey (a 78 per cent completion rate). We asked 'On a scale 1 to 5, where would you rather spend time?' where:

- 1 corresponds to 'never'/'definitely not';
- 2 corresponds to 'seldom'/'probably not';
- 3 corresponds to 'sometimes'/'probably';
- 4 corresponds to 'often'/'very probably'; and
- 5 corresponds to 'almost always'/'definitely yes

The figure below summarises the results. We found that the presence of people was more important than the sense of enclosure.

Visual preference survey on the presence of people in public spaces.

The most popular square was the small one, with a height-to width ratio of 1:1. While 25 per cent of respondents said they would 'almost always' spend time in the small square, if there were people around, 24 per cent would do the same in the large square. By contrast, only 9 per cent of the respondents said they would 'almost always' spend time in the small square alone, and 11 per cent would do the same in the large square. Perhaps not surprisingly, people are slightly more comfortable being in a larger square, on their own, than in a smaller square. 9 per cent of respondents said they would 'never' spend time alone in the small square and only 7 per cent would 'never' spend time alone in the large square. People, on balance, matter more than the size of the square, or the sense of enclosure.



Results of the visual preference survey on the sense of enclosure and presence of people.

9.5 What is the relative importance of vertical versus horizontal infrastructure?

Between 26th and 31st October 2018, we ran an online visual preference survey that was conducted by Ipsos MORI, to understand which types of public places appeal more to the public. The survey asked 2,198 respondents, across Great Britain, to select the preferred place - out of a pair of places - in answer to the question 'Here are several pairs of images of different places. We would like you to think about these as places to spend time in – either walking through or sitting there. Do you think one of the two places is more attractive than the other, are these places equally attractive, or neither attractive?'[z] The survey used five pairs of images (shown below) representing three types of public spaces: arcades, alleys and three squares, all different in size and shape.[aa] Each differed in style but had similar characteristics;

- Two arcades with no horizontal infrastructure, stone flooring and no people;
- Two narrow pedestrian alleys in a medium-dense area, with no horizontal infrastructure and no people;
- Two squares in a medium-dense area, with limited car traffic, benches, trees and people around;
- Two round squares, in a medium-high density area, closed to traffic, with benches, trees and water, and few people sitting; and
- Two small, well-enclosed squares, with limited car traffic, benches, trees and few people sitting.

Our research was intended to tease out the relative importance of vertical infrastructure (benches, trees, level of traffic) versus horizontal infrastructure (what the building looks like). Do buildings or benches have more impact on a place's attraction? How much? Put differently, if the horizontal infrastructure looks welcoming, how big a difference do the buildings make to a place's attractiveness?

The poll found that more traditional urban spaces, surrounded by more place-sensitive and richly-detailed architecture, *were* preferred most of the time, by most people (61 per cent for the arcades, 65 per cent and 56 per cent for two of the three squares). However, the importance of buildings' detailing did not always clearly trump all other factors, if the difference was subtle or other issues were relevant. In the narrow alley, a more colourful, simpler façade

[z] Full question included: 'Do you think…? A is a lot more attractive than B as a place to spend time. 2. A is a little more attractive than B as a place to spend time. 3. B is a little more attractive than A as a place to spend time. 4. B is a lot more attractive than A as a place to spend time. 5. They are equally attractive to spend time. 6. Neither is attractive. 7. Don't know'.

[aa] Pairs were shown in a randomised order. Percentages of 'don't knows' (2 per cent for each pair) are not shown.

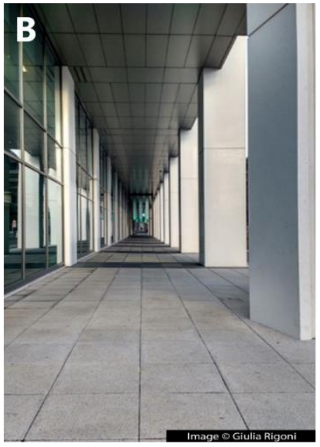
was preferred, and, in one square, the traditional preference, though present, was not strong. The detailed findings were:

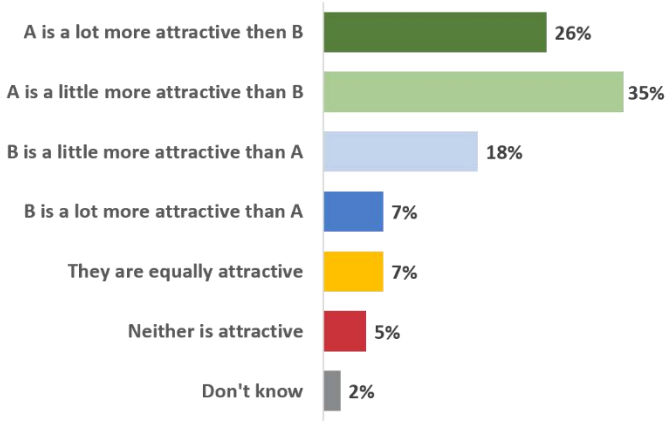
- The more richly detailed arcade (pair 1) was strongly preferred. 61 per cent of respondents found the historic arcade more attractive. Only 25 per cent preferred the modern arcade;
- The colour and flowers in the less richly textured alley (pair 2) appears to have been more important than the façade quality and detail. 41 per cent of respondents found the alley with less articulated facades more attractive. Interestingly 16 per cent of respondents found neither of the two alleys attractive (against the overall average of 5.8 per cent). This is perhaps not surprising given their high height-to-width ratio;
- 65 per cent of the respondents found a traditional square surrounded by historic architecture more attractive than a modern one surrounded by blind glass façades (pair 3). Only 22 per cent chose the modern-style architecture;
- 42 per cent found a historic square with red-brick buildings and stone flooring more attractive than a contemporary square overlooked by modernist buildings (pair 4). However, this finding was more nuanced. 35 per cent chose the more contemporary square. This may be due to the presence in the contemporary square of two steps, which provide an informal opportunity to sit down, or to the historic square's less monolithic buildings; and
- 56 per cent found a small, well-enclosed traditional square, with historical architecture, more attractive than a modern square, surrounded by glass-buildings. Only 12 per cent chose the modern square (pair 5).

The finding are clear, though nuanced. More place-specific, more finely-featured, more 'traditional', building design, or 'vertical' infrastructure, does tend to be more popular and make for more popular places. However, other things matter too. More colour in a narrow alley, or better seating around a pond, can allow more contemporary, though not blank and modernist, design to score as highly, or nearly as highly as more finely-decorated buildings.

Preferences were very similar across different demographic and geographic groups, though (perhaps not surprisingly) with slightly more 'conservative tastes' in older respondents. Public spaces surrounded by more traditional architecture were mostly favoured by 55-75-year-old participants, while more modern environments were more appreciated by 16-34 years old ones.

Pair #1 (Images A (Mantoa, Italy) and B (St. Vincent Street, Glasgow)

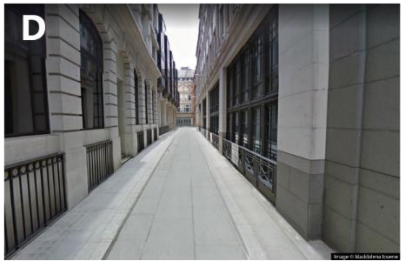




61% A more attractive

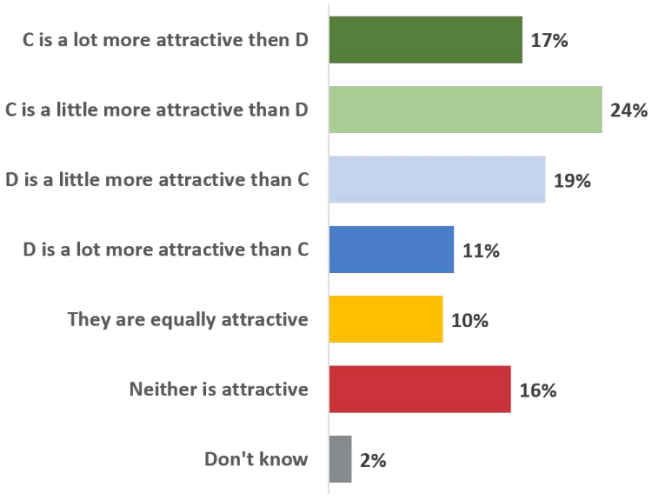
25% B more attractive

Pair #2 (Images C (Red Lion Court, London) and D (Sherborne Lane, London)



41% C more attractive

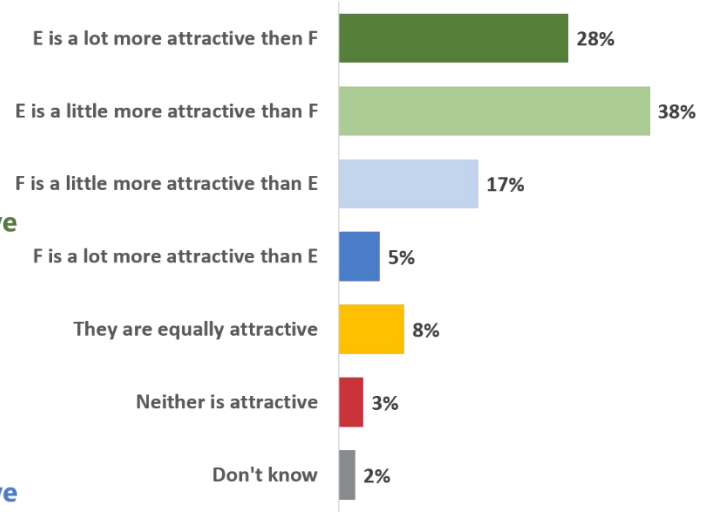
30% D more attractive



Pair #3 (Images E (Fitzroy Square, London) and F (Leonard Street, London)

E more attractive

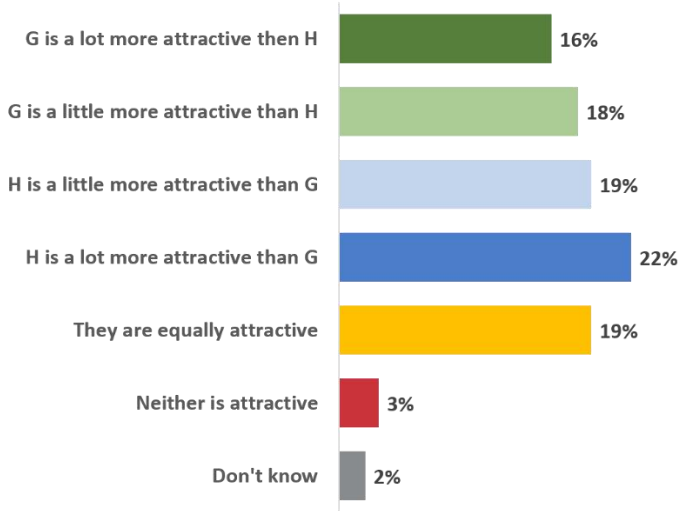
F more attractive



Pair #4 (Images G (Broadgate Square, London) and H (Fountain Chamber Court, London)

G more attractive

H more attractive

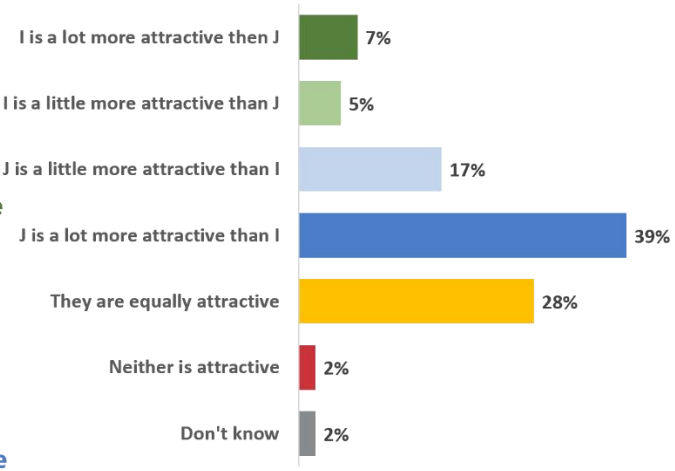


Pair #5 (Images I (New Street Square, London) and J (Old Square ,London)

I more attractive

56%

J more attractive



10.1 Not very welcome to Cambridge

Cambridge CB1 is a much-debated 24 acres and £725 million regeneration project, near Station Road in Cambridge. It was led by Richard Rogers Architects and has 162 new offices and 350 new homes, with offices on ground floors and semi-private gardens.

There are also 1,000 student apartments, three large un-named public squares, hotels and several supermarkets, cafes and restaurants.[221] Writing in June 2017, *The Guardian*'s Architecture correspondent, Oliver Wainwright, condemned it as 'a future slum, plagued by anti-social development and sex-trafficking'.[222] It has certainly been much-criticised. A good deal of criticism has focussed on New Station Square, right by Cambridge train station, which somehow always seems to be clogged with traffic and which only has international retail chains. Others have criticised the buildings, as ugly and having no sense of place, and the serious noise levels (66 decibels during the day and 61 decibels during the night – way above the 50-decibel threshold).

A square… for cars, not for people!

A Square with no name.

10.2 But are these criticisms fair?

To find out if these attacks are justified, we decided to run a study on the new public space behind Station Square. The Square is an L-shaped space about 80 m wide and 88 m long. Surrounding buildings are six or eight storeys high and there is a height-to-width ratio ranging from 1:3 to 1:4. The buildings are in what might be described as the 'low-detail, corporatist, razor-blade aesthetic' of much of the overall development.

Insipid public places round the corner. Definitely not welcoming!

To discover how much people like and use the new public space, we observed passers-by over one to two hours, during weekdays and weekends. We took photographs and marked the position of each person sitting, standing, or walking through the test area. Observations were made on:

- Tuesday 9th October 2018, from 3.30 to 5.15pm (a sunny, warm day);
- Friday 26th October 2018, from 1 to 2pm (a sunny, cold day); and
- Saturday 27th October 2018, from 1 to 2pm (a sunny, cold and windy day.

10.3 Urbanism with the people taken out

Observations showed that an average of 1½ people per minute use the square, 337 people overall (although never more than four to five people at the same time). Of course, it is not surprising that many people pass by. It is very close to the train station. However, what is really striking is that none of these passers-by (or very few) ever spends time there. It does not appear to attract them. Nor, it seems, are the many people working in adjacent offices, or living nearby, ever 'tempted' to stop and spend time in the square.

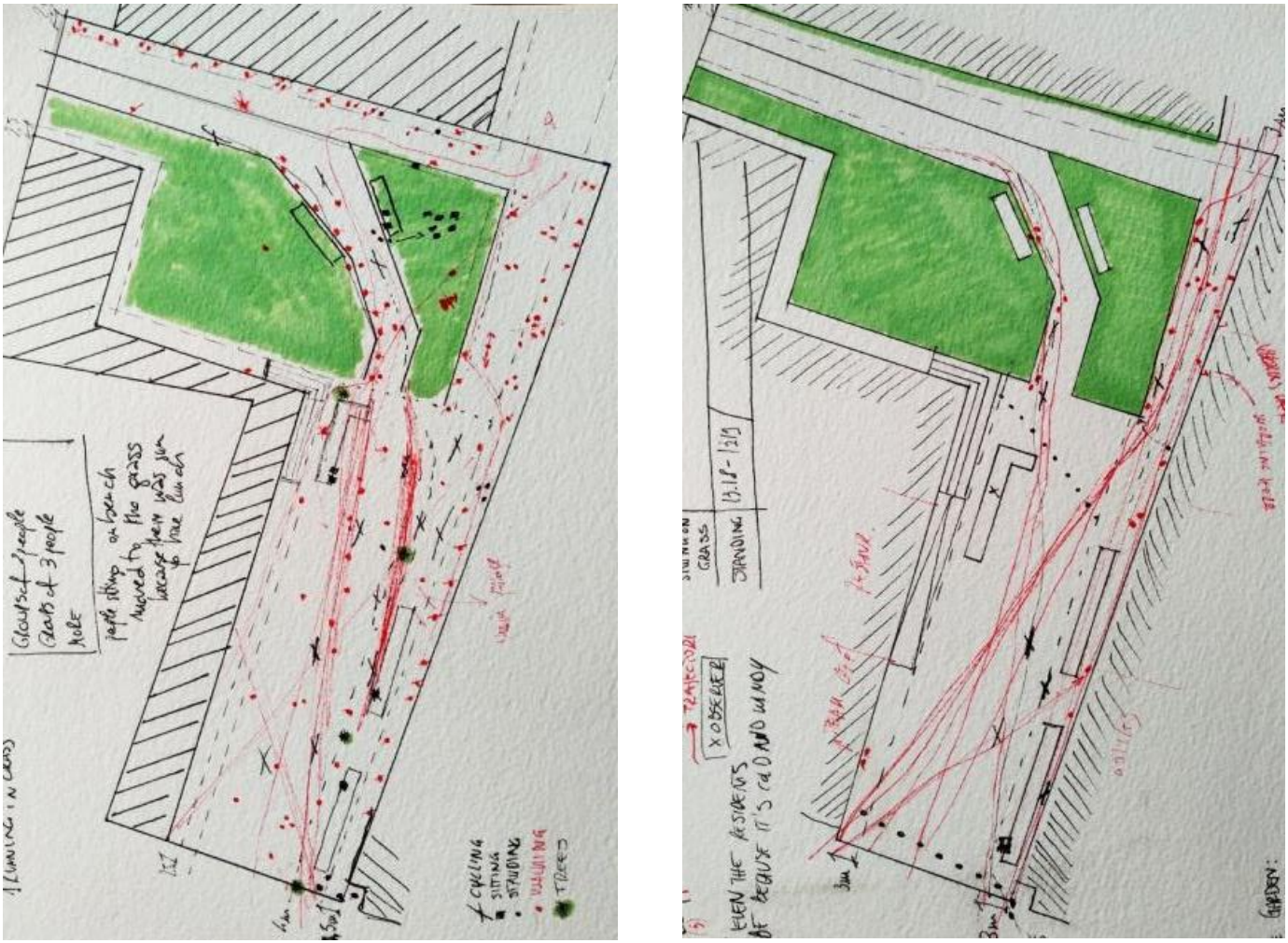
Despite the 137 flats nearby, we did not observe a single resident using the square. Similarly, although the square is surrounded by offices, hotels and cafes, fewer than 20 people working there used the square to take a short lunch (on average, fewer than 12 minutes), smoke a cigarette or make a quick phone call. Those few that did always stood by the wall or at the edge of the grass.

In total we found that, of 337 people observed;

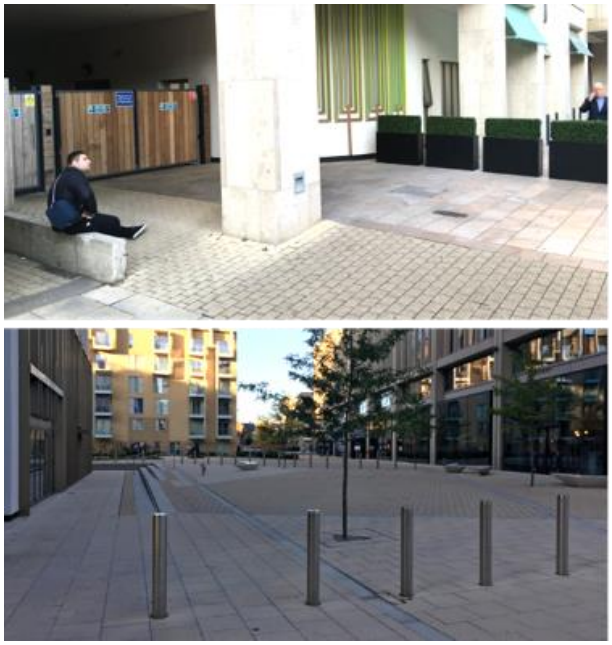
- Only 20 (6 per cent) sat in the square (4 per cent on benches and 2 per cent on the grass);
- Only 24 (7 per cent) stood in the square;
- Most people just passed through. 293 (87 per cent) were walking or cycling, crossing the square very quickly to reach other destinations (less than 1 minute);
- 77 per cent of all the people observed were at the edges of the square, or less than 3 metres away from it.

In particular:

- All the 24 people standing were by a wall;
- 69 per cent of those sitting were at the very edge of a bench;
- 75 per cent of those crossing the square were walking or cycling by a wall; and
- It is possible that these proportions might have been lower had it not been for thin silver bollards partially obstructing the route across the middle of the square, as shown.



Behavioural mapping of Friday 26th October 2018 (151 people observed - left) and of Saturday 27th October 2018 (39 people observed - right). Red dots are people walking, black dots are people standing, black squares are people sitting and elongated crosses are bikes. Red lines show the preferred routes through the square.



No one is 'tempted' by the 'Square with no name.'

We also noticed some interesting patterns;

- Of 19 people sitting on benches, or on the grass, 10 were working nearby having lunch, seven were travelling to, or from, the train station and two were school students;
- People crossing by bike, or on foot, tended to choose this square because it allowed them to cut across two busy roads; and
- It seems that the worse the weather, the more people tended to walk against the wall. Saturday was cold and windy and 78 per cent of the people walked by the wall. 16 per cent did so on Tuesday, which was a warm and sunny day.

People feel protected when they walk by a wall or next to a kerb.

In conclusion, with only 44 people using the 'Square with no name', over a four-hour period, you cannot argue that it is a success. Maybe that will improve when the trees grow. And no doubt the figures would be higher during the summer. But there is a failure to understand here. What has gone wrong? Admittedly,

the height-to-width ratio, at 1:4, for most of the square, is a bit steep and the benches are designed to excite rather to invite. However, many components predict success. It is well-connected. People could wait for a train here, or eat their lunch. They don't. It is largely pedestrian. It is not too large. There are trees (though they need to grow).

Round the corner in Station Square - people like other people but keep them at distance.

What seems to have gone most wrong is that the buildings are bland, at best, positively unpleasant, at worst. They don't speak of Cambridge. There is no clunch stone or stock brick. There is no organised complexity, whimsy, delight, or decoration, merely ground floors of glass and lump after lump of repetitive cladding and feature-less windows. The buildings don't work at different scales, with patterns to look at from afar or from up close. They merely repeat. They are literally utopian. They speak of no place. The wind is sharp in East Anglia, and walls of such little decoration seem to accentuate it. Nothing (or very little) speaks to the passing humans and, in consequence, the passing humans scuttle on to somewhere more useful or less unpleasant.

Passing through the 'Square with no name'.

[221] http://www.bbc.co.uk/cambridgeshire/content/articles/2005/10/20/cbdevelopment_feature.shtml.&http://www.cb1cambridge.co.uk/homes.

[222] https://www.theguardian.com/artanddesign/architecture-design-blog/2017/jun/13/an-embarrassment-to-the-city-what-went-wrong-with-the-725m-gateway-to-cambridge.

Conclusion: what have we learnt?

Our Place Beauty analysis taught us that, although no city is the same, most attractive places tend to have:

- A high built-up area density;
- A rich mix of land uses;
- Older and heritage (listed) buildings immediately present; and
- An above-average diversity of shop types.

Some of the best-scoring places in London, for example, tend to have:

- A high built-up area density;
- A variety of urban amenities;
- A good mix of commercial activities; and
- Proximity to listed and pre-1900 buildings.

The worst scoring places in London tend to lack:

- Engaging and detailed facades;
- Good horizontal infrastructure and urban amenities in general; and
- A mix of land uses and commercial activities.

Based on our five visual preference surveys and the case study, we also found that:

- 8 out of 10 people prefer to sit at the edges of public spaces, with their back against the wall and face to the court;
- 9 out of 10 people prefer to sit away from traffic, rather than with their back to the traffic;
- 60 per cent of people prefer to spend time in a medium-sized square, rather than in a larger square;
- 40 per cent of people prefer to walk along a medium-width street, with a height-to-width ratio of about 1:1, rather than a wider or narrower one;
- The presence of other people is probably more influential on people's preferences than sense of enclosure. 45 per cent of people prefer to spend time in a small square, with a height-to-width ratio of 1:1, with other people around, and 41 per cent of them would like to do the same in a large square, with a height-to-width ratio of 1:3;
- Richly-featured architecture, with a sense of place, does matter to most people, most of the time. For example, 61 per cent of people find traditional arcades more attractive than modern ones. 65 per cent of people find traditional squares, surrounded by engaging façades, more attractive than modern squares surrounded by blind-glass architecture;
- However, other factors matter as well. For example, 41 per cent of people find alleys more attractive, if they are painted or decorated with flowers, rather than more richly-articulated architecture without colour or flowers.

'Si le chemin est beau, ne nous demandons pas où il mène.' Anatole France.

What are the patterns and numbers you should consider when designing a successful public space? What sort of public space will normally persuade people they want to be in it – whether for shopping and selling or showing and meeting? What sort of place will best stimulate social mingling and enhance physical and mental wellbeing? Of course, all places are unique and need to be so. But what homogeneity can we find in this necessary variety? How do you create a place that has diversity and yet is coherent; a place that is busy, but not chaotic; reassuring, but also agreeably surprising?

Based on our survey of existing research in part one, our new analysis in part two, our previous studies on the links between urban design with wellbeing (*Heart in the Right Street*), and value (*Beyond Location*), as well as the practical experience of our team and network in the UK, and around the world, we have developed a list of steps that normally 'should' and normally 'should not' be taken to create public spaces that are uplifting and useful, enjoyable and engaging. As you will see, many of them are about the surrounding buildings, rather than the public square itself. This is unavoidable. A popular place needs to sit within its context and needs people to thrive.

Potsdamer Platz, Berlin – a lively and busy place, with restaurants, shops, nightlife, chaos and traffic. People love it though it's ugly.

It would not be correct to call these guidelines, rules. A street can be a little dull, but still restful and even gently beautiful (for example a typical West End Glasgow street, made up of similar Victorian tenements). They are not rules. They are tendencies. They aren't all true all of the time. But most of them will tend to be true, for most places, most of the time.

A little dull and never going to win prizes, but very nice- Park Terrace in the West End, Glasgow.

11.1 Gentle density is your friend – but 'fine grain' it!

The best and most beautiful streets and squares are typically in areas of 'gentle density', half-way between the extremes of tower blocks and extended suburbia.[bb] Somewhere in the 'middle', 'gentle density' benefits from the advantages of both low and high density, more personal space but also more activity. Dense enough to be walkable and to provide walkable shops and offices. But not so dense as to be overwhelming, to undermine wellbeing or to create problems of long-term maintenance costs. Public spaces in the best areas of 'gentle density' benefit from a wealth of different uses, and nearby residents, they are busy but not overwhelming. Rarely more than four to six storeys high, land is nevertheless intensely-used, with a population density often between 50 and 220 homes per hectare.

[bb] The phrase 'gentle density' was first coined by the President of the Council for Canadian Urbanism and Vancouver's former Director of City Planning, Brent Toderian. He described it as 'the attached, ground-oriented housing that's more dense than a detached house, but with a similar scale and character. Think duplexes, semi-detached homes, rowhouses, or even stacked town houses.' (source: Toderian, B. (2012). Density done well. In *YouTube podcast of Toderian's presentation at the Vancouver Urban Forum*).

'Gentle density' can be traditional or modern.

Our Place Beauty Analysis brought home the importance of 'gentle density'. We measured density as the ratio of the building footprint over the surrounding 100 metre radius area (31,400 sq m). We found that 'built up area density' influenced 'scenicness' 70 per cent more than the average of all urban elements studied. Getting density right is absolutely fundamental to building great spaces.

Postcard pretty in Castle Combe, Wiltshire.

On a scale of 0 to 100, an urban area should ideally have a land-use coverage of between 45 and 65 per cent. Outside of this level, the opposing risks are of sparse, car-dependant environments, or of dark, overly-intense neighbourhoods.[cc] Land-use coverage above 65 per cent tends to be right in hotter climates, where narrow streets protect pedestrians from the sun. For example, a 'street' in the Medina of Marrakesh, or in the Souk of Jerusalem, is usually less than 2 metres wide. The opposite is true in colder climates.

[cc] Average density was computed on the top 15 places in each city, taking out Milton Keynes, because of its very low average density of 22 per cent.

Normally, you should:

- Design medium-high density areas with land-use coverage between 45 and 65 per cent and dwelling density of between 50 and 150 homes per hectare;
- Build streets and squares with between three and seven storeys;
- Build squares between 80 and 100 metres wide and long; and
- Build blocks between 50 and 150 metres long and wide, depending on centrality.

Normally, you should not:

- Build above about seven storeys high (though there can be exceptions);[dd]
- Design neighbourhoods with an average land-use coverage lower than 45 per cent. (The average density in new towns, like Milton Keynes, is about 25 per cent). This can 'work' but does not align with the highest values per hectare, nor with the most popular places. Nor is it very sustainable, in terms of energy use; or
- Place buildings more than 60 metres apart.[ee]

Lovely places that break these rules, and some do, have a specifically small-town, or village, form which is very different.

11.2 When it comes to greenery, little and often is normally best

People like being in green places, but how do you trade this off with the need of the town, or city, to perform multiple other roles? The answer, it seems, is to 'spread it around'. Towns need their one or two big parks, but frequent green spaces inter-weaved into streets and squares nearly always make them better, more popular and more relaxing, above all when they are where people really need and frequent them and when they are not over-designed and thus at risk of degradation. Urban greenery is associated with increased physical and mental wellbeing, as long as it is used. Street trees are normally a no-brainer. However, greenery on its own does not normally 'do it', if most other things are wrong. Squares can be lovely, popular, relaxing places, without a blade of grass in sight – above all, if the buildings are beautiful and the micro-climate is neither too hot nor too cold. Perhaps most crucially, places where everything else is wrong are rarely rescued by the presence of street trees.

[dd] Wind speed increases with the building height and has negative consequences on comfort. For a complete review of wind effects caused by towers, see Boys Smith, N., (2016) *Heart in the Right Street*, chapter 9.7.

[ee] See footnote cc.


Places can 'work' and be beautiful without a blade of grass or a tree in site. St Mark's Square, Venice and Grand Place, Brussels.

How important is greenery? Royal Crescent, Bath.

Our Place Beauty Analysis showed that very green areas, with a number of trees between 55 and 123 per 100-metre radius area, achieved the highest 'scenic-ness' ratings, ranging from 4.9 to 5.8. However, it also showed that the 'presence of trees' was not, in itself, a major driver of perceived beauty more widely. In fact, 'presence of trees' had 55 per cent less influence, on overall 'scenic-ness', than the average of all urban elements studied. For example, Ashdown Road, a residential street in Hillingdon, has 184 street trees, but a 'scenic-ness' score of only 2.6. Clearly, greenery is not sufficient to create a good place, if the surrounding architecture is not widely-appreciated, or there is no agreeable enclosure.

This is in line with earlier analysis of 1.5 million ratings for 'scenic-ness' of 212,000 photos, which found that 'differences in reports of health can be better explained by the 'scenic-ness' of the local environment than by measurements of greenspace.'[223] (It should be added that results may not be entirely accurate, in all cases, due to the likelihood that some trees are missing from the database).

Normally, you should:

- Plant between 5 and 15 trees within a 100-metre radius,
- Plant trees between 8 and 15m apart;[224]

People love Abingdon Street Gardens (score of 5.6) but Ashdown Road, Hillingdon does not do it for them (score of 2.6). Lots of trees and grass can't 'fix' other perceived problems.

- Position trees so that they provide shadow, are equally spaced and aligned, calm the traffic naturally and 'define' the space[225];
- Have about 2-20 per cent of land as private, or communal, shared green space;
- Have about 5-15 per cent of land as public green space;
- Provide front gardens which are less than 3.6 metres and more than 2.7 metres deep;[226]
- Design public green spaces to be frequent, accessible and moderate in size; and
- Design public green space so that it is cost-effective to manage. This typically means neither too sparse, nor too dense and using 'many doors' to keep it safe - ideally relying on the social role of front gardens which are looked after free of public charge.[227]

Normally, you should not:

- Obscure access to front doors with non-private vegetation;
- Obscure narrow streets with too much vegetation;
- Plant evergreen trees in temperate climates, as they obscure too much sun in winter;
- Plant urban trees in a 'messy way', as this can increase feelings of insecurity;
- Underestimate the potential for greenery (especially if dark and unkempt) to engender insecurity. Rows of trees, rather than clusters enhance residents' sense of security;
- Neglect to look after or plant vegetation that you cannot confidently afford to. Tree density explains 89 per cent of the variance in preference ratings and 69 per cent of the variance in sense of safety. Grass maintenance levels explains almost half of the variance (46 per cent) in both preference and sense of safety ratings'; [228]
- Rely on greenery more than three blocks away to influence personal wellbeing; or
- Rely on greenery to fix areas that are too trafficked, polluted, ugly or windy.

No one sits here. Three trees and two strips of grass can't do the job on their own.

11.3 Benches and statues should be structured not randomised

Great and well-positioned horizontal infrastructure (benches, fountains, statues, arcades, street art etc.) can make a good place great, but it cannot fix a nasty place. People go to public spaces to meet other people, or to watch other people, to 'hang out', or have a chat, to be in a crowd and yet watch the crowd. Things to sit on, things to watch or look at, lighting that is bright enough to be safe and subdued enough to be humane, all help pull in the punters. But where it goes matters. Horizontal infrastructure, with a bit of structure, helps humans play the right roles: benches that face a fountain; an arcade that faces a square, with a statue or a podium in it.

Brownian motion should not apply to the horizontal infrastructure. You cannot put 'bench wash' on an ugly and windy chasm, or 'art wash' on a traffic island. Or, rather, you can, but most people will still avoid them.

Our Place Beauty Analysis found that a 'high proportion of urban furniture' influences 'scenic-ness' 33 per cent more than the average of all urban elements studied. Our visual preference survey, on 'where people like to sit', revealed important nuances. Eight out of ten people say they would prefer to sit at the edges of public spaces, with their back against the wall and face to the court. Nine out of ten people prefer to sit away from traffic, rather than with their back to the traffic.

Normally, you should:

- Provide about 0.3 metres of sitting space for every 3 square metres of square space. The best squares have an average sitting area of between 6 and 10 per cent of the total open space;
- Provide chairs that can be moved around for extra flexibility. What is too far for couples may be fine for friends and too close for strangers. Facilitate flexibility if you can;[229]
- Keep it intimate and keep in mind that most groups meeting in public spaces will be small (two to four);
- Place benches at the edges of public spaces and away from traffic, ideally with a nice view;
- Place benches for resting at least about 100 metres apart, on well-walked streets;[230]
- Try to build in a distance of six metres between any 'audience' and any 'performance' (whether it be podium, fountain, bandstand, street stall, or just somewhere you expect something interesting to happen); and
- Build arcades, if the place is busy enough. Arcades that work tend to be in cities' busiest districts (Via Indipendenza in Bologna, Place des Vosges in Paris, or Covent Garden in London), where a good mix of activities makes them lively and safe.

Well-spaced, aligned benches welcome friends and strangers to sit together.

Normally, you should not:

- Place benches in the middle of pavements or squares;
- Place benches randomly or in 'exciting' patterns;
- Place benches less than about 1.2 metres, or more than 100 metres, apart;[231]
- Build arcades in a little-used places, as they can be frightening; or
- Build one-way streets (in fact you should never build one-way streets).[ff]

11.4 Beauty really really matters

Any development that most people don't aesthetically like is missing a crucial trick. The most popular places, with a predictable 70-90 per cent have a strong sense of place and 'could not be anywhere.' Their organised complexity attracts, interests and reassures at different scales. They have 'active facades', which 'live' and have variety in a pattern. They have streets that bend and flex with the contours of the landscape, and some surprises. They are not designed by committee. More finely-grained developments also tend to be more long-lasting and resilient, better able to adapt to changing needs.[232] A square or street with many plots, can see its buildings upgraded, enlarged, improved, even replaced, but still somehow remain the same, or similar. Most beautiful cities are intense, coherent and rich in architectural detail. Their 'flavour' is local, not international. Our analysis of every property sale in 2016, in six British cities, for our study, *Beyond Location*, brought this home very starkly. In London, for example, what you might term the 'heritage premium' consistently trumped the 'new-build premium.' Above average proximity to a listed building, a building in an area with a high intersection

[ff] From *Beyond Location*, chapter 6.5: In 2015 John Gilderbloom and William Riggs studied the impact over three years of the 2011 conversion of two one-way streets in Louisville on levels of traffic, crime and sales values. They found that traffic collisions on the streets dropped by 36 per cent on one and 60 per cent on the other, as did crime, by 23 per cent. Property values rose by 39 per cent.

density (a measure for a traditional street pattern) or in an area with an above average number of pre-1900 properties, accounted for five to seven times as much value (£49,767 to £58,397) as the 'new-build premium' (£8,795). [233]

Our Place Beauty Analysis found that 'presence of listed buildings' influences 'scenic-ness' 19 per cent more than the average of all urban elements studied. It also found that having at least one historic building, within a 100-metre radius area, was associated with places that people found more attractive. We found the most popular places in the six cities analysed (with 'scenic-ness' scores between 5.1 and 6.2) tend to be parks, or enclosed small squares, with a variety of urban furniture, and surrounded by historic buildings, or façades rich in detail.

What buildings look like is crucial, in determining the perceived beauty of a place, certainly far more than the proportion of greenery. Many of the most beautiful squares are surrounded by engaging and fine architecture and have few trees. While beautiful façades make an urban place great, trees are simply not enough. On a scale from 0 to 1, the beauty of the best places, from our analysis, is determined by high built-up area density (between 0.10 and 0.20), a variety of land uses (between 0.15 and 0.40), an above average proportion of historic buildings (between 0.17 and 0.35), the presence of benches (between 0.08 and 0.5) and trees (between 0.05 and 0.30).

A combination of these key aspects makes successful and lively public places. Attention to architectural composition, materials and detail in the facade are a crucial part of the recipe.

Beauty is not all in the eye of the beholder and is fairly predictable, for most people most, of the time. Scale, rhythm, variety and level of detail are crucial. Burano, Venice.

Normally, you should:

- Preserve and reuse historic buildings, when you can – particularly when they are richly-detailed or have a 'strong sense of place';

- Design walking façades, with front doors, generous windows and bay or plot widths, wherever possible of 5.5 to 15m – 'narrow fronts, many doors';
- Design shop fronts with a glass surface area of at least 25 per cent, for department stores, and 60 per cent for small-medium sized retailers;[234]
- Aim for organised complexity, and variety, in a pattern. Some important elements are 'set', but others can vary quite widely; and
- Respect the place – this does not mean that new buildings need to look as if they were built 100 years ago, but it does mean that, in some way, they should 'rhyme' (be that materials, plot width, façade pattern, level of detail, or scale).

Normally, you should not:

- Build long, blind, empty facades; (in fact, you should never do this);
- Prioritise a sense of time over a sense of place;
- Build doors within blocks;
- Design everything 'top-down' – leave some scope for unplanned variety.

11.5 Mix it up!

Put simply, developments with a textured mix of different land uses, and active façades, are nearly always more successful. They attract more people and generate more diverse and engaging environments. They can work for longer portions of the day, by mixing people at work, people at lunch, people at home and people at play. Mixed land use is also more walkable and is associated with lower car use, as it is possible to combine trips in a shorter distance. More self- or custom-build is also associated with greater design flexibility and heterogeneity of architectural styles, which is normally a good thing – up to a point. Mixing use has its limits. Most people don't want to live, work or play next to heavy industry, or the incineration of medical waste. It is not by chance that proximity to industry has a 6 to 11 per cent negative impact on price.[235]

Our Place Beauty Analysis found that 'richness of land uses' influenced 'scenic-ness' almost 60 per cent above the average of all urban elements studied. The 'richness of commercial activities' influenced 'scenic-ness' 10 per cent above the average.

Normally, you should:

- Have a variety of street types (Alley, Lane, Close, Street, Avenue, Boulevard, Parkway);
- Wherever economically possible, have between 15 nd 20 shops per 100 metres of street;[236]
- Encourage self- and custom-build, within a framework which might set height, bay width and some basic rules on materials and façade pattern;
- Encourage flexible use of commercial, retail and

- residential units, within a framework of acceptable urban use classes (no steel-making); and
- Consider residents' living preferences (almost 60 per cent would prefer to live in a mixed-use neighbourhood).[237]

Normally, you should not:

- Have private homes more than 1.6 kilometres form a corner shop, or convenience store;
- Have entirely mono-use public spaces and streets, as they increase pollution and unnecessary car journeys;[238] or
- Design single-use neighbourhoods, with no commercial or retail activities.

11.6 Edges attract and protect

The edges of streets and squares attract us. This is partly lived experience. (It is where we are used to pavements going, even when a street is pedestrianised). But it is also sensory. There is more to look at (shop fronts, cafés) and (in a square) edges allow us to step back and either watch the world go past, or sample the space. Edges permit us, if we wish, simultaneously to enjoy solitude and to do so in a crowd. Our observation of pedestrian traffic, in a public space of about 2,000 sq m, in Cambridge's new 'CB1' development, by the train station, found that, on average, 77 per cent of those walking were walking next to a wall, or fewer than 3 metres away from it. 86 per cent, of those standing, were near a wall.

Normally, you should:

- Provide pavements, for central or busy streets, that are at least six metres wide;
- Plant trees, and put places to sit, on river banks or at the edges of footways, where boundaries are usually well-defined;
- Design the edges of public spaces with care. Equip them with seats, steps and ledges to encourage sitting and play; and
- Ensure that the edges of buildings, in a square, can attract those walking alongside them, but also on the other side.

Normally, you should not:

- Place benches too close together, or too far from the edges of streets or squares;
- Place seats at the corners of public spaces where they will also be obstacles; or
- Design blank and anonymous facades, with nowhere to sit or stand, around a public square.

11.7 People like to feel enclosed… up to a point

Most people like to spend time in places that are enclosed and human-scale, without feeling too claustrophobic. There is a necessary moment for

views that open up as you round a corner, for grand vistas, for open parks, but many of the most popular streets, surrounding and linking such views and vistas, are surprisingly human-scale. Few of the most popular streets are wider than 11 metres, or narrower than 30 metres. Popular, wider streets (Paseo de Gracia or Champs-Elysees) normally 'break up' their width (60-70 metres), with avenues of trees. Many of the most popular squares and public spaces are between 50 and 100 metres in wide.

Our Visual Preference Survey, on squares people would rather spend time in, found that respondents preferred more intimate and smaller squares. 62 per cent said they would rather spend time in a 500 to 700 sq m public square with a height-to-width ratio of around 1:1. Only 38 per cent said they would rather spend time in a 1,000 to 2,000 sq m square with a height-to-width ration of around 1:2.8.

The same was true for streets, though less starkly. Respondents preferred medium-width streets and would rather walk in an airy boulevard than a dark narrow alley. Over 40 per cent of respondents said they would prefer to walk along a street between 10 and 15 metres wide with a height-to-width ratio around 1:1; 34 per cent than said they would rather walk along a street more than 25 metres wide; and fewer than 10 per cent said they would prefer to walk down an alley less than 1 metre wide.

Normally, you should:

- Build side streets and alleys not less than 3 to 8 metres wide (the narrower they are, the more you need to worry that they are busy and safe);
- Build high streets (or main streets in American English) between 15 and 30 metres wide;
- Build avenues and boulevards between 40 and 90 metres wide;[239] and
- Build street height-to-width ratios of between 0.75 to 1.5.

Normally, you should not:

- Build high (or main) streets and squares more than about 140 metres long;
- In temperate climates, for a street around 19 metres wide, create buildings with a height greater than 24 metres (around 6 storeys), or less than 12 metres (around 4 storeys); or
- In temperate climates, for an alley around 1.4 metres wide, create buildings with a height of more than 12 metres (around 4 storeys), or less than 9 metres (around 3 storeys) high.[240]

11.8 It's not what you spend, it's where and how you spend it

Investing money in improving carriageways, pavements and horizontal infrastructure often works.

Our Place Beauty Analysis found that investment in public realm was associated with increasing 'scenic-ness.' On average, in our sample, investment resulted in 'scenic-ness' increases of 0.46, or just under 14 per cent. However, this does not mean it will always work. There is no predictive relationship between the amount spent and the improvement in 'scenic-ness'. It is possible to spend millions rearranging deckchairs, and making benches more shiny, without having much impact. What makes the difference? If a place is inherently challenged (in its lack of enclosure, unavoidably high traffic, or unpopular architecture) there may be only so much you can do.

Our Place Beauty Analysis also found that large redevelopment and pedestrianisation projects are usually associated with higher percentage increases in 'scenic-ness' (up to 40 per cent). However, smaller interventions, such as flooring and road crossings, in very targeted places, are usually associated with much higher increases in 'scenic-ness' per pound spent. (For example, at Lambeth's Van Gough Walk in Lambeth there has seen a 37 per cent increase in 'scenic-ness' with an investment of £0.4 million only).

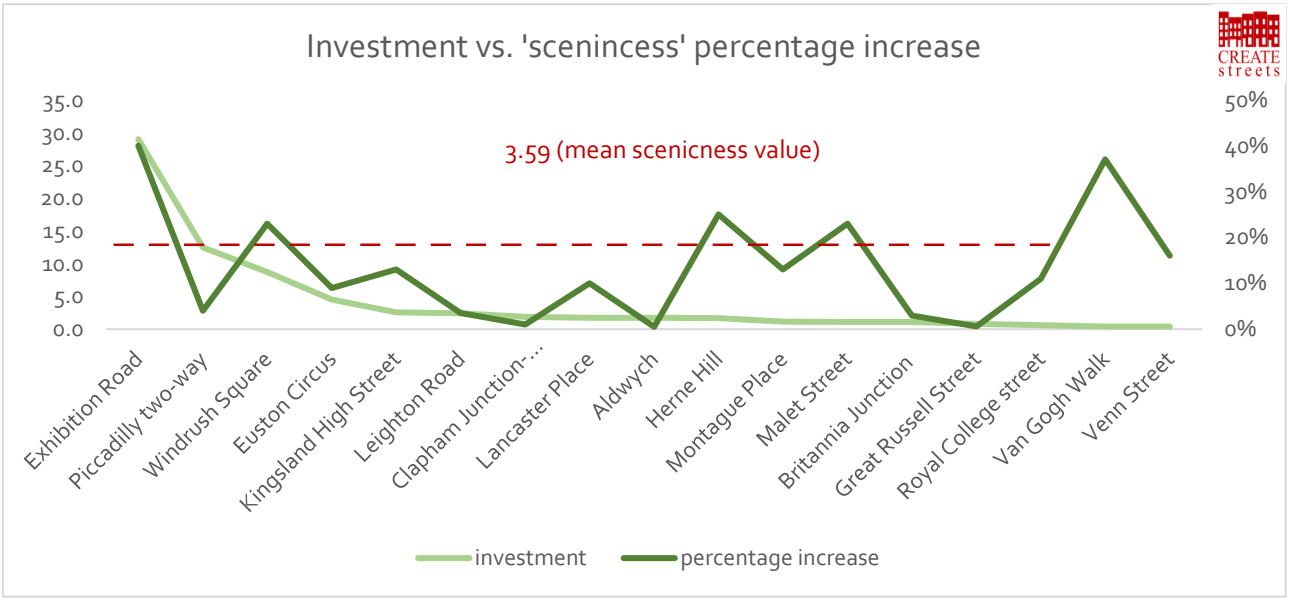
Normally, you should:

- Invest in places where the 'intrinsic' quality of urban form and design are good, but poor maintenance, insufficient pavements, or poor quality public realm is needlessly pulling down an inherently nice place. (For example, Railton Road, by Herne Hill Station in London, had a lot going for it already. Its problems were managerial rather than fundamental: traffic congestion and unsafe junctions, but in a pretty, well-connected, nicely enclosed street. A relatively modest investment of £1.7m repaved the street and reduced the speed limit. This increased 'scenic-ness', from 2.9 (0.7 less than the average) to 3.6 (average), with a percentage increase of 25 per cent).
- Find tactical ways of improving streets without big budget expenditure. For example, the streetscape improvements in Venn Street, with intensification of pedestrian activities and restrictions in vehicle circulation during the week, created a more attractive and active place and improved the activity of the existing local businesses and cafes. An investment, of as little as £465,000, increased the beauty of Venn Street by 16 per cent.
- Support community-led initiatives. Van Gogh Place, previously known as Isobel Street, is an example of pedestrianisation and landscaping led by a positive collaboration between councillors and community organisations. It met local needs and created a safer and more pleasant environment. Despite the very limited investment of £420,000, it was possible to

partially remove cars from a small residential street and create a communal garden and a pleasant and safe route to walk and cycle, by engaging with local artists and architects. The figure below shows the percentage increase in 'scenic-ness' after investment.

Normally, you should not:

- Invest too much in public realm, where there is high traffic, no sense of enclosure, or unpopular architecture. An investment of £4.5 million, in widening the footways in Euston Circus, has only increased the beauty of the place by 9 per cent (with a 'scenic-ness' score of 3.1, 0.5 below average). It is hard to rescue busy roads with too much traffic that are largely enclosed by blank or ugly façades; or
- Invest in smaller interventions, such as footway flooring in public realm with poor architectural quality and high congestion. A £19 million investment in Clapham Junction-Brighton Yard has increased the beauty of the place by 3.4 per cent (with a 'scenic-ness' score of 3.14, 0.45 points below average value).



Percentage increase in 'scenic-ness' (right axis) as investment changes (left axis) – there is no correlation between money spent and proportional or absolute increase in 'scenic-ness'.

11.9 Walkability works, but does not quite mean maximising space to walk

Compact, walkable and 'bike-able' environments are good for you. People walk in them more and are healthier and happier. This drives higher values for investors. So far, so simple, but how to achieve it is a little less understood. It is not just the presence of pavements, or living in denser, more-mixed neighbourhoods. A complex array of elements encourages or discourages people walking or cycling, rather than jumping in the car.

More walking is encouraged by beautiful engaging façades, regularly-spaced trees, and frequent small parks, the presence of resting places (seats, steps or ledges), arcades or colonnades at the edges of busy squares, outside cafes, local shops, sufficiently-wide pavements and (probably) cycling lanes. Huge pavements, with everything else wrong, won't necessarily be very attractive to most people. Our Place Beauty Analysis found that the 'Presence of footways' influences 'scenic-ness' by almost 20 per cent more than the average of all urban elements studied.

Normally, you should:

- Design residential streets with a speed limit of 20 mph;
- Design continuous walkable environments that are more than 400 metres long;
- Plant street trees every 8 to 15 metres, depending on the street type;
- Build street height-to-width ratios of between 0.75 and 1.5;
- Encourage 'walking architecture' not 'driving architecture', with front doors, generous windows and bay or plot widths of 5.5 to 15m; and
- Aim for variety in a pattern. Some important elements are 'set', but others can, and do, vary quite widely.

Normally, you should not:

- Build 30 mph residential streets;
- Design tangled, dead-end roads, as they reduce connectivity within the city and increase traffic pollution;[241]
- Build pavements of less than one metre's width, in narrow streets and alleys of around three metres' total width;
- Build pavements of less than three metres' width in main streets of around 16-20 metres' total width;
- Build pavements of less than 10 metres' width, on both sides, in avenues and boulevards of around 30-35 metres' total width;

- Build pedestrian central islands of less than 10 metres' width, in avenues and boulevards of around 40 metres' total width, without at least two rows of trees;[242] or
- Prioritise increasing walkability within a public realm, where the architecture is blank or featureless, or where there is no richness or variety of uses. If you do, your results will often be disappointing.

11.10 Do people say they like it? And do they mean it?

Design is not rocket science. We all spend time in towns, in streets and squares. People are very good at judging what they like and where they want to be. It is increasingly easy to use technology to map where people do spend time, or to understand this, not by asking simplistic questions, but by performing proper visual preference surveys.

Doing this can correct for the 'design disconnect' (the measurable difference between the design preferences of design professionals and everyone else) and help crowd-source making better places that people really like.[243]

Normally, you should:

- Use pricing data to understand what people pay for and distinguish between the different reasons (location and connectivity, beauty, walkability and diversity of local attractions);
- Use studies of usage of public places to understand where people want to be and the relative importance of location versus metrics of quality;
- Drop the old canard that 'design is subjective' – some of it is, but most of the time, for most people, popular design is predictable;
- Understand that popular design is a key component of good design;
- Design to appeal, not shock (though most cities and some towns will need some shocks and surprises);
- Respect the inherent conservatism and risk-aversion of people's experience of place; and
- Understand that it is normal for people's response to physical change to be emotional as well as rational.

Normally, you should not:

- Ignore that design, urban form, beauty and a pleasing sense of enclosure will have an impact on the use and popularity of the public realm;
- Ignore that design matters to most people most of the time; or
- Forget that the right community engagement process, and the right popular design, will increase support for new developments.

These ten steps have two themes. The first is the need to keep contradictory good things in tension. Density, but so dense as to be overwhelming. Greenery, but not so green as to lose its shape and become potentially threatening. Space to walk. But not so much space that one is lost on a savannah of feature-less hard paving. A reassuring, but not a threatening, sense of enclosure. The second is the need to use living patterns of organised complexity that work at different scales. A façade that is attractive to see from the other side of the square, to walk along, to sit under, to observe from close by. Near symmetries of doors and windows, of buildings and benches, which we find intuitively reassuring and faster and easier to comprehend.

11.11 Good rhymes

The point of this list is not to say that all of these things are always necessary. Places that break some of these rules will not automatically be 'bad places'. That will not necessarily be the case. Indeed, some places are even improved (in the eyes of some) by being a little rough around the edges. However, it is to say that most of the time, places that have most of these attributes, and are able to hold them in tension, will tend to be more popular and more attractive to most of us. Design cannot be done by computer.

Or, not all of it can. Humans are not entirely pre-programmed by our environments or by our evolutionary history. But we substantively are. What we like and don't like is, at heart, a consequence of our humanity and of our contradictory natures, of our need for privacy and for company, for tranquillity and excitement, for stimulation and for shelter. That can be predicted by computer and it is precisely what we have, in part, done in this study. That is why, from Shanghai to Stratford-up-Avon, the best places have many of the same characteristics, why the European tourist enjoys Marrakesh and the Chinese tourist revels in Paris.

Good varies with culture and climate, but rhymes everywhere. That is why, through all the mess of human nature and cultural difference, and through the millions of data points that we have investigated, we can predict what makes for a good street or square and what makes for a bad one. Normally.

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[223] Seresinhe, C. I. *et al.* (2015) *Quantifying the Impact of Scenic Environments on Health.*

[224] Min and max values can be found on page 2 of the following document:https://www.london.ca/business/Resources/Guideline-Documents/Documents/reference-docs/Tree-Planting-Guidelines-Updated-Dec-2005.pdf

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[241] Cited in Ewing R, Kreutzer R. (2006), *Understanding the Relationship between Public Health and the Built Environment.* (p. 25).
[242] Dover, V., & Massengale, J. (2013). *Street design: the secret to great cities and towns*. (p. 19).
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Appendix: Analytical methodology

This section sets out the methodology we used to investigate six cities across the UK, in our Place Score Analysis. This is a quantitative comparative analysis composed of two main parts;

- First of all, working with Dr Chanuki Seresinhe from the Data Science Lab, Warwick Business School and Alan Turing Institute, we used a deep learning (or 'AI') algorithm called Street-View-Scenic, to rate the 'scenic-ness' (or aesthetic attraction) score of 18,966 places, within our six transects. [244] The images were downloaded from Google Street View and the ratings were based on a crowdsourced 'preference survey', completed by over 20,000 people;
- Secondly, we used Create Streets' modelling of urban form, computed on GIS software, to assess the urban quality of places and analyse what relationships there might be between urban form and popular appeal.

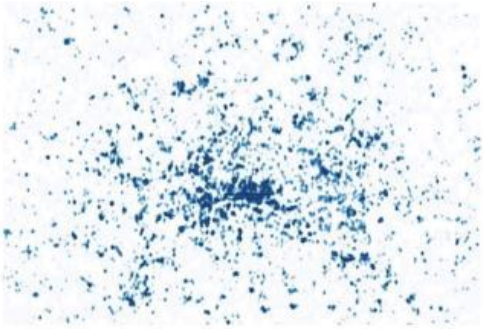
To predict which public spaces people find most 'scenic' (or attractive) and how these are morphologically characterized, we structured a five-step methodology: a) selecting the places; b) choosing the 'spatial unit' of analysis; c) rating the 'scenic-ness' of places through the 'AI' algorithm; d) computing the metrics of urban form; and e) performing an elastic net regression analysis. These are set out in detail below.

a) Selecting the places. Because we wish to understand which public places people like most, based on their 'scenic-ness' score, we looked at those areas with the highest pedestrian density. This is where we are most likely to find people sitting, standing, having a conversation and generally spending time in the public realm.

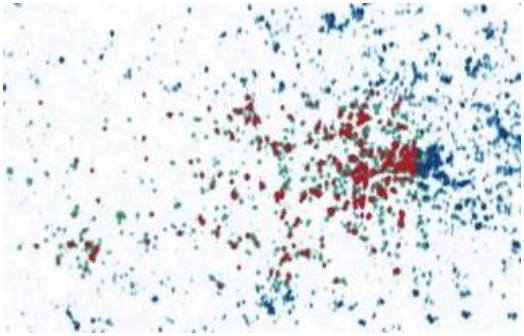
To select sites, we downloaded the dataset of the street network from Open Street Map (OSM) and selected the street links classified as 'pedestrian', 'footway' and 'path.'[99] Based on the places with the highest levels of pedestrian-linked density, we then selected 18,966 places across all cities, from central to suburban areas within the chosen transects. Since we are interested in dense urban areas, we removed sites within parks and large green areas.

The table below shows the list of sites and the number of places (data points) considered for each.

[99] A *Query* was run in QGIS to the street network shapefile to select '*pedestrian*', *footway'* and paths' links only.



Map of pedestrian areas density: from highest, dark blue, to lowest, light blue. London example.[hh]



Selected places within a transect in London, intercepting the top 40 per cent of pedestrian density. Red points: 'very high' density. Green points: 'high' density."[ii]

Case study	Places with top 40 per cent walkability
London	6,589
Manchester	6,986
Birmingham	2,967
Cambridge	1,165
Canterbury	436
Milton Keynes	823
Total	18,966

Number of places considered per city.

b) Choosing the 'spatial unit' of analysis. To permit fair comparison between different parts of different cities, we needed to agree a common unit of analysis. We therefore converted the pedestrian links dataset into data points and attributed geographical coordinates to them. This gave us a dataset of places which were geo-located and corresponded to specific points in space. However, a public space does not correspond to specific points, but most probably

[hh] Map of 'pedestrian', 'footway' and 'paths' links density was obtained by applying the following methodology in QGIS: a) extracting mid-points from the pedestrian street links dataset, b) creating a Heatmap of the obtained points, c) running a Hotspot analysis of the same points through the Raster calculator tool, and d) converting the raster hotspot map into vector using the Polygonise (raster from vector) tool. Finally, sites were classified according to the Quantile classification method and according to five classes.

[ii] Heat mapping, from a geographic perspective, is a method of showing the geographic clustering of a phenomenon. Sometimes also referred as hot spot mapping, heat maps show locations of higher densities of geographic entities' (https://www.gislounge.com/heat-maps-in-gis/).

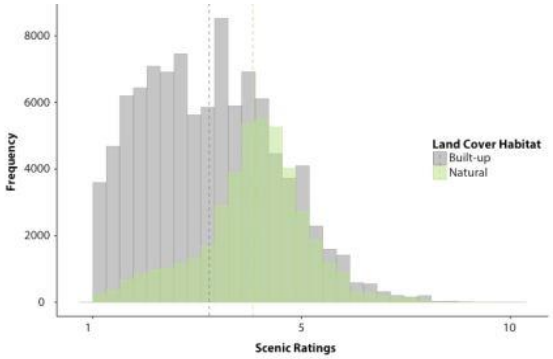
to a slightly wider area. We therefore created a circular buffer of 100 metres radius around each place. We considered all the features that fell within these limits.

c) Rating the 'scenic-ness' of places through the AI algorithm. We then used a neural network algorithm, Street-View-Scenic. This can predict the collective human scenic beauty rating of a wide range of outdoor environments. Neural networks learn to accomplish tasks after being 'trained' with 1,000s of labelled examples. Street-View-Scenic has been trained using 100,000s of images, sourced from Geograph and Google Street View.[jj] These images were rated using an online game, primarily Scenic-Or-Not, in which members of the public rated images between 1 and 10, where 10 means 'very scenic' and 1 'not scenic'. In total, over 20,000 people provided around 1.5 million votes, for over 200,000 images. Dr Seresinhe has found that 'differences in reports of health can be better explained by the 'scenic-ness' of the local environment, than by measurements of green spaces.'[245]Only images with at least three votes were included in training Street-View-Scenic and the average vote was then used to train the algorithm, rather than any individual's vote. This permits sufficient confidence that we are capturing a collective understanding of scenic beauty, rather than a specific individual's preference.

One consequence of using the average, of at least three people's votes, is that our training data is very unlikely to contain many images that have a perfect rating of 10 (or a perfectly bad one of 0). The Street-View-Scenic algorithm therefore very rarely predicts that an image will be a perfect 10. Separately, the average ratings from our human raters, in built-up settings are, slightly lower than ratings in natural areas (the figure below shows the distribution of scenic ratings in built-up versus natural land covered habitats). However, even within built-up areas, people seem consistently to prefer certain types of space to others.

Previous research has shown that there is no unique definition of 'scenic-ness'. What works varies. And this depends, in part, on environmental contexts - whether it is an urban, rural or suburban environment.[246] This research challenged the simple linear assertion that 'what is natural is beautiful.' It showed that, although man-made features tend to score lower than natural ones, historic architecture and bridge-like structures can also lead to high scores.[247]

[jj] Geograph is a web-based archive which aims to collect geographically representative photographs and information for every square kilometre of Great Britain and Ireland (https://www.geograph.org.uk/).



Distribution of scenic ratings in built-up versus natural land cover habitats.[248]

With this study, we aim to take this emerging research further and set out more robust evidence on what man-made features, and surrounding urban form and morphology, tend to be associated with more beautiful, higher-scoring scenic urban environments. We downloaded photographs of the 18,966 chosen places from Google Street View; four for each place, to permit a 360-degree view. All images were classified according to the most recent Places365 dataset.[249] Based on a repository of eight million scene photographs, Places CNN classifies each image according to a list of 365 place categories, such as 'courtyard', 'promenade', 'shop front', 'arcade'. It gives a probability rate to each place – for example, a rating of 70 per cent likely that a place is a 'courtyard'. To identify which images have been taken outdoors, we looked at the top five place categories of each image: if an image has at least three outdoor categories in its top five, we classify it as being outdoors. Our analysis only considers those categories that have been labelled as outdoors. We then ran all of the 75,864 images through the 'AI' algorithm, to rate their 'scenic-ness' and see what the 'collective preference' was. We obtained a predicted 'scenic-ness' score for each place, in each city. As mentioned above, values did not score all the way up to 10. The minimum was 1.52, the mean 3.34, the median 3.24 and the maximum was 6.88.

d) Computing the metrics of urban form. We then used open-sourced data of urban and spatial features, of the six cities, to compute 11 metrics of urban form. We assessed the urban quality of places and identified their morphological characteristics.[kk] Variables of density, distance and presence of listed buildings, as well as proportion of pre-1900 and pre-1939 buildings were considered, together with diversity of land use and richness of urban furniture. The table lists the metrics, the source of each dataset and explains their computation.

[kk] Urban morphology looks at the urban form of human settlements and the process of formation and transformation in time. It allows to understand how the physical form of cities develops in time and what factors contribute to its development (Kropf, K. (2009). Aspects of urban form. *Urban Morphology*, *13*(2), 105).

	Metric	Source Dataset	Explanation
1	Built up density	OpenStreetMap 'building'	Ratio between the built-up area and the 100-metre buffer area around the place
2	Listed Buildings count	Historic England 'Listed Building'	Count of listed buildings within the 100-metre buffer area
3	Distance from Listed Buildings	Historic England 'Listed Building'	Distance (in metres) between a property and the closest listed building
4	Offering of pre-1900 Buildings	Consumer Data Research Centre 'voapropertyage'	Extent to which a neighbourhood has more pre-1900 buildings than in average city neighbourhood
5	Offering of pre-1939 Buildings	Consumer Data Research Centre 'voapropertyage'	Extent to which a neighbourhood has more pre-19039 buildings than in average city neighbourhood
6	Land use richness	Ordnance Survey 'points of interest'	Extent to which a 100-metre buffer area has one or more land uses
7	Retail richness	Ordnance Survey 'points of interest'	Extent to which a 100-metre buffer area has one or more retail types
8	Footway-carriageway proportion	OpenStreetMap 'gis.osm.roads.free1'	Ratio between the total length of footways and the total length of carriageways within the 100-metre buffer area of each place
9	Urban furniture richness	OpenStreetMap geofabrik tool 'pois'	Extent to which a 100-metre buffer area of each place has one or more types of urban furniture (benches, fountains, artworks, trees)

List of metrics, source of dataset and brief explanation of computation method.

To perform the elastic net regression analysis, we first had to make sure that metrics of urban form were comparable with each other. Metrics are measured differently, as they quantify different features of urban form. For example, distance to a listed building is measured in metres. However, built-up area density is calculated as a percentage. To make them comparable, we normalised (or standardised) each metrics' values. This permitted us to compare coefficients that were perfectly compatible with each other. We normalised the values by computing their standard scores (also z scores), by applying the following formula:

$$z = \frac{X - \mu}{\sigma}$$

where X represents the raw value of the variable, μ the mean of the population, and σ its standard deviation.

e) Performing an Elastic Net Regression analysis.

Elastic net models are a compromise between ridge regression and LASSO (Least Absolute Shrinkage and Selection Operator), both of which are adaptations of the linear regression model, with a penalty parameter in order to avoid over-fitting. We use cross-validation to choose the alpha parameter of the elastic net (the mix between ridge and LASSO) as well as the lambda parameter (the penalty) which corresponds to the best-performing model. The number of predictors used for the elastic net analysis was equal to all cities (11). We used cross validation (10 fold, repeated 5 times). Root Mean Square Error (RMSE) was used to select the optimal model, using the smallest value.[II] This ranged between 0.85 in Cambridge, to 0.99 in Birmingham. Each city has a different number of observations depending on size: London has 6,588, Manchester 6,985, Birmingham 2,966, Cambridge 1,164, Canterbury 435 and Milton Keynes 822.

[244] Seresinhe, C. I, et al., (2017). *Using Deep Learning to Quantify the Beauty of Outdoor Places.* & Law, S., et al., M. Street-Frontage-Net: *Street-level Knowledge Discovery using Deep Convolutional Neural Networks.*

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[246] See endnote 254.

[247] Seresinhe, C. I., Preis, T., & Moat, H. S. (2017). *Using deep learning to quantify the beauty of outdoor places*.

[248] Seresinhe, C. I., Preis, T., MacKerron, G & Moat, H. S. (2018) *Happiness is Greater in More Scenic Locations.* Under review.

[249] http://places2.csail.mit.edu/.

[II] The Root Mean Square Error (RMSE) is the standard deviation of the residuals (prediction errors). Basically, how far the data points are from the regression line.

About the authors

Dr Maddalena Iovene is a Researcher and Urban Designer at Create Streets. She has a Doctorate, from the University of Strathclyde, in Sustainable Development and Urban Morphology and a Master's in Urban Planning and Architecture from Università IUAV di Venezia. Maddalena has worked as a researcher for a shared project between Queen Mary University, London, the Department of Computer Science at Cambridge University and the Department of Architecture at Strathclyde University, investigating the meaning of neighbourhood and community throughout history.

Nicholas Boys Smith is the founding director of Create Streets. He has led multiple urban design projects, studies into what people want in the built environment and correlations between built-form, social outcomes and valuations. His books include *Beyond Location*, *Heart in the Right Street*, *More Good Homes* and *Create Streets*. Nicholas is a Commissioner of Historic England, an Academician of the Academy of Urbanism, a Fellow at the Legatum Institute and a Research Fellow at the University of Buckingham. Nicholas has written widely in the general and specialist press about urban design, community design and planning. He was a judge of the 2016 and 2018 *Sunday Times* British Home Awards.

Dr Chanuki Illushka Seresinhe is a data science researcher at the Alan Turing Institute (the UK National Institute for Data Science and Artificial Intelligence). She also works as a senior data scientist at Channel 4. Chanuki's research entails using big online datasets, and deep learning, to understand how the aesthetics of the environment influence human wellbeing. Her research has been featured in the press worldwide, including *The Economist*, *Wired*, *The Times*, BBC, *Spiegel* Online, *The Guardian*, *The Telegraph* and *Scientific American*. She received her PhD from the Data Science Lab, Warwick Business School, University of Warwick. Previously, she ran her own digital design consultancy advising clients on presenting their businesses successfully online.

Cadogan. Cadogan is a property manager, investor and developer with a 300-year history that informs its dynamic approach to estate management. The Estate's 93 acres is a vibrant neighbourhood that spans Chelsea and Knightsbridge - at the heart of their strategy is careful curation, preserving the area's rich history and charm while ensuring future vitality. www.cadogan.co.uk.

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Maddalena Iovene and Nicholas Boys Smith: Tables, charts, drawings and all other photos.

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