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Shearing Layers of Space: Exploration of Permanency and Temporality in the Public Realm

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Abstract

Stewart Brand famously provided a framework for considering change within buildings through his idea of "shearing layers," itself based on earlier ideas from Francis Duffy and Alex Henney. In each case, a loose hierarchy starting with the relative permanency of the site, the building structure/shell, and to a lesser extent the skin, to the more temporary building services, space plan, and ultimately the scenery/stuff that fills the buildings. This article transposes this method of analysis from buildings and structures to public urban space. It achieves this by adding a time dimension in the form of a "rate of change" or renewal to the different layers of site, surface, services, space (spatial configuration), surroundings/skin, signage, and stuff within the public space. While it was initially intended as a thought experiment relating to society, the idea of long-term thinking is a beneficial tool for urban designers and planners. Demonstrated using a city centre public space case study, we present the object-orientated approach to recording and mapping the "rates of change" ranging from constant, hourly, daily, monthly, and yearly through to renewal over decades and centuries. The output is presented dynamically, as a chronological map progression supported by mixed archival secondary sources and primary data gathered using remote sensing and other photographic evidence. A move from end-state planning within the public realm, to thinking about the variable nature of change will support a more flexible and resilient public realm. As we increasingly need to be responsive to challenges, and opportunities, having a better understanding of the time cycle and adaptability of the different layers of our public realm will only benefit the city.

Keywords

chronological mapping; experimental urbanism; public realm; shearing layers; temporary urbanism; urban design

1. Introduction

"The ephemeral and its variable *time* are the great paradigm with which the discipline of contemporary design should be reinterpreted" (Crippa, 2022, p. 41). The importance of temporality, flexible adaptation, and resilience in response to changing requirements within the built environment has never been greater. A cumulation of crises around changes in geopolitics, economic austerity, and perhaps most significantly, the impacts of the coronavirus pandemic have given rise to various and changing demands for temporary, ad hoc, DIY, and occasional urban space interventions (Oswell & Varna, 2024). There are many examples ranging from guerilla urbanism, street closures, temporary signage, pop-up street vendors, external uses, and the reprioritisation of public space for social activities. In this context of adaptation of the built environment to meet changing demands, one example of particular interest is the use of shipping containers for temporary event spaces and flexible uses. This is an example that is pertinent to the day-to-day work of Stewart Brand when he wrote about the creative use of shipping containers, since their invention in 1956 up to his time of writing (Brand, 1994, p. 33). He provides a personal example of repurposing, and the low-cost conversion into his work library and research space. In his famous publication, *How Buildings Learn*, alongside his personal and practical experiences, he also provided a framework for considering change and adaptation within buildings with his idea of "shearing layers," itself based on earlier ideas from Duffy (1990) and Duffy and Henney (1989). In each case, a loose hierarchy is introduced from the relative permanency of the site, the building structure/shell, and to a lesser extent the skin, to the more temporary building services, space plan, and ultimately the scenery/stuff that fills the buildings. In their seminal report that heavily influenced Brand, Duffy and Henney questioned the cumulative cost of replacing these layers when both capital and revenue costs are considered over the entire life cycle of the building:

> Add up what happens when capital is invested over a fifty-year period: the Structure expenditure is overwhelmed by the cumulative financial consequences of three generations of Services and ten generations of Space plan changes. That's the map of money in the life of the building. (Duffy & Henney, 1989, p. 61)

In this article, our overall research objective is to translate Brand's ideas on "shearing layers," from buildings into the public realm, looking through a temporal perspective with attached parameters measuring the "rate of change" as well as creating an inventory of the objects present in public space at different times. We are initially considering changes in public spaces in terms of short-, medium-, and long-term periods and we use an innovative mixed-methods approach to illustrate the complex interrelation between permanency and temporality. We recognise that the boundary between public spaces and the built environment around them is porous and that public life spills out into the surrounding areas. We work within this ambiguity in identifying the layers when looking at our case study of the Bigg Market, located in Newcastle upon Tyne, UK. Therefore, our aim through this article is to highlight and contribute to bridging the gap that exists in relation to longitudinal, temporal studies of public space, and provide several recommendations for the scholarship and practice of urban planning and design. The six separate layers of Brand and the four proposed by Duffy in a convoluted manner all begin with the letter "S." As such we have respected and followed this unconventional naming strategy for the different layers within the public urban space.

This article is structured in six parts; after setting the theoretical foundations related to theories of temporal change and obsolesce and expanding on Brand's "shearing layers" concept, we present in detail our

mixed-methods approach. Following this, we present our key findings and analysis of the case study, after which we conclude with reflections on the research process, outcomes, and the methodologies employed, suggesting avenues for further research on public space and the practice of urban planning and design.

2. Theories of Temporal Change and Obsolescence

Brand's ideas are located within a wider discourse relating to obsolescence within the built environment going as far back as the observational and empirical survey work of Bolton (1911). This has since grown into a developing and changing assessment of the causes of obsolescence as both physical deterioration and driven by behavioural change identified from a variety of diverse sources from a theoretical and data-driven (Thomsen & van der Flier, 2009, 2011), case-study narrative (Hollis, 2009), and practice-based (Laing, 2019) approaches. These perspectives on obsolescence are characteristic of the long-term thinking by Stewart Brand, influenced directly by the work of his professor Paul Ehrlich (Ehrlich & Ehrlich, 1968) evident in the "long-bet" narrative (Sabin, 2013) leading to the establishment of the Long Now Foundation as an organisation concerned with similarly structured "pace-layers" (Brand, 2000, p. 37).

The layers identified by Brand in *How Buildings Learn* (see Figure 1) are also a methodological framework around how a theoretical model of adaptation is constructed from observation and analysis of photographs, illustrations, and other visual sources. In a similar manner, Duffy's (1990) and Duffy and Henney's (1989) studies were based on an empirical analysis of building use in the City of London employing observational methods supplemented with stakeholder/occupant engagement that is increasingly common in post-occupancy evaluation stages. Underlying the approach in this article is the priority shared by Duffy (1990), the then president of the Royal Institute of British Architects, that a lack of any systematic approach to measuring and monitoring the built environment is reputationally damaging the built environment professions. If "measurement is the foundation of facilities management" (Duffy, 1990, p. 17), then this is also the case for the management of change of the public realm. Auditing and measuring change within the built environment are important but unrecognized and often forgotten tasks. The critical question is then what we should be measuring to effectively inform our facility or asset management within the public realm. What do post-occupancy studies look like when applied to the public realm and how do we avoid bias towards recording attributes that are easily measured, or simply because data is easily available? Thus, we are proposing a similar approach to Duffy's (1990) classification within facility/public realm management

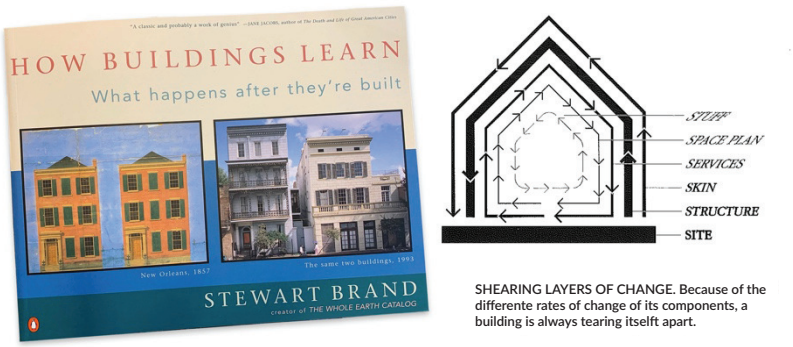

Figure 1. Cover of *How Buildings Learn* with examples of images and photographs that generated the idea of the "shearing layers of change," pictured on the right. Source: Brand (1994, cover and "shearing layers of change" diagram on p. 13).

that aims to measure the nature or rate of change (low to high rates of change, albeit subject to more precision) for a mix of hardware (measurement of physical characteristics) and software (measurement of socio-economic parameters such as replacement costs) that are operationally useful, comparative, and performance-based.

In recent years, there has been considerable growth in studies looking at the temporal dimension of city planning and urban design. The edited collection *Space-Time Design of the Public City* (Henckel et. al, 2013) is a case in point, touching upon different themes such as urban rhythms in the contemporary city, night-time uses, time and urban morphology, as well as considerations of time and social justice in urban mobility research. Rythmanalysis of public spaces became quite a fashionable area of research, famously associated with the work of Henri Lefebvre (Lefebvre & Eldon, 2004) with authors such as Hetherington and Smith (2013), Gibert-Flutre (2022), and Lyon (2020) looking at various aspects of methodologies and applications of this in real-world contexts. In addition, the Covid-19 pandemic has brought to the fore a renewed focus on temporary and tactical urbanism, as a plethora of innovative solutions were sought to and found to activate public, convivial spaces while maintaining safety guidelines (Honey-Rosés et al., 2021; Oswell & Varna, 2024). This work has revived a focus on urban experimentation and temporary, ad-hoc solutions as many cities have seen extensive implementation of pop-up cafes and social outlets and a revival of street life and diversity in the use of public spaces in post-Covid-19 times. We recognise, however, that there is a spectrum of change within the built environment, ranging from temporary and experimental approaches, seeking to promote social interaction and informal meetings of people, stronger social ties and neighbourhoods (Montgomery, 2015), through to more extreme options for planned disassembly or complete recycling (Durmisevic, 2009).

3. Making Sense of Time Layers

This article is proposing an extension of the approach to "shearing layers" with a high-level categorisation comprising site, surface, services, space (spatial configuration), surroundings/skin, signage, and just like Brand, stuff (Figure 2). Within this suggested classification we can add the inventory of public realm "objects" derived from construction object-orientated modelling standards and allocate a mix of critical time-based parameters attached to each of the individual objects within the public realm. This section sets out a descriptive specification regarding each of the separate layers and their relationship with those initially presented by Brand in his seminal publication (1994). They are presented in order of their respective longevity and durability, albeit we are aware that this is an abstraction and simplification of reality as each layer has an impact on the others.

3.1. Site Layer

The "site" layer is dominated by longer-term (deep structure) elements such as the patterns of ownership boundaries and associated plot dimensions. They are typically identified through map-based secondary data sources. The usage here is synonymous with the site context as originally described by Brand. This is a record of the underlying deep structure regarding the wider socio-economic context for the area through to how these inform the patterns of ownership and their boundaries. It has both physical and socially constructed characteristics that can be recorded and measured. This includes the actual geolocation of the area both relative to other areas within the urban context/city and also the introduction of historical

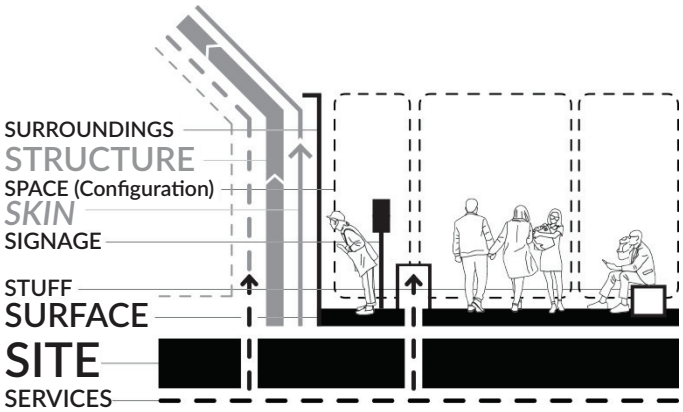

Figure 2. Extension of Stewart Brand's "shearing layers" to elements of the public realm.

boundaries forming between public and private ownerships. There is a contentious issue related to public space boundaries as one can consider the entire city an interconnected network; these boundaries can be based on several interconnected measures and criteria including perceived edges (Lynch, 1964), sense of enclosure, and historical associations, that have often been informed by "the terrier," the map of local highway and public ownership of land (Pounds, 2005). In practice, the site is complex and hard to specify when you have to select or draw site boundaries. For our use case, people in Newcastle know where the Bigg Market is but would find it hard to specify a boundary.

3.2. Surface Layer

The "surface" layer is defined as the visible street surface, the physical materials, paving, and road markings (parking bays, car-club, taxi, servicing bays, traffic restrictions). This is thus a record of the surfaces forming the floorscape or "surfacing" within the analysed site that is in part informed by the content of the UK National Model Design Code (Ministry of Housing, Communities and Local Government, 2021) and the elements of public space included in emerging guidance on design codes within wider UK planning policy. The recording includes the physical characteristics, temporary repairs/scars, and the variety of different materials, textures, and paving that can be observed, including where changes have occurred due to surfaces being removed to undertake underground repairs or access to services.

3.3. Services Layer

The "services" layer relates to the mix of public services and transport infrastructure and is in effect a mix of above and below-ground objects, and as such can only be partially recorded. These "services" are primarily mechanical and engineering as discussed by Brand (1994) but expanded to include additional requirements for service provision within the public realm. Most significant is the provision of surface water drainage, power supply for street lighting, broadband infrastructure, CCTV, electric vehicle charging points, etc. Some areas also have temporary provisions for short-term installations that require a power supply (event-based amplification or lighting provision such as Christmas lighting) and more recently the provision of WiFi. These are often co-located in shared underground trenches and above-ground access boxes, albeit with the recent expansion of privatisation and deregulation of public services or utilities, there is duplication of many types of service objects particularly those relating to telecommunications.

3.4. Space (Socio-Spatial Configuration) Layer

This is an attempt to translate Brand's understanding of the internal space plan, or changes in spatial configuration, into the public realm. Internal to buildings, spatial configuration includes elements of internal walls, partitions, and changes in materials or colours which are used to define activity zones and appropriate uses. Spatial configuration is often based on assumed and/or observable activity zones, such as circulation, seating/waiting, external dining areas, etc. Within the public realm, the spatial configuration is an assemblage of several different elements pertaining to the other layers and tends to be described through different mechanisms, such as small area paving and lighting for trafficked zones, barriers/edges or threshold details to zones which are themselves defined by changes in materials, and level changes or steps. The main distinction within the "space layer" is around areas allocated for movement/circulation and those anticipated as more static zones, albeit there will be many other subtle variations as spatial zones become appropriated by different users.

3.5. Surroundings/Skin Layer

The "surroundings" relates to building façades (lighting, colour) and is similar to Brand's "skin" layer of the buildings. It is a mesh between the external skin of buildings and other surroundings that add to the sense of enclosure of the public space. It is related to Brand's "skin" layer albeit when the concept of "skin" is directly translated to the public space it has a slightly different and more varied function in providing a sense of enclosure. Therefore, we can more precisely describe it as "surroundings" as it refers to building façades delineating the public space, road infrastructure, fences/bollards, and other aspects of three-dimensional enclosure that can include temporary hoardings. Again, it has a relationship with many of the principles set out in the UK Model Design Code (Ministry of Housing, Communities and Local Government, 2021) and the aspects of morphological analysis used to look at defining and measuring the extent and parameters of the building line. These include metrics such as contiguity, variations, projections, and set-backs. Here, the rate of change within the surroundings is often dependent upon changes made to the mix of uses within buildings. The façade of upper stories is less subject to change than the ground floor and entrances/public uses, which can be physically altered every time there is a change in leasehold or tenancy in ground floor activities and uses. This is typically between two to six years between changes in use based on the specific public use.

3.6. Signage Layer

In public space we are proposing a distinction between statutory signage and other elements of street furniture. Official signage is an addition to the public realm that requires a formal legal process to become enacted, and it is something subject to consultation and largely standardised as a result of highway legislation.

3.7. Stuff Layer

"Stuff" is similar to Brand's layer as the daily reorganisation of street furniture and other fixed elements. It is a layer that describes the daily changes to street furniture both fixed and temporary, including advertising, event-specific additions, etc.

3.8. Reflection on the Division Into Layers

We recognise that this initial description and specification of the different layers within public space, introduced as an extension of the concept of "shearing layers," is as imperfect and arbitrary as the work of Brand. This is because many separate "objects" can potentially be classified in several different layers at the same time. It is clear that, at the very least, each of these layers will impact on others, for example in changes to underground services/cabling impacting on the surface. It may be the case that in classifying this scope of "objects" and adding some form of parameters relating to their "rate of change" temporality, durability and responsible stakeholders remains an evolving exercise in classification.

4. Mixed Methodologies Used to Construct a Critical Case Study

Our research strategy consists of an experimental approach to combining mixed and multiple methods, or a form of "mixed scanning" (Etzioni, 1967) to gain a holistic understanding of the rates of change within the public realm. We utilised a common language of methods shared between disparate academic and professional disciplines that can record multiple perspectives and attributes, both intangible and tangible, relating to geographical/spatial and temporal patterns of organisation within the public realm. These include mixed qualitative and quantitative secondary data sources, with semi-automated data mining of public records, digital archives, and social media resources which were then supplemented with a series of primary longitudinal data gathered for the case study location. These data were collected from April to November 2024. This section describes the theoretical basis and scope of each of the individual mixed data sources available to describe and analyse change, alongside a detailed descriptive account of how they have been applied to the critical case study (Flyvbjerg, 2011; Ruddin, 2006) chosen. A tabulated summary of the approaches is set out in Table 1.

These collected methods are essentially ethnographic approaches applied to the urban context and share similar research methodologies with wider ethnography despite being situated in contrasting physical and cultural environments. Indeed, there is an ongoing debate regarding the actual specificity of urban anthropology and ethnography (Toulson, 2015) and whether it is a distinct field of anthropology that requires such novel methodologies or whether it has a commonality over methods of research and theory. Some reviewers go further to suggest that urban situations are by default more complex and interconnected (Pardo & Prato, 2012) around global ideas, artefacts, and communities.

In this article, we have chosen to trial and combine these mixed methods within the Bigg Market, a medieval historic square within the city of Newcastle upon Tyne, UK. The choice of the case study location is one of both relevance and convenience. It had to be relevant with regard to being a suitable critical case with transferable findings. Hence our initial criteria for case study selection were suitably broad, relating to an area under public ownership, with a mix of adjacent land uses/activities, together with variety in the levels of mixed (traffic and pedestrian) activity. Added to these criteria was the availability of open-source historic data records and as such our selection has focused the project location on a central conservation area. The convenience criteria related to accessibility and proximity for the researchers, especially as the location was subject to regular visits for survey and analysis. It is a contested space with regard to a variety of different users due to the time, day, and season, with similar contested locations being used as the basis for the demonstration of temporality arising from leisure and drinking locations (Thurnell-Read et al., 2021). Indeed, the Bigg Market

Table 1. Summary of methods and data sources tested highlighting each layer impacted by the specific method.

Method/data	Description and relevance to a longitudinal study of the public realm	Layers being analysed	Key methodological references
	Secondary sources		
Historical map regression	Comparative content analysis of geolocated series of historical maps	Site	Caniggia and Maffei (2001), Hindle (1998), Oliver (1993)
Secondary rephotography	Combination and comparison of a series of historical photographs to highlight change	Site; surface; surroundings/skin	Brand (1994)
Timelapse rephotography	Open-source digital record of 360° cameras undertaken by Google Street View	Surface; surface; services; surroundings/skin; signage	Carpenter et al. (2014), Cinnamon and Gaffney (2022)
Longitudinal CCTV	Open-source access to live and archive CCTV images covering the public realm	Space; surroundings/surface; signage; stuff	James et al. (2022), Simpson et al. (2022)
Local planning authority records	Open-source statutory planning records (applications) provided online via Planning Portal	Site; surroundings/skin	Devlin and Coaffee (2023), Varna et al. (2020)
	Primary data sources		
Secondary and primary rephotography	Supplementing historical photographs with geolocated (including augmented reality) photography	Site; surface; surroundings/skin	Bae et al. (2010), Rieger (2020)
Survey/record of dated artefacts	Systematic structured survey of the physical assets (building façades, signage, fixed features, public artworks/statues) relating to the public realm	Surroundings/skin; signage; stuff	Crilly and Varna (2024)
Participant observation	Ethnographic mapping of observable activities within the public realm, including the use of video recording	Surroundings/skin; surface; space	Gehl (1971), Hester (1985, 1987), Whyte (1980)
Inventory of artefacts/objects	Systematic, and repeated/repeatable recording of objects within the public realm	Signage; stuff	Otway (2014), Reid-Musson (2018)
Repeated LiDAR scanning of artefacts/objects	Selected LiDAR survey for long-term objects	Surroundings/skin; signage; stuff	Dawood et al. (2017), Golombek and Marshall (2021)

has been chosen as a suitable use case for several studies looking at transformation at different rates. This includes the underlying economic transformation and restructuring of the northeast regional economy with a corresponding impact on a growth in leisure and the night-time economy (Hollands & Chatterton, 2002), and more recently regarding measurable impacts of heritage-led regeneration (Veldpaus & Pendlebury, 2023).

This section presents each of these mixed methods in turn, through a summary description, an extract of the method as applied to the case study location, and a discussion of the benefits and limitations of its practical application.

4.1. Historical Map Regression

Map regression (Figure 3) is a method used for historical analysis and understanding site characteristics, shared by urban planners, conservation professionals, and archaeologists (Hindle, 1998; Oliver, 1993). It involves the collection and combination of a series of historical maps that can be scaled and geolocated for visual comparison and content analysis. This is an approach that is implicitly already widely used throughout urban design and historical analysis, where typologies of urban morphology contained in historic mapping can be categorized (Kropf, 2009) and subjected to analyses through their historical progression (Caniggia & Maffei, 2001). Applying this method to the public space case study highlights specific larger structures (statues, toilets, telephone boxes, etc.) and their date of construction or relocation, specific aspects of public transport infrastructure (tram routes, stops, etc.), physical design features (street edge/kerbs, even the presence of some limited signage, etc.), ownership boundaries (plot boundaries, party walls), and in some instances the use of the property where it has public use indicated (town hall, public house). The actual content analysis is often based on existing agreed typologies. The identifiable typologies, or aspects of the urban form chosen, derive from a seminal study of the Northumberland town Alnwick as well as the city of Newcastle upon Tyne (Conzen, 1960, 1962; Whitehand, 2001) which began to define developmental units in the hierarchy of the urban fabric such as street, blocks, plots, and buildings. This method of morphological analysis is concerned with the physical or measurable spatial aspects of these units, such as frontage width and continuity of the building line, as opposed to more dynamic characteristics such as land use, activities, restrictions, or control/ownership.

The approach is limited by the availability and frequency of the historical map sources; however, it provided a valuable starting point for the longer-term layer within the public realm. Herein there is a critical "ambiguity [as] an inherent feature of built form" (Kropf, 2013, p. 56) identified with typologies (or objects) within the environment being attached to multiple dynamic parameters at the same time and with many of these parameters being time-dependent and evolving (Farrell, 2014). These additional parameters that extend the traditional view of morphological studies can refer to land use patterns, ownership, or even management regimes and responsible stakeholders.

4.2. Secondary and Primary Rephotography

This method describes an approach to repeat-photography (Figure 3), an approach which is an important visual method in the social sciences, including the built environment. It is a method used to generate the key ideas about temporality and adaptation through the use of "then" and "now" images with contemporary photographs from an approximate matching geolocation to the original image. This useful method of revisiting older historical images set up with photographs using the same angle has been used in several high-profile examples, including the revisiting and photographing of a series of famous townscapes painted by Edward Hopper in the US town of Gloucester during the 1920s (Fox, 2012; Halaban, 2012).

Figure 3. Site boundary imposed on historical map progression for a variety of historic maps dating from the 1870s, 1890s, 1910s, 1940s, 1950s, 1960s, 1970s, and 1980s. © Crown Copyright and Landmark Information Group Limited (2024). All rights reserved, with examples of rephotography using historical image progression with first sequence from 1820, 1880s, 1950s, and 1973, and second sequence from 1950s, 1970, and authors' own 2024 rephotography image added to the historical sequence. Source: "Classic Photos of Newcastle and of the East End" (n.d.).

4.3. Timelapse Rephotography

We accessed and analysed Google Street View historic image sources (Figure 4), which has increasingly become a growing open source for historical images from the point of the initial survey by Google (2008) for selected key urban locations onwards. This is an approach set within a long tradition of longitudinal photographic records. Video and photographic analysis was first explored, if not at that stage popularised, by Appleyard et al. (1965), an example that was also Kevin Lynch's last publication with the experimental use of video analysis, amongst other forms of case study data collection and recording, in the experiential qualities of highway design. As such, it has become part of the urban designers' survey and analytical toolkit. The use of time-lapse photography is an observational approach that has been used as part of mixed methods recording and analysis of longitudinal trends based on non-participant observations (Afonso & Fatah gen Schieck, 2020; Simon, 2012), albeit in quite specific applications around digital monitoring and smart city applications. Thus, it has tended to be typically used over shorter time periods, exploring the rhythms (Lefebvre & Eldon, 2004) of hours rather than years, of events and interactions with urban spaces (Chan,

Figure 4. Google Street View images progression and street view images progression from authors' own aerial rephotography survey.

2024), even if repeated. It is a non-participatory method widely used in urban ethnography, where it can be accompanied by supporting field notes. Increasingly it is also used in an applied professional context for construction site monitoring and other applications or scenarios where the qualities of temporality and change in the built environment are evident or anticipated. The emphasis in the application of this method has long been exploring human interaction with time (Hägerstrand, 1985) with examples of street performances (Simon, 2012), different social demographics (Gilbert-Flutre, 2022), or different modes of travel/transport users (Spinney, 2010) using public space. Albeit the use of a visual timeline within Google Street View provides a long-term data set for temporal analysis that is independent from any specific study or research project.

However, the digital resource provided by Google Street View currently has limited applications regarding an element of time progression, being mostly used tacitly for accessing close to real-time information (Anacta, 2024; Mannings, 2009) and semi-automated content analysis for public realm management concerns (Kang et al., 2018), but with some growing interest for community applications (Cinnamon & Gaffney, 2022).

4.4. Aerial Rephotography With a Repeated Drone Survey

We supplemented the Google Street View and historical images, not only with our own rephotography, but with a systematic approach to primary aerial photography (Figure 4) of the case study area. This is ongoing work based on a monthly photographic survey undertaken from several take-off locations within the public realm, albeit it does demonstrate some of the specific challenges of systematic and repeated drone aerial photography. These challenges have been to not only ensure the same geolocations as an experiment, but to aim for comparative image quality that has proven difficult in undertaking the systematic survey with varying weather, especially wind and lighting conditions.

This is an emerging method for digital photography and is increasingly accessible with the use of a lightweight low-cost drone to collect aerial images. This has initially been limited to digital still images but with a future research agenda to use video survey on a similar standard flight path. Initial trials have been able to use a

sample video file to convert to still images using an open-access online file convertor; then, photogrammetry software, using a mix of video and still images, has been able to construct a three-dimensional model as the basis for repeatable visual content analysis.

4.5. Longitudinal CCTV Records

This is a series of CCTV recordings (Figure 5) provided by the Urban Observatory (n.d.) and is a location-specific data source that fortunately was available in several locations in the Bigg Market. As an adjacent method for collecting data, as well as detailed metadata, it is valuable for the ability to not only access certain CCTV cameras in real-time, and to access a historical archive of images, but it also has content analysis (derived from machine learning) of the images for the specific identification of people and vehicles and the rates of movement/usage within any given time period from the initiation of the Urban Observatory in 2014.

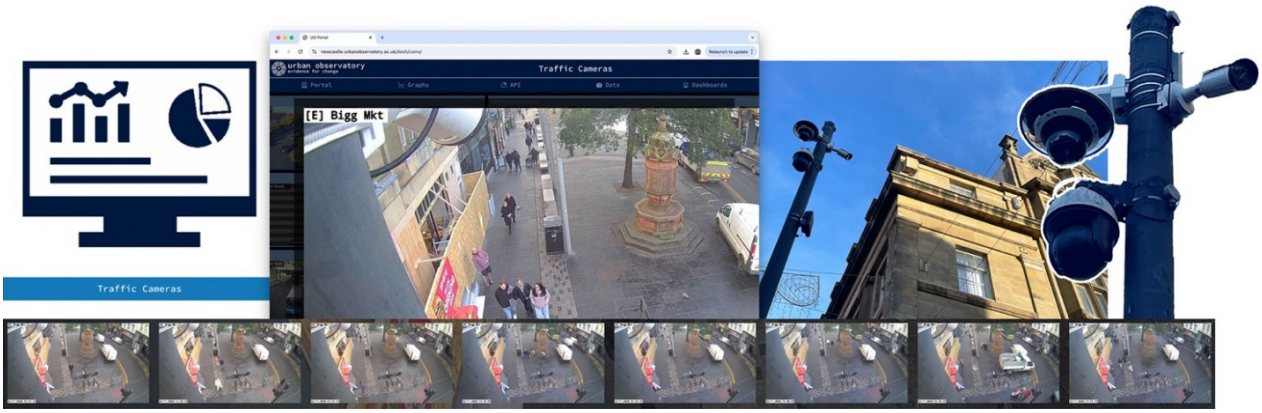

Figure 5. Sample extract from live and sequence of historical image feed from a selected CCTV camera located in the Bigg Market. Source: Urban Observatory (n.d.).

4.6. Dated Artefacts

The dated artefacts (Figure 6) methodology comprised a structured and systematic approach to recording and mapping any dated artefacts situated within the public realm in the case study area. Here, a dated artefact is a bit like a hallmarked object, as it refers to a physical object that contains a date of construction, installation, or refurbishment. We are aware that in understanding the role and significance of physical cultural artefacts, we need to be aware that they are associated with wider social and cultural contexts. There is an inherent bias in the positioning of any artefact within the public realm that is a result of the inextricable power tension between larger institutions and community-based organisations, and sometimes these objects are representative of the pressures of forced partnership arrangements with larger and often governmental entities (O'Hare, 2018). The mere existence of dated artefacts can be indicative of a controlling ownership and the presence of dominant stakeholders that are responsible for work within the public realm. Hence, with a significant collection, we are also able to provide an initial classification, if not meaning, to these artefacts. The approach to classification is adapted from *Nomenclature* (Bourcier et al., 2015), an updated version of Chenhall's system (1978) for documenting and describing historical artefacts in general, albeit mostly used within the context of museums or public archives. Any potential meaning, beyond the significance of the date of construction and/or installation of the artefact would be provided through materialistic association (ownership and/or access; Mackay, 2013).

Figure 6. Dated objects, artefacts, and signage located within the study area. Note: Authors' own images superimposed on OS MasterMap® Topography Layer (GeoPackage geospatial data), Scale: 1:1250, Tiles: GB, Updated: 1 February 2024, Ordnance Survey (GB), Using: EDINA Digimap Ordnance Survey Service (https://digimap.edina.ac.uk), Downloaded: 2024–07-09 12:25:47.538.

4.7. Local Planning Authority Records

Local planning authority development control/management records (Figure 7) are available online as a public archive of changes within the built environment for actions that require some form of statutory consent. We have accessed and analysed the frequency of different types of planning applications, grouped within five-year periods starting with the initial digital records from 1975 onwards. The local planning authority record in England and Wales typically has a summary of planning applications from 1975 onwards, with the last five years including a digital record of all documentation associated with the relevant planning application. As the Bigg Market is situated within a Conservation Area within Newcastle City Centre, (Newcastle City Council, 2024), outline planning consent is not normally accepted, so the analysis has been based on (a) full/detailed applications, (b) discharge of planning conditions attached to full applications, (c) specific change of use that is mostly internal, as well as (d) listed building consent as required for alterations and minor work that affects the character of the listed building, and (e) advertising consent as required for illuminated, projecting, and/or large signage.

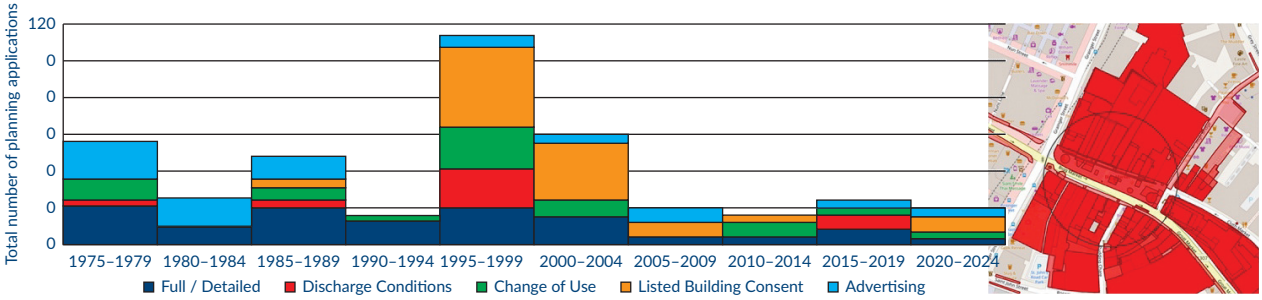

Figure 7. Analysis of the five-year grouped frequency of planning applications by type within 50 m of the Bigg Market. Source: Map extract from Newcastle City Council (n.d.).

4.8. Participant Observation

This is an approach to recording spatial behaviour (Figure 8) specifically the sorts of social interactions evident at the main junctions and nodes for key routes through the Bigg Market, utilising a passive participant observational approach (described as loitering with a good vantage point) after the urban anthropology of Hester (1975, 1985, 1987). It has developed as an accessible and low-cost method for analysing the use of urban spaces (Crilly & Mannis, 2000), albeit it has been mostly concerned with informing the design stage rather than issues of maintenance and management. It is also clearly restricted by limitations on the time and frequency of the observations.

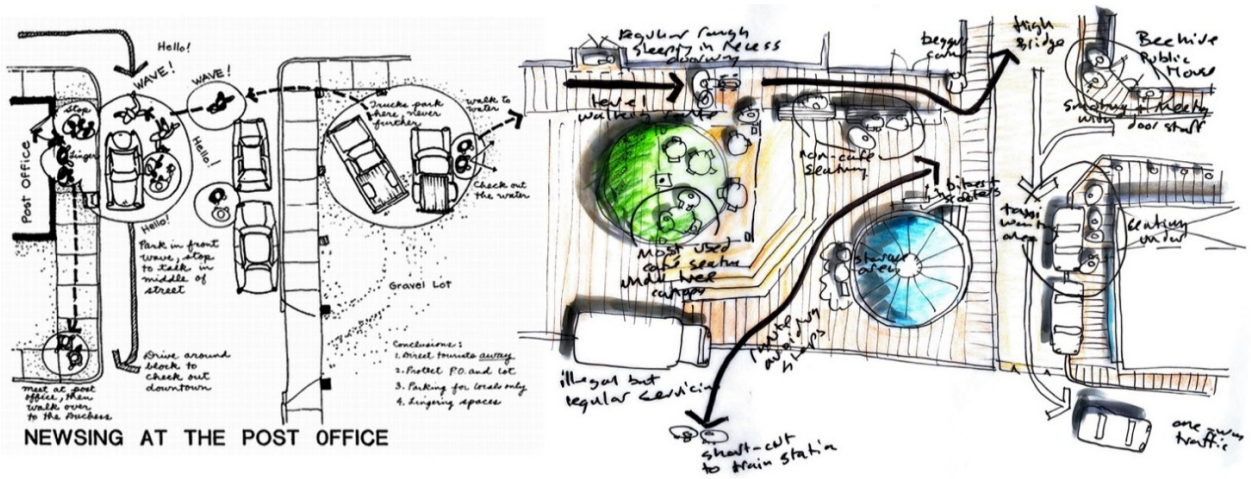

Figure 8. Mapping of participant observation: Example of "Newsing at the Post Office" (left) and lunchtime circulation in the Bigg Market, Newcastle upon Tyne (right). Sources: (a) Hester (1975), (b) authors.

4.9. Inventory of Objects

We undertook a repeated systematic survey of objects and artefacts within the public realm (Figure 9) as the basis of a temporal analysis, recording the occurrence and regularity of their appearance over a day, week, and month, as the main time gaps between the variety of available secondary sources. Other forms of temporal analysis have similarly followed daily and weekly occurrences that can be evidenced in big digital data sets (Halás & Klapka, 2023). As such we undertook a series of systematic recordings and analyses of the case study location based on the use of existing timescape studies with temporal analysis (rhythmanalysis) as a choice of method (Otway, 2014; Reid-Musson, 2018) set within the urban context, specifically short-term daily and medium-term weekly or monthly variations, but extending this to look at longer-term changes. This remains a continuing and repeating exercise.

Period	Inventory of public realm "objects" derived from object-orientated modelling standards
Short term (objects with an observable daily rate of change)	 City scooter (hourly hire vehicle), café furniture, commercial/retail signage for promotions, street café barrier, temporary traffic control measures (movement barriers and traffic cones), street planters.
Medium term (objects with an observable weekly/monthly rate of change)	 Commercial refuse bins, hanging flags (timescale sports tournament related), event/crowd control fencing.
Long term (assumed) (objects with an assumed longer rate of change —yearly plus)	 Cycle rack, cash machine (ATM), pedestrian street sign, telecommunications cabinet, city tourist map, litter bin, fixes bollards, lamp-post & spotlights.
Long term (documented) (objects with documented records that include maintenance schedule)	 Public artwork, semi-permanent objects or requiring maintenance plan or inclusion in an asset management plan.

Figure 9. Inventory of temporal objects in the study area, classified by rate of change.

4.10. Repeated LiDAR Scanning of Artefacts/Objects

We extended the initial systematic survey of objects and artefacts to identify a sample of long-term (as defined within Figure 11) "stuff" that could also be the subject of laser scanning (Figure 10). There are a growing number of studies showing how LiDAR, and specifically mobile laser scanners, are proving to be a valuable technology for accurate data in urban analysis and transportation-related research (Di Stefano et al., 2021; Golombek & Marshall, 2021). This approach is increasingly accessible due to smartphones or other hand-held devices containing lasers as default alongside their digital cameras. While still an experimental approach, due to the limitations of technical distance and access to all visible parts of the object being recorded, many of the platforms support digital sharing with associated metadata including geolocation and most significantly a timestamp of when the object was scanned.

Figure 10. Extract from LiDAR scanning of temporal objects in the study area using a hand-held device and using the professional Polycam LiDAR scanning platform for analysis and digital sharing, with an extract of timestamp/geolocation metadata.

5. Exploring Temporality and Permanency in the Public Realm

This experimental approach to translating Brand's "shearing layers" from the building level to the wider public realm lead us to uncover and compile the above methodologies. Each has the potential to provide meaningful insight and information relating to many of the layers identified (Table 1). Collectively, these methods help reveal the entanglement of time within the spatial fabric of the city. At any stage, urban ethnography suggests we record everything, in part as we don't know what aspects will have significance over time. Therefore, as a result of time and space being inseparable in city development (Madanipour, 2017), it is important to consider more closely the time dimension of spatial studies. This would result both in a deeper and more holistic analysis of urban environments as well as informing future developments to be more sensitive to both the spatially embedded histories as well as the seasonal and daily rhythms of public spaces. We can see from applying the methodology resulting from Brand's approach that public space exhibits a complex layering of different spatial elements, created in different time periods, ranging from very long histories to day-to-day and second-to-second changes. In effect, public space is fluid and permanency is illusory, or as Brand himself writes, "all buildings are predictions…all predictions are wrong" (1994, p. 178). We believe nevertheless that the framework proposed here has validity, and it can describe temporality/rates of change in the public realm by considering three levels: long-term changes that occur over years or decades; medium-term changes which are observable over a targeted study period; and finally, short-term changes happening on a daily/hourly rate.

While the specificity of each "rate of change" is dependent on the methods and the longevity of the study, it is also inevitable there will be gaps in evidence due to the lack of time-related data in most instances. We understand these are clear limitations to this approach. The application of the above methods in the context of a public space could only offer 2D snapshots in the context of the present article, recognising that 3D models, renderings, digital files, and dynamic video footage can reveal even more intimately the passage of time and the fluid, ever-changing life of the public space. We can also infer that the planned lifespan or durability of the different "objects" as identified through the layers will be different to the actual "rate of change" as the most important driving factors for obsolesce are societal changes, behaviours, fashions, trends (Thomsen & van der Flier, 2011), and changing power structures dealing with the public realm (McGlynn & Samuels, 2000), rather than the physical characteristics of the space.

6. Discussion and Conclusions

In this research we took a novel approach to understanding the urban public realm through a temporal perspective, focusing on the ideas of permanence and obsolescence and using them to illustrate and analyse the rates of change for "objects" in the built environment. Our conceptual foundations are anchored in Brand's (1994) thinking on "shearing layers" of change in buildings and transferring this to the public spaces of the city. This led us to our experimental choice of methods and the case study approach employed. The positive impacts of this pilot research project presented here can be summarised in the points below.

6.1. Replicability and Robustness of the Research Methods and Critical Case Study Approach

The exploratory approach followed presents a potential way to address the imbalance in the scholarship looking at building assets as distinct from the public realm in relation to temporal studies. Reviewing the academic literature in relation to temporal and/or longitudinal approaches to the public realm/public spaces yielded very few results and we hope the present article can spark debates and future studies on the topic. The adaptation and application of Brand's "shearing layers" approach highlights the blurred boundaries between private buildings and the public realm, increasingly as layers such as "site" and "skin" have a direct relationship with the external public "site" and the "surrounding" of the external public realm. Therefore, we believe that it is an effective and appropriate extension of a methodological framework that works well in relation to public spaces as well as built assets; we therefore think that our mixed-methods approach, involving both digital and non-digital methods, has the potential for replicability in understanding the temporal dimension of other case studies of public spaces.

6.2. Positive Proactive Planning and Urban Design

We believe that the research design and methodology employed in this article have timely and relevant practical application in providing much-needed positive planning and proactive design guidance (Punter, 2010a), supported by design management skills, but in a manner that is targeted at key stakeholders responsible for ongoing maintenance as well as the statutory/regulatory bodies that have a responsibility for the public realm. We hope that this approach will also help inform future developments and the key actors in charge—planners, urban designers, developers, and civil engineers—to be more sensitive to both the spatially embedded histories as well as the seasonal and daily rhythms of public spaces. This would lead to fostering less disruptive and more transformative urban development strategies that support an authentic public realm and create coherence in the ever-shifting life of the city.

There is clear benefit in a systematic approach to understanding specific layers within the public realm and the individual "objects" relevant to each of these layers to urban design and planning. The ability to add a temporal dimension to "objects" is a prerequisite for adding practical parameters such as "date of construction or installation," "longevity" (anticipated design life), "maintenance costs" (renewal, replacement, and depreciation of assets), alongside the relationship with stakeholder (agency/individual responsibility) roles. This is an approach that fits well with emerging schema regarding the identification of urban elements, for example, the "Uniclass" classification system used within many object-orientated digital models and used as a resource for asset management planning. Linking capital projects with ongoing management and associated revenue expenditure is seen as part of a wider process of supporting the urban renaissance

(Vescovi, 2013) and is needed to ensure quality of life. Thinking in four dimensions regarding urban design ensures that the potential for design rationalization within the public realm can then be maintained in the longer term. This positive approach recognizes and maintains the value of good design (Commission for Architecture and the Built Environment, 2001) and how it is maintained, even in times of economic uncertainty (Punter, 2010b). In effect, the dimension or parameter of time relates to revenue budgets, often allocated pro rata for the longevity of the "object," and can supplement existing parameters relating to capital costs and accurately support better maintenance and management within the public realm.

6.3. It Is Timely to Consider Time

In a period of critical change and polycrisis, as we are currently experiencing as presented at the beginning of this study, the 4th dimension of time does become a more significant aspect in urban design and planning research and practice. While there is still a lot of ambiguity about the definition of time, regarding measurable parameters and how time is interpreted and used in these fields that look at creating successful places, we believe it is valuable to add time-based studies to the existing work. Recent additions integrating time analysis to the previous more spatially focused scholarship comprise studies such as rythmanalysis, 15-min cities, temporary urbanism, as well as time-cost analysis of materials and structural viability in studies related to the construction and management of the public realm. In this context, we glimpse two valuable avenues for further research. Firstly, this spatio-temporal approach to the public realm, based on an expansion of Brand's framework, needs to be tested in other public space case studies, within a variety of urban contexts to determine its robustness and replicability. Secondly, further research and case study work should focus on the identification of the specific agents responsible for governance and change within the built environment and public realm, and specifically how these stakeholder roles and responsibilities can become additional parameters to attach to this object-orientated framework. This will then be able to show how a visual representation of permanency and temporality through the approach presented here can influence the underlying power structures and the decision-making landscape in urban policy and practice.

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Conflict of Interests

The authors declare no conflict of interests.

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