095

The architectural adaptation of urban economic life: Location, use and form of the commercial-residential building in Cardiff

Laura Narvaez
Space Syntax Laboratory, Bartlett School of Architecture, UCL
l.zertuche@ucl.ac.uk

Alan Penn
Faculty of the Built Environment, The Bartlett, UCL
a.penn@ucl.ac.uk

Sam Griffiths
Space Syntax Laboratory, Bartlett School of Architecture, UCL
sam.griffiths@ucl.ac.uk

Abstract

Revisiting Jane Jacob's notion of locality knowledge, this paper argues that combining commercial space and dwelling fosters social, economic and architectural processes that come about by factors of local urban economies. The mixing of uses merges the relation of 'what one does' and 'where one lives' in a particular building whereby urban and architectural scale effects come into place. Comparisons of commercial-residential buildings in two local districts of contrasting morphologies in the city of Cardiff are studied in the context of their urban-architectural design scales. From an urban scale analysis, attention is given to the distribution of commercial-residential buildings in relation to spatial centrality; from an architectural perspective, it examines the way residential building adapts commercial additions, defining how different functions associate distinctive adaptable typologies depending on the building's urban location.

By using syntactical and morphological approaches, the paper combines Depth Distance analysis with patterns of use and building form, drawing two reportable findings: The identification of corner shops located within one turn of direction from main high streets within gridiron urban forms, while activities combining retail or local office businesses with residential functions are located in corner blocks along streets within radial urban morphologies. These spatial attributes of location combine the adaptability of local property markets to mixed use with advantages in accessibility to produce an urban building that can flexibly accommodate innovation that is both a reflection of new skills and knowledge contributing to a local diversity.

Keywords

Jacobs, adaptation, location, urban form, local knowledge.

1. Introduction

Cities have often been recognised as 'spontaneous' spatial orders, referring to complex social orders that are not deliberately created and that they can't be. They arise largely unplanned by the interaction of many people and many minds. Since the early writings of urban theorists (Jacobs, 1961, 1969; Alexander, 1964; 1966) and in the field of urban economy (Webster and Lai, 2003), a spontaneous order includes markets, culture, money, and language. Amongst these things, there is the genius of many ordinary people using their own knowledge to solve problems and to create favourable conditions for handling future change.

The works of Jacobs (1961; 1969) and Hillier and Hanson's theory of *The Social Logic of Space* (1984) shared the view that cities are a site of exchange between different kinds of people that pose 'problems of organised complexities' and that these should be understood in the sense of 'how cities work'. Building on these two works, this paper brings the subject of economy in architectural theory with an empirical analysis of spatial adaptation in buildings.

From a spatial point of view, Jacobs (1961) prompted the recognition that spatial arrangements can emerge from a myriad of individuals pursuing their needs within a framework of rules encouraging cooperation over aggressive formal policing. On the other hand, the perspective from the field of economics proposes the idea that bottom-up flow of information facilitates social cooperation and coordination in markets underpinning an emergent order that have recognised cities as places where entrepreneurial discoveries can be realised. From these perspectives, the productive use of knowledge is focused on the idea of how the information necessary to coordinate markets held by individuals, whose tacit knowledge is bound in locality, is materialised in the urban-architectural form. This idea was referred as '*local knowledge'*, originally proposed by the economist Friedrich Hayek (1945, p.40) emphasising the "particular knowledge of time and place" held by individuals in the market planning. Local knowledge parallels to Jacobs' notion of '*locality knowledge*' (1961, p.544) in city planning. She argued that entrepreneurs and consumers are the key players to have the information necessary to determine what the best outcomes for their communities would be rather than bureaucrats.

For Jacobs, locality knowledge meant knowing how to get things done, but also knowing who to trust and under what circumstances. One of her main contributions about understanding the spontaneous order of cities is her insight that safety and trust depends largely on the structure and location of public spaces. Although some of the shortcomings of this proposition are the absence of relating the consequences of business regulations and rent control (Ikeda, 2011), the specific conditions she prescribed in order to account for an urban diversity also implied the creation of local knowledge (Jacobs, 1961, p.198-289). Firstly, public spaces should have mixed uses, in particular primary uses (i.e. retail or commercial) that can attract people to certain areas.

Secondly, short blocks with frequent opportunities for people to turn corners and varying their routes make streets more interesting. They multiply the number of potential encounters –meeting points that increase also the chances of discovering or making unexpected connections to other uses. Thirdly, "old ideas can sometimes use new buildings. New ideas must use old buildings" (ibid, p.188). Newer buildings can be combined with older buildings that have lower property values and older buildings would provide an environment in which ideas are less costly to become established.

Lastly, there must be a sufficient amount of concentration of people in order to promote diversity and demand for multiple activities, may it be living, working or of entertainment nature. The concentration of people would contribute to the mixing of uses, multiplying its effect to create liveable districts.

Under these four conditions, streets become the focus of interest for living, working and leisure activities. City dwellers, however, acquire the knowledge through the support of other sources of information in which they can rely on. In this sense, the creation of a local diversity in a location underlies the acquirement of new knowledge and the know-how in creating new businesses (1969) Local knowledge, therefore, implies a social process that creates economic situations.

This paper investigates the interplay between the designed qualities of urban form and the economy in creating local knowledge through the mixing of uses. Its focuses on the local design city scale through key aspects of *location, use and form*. The motivation of this paper is largely based on two principles: The first one comes from questioning how combining techniques of space syntax with urban economic analysis (Narvaez et al., 2015; 2014; 2012) can explain the morphological conditions in the architectural scale. The second comes from what in particular Jacobs' theories has taught us about the importance for entrepreneurial development on the way streets and the use of public spaces –places where social encounters take place- are designed.

The analysis proposed in this work is built on quantitative data of Cardiff, UK. Cardiff as a case study is studied as an example of local knowledge mainly for two reasons. First, the spatial transformation of the city resulted in a decentralised growth[1], causing local districts to form different spatial structures in various sectors of the city. From forming radial distributions of street patterns to more regular grid structures, the different urban settings within Cardiff have allowed developing mixed-uses in strategic locations. Second, the location of mixed-uses, specifically concerning to the reconversion of the house into a shop or an office, is influenced by how spatial centrality plays a role in adapting diverse mix of uses. Certain activities are accommodated in corner locations closer to busier roads or at middle block of streets depending on the morphological structure of the local urban area. In this respect, Cardiff is explored to investigate the concept of local knowledge within an historical context of mixing uses -where they are generated and how their urban location can offer different possibilities for architectural adaptability.

The methodology of this work uses the syntactical analysis of 'step depth' –the distance from a street to the all other streets. The analysis allows measuring three definitions of distance in the urban street network: *topologically*, referring to every change of direction or turn between a street segment and its neighbouring street segments; *metrically*, referring to the distance in metres between the centre of a street segment and the centre of a neighbouring segment; and *angular*, assigning a value of the degree of angular change of direction between a street segment and its neighbour.

With the use of these syntactical analyses we are able to investigate the location of different types of activities. In particular, where the mixing of uses is concentrated and how morphologically and architecturally they were established over time. The methodological choices are informed by theories on configurational and morphological studies as well as those on the socio-economic aspects of cities (Hillier, 2009; Marcus, 2010; Samuels et al, 2004; March, 1976; Jacobs, 1969; Webster, 2010), which underwrite our methodological plan.

The outline of this paper is as follows. We begin by briefly discussing the commercial-residential building as an example of a mixed-use building that materialises local knowledge in the wider socio-economic context of the building's function. Next, we discuss the three common aspects in which local knowledge comes to effect in spatial terms: Firstly, the factor of *location* and its characteristic regarding commercial-residential buildings. Secondly, the aspect of *form*, which relates to the urban morphological setting and historical context in which spatial adaptation of mixed-use occurs. Thirdly, how *use* influences location and form in both the urban and the architectural scale. Finally, the paper concludes offering some closing thoughts.

[1] A 'decentralised' pattern refers that the strength of developing spatially can be in the network, not in the hub (concentration of activities).

2. Urban economic life shaped by architecture: The case of the commercial-residential building

A mixed-use building, like the case of a commercial-residential building (hereafter CRB) commonly found on local neighbourhoods, brings into consideration several aspects of scale, form and use: From an architectural perspective, the building contributes in reversing the effects of the separation of uses and social class through planning regulations.. From an urban point of view, design regulations influence the spatial dimensions in which urban order takes shape over time, managing the distribution of uses, patterns and built form.

The existence of the CRB, also related to the concept of the 'shop/house' (Davis, 2012; Davis et al., 2011), has been historically present in various cultures that emerged in different cities partly as an economic condition of living and working in the same place. According to Davis (2009), the CRB is a spatial unit that results from an architectural transformation influenced by economic necessity as well as cultural adaptation.

Working and living presents a relation between accessibility and location through changes in building use and form. When non-residential use is adopted in a dwelling, location becomes crucial and so too the price of accessibility in an urban neighbourhood. While residential and commercial uses are opposing uses there are also complementary, since they both require a degree of pedestrian catchment area.

Often, a commercial-residential building is located in streets that allow more public use (busier streets) than private ones (quieter streets). The accessibility to a CRB and its connectivity to the wider urban centre can significantly impact on how different activities are reached or how frequently a specific location is likely to be used as a route to pass through (Hillier and Iida, 2005). The interest here is how two functions, residence and commerce (the public and the private), are optimized in the same location providing that a single property can have a financial return that then leads to a potential mixed-use district. This, in turn, would also impact in the flows of pedestrian movement in the urban configuration.

For example, Siksna (1997) argues that changes in the morphology of the urban block relates to the degree of pedestrian movement. If higher number of smaller blocks exists, meaning higher grid intensification, then a higher density will tend to take place –an often characteristic of city centres (Hillier, 1999; 1996). However, land-use patterns and the arrangement of blocks must be taken into account in order to optimize the circulation of the street network. Siksna (1997, p.29) argues that lot location and its subdivision create differentiated land-use patterns which define the 'circulation mesh' within a block, such as "through-lots [that] assist subdivision into two back-to-back lots using both street frontages." The CRB provides support to spatial properties of block patterns and frontage use, providing the socio-economic conditions for families to use minimum resources.

It is suggested that the CRB acquires a vital importance in revitalising streets and centres as a new kind of economy that can increase a city's urban diversity by maintaining liveable centres. The building can also impact in the land value of residential space due to the proximity to services. According to Davis (2009; 2012), the combination of functions of the CRB emerges as a socio-economic process that is economically driven by its urban location and by being a changeable spatial unit, grounded locally in social and cultural forms and contributing globally to an urban process. Essentially, the CRB has the flexibility to accommodate different functions: Shops are located on the street level and dwellings on the upper floors. This means changes of access either to a shop or to a residence, depending also in the building's relation to the street and its connectivity to other streets.

The differentiation of shops and dwellings is also an issue of topological factors. For instance, this can be in relation to the street (i.e. the clustering of shops for mutual competition along the same road), the position and organisation of the urban block (i.e. the location of storage facilities of a shop within two blocks from a main high street), and the unit of the building (i.e. structural adaptations or the design flexibility to accommodate different uses).

From an economic perspective, the CRB implies maximising cost and minimising distances; people benefit from cost and time in accessibility by setting up their own businesses, enjoying the benefits of working from home and the financial gains of maximising rent. If commercial uses are located in close proximity to residential use then housing rents tend to increase, making a particular location to be a highly valued asset of the property that favours the CRB due to its commercial and residential profitability. An important requirement of the CRB is having the residential densities to support retail shops, but the problem lies in balancing how living can be kept away from the public realm of the street for reasons of privacy or even safety, while still being close to commercial activities.

3. Research Method

The CRB is studied in two types of building forms: mixed-use buildings that are located at corners in an urban block and those that are located along streets. In particular, these two building forms are given special attention in local districts rather than the city centre area. The reason for not including the city centre area is because mixed-use properties are found as high-rise developments. The most characteristic mixed-use developments in the city centre of Cardiff consist of retail shops, commercial services, offices and civic uses on the ground floor and apartment-style housing on the upper floors.

CRBs in local neighbourhoods are typologies in which the function of work/living relationship is brought together relating to either a building in which the family owns the shop and lives in the same property, or the building takes independent functions of shops and dwellings. In both cases, the CRB is part of an architectural adaptation influenced by a given economic situation, such as renting a house or a retail space.

The CRBs in Cardiff were mapped using two extensive sources of data: Council tax band values contained in mixed-use properties and land uses. Council tax bands mean a tax indicator that is assigned to only residential properties, which are divided in categories (bands) according to the residential value of a property. This tax indicator is defined by a government agency, the Valuation Office Agency (VOA, 2013). Each tax band is defined by the VOA and is estimated according to spatial factors that contribute to the value of a residence: its location in the city, size of the building and its age.

According to the VOA, tax bands are included in either purely domestic or in mixed-use properties. These were obtained from the Council Tax valuation list which contains a list of properties that can be as only domestic and properties that are used as part domestic and part business properties, and therefore considered as mixed-use. Tax bands referring to mixed-use properties include those in which residential spaces are banded within a mixed-use building.

For the purpose of this paper, tax bands are not used as part of the analysis[2]. Rather they form part of the research method to identify where dwellings banded within mixed-use properties are located. Land uses were then compared with the location of council tax bands of mixed-use properties in order to identify which kinds of uses are associated to those properties, allowing us to map the location of CRBs in different parts of the city. It should be noted that an observation survey of CRBs conducted by the author was added to the data of mixed-use properties. The observation was done in three local centres of Cardiff: Canton, Plasnewydd and Grangetown. The source of information was gathered through informal interviews to the owners of the shops. This informed whether some properties had the shopkeeper living and working in the building or if the CRB had separated functions renting the space for the shop or the dwelling.

With 679 mixed-use properties from the tax band data plus 245 properties that were mapped, a total of 924 mixed-use buildings were assessed. As expected, CRBs located along street were found more common than corner types. With 147 corner shops, the data showed to be a good indicative to

[2] Council tax bands are used to correlate spatial accessibility metrics in Cardiff as a separate analysis. Please refer to: Narvaez, L. (2015) Architecture, Economy and Space: A study on the socio-economics of urban form in Cardiff, UK, Chapter 5, PhD Thesis, Bartlett School of Architecture, University College London.

explore the analysis of mixed-use patterns across the city and possible differences between a location in a corner of a street compared to a mixed-use building along a street, whether it may be a high street or not. The types of non-domestic land uses found in CRBs showed that the dominant use is of general commercial[3], followed by shopping, office and take away activities.. Furthermore, the types of land uses are distinguished between the two types of CRBs, as corner shops and along street types, as shown in Figure 1.

An approach of a morphological analysis is emphasised here because it helps progressing from an urban analysis of the street network to an analysis of architectural generation. Morphological analysis regards the street system, plot and building patterns that construct the landscape whereas syntax analysis takes the elements and the structure of elements as the components of the urban structure. While configurational metrics can inform about advantages of accessibility and location, a morphological approach can inform how the geometric configuration of a location distributes and adapts different forms of activity.

The reason to select corner shops and along street type CRBs is based on the spatial characteristics of adaptation and location –configurationally, morphologically and economically– which brings an innovative perspective to the traditional syntactic approach in syntax analysis. For example, if we think about a layperson's decision to set up a shop, where's the best place? A corner location or a middle of the block? Within one's home or at a different location? In all of these examples, there are also the characteristics of social and economic factors that thrive the mixing of uses. Therefore, it is proposed that both morphological and configurational aspects of location indicate particular typologies of building form and their use, and which are dependant to their urban location.

[3] Land uses were obtained by Ordinance Survey as an information layer called 'Address Layer 2' (AL2). According to the Ordinance Survey agency, the classification of 'General Commercial' is assigned as a general remark that can denote either office or retail use.

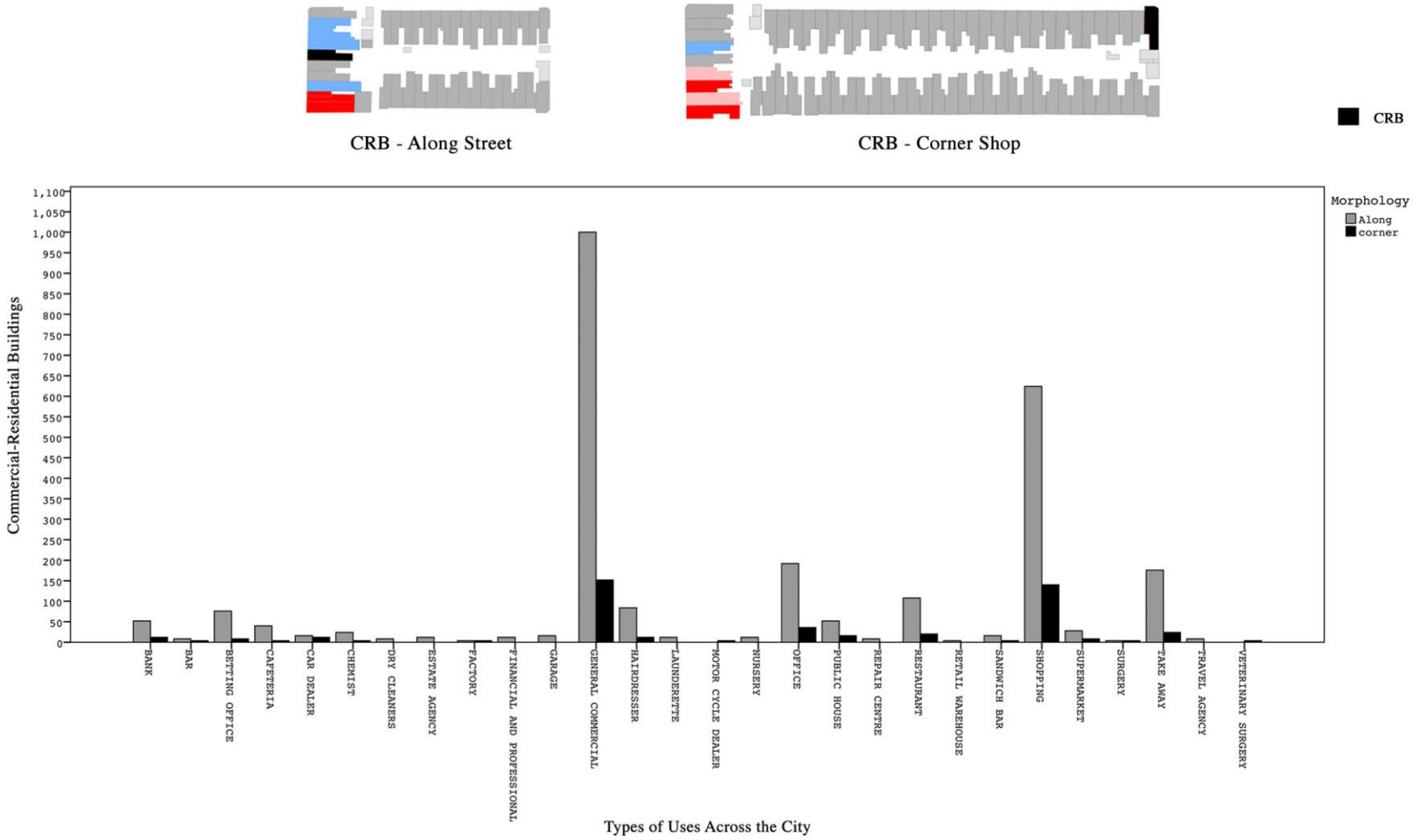


Figure 1. Non-domestic land use distinguished by types of CRBs across the city.

4. Location: Middle or Corner?

CRBs located at corners are predominantly of general commercial use, businesses that can either be professional services or retail use, such as shopping or take away businesses. The type of land use in corners reflects the kinds of activity that is allowed in locations that have residential streets and commercial activity at close proximity. Even more interesting is the spatial qualities that the corner as a location itself involves. For instance, in terms of accessibility, a corner is a location that has more than one alternative route to reach or pass through it; it is part of an urban path among multiple competing alternatives. Similarly, a corner has the advantage of the visibility of its location. A corner that is located on an urban block that forms part of a large main high street has the advantage of being visibly accessible from the high street as well as from local streets of more residential use that connects to the high street.

The location of CRBs is investigated by correlating them with their topological distances (step depth) from the high street of a local urban district. Four main districts were examined: Plasnewydd, Canton, Grangetown and Butetown (Figure 2, from a-c). This way the study is able to establish how these types of CRBs tend to distribute across the city and how they develop in terms of their location. Topologically, corner shops tend to locate at one step depth from a main high street. In particular, Plasnewydd represents the area with the highest amount of CRBs at corners, followed by Grangetown and Canton.

The corner shops at distance zero in the graphs represent the corner shops that are within urban blocks placed in the main street. Yet, the largest amount of corner shops are not located in the main street, but rather at the most proximate location from the high street. Relating location and type of use, corner shops are found containing a variety of activities at one turn of direction from a high street; the most consistent type of activity is general commercial, followed by shopping, public houses and takeaway shops. Other businesses such as a hairdresser, a chemist or a restaurant are less frequently found to be proximate to the high street. In physical distances, at less than 500m from the main street, we find the same kinds of activities as in one topological turn. This suggests that at one single turn of direction from a block that is possibly in less than 500m away from the high street we are able to find a CRB at a corner that is likely to combine residential use with a general commercial or retail use.

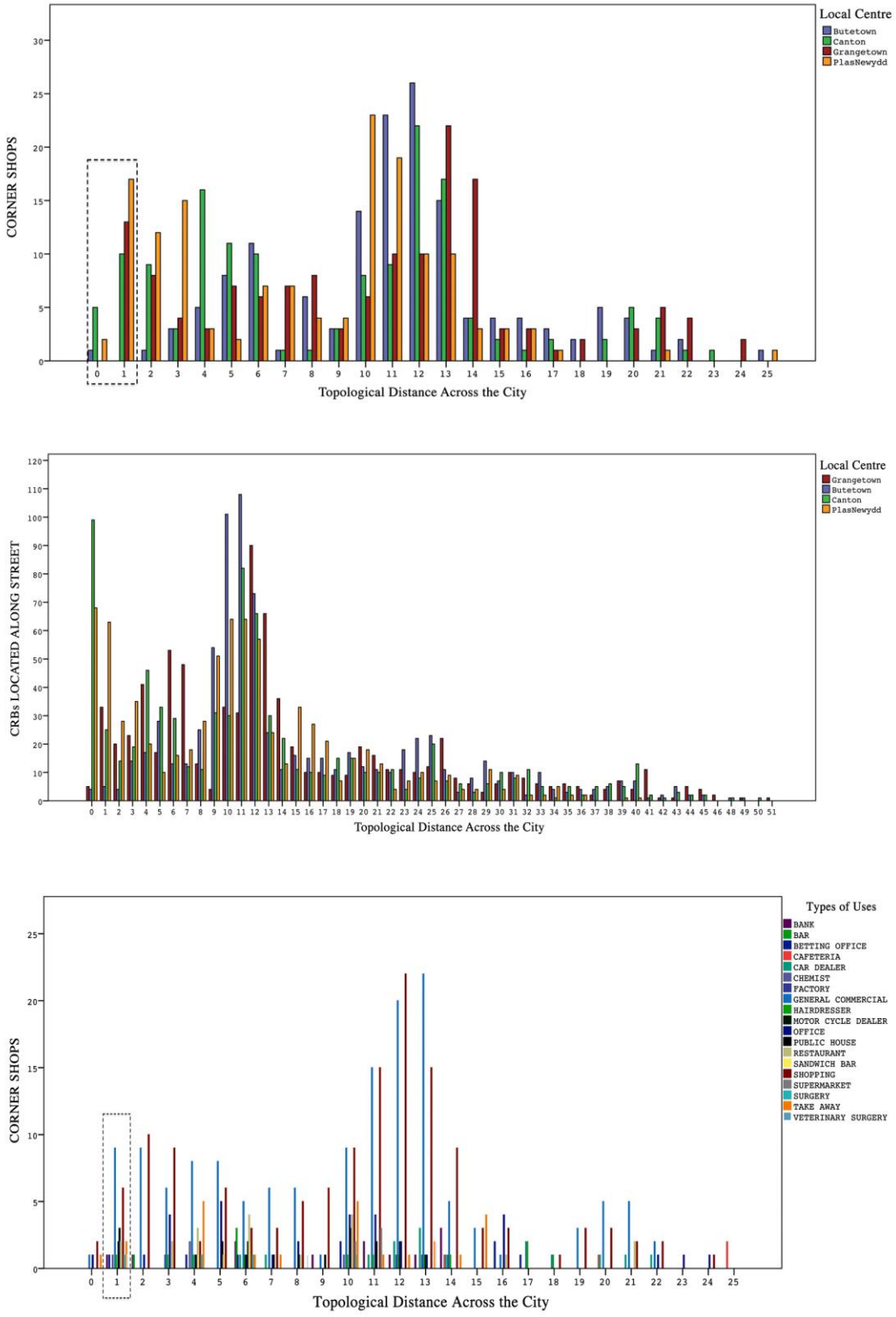


Figure 2 (a-c). (top) topological locations of corner shops across the city; (middle) graph showing middle block CRBs; (below) corner shop locations based on their type of activity across the city.

5. Form: Shaping spatial morphologies

The previous analyses on corner shops showed how these are distributed in local centres. Each local centre has contrasting forms, mainly radial and non-radial structures. In what follows, the analysis focuses on how corner shops have developed in gridiron/linear urban forms, such as the case of Plasnewydd and Canton, and in a radial morphology, such as the case of Grangetown. A common trend that the topological distance graphs showed in the previous section is the high number of CRBs located between 10 and 13 topological steps across the city. This result means that at those distances the local centres begin to overlap, and so eventually the number of CRBs from one location gets into the spatial territory of another local centre. In order to isolate the cause of this finding, the analysis takes only the first 5 topological step depths from each local centre and their corresponding high street in order to account only corner shops within the boundaries of the centre.

CRBs in non-radial urban forms

The morphology of Plasnewydd has transformed over time into a commercial district composed by its two main streets, Albany Road and City Road. Historically, Plasnewydd's form evolved as a regular pattern of blocks that was due to an extensive housing construction during the 20th Century. However, part of the urban transformation of Plasnewydd is due to the lack of space in the area where properties are not particularly large or spacious and the demand for a higher concentration of commercial activity became to increase over time (Morgan 2003). Albany Road, the main shopping street in Plasnewydd, is composed by large frontages on the north side of the street with fewest number of plots; whereas on its south side the length of the block is parallel to the street, having more plots with smaller frontages.

The blocks from the north side of Albany Road are those that have had the least changes over time of conversions from residential to commercial use. Mixed-use buildings combining dwelling and takeaway shops are found to be at corners that connect the main high streets and local streets, shown in step depth 0 (see Figure 6). These corner shops take the advantage in accessibility of the commercial roads of Albany Road and City Road while also connecting to residential streets. A larger amount of corner shops in the immediate proximity to the high streets include mixed-use buildings combining residence with activities of general commercial and shopping. These two types of uses are the most persistent ones within the boundaries of Plasnnewydd, followed by corner shops containing office use, hairdressers and a supermarket.

Figure 3 (a-b). (top) Plasnewydd in 1920s (Digimap 2014); (below) section of Albany Road as the main high street.

A second example of a non-radial form is Canton. The morphology of Canton is largely organised through its single long shopping thoroughfare. The proximity of the area to the city centre has been an attraction for young professionals to establish in Canton, which has partly resulted in developing more commercial uses around the area influenced by the local population and creative industry (Morgan 2003).

The development of the main street, Cowbridge Road, has kept dwellings along the street, most of them delimiting their entrances using front gardens and car parking contrasting with other

commercial units that have a direct entrance to the street with commercial extensions in their frontages. The CRBs at corners in blocks along the thoroughfare, indicated in step 0 in the graph (Figure 6), include uses such as a bank, office, takeaway, restaurant and public houses in its majority. At one step depth from the high street we find takeaway shops and specialised services, such as a veterinarian surgery. General commercial and shopping remain as the predominant use in corner shops within the vicinity of the high street.

Drawing from the observation survey in Canton, it was found that most of the dwellings are at one or two steps away form the main street yet adjacent to retail activities that involved restaurants, cafes and food markets. In some cases, the restaurants were found to be fast-food places like pizzerias, sandwich bars and a Chinese restaurant where the owners of the shop also lived in the building.

Figure 4(a-b). (top) Canton highlighting Cowbridge Road in 1920s (Digimap 2014): (below) section of Cowbridge Road highlighting housing blocks.

CRBs in Radial Morphology

Grangetown represents an example of a radial urban form. Historically, the area has attracted large businesses of ironworks and large industry companies. The radial form of the district has allowed to transform large-scale facilities into shopping retail stores, sporting facilities and retail parks that links to Butetown and the Docklands in the south east of Cardiff (Figure 5).

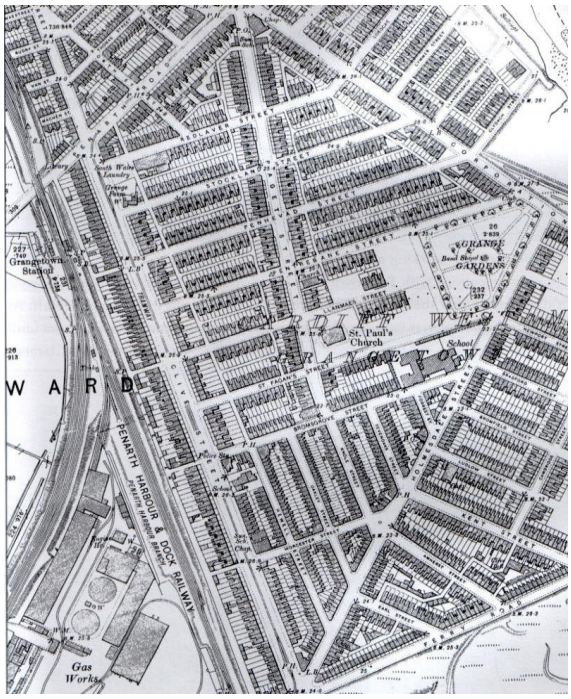


Figure 5. Grangetown in 1920s (Digimap 2014).

The radial organisation of Grangetown has also acquired a relevant connection to other towns at the south west of Cardiff. One of its main thoroughfares, Penarth Road, connects from the city centre of Cardiff, crossing Grangetown and leading to the upmarket town of Penarth at the south of Wales. The road has gradually been filled primarily with car dealers, fast food outlets and warehouses.

The urban geometry of Grangetown is argued to have a major morphological influence in the location of mixed-use buildings. For example, the configuration of the street layout allows only access to residential streets from other secondary roads and not directly from the main high streets. So it is expected that the major flow of vehicular movement occur in these main radial routes of the district. Along these routes, the vehicular access is restricted by elements like trees, bus stops and urban furniture, allowing only pedestrian traffic. The restriction of vehicular access suggests a matter of control, keeping more private residential streets from the more commercial and busier high streets. The control of access then depends on the configuration of the street network.

The analysis of corner shops in Grangetown demonstrated that these types of CRBs are not found along the radial routes, but rather in local streets. Some of the activities found at one change of direction from the high streets are specialised uses, such as a surgery facility with specific working hours; office use, restaurants, shopping and general commercial uses were often the most common types of use in the surrounding area. Grangetown presents the corner shops with the most diverse activities in comparison to Plasnewydd and Canton.

These findings suggest that a corner shop distributed in a radial urban form is likely to be found more frequently in back streets rather than connecting directly to the main streets. It is argued that this is partly due to the control of accessibility to direct the movement, at least vehicular, through secondary roads. Corner shops, then, are in locations where they can retain customer demand from their neighbourhoods with more diverse or even specialised activities than those found in non-radial forms, where corner shops have primarily retail and general commercial use (Figure 6).

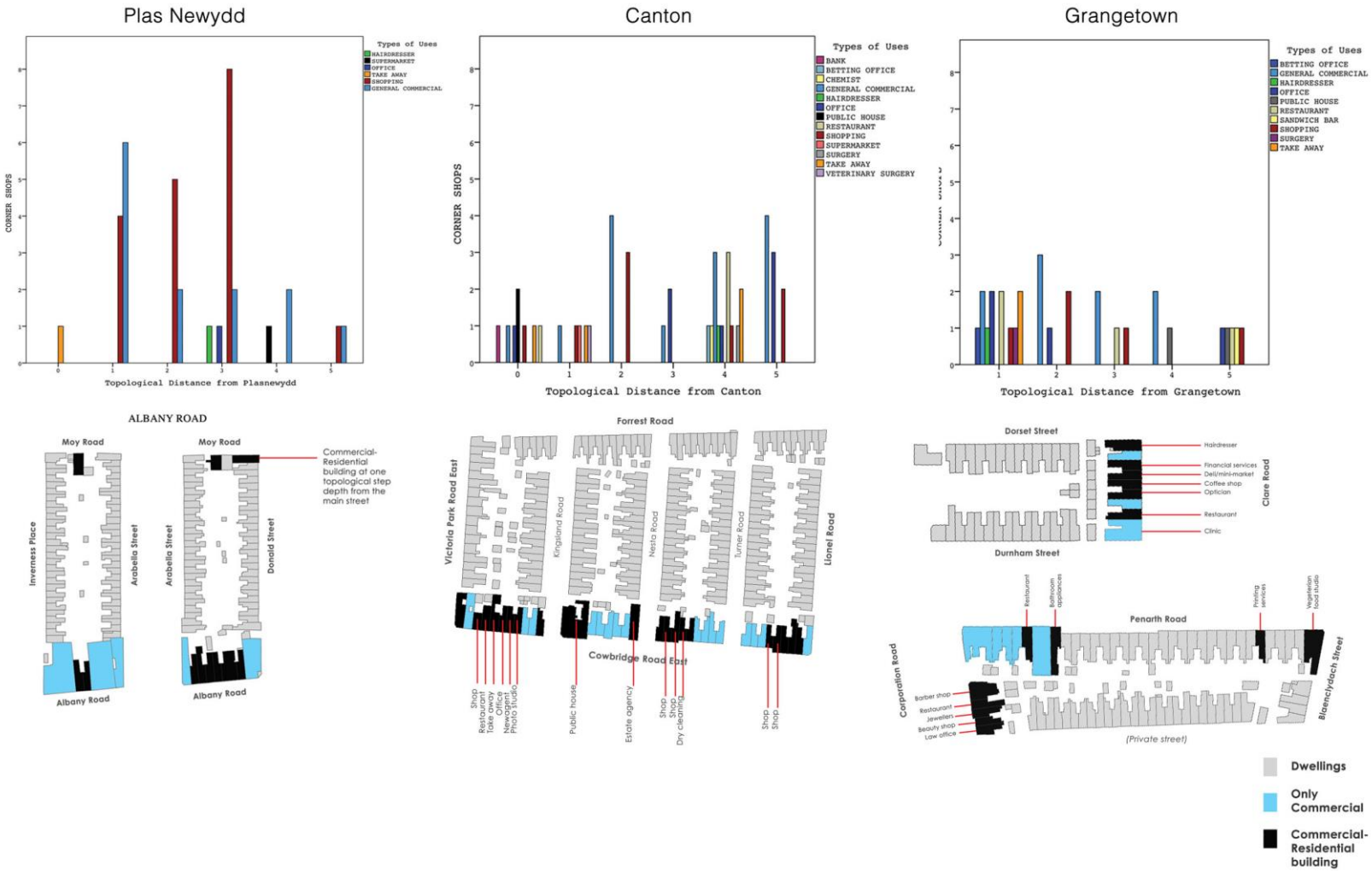


Figure 6. Topological locations of corner shops in radial and non-radial urban forms.

6. Use: Spatial adaptation

We now turn to describe the two types of CRBs according to their location and form. The first types of adaptation are those that are at mid-block of a street. Positioned at a location on a plot that is in the middle of a row of properties, the changes of the building occurs in mainly two ways: In the front façade and the back side of the building. The house on the upper floor is removed from the traffic and noise at street-level, and having the access with a separate staircase from the shop or a double access from the exterior of the building.

Figure 7. Spatial adaptation of middle-block shop located along the main high street.

Corner locations bring more possibilities of spatial adaptation. Corner shops can be either in urban blocks that link to main roads (at the beginning of the block) or at the end of the block. Figure 8 shows four types of spatial adaptability of a CRB at a corner. A corner shop can take full advantage of the plot by either including commercial additions in the front or in the rear sides of the building, and subsequently these can be combined and extended upwards.

Type 1 shows a typology that has only one commercial addition at the front of the building. This type can subsequently be adapted by expanding the space in the upper floor. Type 2 refers to the same addition but at the rear side of the building without altering the front façade. The choice of using the rear side of the property can also allow using the backside of the plot for the shop. The combination of having these two additions at the same time is indicated in Type 3 in which the additions are included at the ground floor, but the house is kept in its original state. Type 4 shows that two or more combined additions are also possible. The adaptation of the building can combine the additions of commercial use in the ground floor and the extension of the upper floor either at the rear or at the front, or both. The use of the back-side of the property is also an alterative for adapting the building with commercial or residential use.

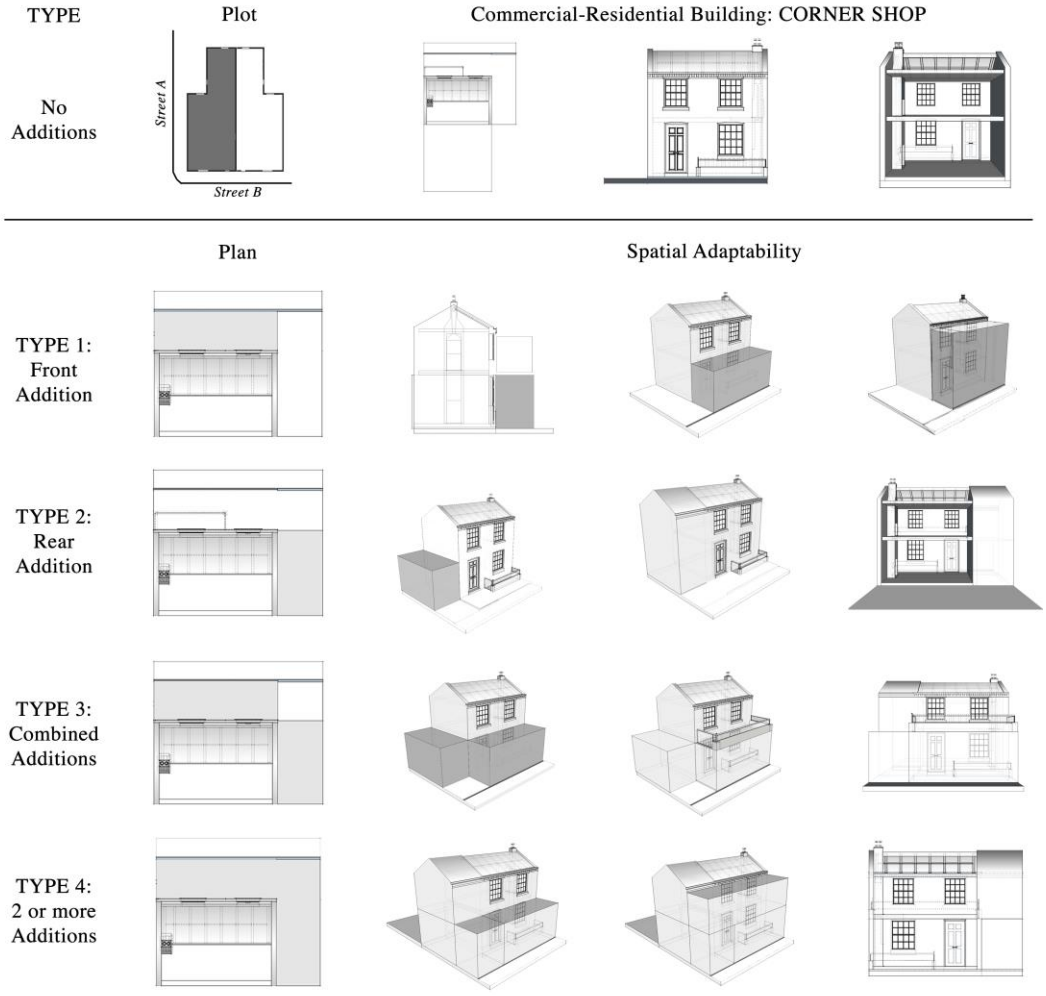
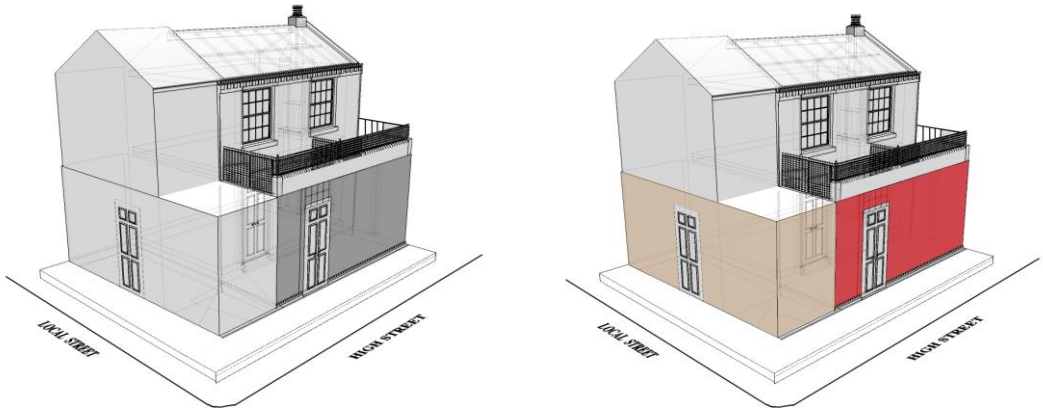
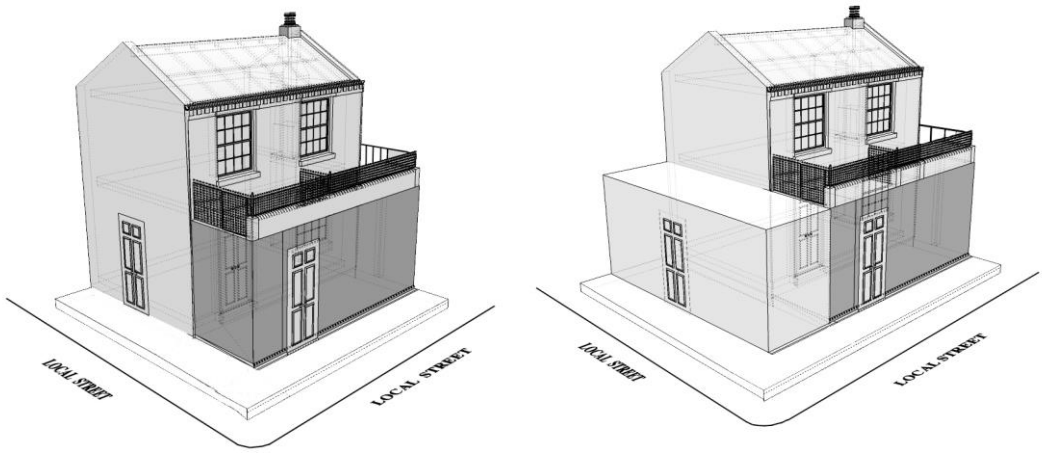


Figure 8. Possibilities of architectural adaptation of a CRB in corner locations.

Every type of spatial adaptability has the option of including two entrances to the building. The entrance to the property also depends if the corner shop is placed at the beginning of the block, assuming that the block connects to a high street; or, depending if the corner chop is at the end of the block, in which case it is assumed that the corner is in-between two residential streets. Figure 9 shows the most common case of a corner shop that is directly linked to a main street having the entrance of the shop linking to the high street and a secondary entrance for the house. If the dwelling is extended in the upper floors, then there can be several possibilities. First, the extension of the property is used for residential space. Second, the property is able to contain 2 or more non-domestic uses combined with a dwelling, in which case we can find two secondary entrances at the rear side of the building. The second case is corner shops that are between two local streets usually consisting of mainly residential use. The adaptability of the building and its use can be similar to the first case –two different entrances, one for the shop and one for the dwelling. The difference is that the entrances to the property can be altered depending on where the owner wants to capture more visibility to the location of the shop.



Corner between a **high street** and a **local street**: Access to the shop from the high street and entrance to the house on the rear side.



Corner between **local streets**: Commercial addition can be either at the front, the rear side, or both; entrances are separated.

Figure 9. Spatial adaptability of corner shops according to their entrances.

7. Contextualising 'local knowledge'

This paper has presented the urban and architectural context of adaptability to mixed-uses. Stemming from the notion of 'locality knowledge' by Jacobs, this study has aimed to explore further morphological and configurational features of urban space and economy. Examining the commercial-residential building within the context of the city of Cardiff, this study offered an exploration of how accommodating different uses within a building means how local knowledge is produced and the forms in which these can take place. It can be either by the most common act of putting a shop or a business that requires working from home. The mixing of uses also reflects the *knowledge work* embedded and changed in architectural form. In addition to the analyses presented, a three-floor terraced house that was mapped from the previous analysis shows the two most common cases of living and working, either by having a shop or working from home. In both cases, it can be a family-owned business or the building having independent functions.

A tradition of working at home goes back many years from repairing cars or selling insurance. In more recent years, with the development of Internet and e-commerce, many people are working at or from home, using the employer's office as a base only for meetings or picking up work. This new trend of office work migrating to the home has re-defined knowledge into what we call now the creative economy. The observations survey from the analyses offered two cases in this respect. Establishing a shop on a corner implied more structural changes in the exterior of the building and taking full advantage of the corner in having two entrances. Service businesses that implied working

at home had more changes in its internal layout than externally. In some cases, a CRB would contain two businesses combining to a residential use in corner locations (Figure 10).

Overall, a commercial-residential building represents the knowledge of combining activities in a household that are functional aspects of everyday life. It is suggested that, in the context of Cardiff, CRBs developing in different morphological settings showed that urban resilience for change over time plays a critical role in connecting socio-economic activity from the building, to the neighbourhood and to the city. The resilience to change is the result from individual decisions that respond to locational contexts. Design can complement to this but it is human design that begins to contribute to urban diversity and often substituting the planned for the spontaneous order in cities.

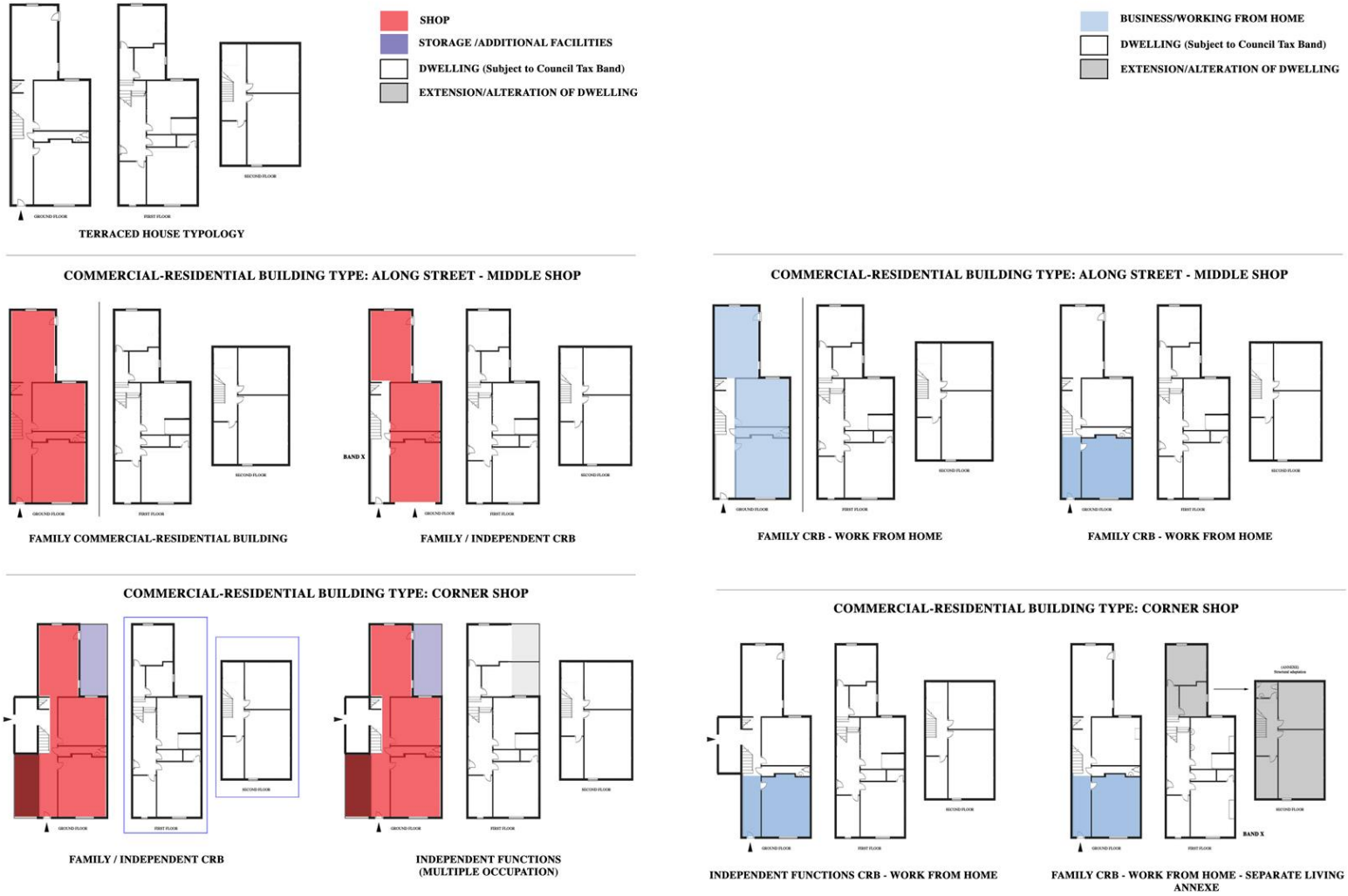


Figure 10. Examples of shopping and working from home in a CRB.

References

Alexander, C. (1964) *Notes on the synthesis of form*. Cambridge: Harvard University Press.

Alexander C. (1966) A city is not a tree. In *Design*, 206, p.46-55.

Davis, H. (2009) The commercial-residential building and local urban form. In *Urban Morphology*, 13(2), 89-104. International Seminar on Urban Form.

Davis, H. and Brown, M. (2011) Resilient urban morphologies and grassroots economic development: preliminary results of fieldwork in Guangzhou, China. *Presentation at International Seminar on Urban Form*, 29-29 August 2011, Montreal, Canada.

Davis, H. (2012) *Living Over the Store: Architecture and local urban life*. London/New York: Routledge.

Hillier, B. and Hanson, J. (1984) *The Social Logic of Space*. Cambridge University Press.

Hillier, B. (1996) *Space is the Machine*. Cambridge University Press.

Hillier, B. (1999) Centrality as a Process: Accounting for attraction inequalities in deformed grids. In *Urban Design International*, 4 (3-4): 107-127.

Hillier, B. and Iida, S. (2005) Network effects and psychological effects: a theory of urban movement. *Proceedings of the Fifth International Space Syntax Symposium*, Delft: University of Technology. pp.553-564.

Hillier, B. (2009) Spatial sustainability in cities: organic patterns and sustainable forms. In: Koch, D. and Marcus, L. and Steen, J. (eds.) *Proceedings of the Seventh International Space Syntax Symposium*, Stockholm: KTH Royal Institute of Technology.

Ikeda, S. (2011) Economic Development from a Jacobsian Perspective. *Proceedings of Colloquium on Market Institutions and Economic Processes*. 28 February 2011: New York University.

Jacobs, J. (1961) *The Death and Life of Great American Cities*. 3rd Edition, New York: Random House.

Jacobs, J. (1969) *The Economy of Cities*. New York: Random House.

March, L. (1976) *The Architecture of Form*. London: Cambridge University Press.

Marcus, L. (2010) Spatial Capital and how to measure it – an outline of an analytical theory of urban form. *The Journal of Space Syntax*, Vol. 1, No. 1.

Morgan, C. (2001) *The Cardiff Story*. Heckman Printers Ltd.

Narvaez, L., Penn, A., and Griffiths, S. (2015) The Spatial Dimensions of Trade: From the geography of uses to the architecture of local economies. In *A|Z ITU Journal of Faculty of Architecture*, Vol. 11 (2), pp. 209-230. Available at: http://www.az.itu.edu.tr/azvol11no2web/15-narvaez-penn-griffiths-1102.pdf

Narvaez, L., Penn, A., and Griffiths, S. (2014) The Social and Economic Significance of Urban Form. In *New Urban Configurations. International Seminar of Urban Form and EAAE*. Cavallo, R., Komossa, S., Marzot, N., Berghauser Pont, M and Kuijper, J. (eds). IOS Press, pp.551-558.

Narvaez, L., Penn, A., and Griffiths, S. (2012) Creating Urban Place: Re-thinking the value of residential and commercial use in urban street networks. In *Spaces and Flows: An International Journal of Urban and ExtraUrban Studies*, Volume 2, Issue 3, pp. 149-168.

Samuels I., Panerai P., Castex J and Depaule J. (2004) *Urban Forms: The Death and Life of the Urban Block.* London: Architectural Press.

Siksna, A. (1997) The Effects of Block Size and Form in North American and Australian City Centres. In *Urban Morphology*, 1, 19-33.

VOA, Valuation Office Agency. (2013) *Council tax*. [online] Available from: http:// http://www.voa.gov.uk/corporate/index.html [Accessed: 10 November 2010].

Webster, C. (2010) Pricing accessibility: Urban morphology, design and missing markets. *Progress in Planning,* 73 (2): 77-111.

Webster, C. and Lai, L. (2003) *Property Rights, Planning and Markets: Managing Spontaneous Cities*. Cheltenham/Northhampton: Edward Elgar Publishing Ltd.