

Article

# Built Form and Community Building in Residential Neighbourhoods: A Case Study of Physical Distance in Subiaco, Western Australia

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**Abstract:** With physical and social aspects being inseparable within urban environments, design for sustainability needs to include the link between the distance and sense of community. However, only a few studies examine residential suburbs and specifically focus on the physical and social interactions occurring within the streets and adjacent to them spaces, such as verges, sidewalks and front yards. Using a case study method, including observation and a perception-based survey in the inner-city suburb of Subiaco in Perth, Western Australia, this investigation opens up a new understanding of physical distance and social interaction. It develops a novel typology of physical distances and social closeness within a residential neighbourhood which allows better conceptualising the sense of community for achieving integrated sustainability.

**Keywords:** social sustainability; sense of community; quality of life; community building; built form typology; front yard; street; communication; social interaction; distance; closeness; social bonding

## 1. Introduction

The integration of all aspects of sustainability is attracting increasing attention, particularly in relation to urban environments [1,2] where the majority of the world population now lives (54% in 2014, expected to reach 66% by 2050 [3]). A major priority for 21st century living is urban areas to provide a good quality of life in terms of housing and health [4,5] but also regarding the more intangible properties which describe social cohesion and sense of community. The United Nations' Sustainable Development Goal 11 Sustainable Cities and Communities specifically emphasises safety and inclusivity of access to green and public spaces as places which integrate environmental, social and economic opportunities. Whilst there is a broad understanding of the importance of public open spaces, residential neighbourhoods also deserve attention.

Residential streets [6,7] are a typical example of public spaces that can contribute to the sense of community. Adjacent and connected to residential streets are house fronts which, although legally private, represent very unique semi-private–public spaces with the potential to enhance urban quality of life [8]. If properly designed, they not only make residential streets more attractive but also offer opportunities for socialising and social interactions. This study focussed on understanding the links between physical distance and social interactions within the context of residential streets with adjacent front yards using a case study from Perth, Western Australia. It aimed to develop a typology through examining linear distances (physical and perceived) and social interactions related to one particular built form, namely the front yard. Such neighbourhood-based studies are rare despite the obvious link between the physical and social factors and their influence on human behaviour. Understanding the

social dimension through the physical distance opens new opportunities to create more sustainable and resilient communities.

This paper first discusses the theoretical framework which connects the concepts of sense of community with the built form and human behaviour at a neighbourhood scale. The adopted methodology for the case study is then explained and the research findings are presented. A new typology of the link between physical distance and social interaction, referred to as typology of social closeness, is developed. This allows for better appreciation of the connection between urban built form and sense of community within residential neighbourhood settings.

### *1.1. Sense of Community and the Built Form*

The built environment—the expression used to represent urban areas—is often juxtaposed to the natural habitat characteristic of rural settlements [9]. Its functions are not only to provide shelter for human activities but also “to define patterns of movements” as well as “patterns of encounter and co-presence” [10] (p. 26). Urban design, planning and architecture are projected to last for decades, if not centuries [11], potentially making cities a catalyst for sustainable development [12]. Sustainability as a conceptual urban framework also incorporates the development of sense of place and sense of community [13] which contribute to improved quality of life, social relationships and interactions between the physical form and city dwellers as well as among neighbourhood residents and visitors. Social cohesion within the built environment becomes a counteracting factor to urban decay and makes residential neighbourhoods desirable and attractive.

By definition, the sense of community is a “feeling” [14] of belonging and of individuals being important to each other; a shared faith that community members’ needs will be valued with commitment [15]. These relational feelings contribute to the quality of life defined by the relations between individuals and their physical and social environment [16]. Within a neighbourhood, residents develop both strong and weak relationships [17]. Physical distance can impact on the strength and nature of these relationship. The intensity of the relationships can also vary from, for example, saying hello to working as a group [18]. Both chance encounters between neighbours and more intimate social relationships within a neighbourhood reinforce the sense of community [18] (p. 192).

Urban design and typology shape the environment within which the feelings of community belonging and attachment develop. In fact, new urbanism calls for built form and urban space typologies which create modern cities of human scale and sense of community [19]. Scholars [20–24] strongly advocate for place-based social sustainability to foster interactive vibrant communities [5,25–27]. Sustainability thus becomes the outcome from the combined effort of creating the physical and social environment [28]. Urban design is used as a tool shaping human behaviour [29,30] and encouraging certain conduct and activities, such as in community celebrations, whilst discouraging others, such as for crime prevention [31]. Understanding the impact physical distance has on social interactions is one unexplored area of the built form design’s role for sustainability.

### *1.2. Built form Typology*

The typology of the built form sheds light on how urban spaces function and the interface they provide between the public and private realms [19]. Being the study of types, in the field of urban planning and architecture typology refers to the taxonomic classifications of places and buildings in reference to various criteria, such as location (rural or urban), use (agricultural, commercial, residential, medical, educational, governmental, industrial, etc.), age (old or new), etc. An assembly of indoor and outdoor space types helps form the physical language of architecture by organising public–private zoning to achieve a desired architectural experience [32] (p. 14). Normally, building types are identified by their basic form, surroundings or scale but not by their architectural style [33]. The role of types in modern architecture allows to incorporate upcoming developments without mimicking historic expressions and styles emerged in the course of time [34] as well as maintain continuity in the

cityscape [33]. New urbanists recognise typology as a vital means to further define user-friendly places [33,35].

Moudon [34,36] identified blocks, lots and street patterns as essential for typological consistency in neighbourhood design. Normally, neighbourhood streets and lots are readymade infrastructures or the “building blocks” for the city. In the pre-design phase, the common urban tissue patterns—a combination of streets, lots and public open spaces—are identified to inter-relate and form the neighbourhood. This urban fabric provides the physical environment and surroundings for the sense of community to emerge and make neighbourhood areas socially active.

As there are no distinctive tools for measuring social sustainability in neighbourhood design, one possible way to analyse the sense of community is through creating a typology of the places perceived by people as contributing towards this. Within the well-defined boundaries which spatially position a neighbourhood, social interactions are the ones creating a sense of community as they allow for emotional connections and social relationships to build up. Hence, the front yard is an important space for social interactions.

### 1.3. Private–Public Interface

Within a residential neighbourhood, the front yard, which we describe as a “semi-private–public” place [8], is the interface between the public realm, represented by the streets and the private domain, represented by the blocks with houses. It is the extension of other forms of interface, such as public sidewalks, pedestrian paths, walkways, and access lanes, which balance power relations and where privacy acts as a stabiliser between private and public [37]. According to Simmel [38], this interface is a separating and connecting device, where strangers are greeted or excluded [39] and where exposure and confidentiality are frequent.

The front yard in all of its manifestations, such as front garden, veranda, porch, entrance deck, plinth, al fresco dining place, etc., represents a socialising and activity interstitial space which welcomes visitors as well as establishes boundary, transparency, identity and natural surveillance ensuring the feeling of safety [40]. This built form is something in between indoor and outdoor, leading from inward to outward to pedestrian areas and ending in the streets (or vice versa). Gehl [41] emphasised its importance in providing opportunities for prolonged outdoor stays and therefore increased social interaction among community members. Social interaction can also be intensified by adding stationary (ledges, stoops, steps, and low walls) or mobile (chairs, stools, and benches) sitting arrangements [42].

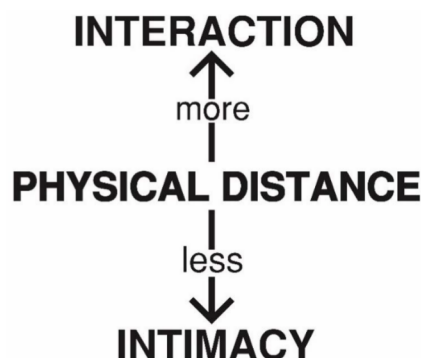
However, the line between the real and symbolic ownership [43] of the interface places can be blurred. For example, private space, if visible, can perform as public [43–45] even without physical accessibility. Furthermore, the residents’ sense of control over the privately owned front yard can extend towards the adjacent public space types, such as sidewalks, verges and streets. These activities interconnect neighbours not only through face-to-face encounters, but also through spiritual relationships [14] where the physical space works as a common ground for social interaction.

### 1.4. Physical Distance

The main defining characteristic of a neighbourhood is physical proximity. Residential neighbourhoods act as common places and “behaviour settings” [46] where community building tends to develop by way of familiarisation through seeing, meeting and greeting [47]. Residents’ daily life routines offer opportunities to create physical familiarity as well as social acquaintances and friendships [47]. Close juxtaposition also makes people interact more frequently [48] and this kind of regular mixing is adaptive rather than optional. The “mere exposure effect” [49] claims that repeated acquaintance creates positive familiarity between individuals.

In fact, in a neighbourhood the physical distance between individuals either brings them closer towards stronger intimate relationships, or helps them maintain a weak relationship of minimum interaction which is also needful to survive in a community (see Figure 1). Social space can be characterised objectively, namely through physical distance, or subjectively, for example through the

perception of distance. Observation is the method used to capture physical distance while perception surveys collect people's opinions which also predict future behaviour [50]. Applying observation and perception can provide insights as to how people relate to each other, their neighbours and the built form. This in turn can inform the potential for community building and quality of life in a residential neighbourhood.



**Figure 1.** Relationship between distance, interaction and intimacy (Source: Authors).

Table 1 summarises the theoretical frameworks which link social interactions with physical distance together with the methods used for theory testing. According to Hall [51], physical closeness can be applied to measure the level of socialisation, including interpersonal communications and the use of senses (smell, hearing, sight, touch and taste in relation to food). He also explained that human perception works better horizontally for establishing personal space and relationships (rather than vertically where a sense of hierarchy or sub-ordination may be implied) [51]. Gehl [52] stressed the importance of passive participation, chance encounter and acquaintance as low-intensity contacts in the private–public interface which provide important opportunities for participation in public life. However, physical distance as a social indicator has been widely ignored [53], particularly in relation to socialising in a residential context [54]. Latané's [55] theory of social impact is a rare exception according to which “immediacy” (intimacy/closeness) is inversely affected by physical distance and social interactions—intimacy, time spent, recalling memories, attentiveness and persuasiveness—decrease as distance increases [56,57]. Studies of social behaviour related to physical space are also scarce, with Bay's [58–60] enquiry into the convenient size of semi-open spaces (such as forecourt) in multi-storeyed living being such an example.

**Table 1.** Theoretical frameworks linking social interactions with physical distance.

Theorist	Theory	Method Used
Hall [51]	Human perception works better horizontally and physical distance influences social relationships.	Literature review
Gehl [52]	Various social dimensions (based on linear physical distance) affect human perceptions during socialisation in public places.	Observation Perception survey
Latané et al. [54,56]	Social interaction is extensively determined by the physical distance between two individuals; immediacy is inversely proportional to physical distance.	Literature review
Wang and Bay [60]	Optimum size for semi-open forecourt/veranda/front-yard can ensure maximum positive socialising output in high-rise residential buildings of Singapore.	Observation Perception survey

Technological advantages, such as the telephone, Internet, computer, automobile and high-speed mass transit, have made communication easier than ever before. Nevertheless, face-to-face or chance encounters are still more appealing to people than emails or other electronic media [61]. Many argue that physical space is superior to virtual presence [62–64]. Therefore, this research explores the potential of physical distance to influence social relations and applies it as an indicator for interactions and community building using one particular case study—a neighbourhood in the Subiaco suburb of Perth, Western Australia. The study creates and explores a typology of places for social interactions based on physical distance.

## 2. Methodology and Case Study

The definition of the sense of community and its links to the built form provide the framework for studying residential front yards from a physical distance perspective. These semi private–public spaces are seen as essential in residential neighbourhoods for community building and good quality of life.

### 2.1. Methods

The aim of the study, approved by Curtin University Human Research Ethics Committee, was to analyse the contribution of the front yard to creating a sense of community by analysing the observed and perceived physical distance. A mixed-method approach [65,66] was applied which combined:

1. Neighbourhood selection and case study description [67];
2. Detailed observation [42,52,68,69], particularly of streets and front yards; and
3. Perception-based survey [70].

Using the mixed-method approach allows for cross-evaluation of observation and perception analysis within a neighbourhood case study [65–67]. This is utilised, among others, in architecture [42], urban design [52,69] and behavioural studies [66]. A case study is a well-defined unit of analysis which requires a detailed, in-depth depiction to generate new knowledge in complex social investigations which is very different from a numerical or statistical description of multiple items, places, events or phenomena. The choice of the case study is based on the researchers' interests and its ability to provide a basis for analytical development and conceptual generalisation [67]. After the residential neighbourhood in Subiaco was selected for the purpose of creating a new front-yard typology, the actual research steps taken followed those presented in Figure 2.

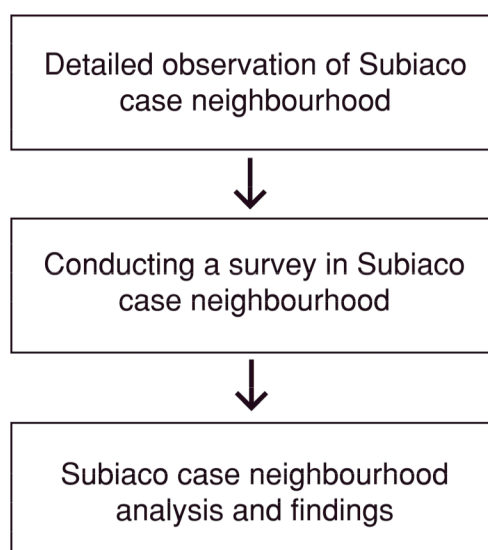


Figure 2. Research steps (Source: Authors).

Observation was conducted on all streets and front yards of the selected case neighbourhood. Activities in all front yards were observed on a street by street basis during the spring and summer seasons of 2016 and 2017 in different daytimes of weekdays and weekends. The physical distances between the edges of the verandas and the centre points of the sidewalks were measured for all houses with AutoCAD software. This allowed for the front yard—the most significant residential outdoor space—to be analysed from the point of view of physical distance which was then linked to the level of social closeness. For example, physical distance of 20 m was identified as recognisable as people’s gestures and postures are identifiable.

The perception survey was conducted with 61 residents in the case neighbourhood using semi-structured interviews. Based on the processed, organised and interpreted information acquired through the human senses [71] (p. 1604), perception influences people’s attitudes and lived realities in the neighbourhood context [72]. The residents’ perceptions [44,45] about the front yard’s usability can influence the activity patterns of socialising which are able to contribute for enhanced sense of community. Table 2 presents the demographic profile of the interviewees. It shows that the majority are homeowners (66%), female (59%), of working age (87% with 48% being people between 45 and 64) and working (85% with 41% on a full-time basis, 23% on a part-time basis and 21% self-employed or freelance) as professionals, including managers (54%).

**Table 2.** Demographic profile of the interviewees in Subiaco case neighbourhood.

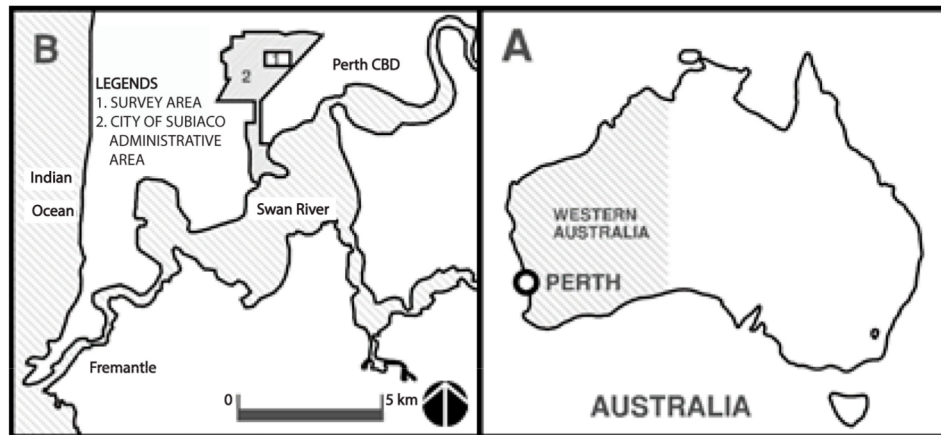
Characteristic	Number	Percentage (%)
Home ownerships		
Homeowner	40	66
Tenant	17	28
Other	4	6
Gender		
Female	36	59
Male	25	41
Age		
18–23	3	5
24–35	8	13
36–44	13	21
45–64	29	48
>64	8	13
Employment		
Full-time	25	41
Part-time	14	23
Self-employed/freelance	13	21
Studying	5	8
Unemployed	4	7
Profession		
Managers	10	16
Professional	23	38
Other professions	12	20
Without an identified profession	16	26
TOTAL	61	100

Both, observation and perception analyses generated insights about the selected case neighbourhood. The findings, including the developed typology of closeness, are described below.

## 2.2. Case Study

The case study for this analysis is a neighbourhood in Subiaco—a suburb situated at the immediate west of the central business district of Western Australia’s capital city of Perth. Geographically, it is

five kilometres east of the Indian Ocean, 12 km northeast of the port of Fremantle, and is situated north of the Swan River (see Figure 3). According to the Australian Bureau of Statistics [73], the 2016 resident population of Subiaco was 16,234, with a density of 31 persons per hectare over a total land area of 562 hectares (6 km<sup>2</sup>).



**Figure 3.** Maps of: Australia (A); and Subiaco (B) (Source: Authors).

Established in the 1880s as part of the development of the Swan Colony [74] and following its working-class origins in the early 20th century [75], Subiaco emerged as a culturally vibrant centre in the 1990s encouraged by the proximity to the University of Western Australia. It is a relatively wealthy and well-educated suburb. The personal median annual income was A\$59,592 in 2016 compared to A\$37,648 in Western Australia and AUS\$34,424 in Australia, and half of the people above 15 have university education compared to 20% for Western Australia and 22% for Australia [76].

### 2.3. Case Study Neighbourhood

The selected neighbourhood area includes several streets in Subiaco, namely Axon Street, Townshend Road, Olive Street, Bedford Avenue, Barker Road, Park Street and Bagot Road (see Figures 4 and 5). It is an entirely residential area with no commercial or industrial enterprises. Each street has house front yards in a face to face and side by side manner allowing for social interaction between neighbours within their immediate vicinity.

The selected neighbourhood for the case study is a traditional inner-city part of Subiaco. It is representative of the original area which has stood up and adapted to the challenges of time. In Figure 4, it is marked as “survey area”. Figure 4 also shows the main outdoor spaces and socialising places in Subiaco which include several parks and playgrounds, community centres, coffee shops, sports and recreation venues. The residents of the case neighbourhood have access to all of these places. This particular neighbourhood is relatively well-defined, unobstructed or divided by public open spaces making it distinctively local and relatively easy to explore the built form typology of social bonding for Subiaco residents.

Using a semi-structured questionnaire, the 61 interviews were conducted with residents in the selected neighbourhood about their front yards. The questionnaire canvassed demographic information (age, profession, home ownership, etc.; refer also to Table 2), opinions (on a Likert scale) and contained open-ended questions (comments, suggestions, recommendations, etc.).

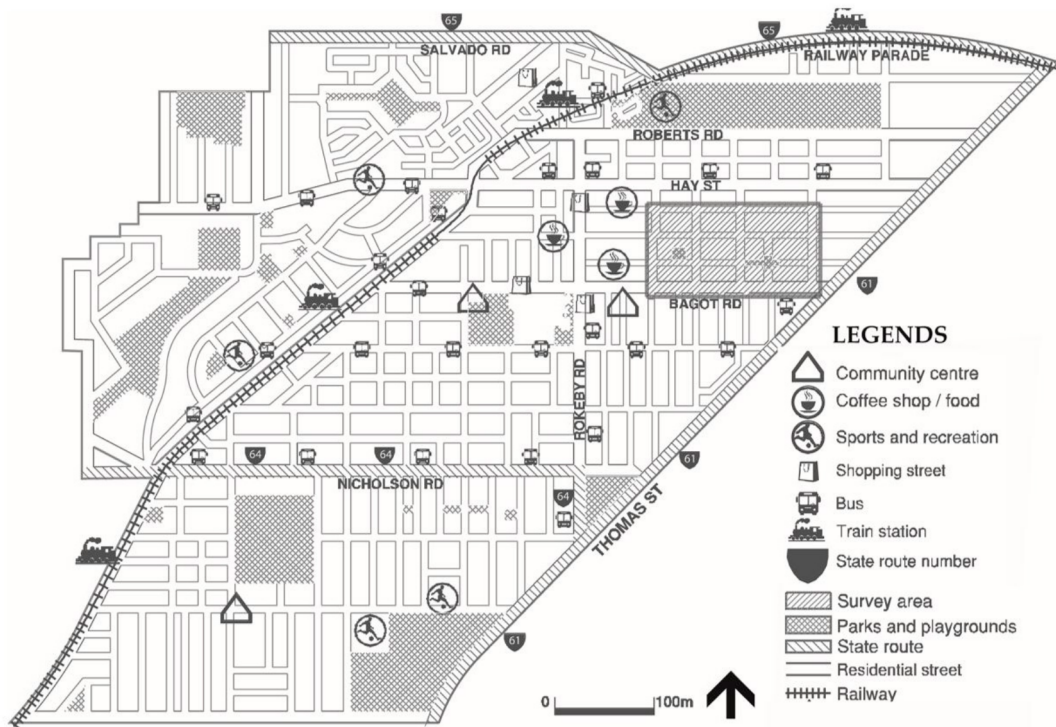


Figure 4. The suburb of Subiaco in Perth, Western Australia with the case neighbourhood (survey area) and public and outdoor places (Source: Authors).

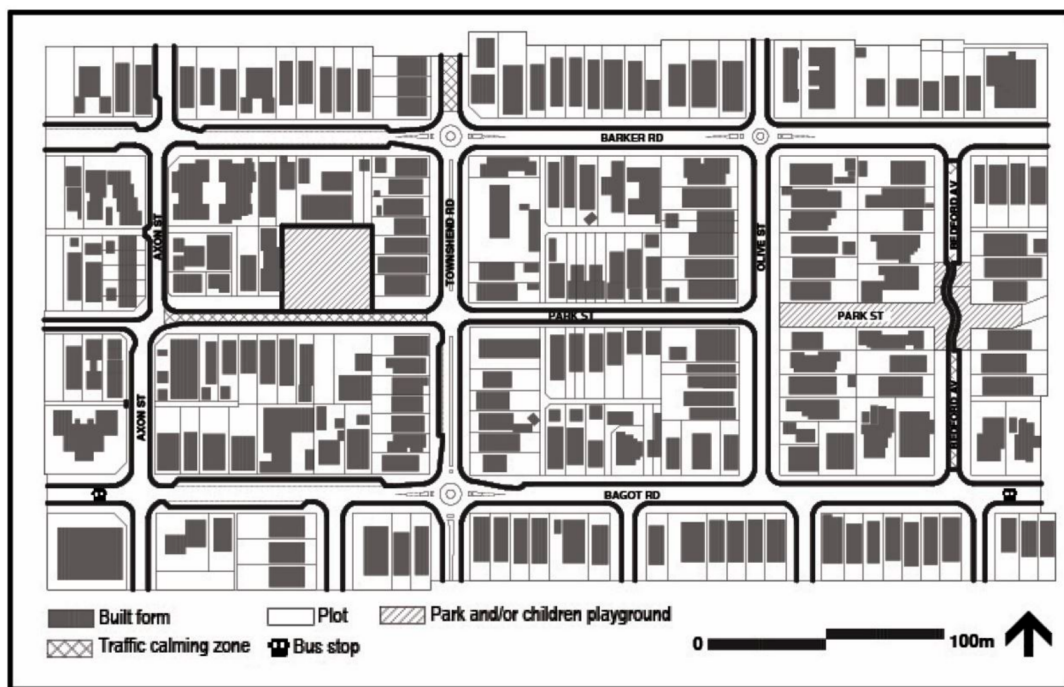


Figure 5. The case neighbourhood in Subiaco (Source: Authors).

#### 2.4. Typology of Communication

Human interaction depends on the physical distance between people. It is based on immediate receptors such as skin, membrane and muscles, and distance receptors, such as eyes, ears and nose [51]. The former are used in close proximity while the latter enable people to see, hear and smell at a different

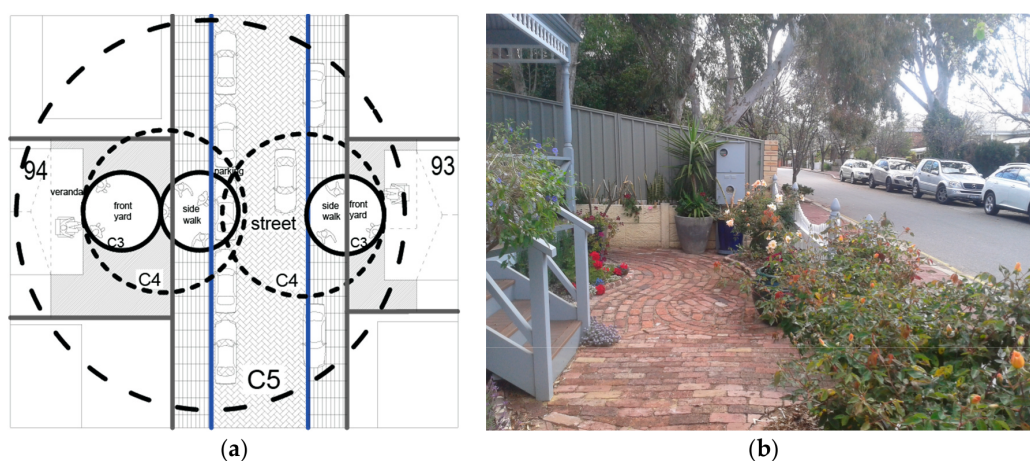


degree depending on the distance (see Table 3). With eye sight allowing people the longest distance communication, Gehl [41] described the range up to 100 m (325 feet) as the social field of vision. In this range, human beings might engage in various degrees of communication and social interaction with each other. The assumption is that human contact is not capable of passive communication beyond 100 m based on anatomical receptors (seeing/hearing/smelling). On a neighbourhood street scale, however, 25 m (or 80 feet) is the threshold for perceiving and understanding the feelings and moods of others and hence the limit of meaningful social interactions.

**Table 3.** Human perception and level of contact intensity (based on [41]).

	Receptor	Range	Purpose/Ability to Perform
Short distance ↓ Longer distance	Nose/Smell	1 m (39 inch)	Weak odour can be felt
		2 to 3 m (7 to 10 feet)	Strong smell like perfume can be felt
Shorter distance ↓ Long distance	Ear/Hearing	7 m (23 feet) (Maximum)	Normal conversation
		35 m (100 feet) (Maximum)	Lecture/question-answer session/one way communication
Short distance ↓ Long distance	Eye/Sight	0 to 0.5 m (0 to 2 feet)	Intense emotional contact
		0.5 to 7 m (2 to 20 feet)	Less intense contacts
		1 to 3 m (3 to 10 feet)	Normal conversation, meaningful human contact
		20 to 25 m (60 to 80 feet)	Understanding of feeling or mood
		30 m (100 feet)	Recognition of age/facial feature/hairstyle
		70 to 100 m (250 to 325 feet)	Recognition of age/sex/activity (e.g., people at the beach, football match)

Table 4 presents a communication typology based on social distance. The range of each category is determined based on a circle (see Figure 6a,b) that excludes any previous types. For example, social distance (category C3) excludes intimate (category C1) and personal (category C2) distances. Intimate (C1) and personal distances (C2) are limited to family and friends and useful for interactions in semi-private spaces (e.g., veranda).



**Figure 6.** Section of Park Street in Subiaco, Perth, Western Australia: (a) top view of the inter-relationships between the front yards on both sides of Park Street showing the different distances, namely C3 (social distance), C4 (public distance) and C5 (recognisable distance); and (b) perspective view of Park Street showing different space types, including front-yard, sidewalk, street parking and street (Source: Authors).

**Table 4.** Communication typology based on social distances [51].

Sense	Level of Interaction	Distance Type	Diameter Range	Code
Smell + Hearing + Sight	High intensity contact (tenderness, comfort, love, anger)	Intimate distance	0.45 m (1.5 feet)	C1
Smell + Hearing + Sight	Normal conversation (close friends, family, e.g., family dinner table)	Personal distance	1.3 m (4.5 feet)	C2
Hearing + Sight	Ordinary conversations (friends, acquaintances, neighbours, co-workers, etc.)	Social distance	3.75 m (12 feet)	C3
Hearing + Sight	Formal contacts usually when someone watches, hears but may not want to participate (teaching, one-way communication)	Public distance	7 m (25 feet)	C4
Hearing + Sight	Normal voices are lost, facial expressions and movements are difficult to recognise; the main recognisable features are gestures and postures.	Recognisable distance	20 m (60 feet)	C5
Hearing + Sight	People are able to perceive feelings and moods while meeting others; this is the threshold of meaningful social interactions.	Identifiable distance	25 m (80 feet)	C6
Hearing + Sight	One-way communication (e.g., lecture with questions and answers or a theatre performance), visibility and participation in a conversation are difficult; only infrequent contacts are possible	Observing distance	35 m (100 feet)	C7
Sight	People can recognise others' gender, approximate age and type of activity.	Visible distance	100 m (325 feet)	C8

In a neighbourhood scale, the interactions within the semi-private–public (front yard) and public (e.g., sidewalk, verge, street parking, street, etc.) spaces are crucial for this study and they fall within the C3 (social distance) and C4 (public distance) categories. Social distances (C3) allow comfortable interactions between friends, neighbours and co-workers. Public distance (C4) is just double the size of social distance (C3). If a front yard and sidewalk fall within the range of social distance (C3), then the physical condition is considered as highly communicative for encouraging community interactions. When a front yard and sidewalk are within public distance (C4), this is seen as a medium communicative physical condition. Any distance beyond C4 is considered as low communicative physical conditions and typically falls within the distance range of C5 (recognisable distance). Recognisable distance (C5) helps to determine the level of social interaction between front yards across the street. In this range, people cannot talk comfortably as their voices are lost or fade. It is also difficult to clearly understand the facial expressions or movements of the other persons across the street. However, people can still identify the gestures and postures of others from this distance. Hence, a passive communication prevails. This situation is good for natural surveillance [29] but not for normal conversation. Natural surveillance is encouraged in planning schemes in various parts of the world with the aim to reduce crime. This is one of the main principles of Crime Prevention Through Environmental Design (CPTED) [77].

Categories C3–C5 are the ones of interest for analysing community building at a neighbourhood level. They can also represent the level of social closeness within the community based on the physical distance (see Table 5). The interaction and communication level is determined by the distance between the edge of the veranda and the centre point of the sidewalk.

**Table 5.** Scale of closeness based on distance categories.

Category	Physical Distance	Distance Category	Scale of Social Closeness
C3	From 1.3 to 3.75 m (4.5 to 12 feet)	Social distance	High closeness
C4	From 3.75 to 7 m (12 to 25 feet)	Public distance	Medium closeness
C5	From 7 to 20 m (25 to 60 feet)	Recognisable distance	Low closeness

### 3. Discussion of Case Study Results

Four of the seven streets in the case study neighbourhood have a north–south orientation, namely Axon Street, Townshend Road, Olive Street and Bedford Avenue, while the remaining three—Barker Road, Park Street and Bagot Road—are oriented along east–west (see Figure 7 for snapshots of the case neighbourhood). The house numbers considered for inclusion in the study for each street are based on the orientation of the front yard rather than the address. For instance, the orientation of the front yard of a corner plot, rather than the postal address, defines whether a house falls under a particular street. Moreover, the front yard’s orientation is important to observe the face-to-face (houses opposite to each other) or side-by-side (houses adjacent to each other) interaction level between immediate neighbours. The results from the detailed observation and the perception-based survey are presented below.

**Figure 7.** Cont.



**Figure 7.** Snapshots of Subiaco case neighbourhood: (a) Bagot Road view shows wider streets with bus routes; (b) Barker Road view shows a wide sidewalk along a fenced front yard; (c) Townshend Road view shows a sidewalk along different types of fenced front yards; (d) Townshend Road view from a veranda overlooking sidewalks, verge, parking and neighbouring front yards across the street; (e) Bedford Avenue view shows the use of the verge as an extended playground; and (f) traffic calming in Bedford Avenue (Source: Authors).

### 3.1. Detailed Observation

Table 6 shows the closeness patterns in the Subiaco case study neighbourhood. The majority of houses in the entire neighbourhood, and in all streets with the exception of Bedford Avenue, belong to the medium social closeness category (C4). At the two extremes are Olive Street, where all houses fall within this public distance category, and Bedford Avenue, where they are evenly spread between medium (C4) and low (C5) closeness. Hence, the front yards of Bedford Avenue have the lowest level of closeness compared to the other streets. The reason is the wider front yards which prevent residents and users to communicate with pedestrians. Although Bedford Avenue is a street controlled with traffic calming, it has the least pedestrian movement observed. The front yards in Olive Street have a uniform width. The observation showed this to be the least interactive street due to its quiet ambience. Being a cul-de-sac might hinder the level of social interaction.

**Table 6.** Social closeness patterns in the Subiaco case neighbourhood.

Street Name	Closeness		
	High	Medium	Low
	C3	C4	C5
	%	%	%
Axon Street	22	78	0
Townshend Road	17	79	4
Olive Street	0	100	0
Bedford Avenue	0	50	50
Barker Road	17	79	4
Park Street	39	52	9
Bagot Road	17	67	16
All streets	18	72	10

The front yards of the remaining five streets exhibit a combination between high and medium social closeness with social and public distances. Park Street has the highest share of high social closeness (C3) with 39% of its front yards belonging to this category.

It is important to stress that the front yard width and driveway width are crucial factors in this analysis. If the front yard is around 3.75 m (12 feet) wide, that is across the street or less, the possibility for social interaction is high. In such a situation, it is easy for relationships between the front yard, sidewalk, verge or parking to take place. On the other hand, the relationship between the house front yards across the street depends greatly on the width of the driveways. In the case of Park Street, both the front yards and driveways are narrow enough to facilitate high level of social interactions. Furthermore, traffic calming, low speed and comfortable shaded and paved amenities are all factors which make the physical environment suitable for fostering social interactions.

The above analysis shows that all streets in the surveyed area are able to accommodate medium level of social interactions. Park Street can be identified as the one with the highest social closeness while Bedford Avenue has the lowest.

Front yards with high levels of closeness (C3) can accommodate very effective social encounters between neighbours in close proximity. As medium closeness (C4) distances are just double the distance (diameter) of C3, people can communicate with each other in a moderately comfortable way. Based on physical distance, only a small share of the front yards in this Subiaco neighbourhood (namely 10%) have low social closeness.

Previous studies [43,62,63] have shown that physical distance is important in determining social contacts. The relationship between physical distance and social interaction between individuals is essential to better understand ordinary social life [47,54,55]. Our regular activities—going to work, children going to school, cleaning, moving rubbish bins, walking dogs, collecting the mail, strolling and so on—are predictable, which is a tremendous opportunity to design the urban social settings by manipulating the existing physical spaces and routes [47]. Bay's [58] study further extended this concept within a high-rise residential apartment context and similar patterns are observable in all neighbourhoods. A social reformation of the regular residential physical environment is predictable which is impossible in the public space because of its anonymous character. Familiar faces enable acquaintances and brings people closer. Regular and repeated interactions make people closer and create the sense of community.

### 3.2. Perception Survey

Table 7 presents the survey results from the 61 interviews conducted in the neighbourhood area. The first three questions indicate the degree of social interaction in terms of physical distance. Saying hello is a weak one-way communication which takes place when two persons communicate with each other from a distance where watching is comfortable but hearing is not (see Tables 2 and 3). It corresponds to public distance (C4) or medium closeness. On the other hand, "talking" or "chatting" is only possible where two-way communication takes place and corresponds to social distance (C3) or high closeness. Inviting neighbours, passers-by or visitors may be possible only with the house owner's permission at a personal distance (C2). These first three questions show that there is a strong and direct relationship between the linear physical distance and level of social closeness with residents from all streets, except Bagot Road, indicating that they are more likely to maintain a public distance than engage in closer interactions. Barker Road residents do not perceive any major differences between public and social distance with all happy to use both in relation to their front yards. Olive Street residents are similarly uniform in using the public distance while more Bagot Street residents prefer social to public distance.

**Table 7.** Social interaction in the Subiaco case neighbourhood.

Question	Axon Street	Townshend Road	Olive Street	Bedford Avenue	Barker Road	Park Street	Bagot Road
	% Yes	% Yes	% Yes	% Yes	% Yes	% Yes	% Yes
1. I like to say hello to my neighbours from my front yard (C4).	92	90	100	70	100	86	70
2. I like to talk to my neighbours in my front yard (C3).	87	80	86	59	100	86	80
3. I like to invite my neighbours in my front yard to participate in daily life or recreational activities (C2).	49	40	43	59	85	36	70
4. I feel the front yard is an appropriate place to participate in community life.	72	70	100	45	82	57	90
5. I made new friends in my front yard during the last few years.	64	80	71	96	43	50	90
6. I feel a strong sense of ownership and sense of belonging in the front yard of my house which help me to engage with my neighbourhood community.	77	80	100	62	87	50	100
7. I think my front yard allows building familiarity with my neighbours and encourages involvement in community activities.	64	70	72	45	75	72	40
Average level of closeness	72	73	82	62	82	62	77

It is interesting to see that the perceptions about the role of the front yards in creating sense of community can either mirror the physical distances or compensate for them. For example, all front yards on Olive Street have medium social closeness (see Table 6) and again all residents feel that the front yard is an appropriate place to socialise. On the contrary, Bedford Avenue is the street with the longest physical distance and while the front yard is perceived as a place to socialise only by 45% of the residents, 96% admit of having made new friends there in recent years. Park Street has the shortest distances but only 36% of its residents perceive the front yards as a socialising place. Overall, most residents feel a strong sense of ownership and belonging in the front yard of the house which helps them engage with their neighbourhood community. On Olive and Bagot Streets this perception is shared by all residents, while on Park Street only by half of them. The perceptions about the role of the front yards in developing closer relationships at the level of familiarity are shared by a smaller number of residents, as low as 40% for Bagot Road and 45% for Bedford Avenue. Hence, there are big differences in perceptions about the role of the front yards in creating a sense of community which not always align with the theoretical framework about the role of distance in creating social relationships.

### 3.3. Typology of Closeness

The typology of closeness based on the physical distance is perceived differently by the residents of the Subiaco case neighbourhood. In all residential streets, the number of front yards with medium level of social closeness is the highest. However, for three of them the perceived closeness was lower than the one determined based on the physical distance while for the remaining four, it was the

opposite (see Table 8). This discrepancy requires further understanding of the social factors influencing people's perceptions. Notwithstanding this, the difference between the medium level of societal closeness and the average perceived level was relatively low (maximum 18%). This shows that the physical distance can be used as a rough measure for social closeness.

**Table 8.** Medium level and average perceived social closeness in the Subiaco case neighbourhood.

Street Name	Social Closeness		
	Medium	Perceived	Discrepancy
	Level	Level	
	%	%	%
Axon Street	78	72	8
Townshend Road	79	73	8
Olive Street	100	82	18
Bedford Avenue	50	62	18
Barker Road	79	82	4
Park Street	52	62	16
Bagot Road	67	77	13

The three types of front yards based on physical distance allow for high (or social distance), medium (or public distance) and low (or recognisable distance) social closeness. They stimulate different types of interactions and social activities contributing to the sense of community. A distinctive feature of this typology is that it includes the link between the physical and social components which is rarely the case. Previous typology studies have ignored the role of the front yard as well as social aspects, and used only physical characteristics, such as scale and size (e.g., housing typology [78]), landscape features (e.g., parks [79]), traffic management (e.g., streets [80]), and architectural forms (e.g., buildings [81]) or used only social interactions (e.g., back alleys [82]). The study by Martin [82] mentions the front yard as a formal and uniform representation of the human personality with a desire to be seen from the public streets. This current study acknowledges the importance of both physical and social aspects in creating sense of community.

Understanding the typology of closeness also aligns with academic efforts to encourage safety and walkability in urban environments (e.g., [83]). It further emphasises the special role the front yards play as semi-private–public and socially interactive spaces.

#### 4. Conclusions

The principles of sustainable development include resident-driven local communities [84] and the front yards in residential neighbourhood seem a logical place for initiating and maintaining social interactions. The distance-based observation study in the Subiaco neighbourhood confirmed the theory that social closeness is directly related to physical distance. There are however mixed results based on the residents' perceptions about the potential of the front yard. While overall the majority of residents on all seven streets gave some importance to the front yard in community building (ranging from 62% on Bedford and Park Streets to 82% on Olive Street and Barker Road), its place was perceived very differently. In some cases, it mirrored the physical distance, in others it was compensating for a longer or shorter distance by respectively being more or less used for socialising.

This study shows that theoretical understanding is not enough in design decision making during the planning process and testing of theory in application is required for proper diagnosis. Subiaco residents' behaviour in their semi-private–public front yards is a complex phenomenon that requires careful observation because the key to the design decisions lies beneath a blurred zone. Like every other case of human settlement around the world, Subiaco people have their own attitudes, practices, customs and beliefs which need proper understanding. Front yards in the selected Subiaco

neighbourhood play an important role in this cultural background and the understanding uncovered in this study enriches our knowledge.

Subiaco residents' conservative response to their neighbours in close proximity proves their careful nature of being selective in choosing friends. The overall medium closeness level represents their moderately open-minded attitude during social interactions. They are not only careful about closer interactions, but also maintain the necessary basic relationships with their neighbours. This careful interpretation of a balanced nature is a unique quality to be considered in the planning process. Hence, the typology of closeness is an important tool to boost better understanding by different interest groups, including planners, urban designers, architects, policy makers and users, and help the sustainability agenda towards better communities.

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