Chapter 4
Legibility and Continuity in the Built Environment

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4.1 Introduction

When people are asked about wayfinding, they usually respond with “signs.” *Wayfinding* has become shorthand for adding signs to help people on their way. And yet, wayfinding is so much more. According to Massimo Vignelli, author of the 1972 New York City subway map,

> Any sign is an admission of architectural failure. (Busch 2007)

This chapter discusses wayfinding with emphasis on design considerations rather than signage. It focuses on two paramount themes in community wayfinding: *legibility* and *continuity*. Legibility revolves around reading. We “read” streets and cities in much the same way that we read landscapes and maps. Water flows downhill from hills toward creeks. Thicker lines on maps represent higher concentrations. We look for clues that tell us where we are, what others are doing, where we want to go, and how to get there. The clues are context, network, and markers.

Continuity is about consistency—in design, colors, signs, structure, and phases. Driving along the highway you typically encounter a consistent set of signs. Crosswalks are typically the same wherever you might be. Bike lanes are consistently green (or red or blue depending on the country). Trolley tracks indicate the presence of transit (or in some cases the former presence of transit). When these markers are placed consistently and continually along a path, wayfinding is enhanced.

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The two images in Fig. 4.1 illustrate the fundamental concepts of wayfinding—legibility and continuity—in the built environment. Figure 4.1a shows the Flinders Street Station in Melbourne, Australia. The clock identifies the function of the building. The entrance to the station, a major aspect of the building's architecture, is obvious to all who approach the building. Little signage is needed to tell how to access the building. Figure 4.1b shows the promenade along the Beiramar Norte in Florianópolis, Brazil. Notice the separate lanes for people in cars and buses, people on wheels like bicycles and skateboards, and people on foot. Smallish signs appear every now and then, but the general layout is pretty clear. On Sundays this promenade is *the* place to be in Floripa, whether you are exercising, people watching, or celebrating the local soccer team's victory.

4.1.1 Users

Wayfinding systems, be they a series of signs or a series of landmarks, can be analyzed and designed according to the informational requirements of the variety of users expected. In general, users fall into three categories: locals, regulars, and visitors. Locals are people who spend most parts of their days in the immediate area: children attending the local school, people who work at home or nearby, retirees, or people walking dogs. They generally walk, cycle, or drive short distances around the community. They are very familiar with how to get around and rely mostly on landmarks.

Regulars are commuters—people who come to the area day in and day out. Perhaps they arrive by transit and walk to and from bus stops, perhaps they drive and walk to and from a parking garage, perhaps they cycle in via a greenway. Regardless they are quite familiar with their route. They do not necessarily need maps, signs, or local information but benefit from them when exploring the area off their commute routes.

Visitors vary in their degree of familiarity, if any, with the environment. Visitors from the general geographic area may know something about the area but do not know it extremely well. For example, they may know where certain parking locations are or where a transit station is located. Local visitors may not know the extent of multimodal wayfinding system opportunities in terms of the system's characteristics (such as connectivity, directness, redundancies, route choice, and distances) and constraints (such as pedestrian safety hazards, including incomplete sidewalks, obstacles, pavement condition, lack of mid-block crossings, and poor directional signage). Regional visitors may travel infrequently to a geographic area, such that the multimodal wayfinding and traffic circulation systems seem "foreign" to them. National or international visitors, including business and event tourists, will know even less about the multimodal network and wayfinding system than other visitors.

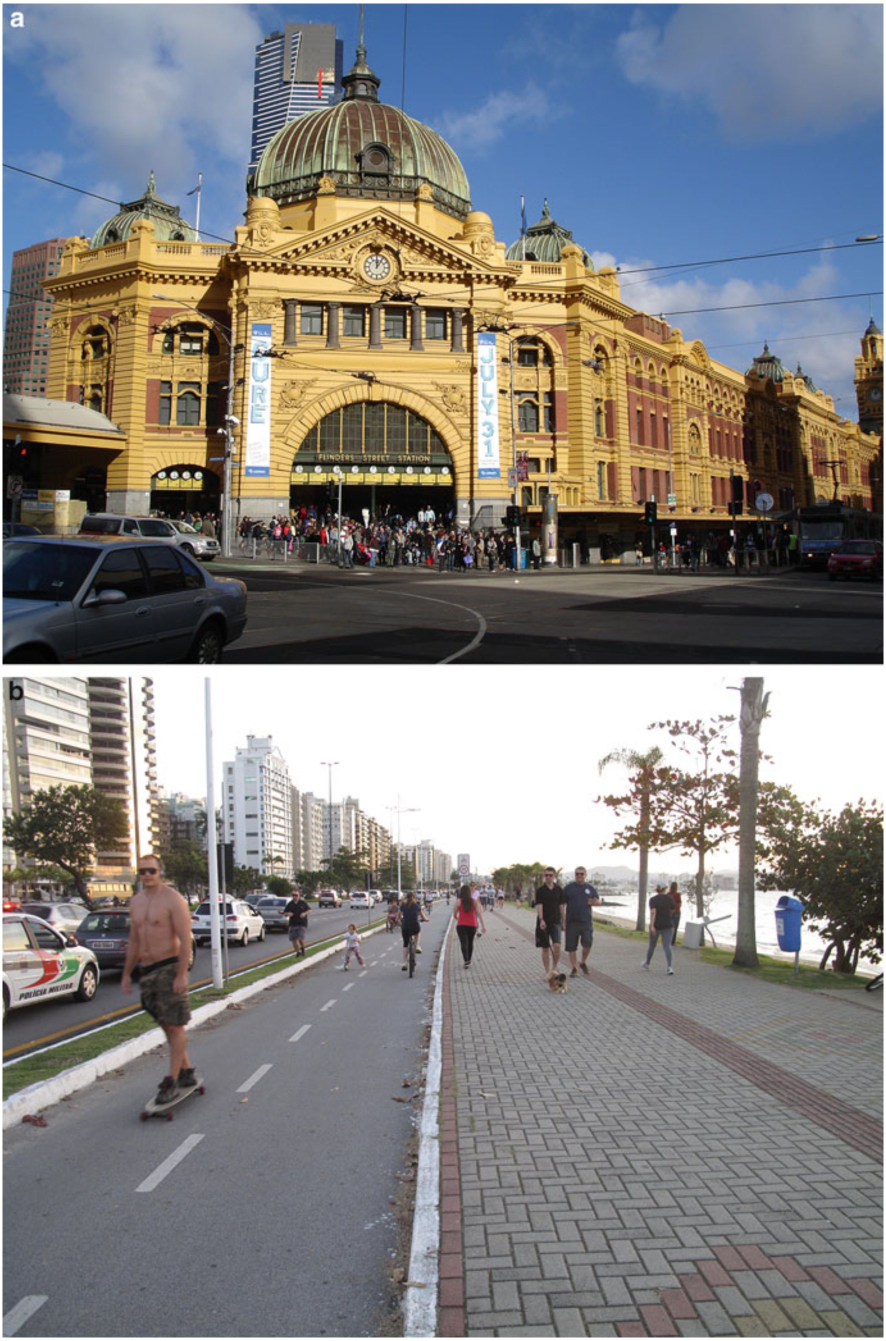

Fig. 4.1 (**a**) Melbourne, Australia (Photo: Elise de Jong); (**b**) Florianópolis, Brazil (Photo: Michael King)

4.1.2 Routes

The best routes are the easiest to navigate, most memorable, usable both day and night, least stressful, best suited for persons of all abilities, and open in all types of weather (Timpf and Heye 2002). Successful factors for wayfinding include the following:

- *Connectivity* Ensure that routes are continuous and allow people to travel to their destinations without diversion or dead end. This reduces travel distances and the need for detour wayfinding.
- *Hierarchy* Emphasize places of prominence such as schools, boulevards, mosques, high streets, and parks. These form the skeletal outlines of one's mental map of the area.
- *Interconnectivity* Ensure that people can transfer between modes (from train to plane, from sidewalk to subway, from parking to walking) with relative ease.
- *Proximity* Locate origins and destinations near to each other. This minimizes travel and thus the need for wayfinding.
- *Redundancy* Include multiple routes and options. This provides variety (a desired trait in travel) and alternatives (in case of a disruption in the system such as a bridge closed for repair or a stalled train).

4.2 Legibility

This section discusses street grids, size and scale of city blocks, context of the built and natural environment, and urban design. Each contributes to the legibility of a location.

4.2.1 Street Grids

From a city planning point of view, wayfinding is about legibility. Street networks that are legible do not really need signs other than perfunctory ones identifying points in the network. A classic example is the grid of Manhattan (United States). Avenues run north–south, which is uptown–downtown. Streets run east–west, or cross-town. Both are numbered so someone who is only a little familiar with Manhattan knows that walking from 34th Street to 42nd Street is eight blocks, or about an 8-minute walk. Streets with even numbers generally are one-way eastbound. All this creates a highly intuitive network that needs only a little wayfinding information for people to orientate themselves.

Legible street networks do not necessarily need to be in a strict gridiron pattern. Grids can be stretched or otherwise morphed to fit the geography (Marshall 2005). Grids can and are often joined at odd angles, leaving wonderful (or difficult) triangle junctions and plazas. Different developments throughout history have used unique patterns. Yet they remain legible via unifying elements such as a metro system or boulevard. For example, the transit map of a city can become one's mental map of the city. Parkways such as Philadelphia's Roosevelt Boulevard (United States) or Mexico City's Paseo de la Reforma (Mexico) connect various neighborhoods. These unifying elements then become the larger wayfinding system.

Some cities or neighborhoods have been laid out with unique grids or with certain unique characteristics. The impact on legibility and hence wayfinding varies. Sometimes the layout is overly complicated. Buenos Aires (Argentina) and Barcelona (Spain) have quite recognizable grids with a few select diagonals. New Delhi (India) and Washington, D.C. (United States) are overly complex—each has so many diagonal streets that in effect an alternate grid is created. Bath (England), Ulan Bator (Mongolia), and Yerevan (Armenia) have circular streets that are at once recognizable and readable.

Places can be made more legible—and thus wayfinding made naturally easier—by altering select streets. This would be an important component of a community's wayfinding program. Towns and neighborhoods that have a main shopping corridor or plaza can convert these to primarily walking zones. Surface transit lines such as streetcars and bus rapid transit can transform corridors from car-choked roads to places teeming with life. Metro stations encourage transit-oriented development, which then creates a center of activity, which become a mental map touchstone. The resultant places anchor communities and become part of people's mental maps when they act as wayfinding reference points. To wit, the SoMa neighborhood in San Francisco is South of Market, a street replete with transit; the Deep Ellum neighborhood in Dallas is centered around Elm Street, which once had a streetcar on it; the entire Copacabana neighborhood in Rio de Janeiro (Brazil) is within five blocks of the Copacabana beach.

Figure 4.2 provides simplified street maps from six cities around the world, illustrating how street grids affect legibility and wayfinding. The cities of Barcelona (Spain), Buenos Aires (Argentina), Abu Dhabi (United Arab Emirates), Chandigarh (India), Ulan Bator (Mongolia), and Yerevan (Armenia) all have defining and memorable characteristics. Barcelona (Fig. 4.2a) contains a gothic quarter to the south, the former town of Grácia (now a neighborhood) to the north, and a regular grid in between. The grid is cut by a large diagonal street known as the Diagonal. Most streets in Buenos Aires (Fig. 4.2b) follow a regular grid. The city has two diagonal streets and one monumental street (now with a bus rapid transit system). Monuments placed at the ends of "view corridors" can be seen from long distances and serve as key landmarks. Abu Dhabi (Fig. 4.2c) has a regular grid, albeit at a much larger scale than the two preceding. The boulevards are numbered, so there is a sense of location.

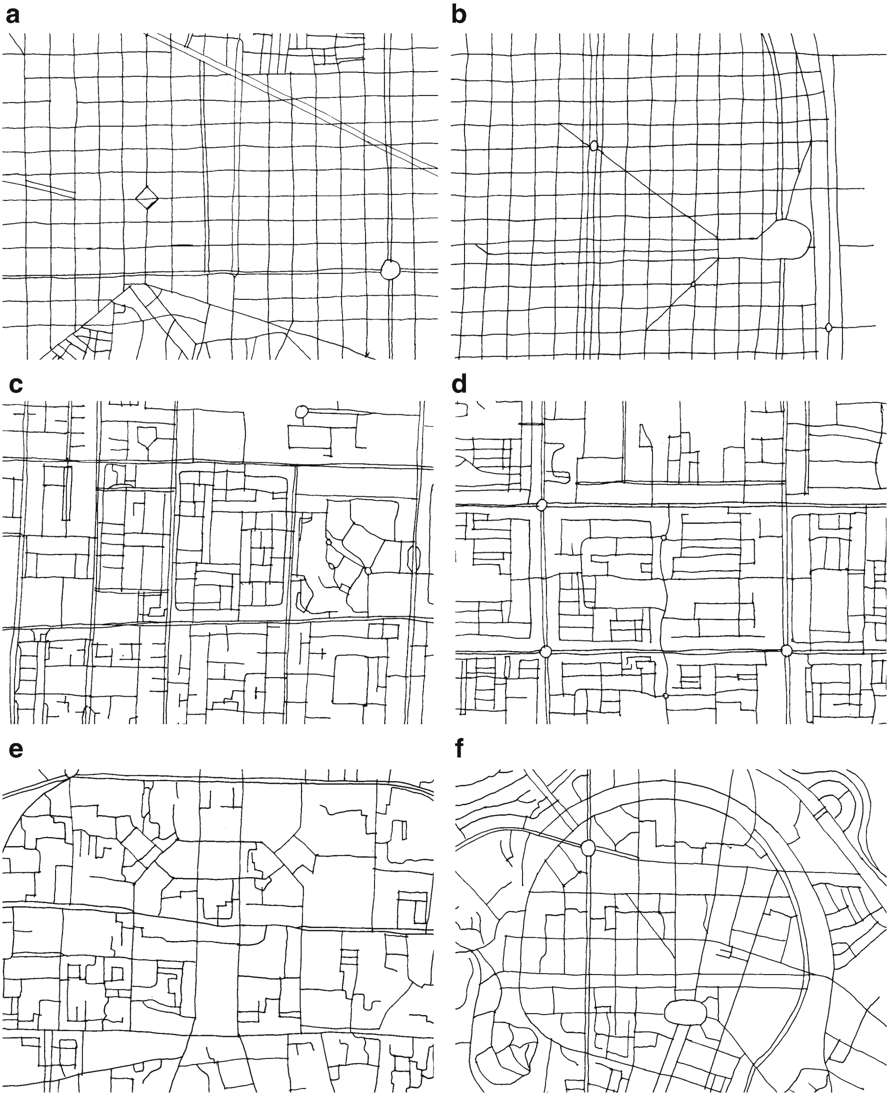

Fig. 4.2 Maps of (**a**) Barcelona, Spain; (**b**) Buenos Aires, Argentina; (**c**) Abu Dhabi, United Arab Emirates; (**d**) Chandigarh, India; (**e**) Ulan Bator, Mongolia; (**f**) Yerevan, Armenia—all drawn at the same scale (Images: Michael King)

Chandigarh (Fig. 4.2d) has a similarly large system of super blocks, which are all numbered in the city plan. Ulan Bator (Fig. 4.2e) has a distinctly angled ring road, centered on the government palace. The center city of Yerevan (Fig. 4.2f) is encircled by roads and greenbelt. This provides an edge and informs people where they are in relationship to that edge.

4.2.2 Size and Scale

The street maps in Fig. 4.2 are all drawn to the same scale, thus illustrating compelling issues of wayfinding by mode. Barcelona and Buenos Aires are recognized as two of the most walkable cities in the world. Their typical block face is 113 m (372 ft) and 100 m (328 ft), respectively. This is larger than the blocks of Manhattan (61 m, or 200 ft, on the short side) and Munich (about 50 m, or 164 ft). It is considerably smaller than the blocks of Abu Dhabi (300–800 m, or 984–2,625 ft) and Chandigarh with its superblock grid (800 m by 1,200 m, or 2,625 ft by 3,937 ft). Manhattan and Munich both predated the automobile, while Abu Dhabi and Chandigarh were built by and large for driving. Nevertheless, as the drawings attest, the superblocks have been subdivided into streets and passages much more geared to walking. In fact, walking and cycling within the superblocks of these two cities is quite convenient.

Roads in the latter half of the twentieth century were largely laid out according to what is known in the highway industry as *functional classification*. This system propagates a binary, automobile-based classification system for streets and highways. On one end of the scale are freeways (expressways, autobahns, national roads), which provide 100 % mobility for automobiles and have limited access to adjacent properties. On the other end are local streets, which provide full access to adjacent properties and have limited throughput function for traffic. In between are arterials and collectors.

Figure 4.3, based on South African practice, illustrates functional classification's impact on wayfinding. Generally, freeways are to be spaced at 5–10 km intervals; arterials are to be at 1.5–5.0 km intervals (South African Committee of Transport Officials 2012). Collector and local streets fill in the gaps. While this provides an organized system for driving, it is not ideal for walking and cycling. Collector and local streets are seemingly plotted at random, with no organizing theme. In a car with a Global Positioning System (GPS) and a full tank of gas, that is not a problem. But trying to find your way on foot is a challenge.

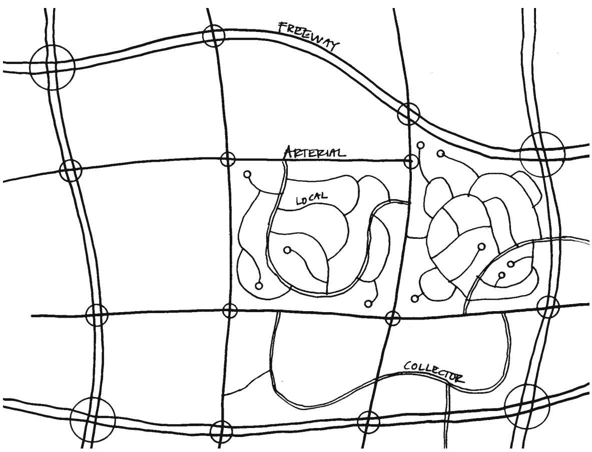

Fig. 4.3 Streets and roads organized along functional classification principles (Image: Michael King)

Currently, functional classification is being challenged for use on city streets. Alternate systems hopefully will be more amenable to wayfinding for all users (see for example National Association of City Transportation Officials 2013; National Cooperative Highway Research Program 2016).

4.2.3 Context

Context affects wayfinding: how legible a place may be, how many and what type of signs may be necessary, or the spacing of signage. Context in the built environment encompasses a broad spectrum of environmental, socioeconomic, and historical aspects of a community and its people. Renewed emphasis on context sensitivity in planning and engineering is addressing some of the problems created by the historical emphasis on vehicle rather than pedestrian traffic.

Cities, buildings, streets, and spaces can be characterized by their context within the built environment. Context describes size, use, form, and spatial characteristics. High-rise office buildings or flats in center city are one type of context; towers in a superblock are another. A high street is a particular context; big box retail and warehouses are another. Single-family residences on quarter-acre lots are context, as are row houses. The context of a particular location gives navigational clues to people. For example, skyscrapers or a water tower downtown are generally visible. The walls of a campus suggest there will be a gate or entry at some point. If that gate is clearly visible from a distance and indicated with a vertical marker like a pole, banner, or flag or a horizontal entrance marker like an archway, then its legibility is increased.

A useful methodology to appreciate context is known as the *transect*, as illustrated in Fig. 4.4. Transect is an urban development theory which describes the progression of development from the center city to rural and natural areas. Transect promotes observing development patterns—population, housing, and parcel density;

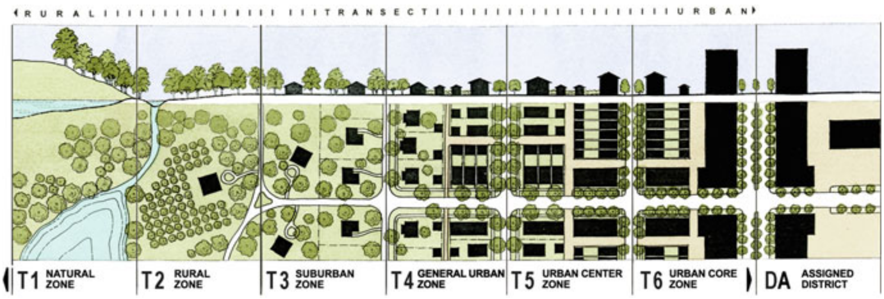

Fig. 4.4 Transect zones (Used with permission of Duany Plater-Zyberk and Company; http://www.dpz.com/Initiatives/Transect)

building setbacks; building types; roadway grid characteristics; land use; and transit service—to classify streets and context (Institute of Transportation Engineers 2010). Transect is very useful concept for planners, engineers, and policy makers to understand how to plan and implement capital projects for multimodal wayfinding systems. It helps establish parameters for the type of wayfinding necessary across the broad spectrum of the built environment, setting the scale for design of the regional transportation network as well as for individual transportation facilities.

4.2.4 Urban Design

Wayfinding is about urban design: the form and structure of a place. If the morphological components of a location are consistent with your own experience, then finding your way will be less mentally taxing. This idea is borne out at train stations, which have generally similar functional layouts: entry, ticket, platform, and exit. When visiting a city of a similar origin, you recognize clues consistent with your own city. Towns of the former Hanseatic League (e.g., Lübeck, Dortmund, Rīga) in northern Europe had a similar walled layout. Towns of the Spanish empire, whether in the Caribbean (Old San Juan in Puerto Rico) or Southeast Asia (the Intramuros area of Manila in the Philippines), have similar characteristics like a cathedral, governor's mansion, and monumental boulevard. Islamic cities (Isfahan in Iran, Cairo in Egypt) have minarets throughout—smaller ones in every neighborhood and a larger one downtown. These characteristics give people clues and comfort and facilitate wayfinding by providing consistent, recognizable aspects.

Some characteristics of a place are universal (Lynch 1960). A *view corridor* is generally an opening where you can see the view: ocean, mountains, sunset. If the streets are aligned, they may all afford a similar view. Passing along a cross street, you experience this view at every intersection. Emerging from a Metro station, if you can see the ocean at the end of the street, then you can orient yourself accordingly. A set of streets may be aligned to provide a view of a particular monument, such as the Capitol building in Washington, D.C.

Monuments, especially iconic ones, are often used for orientation. These are known as *markers*. Generally these are higher than the rest of a place, such that they can be seen from various locations. The Obelisk in Buenos Aires is one such monument. St Paul's Cathedral in London is another.

An *edge* condition is one that creates a boundary. Boundaries are often formed by rivers, railroads, walls, cliffs, or canals—anything that cannot easily be crossed. The Copacabana area of Rio de Janeiro lies between the beach and cliff and thus is highly legible. The area has one boulevard along the beach, another three or four inland, and a series of cross-streets. Table Mountain to the south of Cape Town provides a consistent reference for city dwellers, especially in the neighborhoods near it as the land slopes away from it.

Figure 4.5 captures four aspects of urban design in wayfinding. Lane Xang Avenue in Vientiane (Laos) (Fig. 4.5a) connects the presidential palace and Patuxay

Fig. 4.5 (**a**) Vientiane, Laos (Photo: Michael King); (**b**) Brooklyn, New York, United States (Photo: Elise de Jong); (**c**) St. Louis, Missouri, United States (Photo: Michael King); (**d**) Queens, New York, United States (Photo: Elise de Jong)

Patuxai monument. This photo is taken from atop the monument, looking at the palace. The street serves as a spine for this area of the city, is a natural collector for traffic and economic activity, and is prominent on maps (both mental and actual) of the city. The Eagle Clothes sign in Brooklyn, New York (United States) (Fig. 4.5b), while a remnant of a shuttered textile company, has become a local landmark that people use to orient themselves. It is so beloved that local politicians have organized campaigns to keep it. The archway over the street (Fig. 4.5c) is on South Grand Boulevard in St. Louis, Missouri (United States), and proclaims the presence of St. Louis University. The gate on the sidewalk (Fig. 4.5d) is in Queens, New York (United States), and indicates the periphery of the Woodside neighborhood. All of these examples assist people in finding their way without signs.

4.3 Continuity

This section looks at continuity from the perspective of the three basic modes: walking, cycling, and driving. Because each mode operates at its own speed, the needs for wayfinding vary.

4.3.1 Speed and Scale

Speed and scale are good portals to explore continuity. How fast one is traveling determines quantity and frequency of information processing. People walking need smaller, more frequent cues. Drivers need larger cues spaced farther apart. Cyclists are in between. If a place is too large and the inputs too infrequent, then people are not reassured that their route is correct. Regular markers reassure travelers. This is evidenced in mile markers along a highway, trail markers in the woods, and bike stencils in the street.

Is there a preferred time interval for route marking? Figure 4.6 charts a range of speeds and inputs. An individual traveling at 60 mph will pass a mile marker every minute. An individual walking at a pace of 4 ft per second down a street with

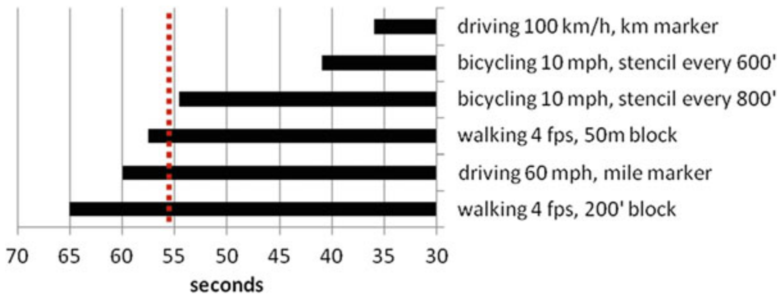

Fig. 4.6 Range of wayfinding inputs by mode and speed (Image: Michael King)

50-m-long blocks will reach the end of a block every 58 s. An individual cycling at 10 mph on a road with stencils placed at 800-ft intervals will encounter a stencil every 55 s. The median time interval is 56 s.

4.3.2 Walking

Walking is the fundamental way that people get around; communities that fail to provide for it fail (Appleyard 1980). For our purposes, walking includes people using wheelchairs and other mobility aides.

A number of urban and site design concepts facilitate wayfinding for those on foot. For those walking along a street, the way that walkway is detailed contributes to comfort. Details include building orientation and setback; building context; building design; and building height, width, scale, variety, and entry locations. Ideally, street furniture such as bus shelters, trees, and parking meters do not obstruct the travel path (Institute of Transportation Engineers 2010). For those crossing the street, some sort of physical intervention may be helpful, in terms of both safety and wayfinding. Options include a crossing island, a pinch point, a raised crosswalk, or a simple painted crosswalk. People see these and, if located along their desired path, will more often than not use them.

Transportation practitioners can contribute to wayfinding by observing user behavior and locating street elements accordingly. Space syntax can assist in this regard by quantifying potential walking routes and hence wayfinding needs. They can show where to locate design cues, crossing islands, and other infrastructure to facilitate walking and obviate the need for signs. Similarly, space syntax can document where routes are severed and can be re-stitched.

The images in Fig. 4.7 show a range of wayfinding elements scaled to walking. The pedestrian street in Doha (Qatar) (Fig. 4.7a) is a reinterpretation of the traditional Middle Eastern *souk*. Basically a shopping street, it requires no markings or signs whatsoever as people intuitively know to walk on the right and give way. All the entrances to transit stations in Boston, Massachusetts (United States) (Fig. 4.7b), are indicated by a large T logo on a sign, which makes them easily recognizable. In this instance the train is just below the street, so the relationship between train and street direction is easy to establish. If you ride a train traveling northbound, exit the train, and walk up the front stairwell, you will continue going northbound. People use the crossing island in Dortmund, Germany (Fig. 4.7c), without the aid of a painted crosswalk or a jumble of signs. It is well located, it provides a refuge for people to wait in the middle of the street, and it keeps drivers in line. The directional wayfinding sign on a hiking trail in the middle of nowhere (actually Ottfjällets, Sweden) (Fig. 4.7d) reminds us that we need information wherever we walk, not just in cities.

Fig. 4.7 (**a**) Doha, Qatar (Photo: Elise de Jong); (**b**) Boston, Massachusetts, United States (Photo: Elise de Jong); (**c**) Dortmund, Germany (Photo: Michael King); (**d**) Ottfjällets, Sweden (Photo: Elise de Jong)

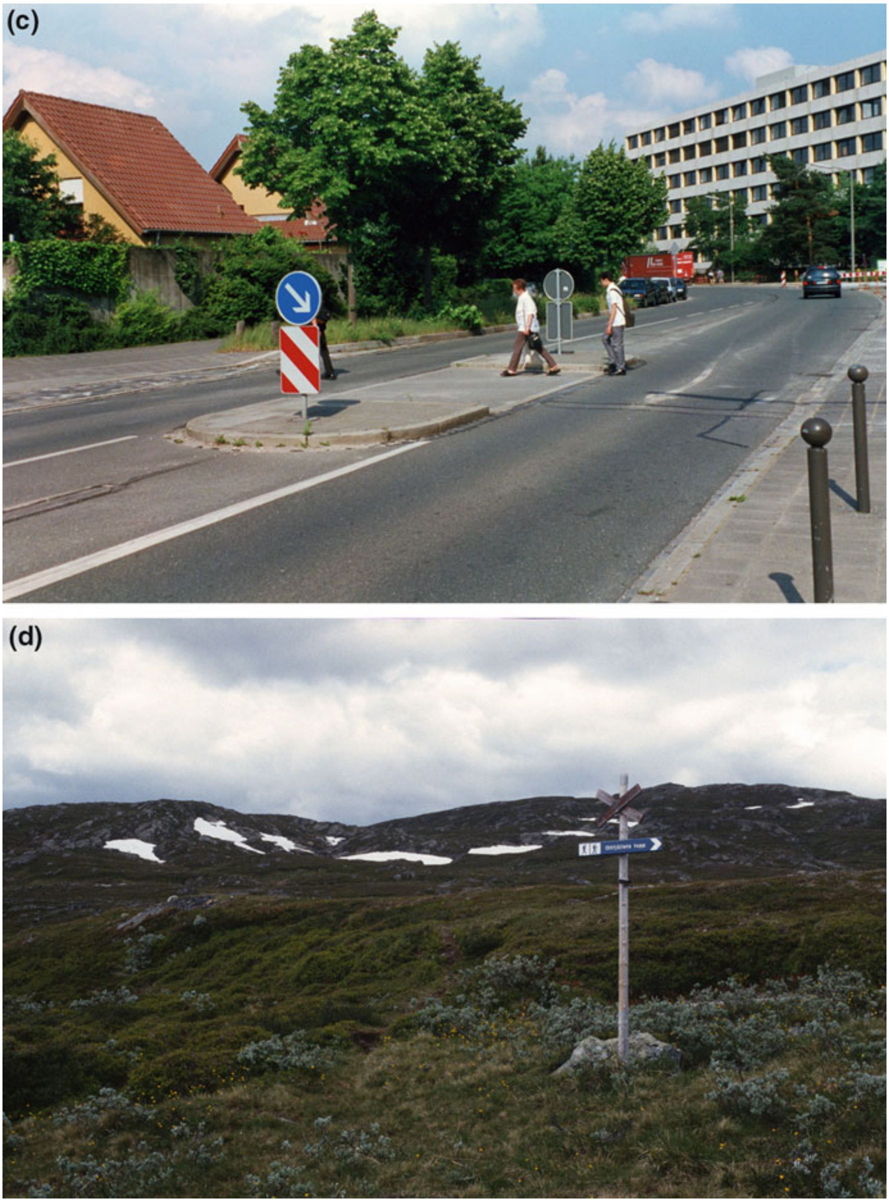

Fig. 4.7 (continued)

4.3.3 Cycling

Experiencing a place on bicycle presents different wayfinding issues. This is largely due to two factors: speed and ability to manage information. One can generally cycle through a built up area at about 10 mph, faster than walking and slower than driving. Accordingly, time-based information needs to be presented at bicycle-speed intervals. When riding a bicycle, one needs to concentrate primarily on that activity. Unlike when walking, stopping to check the map is inefficient. And unlike when driving, there is no one riding in the passenger seat to read the map. Thus cyclists rely on more intuitive markers and signage.

The primary method of intuitive wayfinding for cyclists is color. Color is used to indicate the bike lane, where the bike lane crosses an intersection, and where the bike lane turns. Generally, a set of white lines demarcates the bike lane, and the lane itself is colored (typically green, blue, or red, depending on the country). Not only does color assist the cyclist in wayfinding, it also assists in recognition by others. It indicates to drivers the bike lane's presence at a driveway or intersection. It indicates to people walking where to expect cyclists. And it indicates to cyclists where to stop (National Association of City Transportation Officials 2014).

The images in Fig. 4.8 illustrate how paint and other elements contribute to self-explaining bicycle facilities. The street in Amsterdam, Netherlands (Fig. 4.8a), is one-way for drivers and two-way for cyclists. Cyclists going in the same direction ride in the middle of the street with the autos. Just ahead of the traffic signal is an intersection-only bike lane on the right hand side. Cyclists going the opposite direction use the contra-flow bike lane on the left hand side. The lanes are painted red, as all bike lanes in the Netherlands are. The dashed line means that drivers may cross the bike lane to park. The protected two-way bike path in Barcelona, Spain (Fig. 4.8b), uses a nicely decorated barrier of grass and bricks to separate cyclists from motorized vehicles. Only a white painted dotted centerline and bike stencils are added to indicate the use for bikes and directions. Route signage is needed at turns and other decision points, but these facilities generally make clear where the cyclist is to ride.

4.3.4 Driving

Fortunately for drivers, road agencies have codified and installed signage on most roads. This signage, along with international driver's licenses, makes operating motor vehicles around the world more convenient. A standard set of signs, symbols, and color is paramount when driving a 2+ ton vehicle at 60 mph.

Fig. 4.8 (**a**) Amsterdam, Netherlands (Photo: Michael King); (**b**) Barcelona, Spain (Photo: Evan Corey)

Legibility of the street network—including spacing of signage, clarity of the road network, and context of the roadside—was discussed in preceding sections. It is important to remain cognizant of these concepts in the face on multiplying signs, such as street name, directional, regulatory, and warning signs. In fact, the *Manual on Uniform Traffic Control Devices* (MUTCD), the federal roadway sign manual for the United States, reminds practitioners that

> Regulatory and warning signs should be used conservatively because these signs, if used to excess, tend to lose their effectiveness. (Federal Highway Administration 2012, p. 27)

Communities would do well to take this advice to heart. It would not only reduce sign clutter, but also encourage an examination of the use of signs as the sole wayfinding device.

Figure 4.9 provides two examples of information for drivers effectively communicated. The parking spaces in Bogotá, Colombia (Fig. 4.9a), have been closed off—replaced with planters and guarded by curbs. The parking space in Doha, Qatar (Fig. 4.9b), is reserved for cars of families with children.

4.4 Conclusion

This chapter emphasizes the importance of good design to wayfinding. It focuses on two themes: legibility and continuity. It describes a number of techniques, from size of city block to color of bike lane, that ease navigation while on foot, on a bike, or in a car. It discusses how "inputs" (signs, markings, corners, reference points, stencils) need to occur consistently and at regular intervals to maintain meaning. The underlying theme is: wayfinding is enhanced when a city is properly designed, in much the same way that buildings are enhanced with well-located front doors.

The reader might ask: OK, but how do I help improve navigation in all the areas of the world that are already built? Fair point. The reply, in our humble opinion, is that more can be done to understand a community's organization and build on it. Map where and how people actually walk, i.e. desire lines. Explain that when people see their destination, they tend to go straight to it. Add markers to the existing landscape and be consistent in their application. Use logical street names. Maintain view corridors and views of important landmarks. Do this and the need for signage will be minimized.

Who are the players in improving a community's wayfinding? City planners, landscape architects and urban designers can locate buildings such that their entrances are obvious and respect the street grid. They can sculpt skylines to create reference points. They can co-locate density and high-occupancy transit so that people do not have to walk ages to the train. They can respect pedestrian paths across parks and between buildings.

As discussed further in Chap. 12, transportation planners, designers, and engineers can ensure that the streets are consistently designed and signed. They can provide safe crossing facilities where trails and side streets cross main roads.

Fig. 4.9 (**a**) Bogotá, Colombia (Photo: Michael King); (**b**) Doha, Qatar (Photo: Elise de Jong)

They can make sure that bike routes do not suddenly stop mid-block. They can incorporate trails and paths into the circulation network. All in all, transportation professionals make innumerable decisions affect wayfinding. Ideally, those decisions would be made in close concert with other practitioners involved as well as with citizens.

Community and economic developers can develop properties in extant communities, where wayfinding is already established. They can organize sub-divisions to cross-connect with other sub-divisions. They can ensure that their developments respect and complement the community fabric.

Collaboration is key.

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