Chapter 4
Representing Environment

Phil Thiel in his book, *People, paths, and purposes*, proposed that a scene can be understand in terms of three basic components:

1. Space, – a more-or-less discrete and delimited volume affording human occupation and movement
2. Place, – the further perceptual qualification of space to achieve an identity as a particular behavioral setting
3. Occasion, due to the presence and activity of people in the place (Thiel, 1997)

Referring to Thiel’s notion of basic components in environment, our simulated environment consists of **Block**, **Cheese**, and **Mouse**. While a ‘block’ is used mainly to establish the space, ‘cheese’ is used to qualify the place, and ‘mouse’ conditions the characteristics of occasions.

Previous chapter explains how the objects in simulation system relate to one another. This chapter we describe the first two elements of the simulation, block and cheese, and we will extend the description of the significant third element, an agent mouse representing pedestrian behaviors, to the next chapter.
Block

Blocks, in this context, represent geometry in space. The arrangement of blocks defines the configuration of space that affects individual movement in many different ways. Each block has an identity according to its character and other attributes such as location and size. We characterize each block as to how it interacts with the other agents. As in the diagram shown in Figure 4.3, the three parameters of a block describe whether the block will – (a) allow an agent passing through, (b) allow an agent seeing through, and (c) allow an agent to rest on it. We can also define a block's character as a combination of their parameters. For example, here are several common elements found in urban space and their description in terms of these parameters:

1) Block: Wall, It does not allow an agent to see through, pass through, and rest on. Therefore, this block indicates an obstacle in space and can only interact with an agent at the reactive level of behavior; when an agent perceives it at range, it must perform the action "obstacle avoidance". This block can be a high wall or a building (without entry) in the urban environment.

2) Block: Green, allows an agent to see through, pass through and rest on it. The character of a "green" block expresses a quality that corresponds to the state, relax, of the agent because it allows a relaxing agent to sit on it. But for other agents that are not in a rush and do not want to rest may avoid passing through it as if it is an obstacle. This can be viewed as an outdoor café, step plaza, or grass area.

3) Block: Light traffic, we can think of a small street with no cars that we can actually pass through but people will feel not comfortable to rest on. This block works as a secondary pathway that, at some certain level, does not encourage an agent to pass through.

4) Block: Flowerbed, only allows an agent to see through. This element may indicate a height low enough to see through, but high enough to prevent sitting, or some quality or texture that an agent cannot walk through.

5) Block: Seat, This block also indicates the height influence for sitting such as the edge around the plaza or a fixed bench.

We have built only two characters of block, an obstacle block and a green block, presented in the simulation to display how space configuration impacts on the local movement of individuals. The others, however, are logical extensions of our simulation and could easily be built.
Figure 4.3: Diagram shows blocks representing different geometry in urban space. (photographs of urban spaces from the book “Public Spaces Public Life” by Jan Gehl, 1996)
Cheese

Cheese represents an attraction in space (Figure 4.4). It has more to do with the quality of space. It is movable, changeable, and more flexible than a block, and the size of cheese is not significant. In urban environment, attractions can range from more physical elements, like sitting spaces, food, trees, water, to climatic elements such as sun and wind. We characterize attraction or cheese space into 3 groups:

1) Something that looks good and enhances visual perception such as planting, flowers, a small sculpture, small fountain,
2) Something that tastes good such as food, coffee, and
3) Something fun and entertaining.

The combination of these three characters can also create a different effect such as something that looks good and is also fun to play with (Figure 4.4 (4)). We can have a combination of blocks and cheeses that makes the simulation much more complex and interesting.

In the present study, we assume that an individual interacts with other components because of the agreement of external perception and internal state. Each agent has two internal states, hunger and relax, and the need for relaxation can be fulfilled with the green space, so we need external stimuli that can satisfy the need for hunger, i.e., food. In the simulation, we therefore have the cheese that tastes good.

Other than the three basic components of environment, we also consider 'gate' as a sub-component of the space because it gives ways for those agent mice to enter the environment.
Figure 4.4: Diagram shows cheese representing attractive elements in urban space. (photographs of urban spaces from the book “Public Spaces Public Life” by Jan Gehl, 1996)
Gates

We defined ‘gates’ as parts of the edge of the scene (simulated environment) which is not occupied by any block. In a real environment a gate simultaneously engages form and boundary and, eventhough it might not be an actual entrance, it suggests the beginning of another space. The locations and proportions of gates (both origin and destination) are important to how people use spaces. If people do not see a space, they will not use it (Whyte, 1980). The gates can make urban spaces be inviting and easily accessible and thus encourage people and activities to move to the environment (Gehl, 1996).

In our simulation, agents are only allowed to enter and exit the space through the gates defined at the edge of the space (Figure 4.5). Although, we realize, in the real urban environment pedestrians not only come to the space from outside but they also get into the buildings or come out from transportation nodes within the site and they, certainly, have an impact on the global movement. However, we do not consider questions about route choices such as which way an individual prefers to use from one fixed origin to any destination. We pay more attention to how local interaction among all components of the system creates a complex environment. In the simulations, each agent approaches the environment when they see the gate. They enter and leave the space (to another space) at any point along the edges that is not obstructed by an object. A gate plays a role of a final goal for a purposive walker and, possibly, a motivated goal for any rush walker.

Figure 4.5: Gates defined at the edge of space (shown in the orange lines)

The next chapter presents the most important component in our simulation, the agent mouse, describing its structure and behaviors. We then convert the behaviors into a computational form ready to be modeled.