Chapter 5

"Virtual worlds aren't pictures, they're places. You don't observe them, you experience them"

-D. Steward 1991 [5]

Drought in Africa

In this chapter the design, authoring and simulation of a virtual laboratory developed with the iTiles Ecosystem Virtual Laboratory application is presented. This virtual laboratory is titled 'Drought in Africa', and is aimed at teaching young learners the ecological occurrence of drought. Firstly the lesson objects of the virtual laboratory are highlighted, followed by a description of the authoring of the iTiles world. Next the behaviour specified for the iTiles world is discussed, followed by the simulation of the iTiles world.

5.1 Identifying lesson objectives

The *Drought in Africa* virtual laboratory aims at teaching young learners the environmental effects of drought in an African savannah. By using this virtual laboratory, young learners should understand the following ecological occurrences:

- Scarce food and water supply in times of drought.
- Thirst of animals.
- Fragile terrain.
- Depletion of resources such as a water source and plant life.
- Plant life affected by overgrazing and over-browsing.
- The desertification of a geographical region as a resultant of drought.

5.2 Authoring

After taking into account the requirements and lesson objectives of the virtual laboratory, the iTiles Workbench tool is used for authoring of the iTiles world. The focus here is the layout of the base terrain and world objects that are added to the authored iTiles world.

In tile authoring mode, the base terrain of the iTiles world is authored to look like an arid African savannah during a harsh drought. See Figure 47 below, where the majority of the base terrain is sand, and contains areas with a scarce supply of water, with patches of grass near the water.

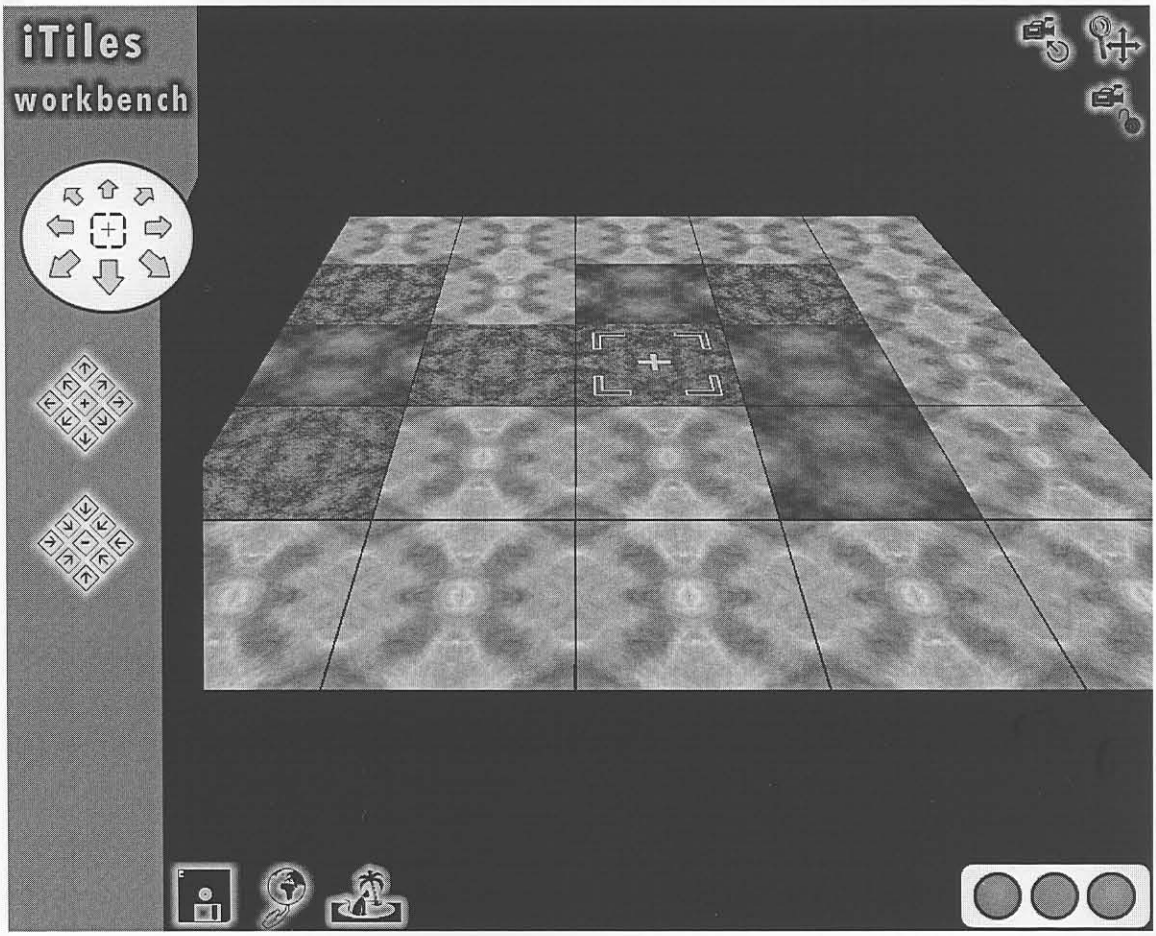

Figure 47. Authoring the base terrain to look like an arid African savannah

In world object authoring mode, the base terrain is thereafter populated with world objects (see Figure 48). The world objects added are:

- A herd of elephants (classified as dynamic world objects), which have been scaled to different sizes to depict ages such as young calves, adult cows and bulls.
- A few broad trees (classified as static world objects), to serve as food for the elephants.

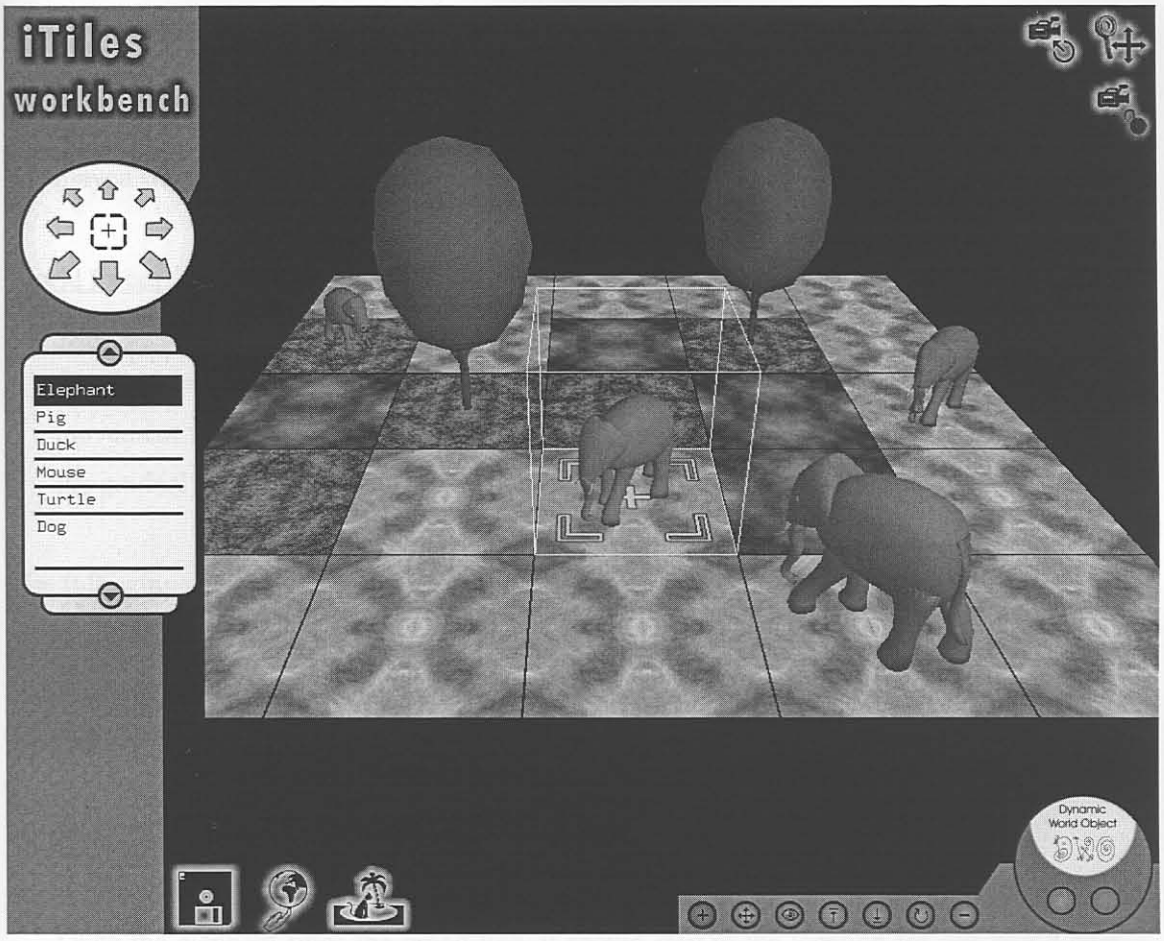

Figure 48. Populating the African savannah with elephants and trees

5.3 Specifying behaviour

Using the iTiles World Flow tool, the behaviour of the world objects and environmental changes that should occur in the simulation of the authored iTiles world are specified. Adding world transformations and world forces to the iTiles world helps establish the lesson objectives. A description of the world transformations and world forces added is presented next, followed by a summary at the end of this section for a clearer understanding thereof.

World transformations

The following tile transformations are added:

- *Grass to sand.* A grass tile element should transform to a sand tile element gradually. The 'magic' sound clip should be played when the transformation occurs (transformation sound).
- *Water to sand.* A water tile element should transform to a sand tile element gradually. The 'water splashing' sound clip should be played when the transformation meter is triggered (meter alteration sound). The 'magic' sound clip should be played when the transformation occurs (transformation sound).

The following world object transformations are added:

- *Broad tree scale smaller immediately*. A broad tree should transform in scale, and should scale smaller by 10% of it's current scale immediately. The 'magic' sound clip should be played when the transformation occurs (transformation sound).

World forces

The following movement forces are added:

- *Elephant grass movement force*. When an elephant moves on the grass tile element, this movement force's action should trigger the 'grass to sand' transformation, and increase the gradual transformation meter by 10% with each trigger.

The following positive forces are added, indicating to which world components an elephant is attracted:

- *Another elephant*. This is a constant positive force seeking type with a force strength of 50%. When the other elephant is found, the elephant will do nothing (found action). The 'elephant trumpet' sound clip should be played when this elephant finds another elephant (found sound).
- *A broad tree*. This is a constant positive force seeking type with a force strength of 50%. Once the elephant finds the broad tree, it should stay in the location for one world beat (found action). This positive force's action should trigger the broad tree's transformation of scaling smaller by 10% immediately to occur.
- *Water tile edge*. This is an incremental positive force seeking type, with an initial force strength of 10% which increases by 10% every 2 world beats, and resets to a force strength of 40% once the water tile edge is found. Once the water tile edge is found, the elephant will remain in the location for two world beats (found action). This positive force's action should trigger the water tile element's 'water to sand' transformation to occur and increase this gradual transformation meter by 20%.

Summary

The world transformations and world forces described above can be summarised as follows: The elephants drink from the scarce supply of water, and it dries out to sand, indicating the drought as the water source gets depleted. The elephants also walk on the fragile grass and it erodes to sand, indicating the fragile terrain. In times of drought elephants eat the leaves and bark of a tree to absorb the moisture. With the broad tree getting smaller, this depicts that this resource is being depleted. Also, when elephants come in close contact they trumpet, indicating communication.

5.4 Simulation

The iTiles Virtual World tool presents a simulation of the authored iTiles world. Figure 49 presents the simulation of the iTiles world at the start of the simulation. With simulation time as a factor, the environment is slowly transformed in time. Scenes at various time intervals in the simulation of the Drought in Africa virtual laboratory are presented in Figure 50. In time the iTiles world is eventually transformed to sand and the food supply gets scarce, indicating the desertification process. Figure 51 shows thirsty elephants drinking the last bit of water.

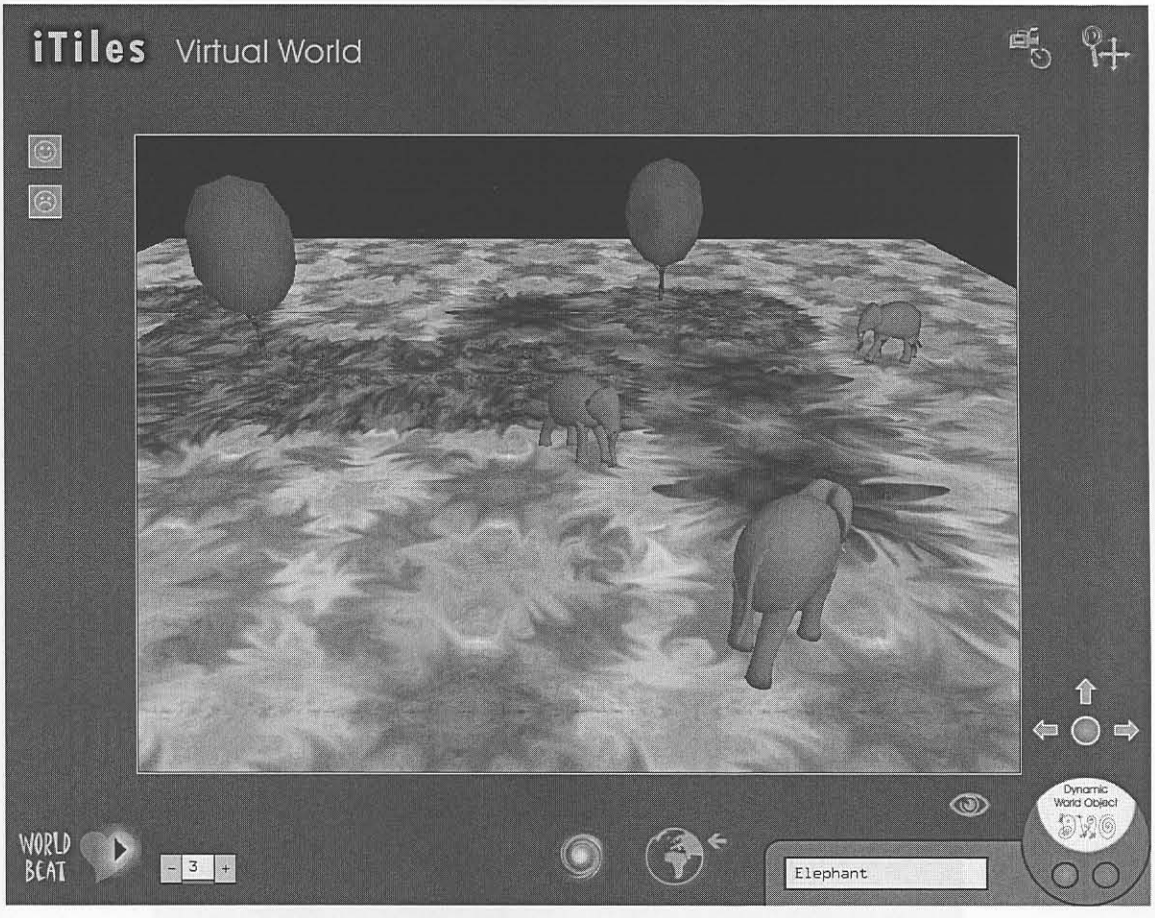

Figure 49. The iTiles world at the start of the simulation

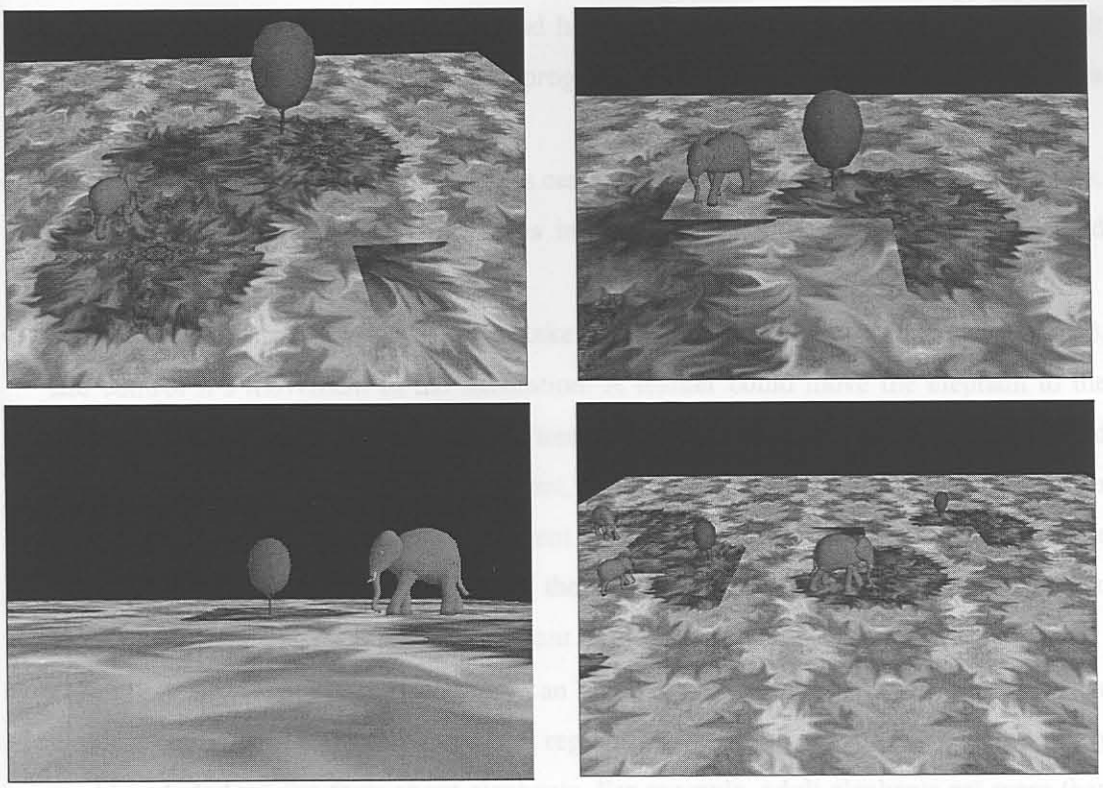

Figure 50. Scenes from the simulation of the Drought in Africa world

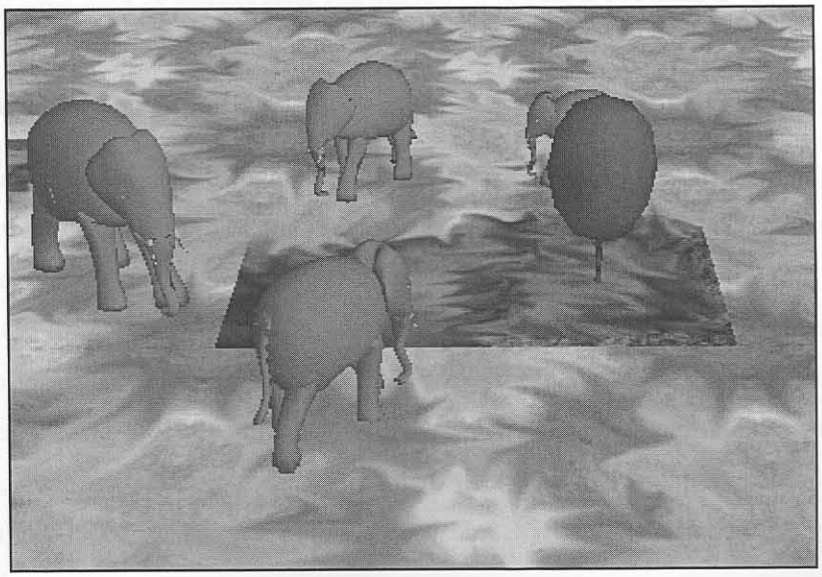

Figure 51. Thirsty elephants drinking the last bit of water

The following pedagogies can be addressed when teaching young learners with the Drought in Africa virtual laboratory:

- *Observation*. By observing the simulation, learners will understand the harshness of drought. The lesson objectives in terms of the ecological occurrences that young learners

should understand are achieved through observation of the simulation. The behaviour of the elephants will depict their thirst, and how the environment is transformed by their actions. Learners will also experience progression of time and the desertification of a region.

- *Mathematics and classification*. Learners can be tasked to count the number of elephants. They too can understand the differences in sizes of elephants, depicting their age and gender.
- *Interaction*. A learner can be tasked to take on the role of an elephant (virtual identity), and control it's movement in the simulation. A learner could move the elephant to the waters edge to cause it to drink, or to a tree to browse leaves and bark. A learner could also move that elephant to another elephant, and both elephants would trumpet. A learner could also be tasked to experience different views of the world. When taking on the role of an elephant, a learner can experience the world as an observer from the third person view, or from the perspective of an elephant in the first person view.
- *Offline activity*. This virtual laboratory can be linked to another curricula activity where children learn about elephants and desert regions. An example of such a curricula activity could include learning facts about elephants. For example, adult elephants eat more than 200kg per day of vegetation. Elephant conservation efforts can also be addressed. For example, during a severe drought in the 1970's, 7000 elephants of Tsavo East National Park in Kenya died of hunger after consuming all the trees and bushes [51].

5.5 Summary

This chapter presented the Drought in Africa virtual laboratory as an example of a virtual laboratory produced with the iTiles Ecosystem Virtual Laboratory. This virtual laboratory aims at teaching young learners about the environmental effects of drought. The chapter described how the iTiles Workbench was used for authoring the iTiles world and how the behaviour of that iTiles world was specified using the iTiles World Flow tool. Lastly the iTiles Virtual World tool illustrated how this virtual laboratory can address pedagogies in observation, mathematics and classification and offline activities. Other examples of virtual laboratories produced using the iTiles Ecosystem Virtual Laboratory are presented in Appendix C.