The garden of virtual delights: Virtual fauna for a botanical garden

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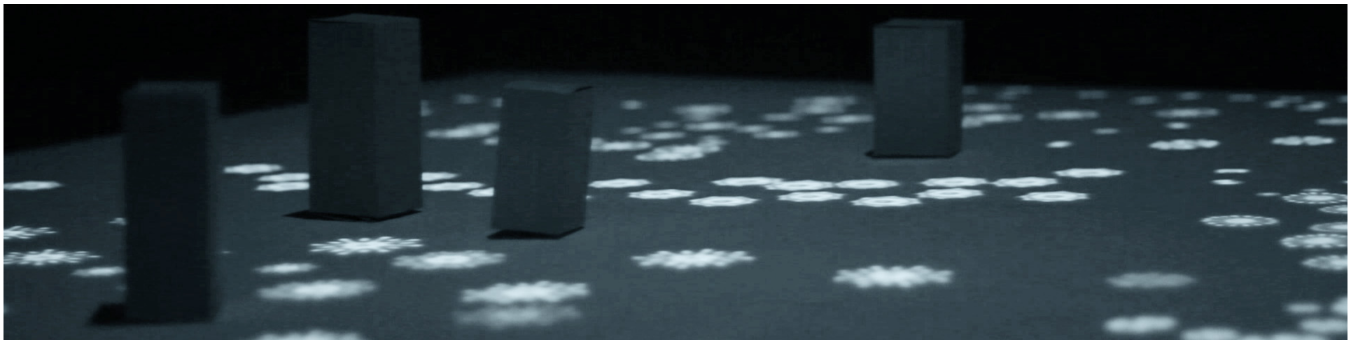

Figure 1 *Working prototype of the installation. The cardboard blocks represent people.*

1 Introduction

We describe *The garden of virtual delights*, an interactive installation developed for the botanical garden of Coimbra, with the goal of attracting visitors and promoting the visibility of the garden. The installation builds and simulates an artificial ecosystem, where visitors become part of this ecosystem, interacting effortlessly and seamlessly with the artificial organisms. The name of the installation is a reference to Hieronymus Bosch's masterwork "The Garden of Earthly Delights", where a swarm of birds can be seen in the upper left corner.

The ecosystem is composed of several species, which constitute a food chain. Each species is characterized by its physiological and behavioral features — appearance, dimension, energy, life span, speed, stamina, reproduction and predatory behavior. The organisms are influenced by the presence and movement of the visitors, which become part of the ecosystem and top of the food chain.

2 Implementation and behavior

The ecosystem is implemented through a particle system where each species is represented by a swarm [Reynolds, 1987] and where each particle is an organism. The behavior of each organism is determined by its local view of the environment. Like in the work of Reynolds [1987] intra-species behavior follows the rules of: separation, steering away from close organisms; cohesion, steer towards the center of the organisms in their vicinity; alignment, steer towards the average heading of the agents in the vicinity (figure 2). Inter-species behavior is attained as follows: predators steer towards preys in their vicinity, i.e. the cohesion and alignment rules are applied; preys, steer away from predators, i.e. separation rules are applied. By adjusting the weights and vicinity's radius of intra and inter species rules we are able to convincingly simulate the desired predator-prey behavior.

The physiological and behavioral characteristics of each organism depend on its species but also change through time. The energy level determines the dimension of the organism, the probability of reproduction, and its stamina, which influences its ability to hunt prey and flee from predators. The age of an organism determines its maximum velocity, probability of reproduction and of death by aging. When an organism dies its body remains in the ecosystem for a given period of time, providing food for scavengers. If it died at the hands of a predator, the predator gains half of its energy, and the other half becomes available for scavengers. If it died due to age, its entire energy becomes available.

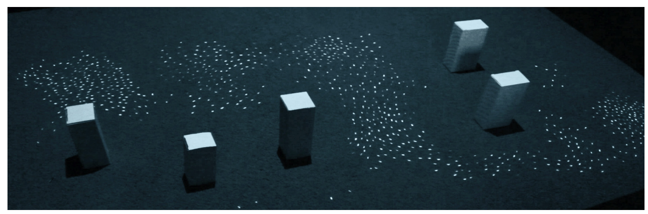

Figure 2 *Swarming behavior of the organisms.*

The detection of people is performed in real time using Microsoft Kinect, employing a tracking mechanism that allows the analysis of the movement of each volume individually. Speed determines the area of repulsion of each volume (see figure 3). As such, sudden movements are perceived as threats, making the organisms flee away. Gentle and subtle movements promote trust and curiosity, triggering the interest of the organisms by such visitors, and making them steer towards them. This encourages a contemplative attitude that fits the nature of the space.

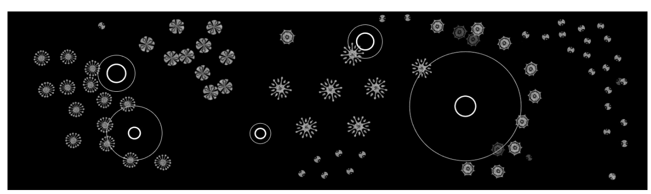

Figure 3 *Snapshot of the application that controls the installation. Two circles are drawn for each detected volume. The inner circle represents the area of the volume, the outer circle represents the repulsion area.*

Acknowledgments

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References

REYNOLDS, C., 1987. Flocks, herds and schools: A distributed behavioral model. In *Computer graphics and interactive techniques (SIGGRAPH '87 Proceedings of the 14th annual conference)*, ACM, 25-34.

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