

"Menagerie": Technical Notes

The paths of both the legged and the flying animals are constrained by a flocking and herding algorithm. This algorithm insures that animals do not collide with each other or the virtual coordinates of the user. It also controls the goals and behaviors of the animals by demarcating their patterns of influence during each event.

The flocking and herding algorithm employs vector force fields as a means of "interaction at a distance". Vector field attributes include its 3D shape, strength, "charge" (attractive vs. repulsive) and decay (how strength falls off with distance). Force fields are attached to every 3D element in Menagerie, the animals, the doors and the user, resulting in a behavioral "n-body problem": all animals maintain a degree of autonomy as they adaptively alter their behavior and direction of movement in response to the vector fields of each of the other animals. Their precise movements are unpredictable since they depend on the constantly shifting circumstances of interaction between each of the animals, the appearance are attractive or repellent elements, such as doors or portholes, and the force field of the user. The 'avoidance/approach' gradient surrounding the location of the user may be tuned by attaching multiple fields that combine to be attractive at a distance, but repellent up close.

The motion of the individual animals is modeled with algorithms that simulate the physical qualities of movement. Many of the techniques employed are inspired by the robotics field. Legged animals respond to simulated gravity as they walk and run in various gaits. They are able to spontaneously plan footholds on the ground so that they appear to be dynamically balanced. Gait shifting algorithms were developed that minimize the dynamic perturbation of the body as legs undergo a phase shift during the gait transition period. Birds and other flying creatures accelerate when flapping their wings and bank realistically into turns.

Sound Simulation

Auditory sounds were spatialized in 3D using Crystal River Engineering's beachtron boards. The boards are able to simulate the placement of sound about the user's head location in the three dimensional virtual space. Software was written by Mark Trayle to attach sounds to the doors and animals appearing in the virtual space. Sounds were stochastically triggered within predetermined tonal ranges using predesigned sets of scales and timbres associated with different animals and events.

Fake Space "Boom"

The BOOM (Binocular Omni-Oriented Monitor) is a counterbalanced stereoscopic viewing device utilizing high resolution CRT displays. Optical encoder technology provides lag free tracking and eliminates noise problems associated with magnetic trackers. Menagerie employed a monochrome BOOM, although full color rgb BOOMs are now available.