

# Flora Electronica: A Media Performance Space Across the Physical and Virtual Worlds

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## Physical/digital media spaces

Virtual spaces have long been projected into, evoked by and intertwined throughout our physical environment. Wall paintings provide windows onto alternate realities; statues capture imaginary scenes at particular moments in time; theatrical plays recreate fictional scenes on constructed sets. Cyberspace is a newer kind of virtual world, where human imagination can exercise its creative and artistic capabilities. And while digital interactions today remain dominated by a limited set of interaction portals (desktop PCs, mobile devices), emerging sensor technologies integrated into physical spaces/artifacts provide opportunities for our physical lives to feed into computationally-mediated virtual worlds, which in turn can feed back into our surrounding environment.

Flora Electronica is a collaborative artwork created by artists and researchers during a course in tangible media arts. This playful artificial/computational garden is a stage where spontaneous media performances unfold, manifested across both the physical and virtual worlds. The emotional tone of the space is set by the real-time perceptions/interactions of a participating audience, both local and remote.

## Media arts and technology in education

Technical research and innovation can create new opportunities for artistic expressions and experiences. At the same time, emerging ideas and trends in arts and culture can help to steer the development of emerging technologies in directions that can be of general benefit

to society. The past decade has witnessed a rapid growth in areas of research such as tangible and ubiquitous computing. Underlying these trends is an increasing interest in how emerging technologies can be used to support stronger connections between the physical and digital worlds. These research interests are also affected and reflected by evolving trends in media arts, which are increasingly incorporating practices that bridge artistic expression with tangible interaction technologies.

The creation of tangible technology-based art works is an inherently interdisciplinary practice, spanning across a potentially large number of skill-areas, such as visual arts, design, architecture, engineering and computer science. As such, successful tangible media arts projects require collaboration by individuals from these and other disciplines and/or participation of individuals who are themselves well-versed in multiple disciplines at once.

The Experimental Media course in the Digital Media program at Georgia Tech enables students to develop the critical, intellectual and creative tools necessary to understand and work at the developmental stages of emerging technologies. The course focuses on physical computing and the construction of hybrid physical/digital spaces through the design and creation of large-scale tangible media artworks. It attracts students from a broad range of backgrounds, ranging across computer science, engineering, arts, design and architecture.

In spring 2007, the Experimental Media course focused on the development of a hybrid physical/digital performance space called Flora Electronica, created for a public exhibition at the end of the semester. Students

in a user interfaces class at New York University collaborated with Georgia Tech to create web interfaces allowing remote audience interaction with the piece.

## Flora electronica: design and implementation

The inhabitants of the artificial garden are reactive plants equipped with sensors and actuators, which invite visitor interaction and enact captivating robo-media performances. The plants are clustered into three groups with different personalities: sociable, shy and curious. They respond to visitors through light, sound and movement, influencing the overall emotional tone of the space. Through data capture, the garden maintains an online presence in applet-based web interfaces. In addition to providing a virtual representation of the activity in the garden, these connected spaces allow remote visitors to influence the physical garden from afar. When visitors (both local and remote) coordinate their interactions with the plants, the responses of the individual clusters intensify, ultimately resulting in a synergy of movement, sound and light that is displayed both physically and virtually.

The physical elements of Flora Electronica consist of three large circular mounds, each with a scrim overhead and containing the clusters of plants. Software was developed to drive audience interactions with the piece, and web applets enable the participation of remote audiences. The components of the piece are:

- **Mounds:** Each is four feet in diameter and contains three clusters of three plants. The mounds have different personality types that determine how their plants react to nearby visitors: sociable, shy or curious. Motion tracking sensors and microphones allow the plants to respond to visitors nearby. Speakers inside the mound provide audio for the piece: a low ambient soundtrack when activity around the mound is low, and increasingly loud/complex sounds themed according to mound personality as the activity level increases. When the activity level

around all three mounds is high, their audio tracks synchronize across the space, providing a climax for the piece.

- **Plants:** Each plant consists of a long white stem and a fiber optic head, illuminated by a bi-color LED. Groups of three plants are arranged on an acrylic disc, mounted on a moving arm, driven by three servo motors to provide orientation and height. The plants grow, turn and glow in response to the movements and voices of the visitors who approach them, and also in response to remote events from visitors in the networked spaces.
- **Scrim:** Each scrim is supported by a pole in the center of its corresponding mound and acts as an overhead shelter for the piece, providing a sense of spatial completeness. The scrim is made from translucent white fabric that allows colored light to shine through from two RGB LED lamps placed mid-way up the pole. The lighting for each mound is designed to reflect its personality type, and changes with the level of plant activity.
- **Software:** A server-side application acts as a networked “brain” for the garden, and manages data communication between the physical and virtual garden spaces. A client program in Java runs on a PC inside each mound, and communicates sensor data to/from the server in XML form.
- **Web Interfaces:** Data is also transmitted back and forth from remotely connected interfaces, which are realized as Java-based web applets. These applets are designed to be virtual garden spaces that visually reflect the physical garden and allow users to engage in remote interactions with the physical plants.

## Gallery exhibition

The public exhibition of Flora Electronica took place in April 2007, at the Eyedrum gallery in Atlanta, GA, during the Listening Machines show. A second



**Flora Electronica at the Listening Machines show, Eyedrum Gallery, Atlanta, GA, April 2007.**

exhibition was held on the Georgia Tech campus, during the spring Digital Media Showcase, in May 2007. The first event was open to the public and around 150 people visited the exhibition over the course of four hours. The second event was by invitation and the attendance was roughly half that of the first. Both events were a great success for piece. They succeeded in engaging visitors and maintaining a harmony between the physical response of the plants, and the overall visual aesthetics

of the performance. We were pleased to see that visitors established a connection with the plants over time, often choosing one cluster as their favorite based on its perceived personality. Given the time-restricted duration of the exhibitions, we feel we were not able to fully capture the potential of a remotely participating audience, and hope to further explore these possibilities in our future works.