

## Frequently Asked Questions Critique on Biosphera project

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### 1. *What are you doing in the Biosphera project?*

A. We are trying to build a micro world for children to have a hands-on experience of Life science education. We are interested in putting them in control of an enclosed ecosystem, in which they can change environmental factors and observe the results on living plants.

### 2. *Why?*

A. Because a lot of different research shows that children make a lot of mistakes in learning Biology concepts like growth, life cycles, species relation, etc. We are not against the pedagogical value of the “mistake”, but we strongly believe that this field is missing a constructionist arena in which children can make playful experimentations and test their beliefs. We want to build this arena, through our micro world.

### 3. *What is your theoretical approach to this problem? What do you mean by “constructionist?”*

A. We start from Seymour Papert’s work. We are trying to build an environment in which it is possible to learn by doing, in which everybody can learn with their own modality regardless of their culture, gender, religion, economic class, and in which everybody can “construct” his own knowledge regardless of personal differences.

### 4. *What is your technical approach to this problem?*

A. We built a polycarbonate dome that works as a greenhouse, with more control functionality. In this “bubble”, in fact, it is possible to change the temperature, the humidity and the level of light. There is a rack of sensors that constantly monitor the environment, and there is a set of subsystems for modifying specific environmental parameters. As the counterpart of the physical interface, a virtual interface displays the invisible forces and quantities inside the dome and also works as a command center for the environmental subsystems.

### 5. *Why would using this system make a difference?*

A. This approach solves most of the problems faced using the traditional approach to Life science education.

6. *What is the traditional approach?*

A. Planting a seed and waiting until it germinates, grows, reproduces and dies, eventually changing the environmental conditions on two different sets of plants. Unfortunately, this simple method presents a lot of problems - like the amount of time required for the plant to grow. It is also impossible to go back in time once a certain action is carried out, or to visualize invisible quantities such as oxygen production or pollen.

7. *How does your approach solve these problems?*

A. The virtual interface solves most of the problems because we are able to simulate a virtual alter ego of the plants inside the Biosphera. This alter ego can display the growth in real time. It can also display different futures of the plant for different environments, based on the user's choices. . Some animation can display quantitative information coming out of the physical world such as oxygen production.

8. *So, what's the point of having a physical counterpart?*

A. The physical plant is a statement that we are not just creating a simulation, we are experimenting. The child, the user, is like a researcher; building his own knowledge and touching with his own hands the effects of good or bad choices. Having the distinction between real and virtual encourages the user to try out his ideas and to test before applying them to the real world.

9. *How does the virtual side interact with the physical side?*

A. The software interface records the interaction of the user with the system and tracks his choices and settings. The time-lapse algorithm spreads these choices over a longer period of time, trying to adapt the environment to follow the interaction. It is as if the user can follow multiple dimensions of the same reality. Some of these dimensions can actually cross and reach the same result, while others always remain distinct and only survive inside the simulation.

10. *Are there any other approaches to this problem?*

A. So far, I am only aware of simulation environments.

11. *What is your approach lacking?*

A. We are still using a growth algorithm to simulate the plant growth. We are trying to design a self-redefining algorithm that would be able

to redefine itself using the data from the physical interface. This is the dichotomy between the physical and the virtual. Our utopia is to build a tangible interface able to solve these problems off the computer screen.