Eco pods: tangible User interfaces for early learning of Systems thinking

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ABSTRACT
I propose to present a demo of "Eco Pods," a tangible user interface (TUI) game to teach children "systems thinking."

Categories and Subject Descriptors
[**C. Computer Systems Organization]**: GENERAL – *Hardware/software interfaces.* [K.3.1 Computer Uses in Education**]**: *Computer-assisted instruction.* [**H.5.2 User Interfaces]**: *Input devices and strategies, Prototyping.*

Keywords
Systems thinking, tangible-user-interfaces, video games, collaborative learning, playful learning environments

1. INTRODUCTION
"Tangible user interfaces" (TUIs) typically use manipulable objects, rather than keyboard and mouse, to interact with software operations. "Systems thinking" is a holistic way for looking at the world; to learn systems thinking at an early age offers children new perspectives on the world, and develops the cognitive skills needed to organize, represent and interpret how the world works.

TUIs have been successfully used to teach mathematical and logical thinking (Howden, 1986; Hartshorn, 1990). My research concerns its use to teach systems thinking.

2. Systems Description
I wish to demonstrate "Eco Pods," a TUI-controlled system which mimics the growth of a flower. There are four "pods," each of which can be held in the hand, representing (respectively) wind, rain, the sun's heat, and the sun's light. Each can be manipulated with a movement characteristic of the natural element it represents: waving the wind pod violently, for instance, activates an internal windmill.

A group of children are encouraged, as a game, to physically enact the role of the elements whose pod they hold. Their combined effect is shown on a computer screen as the gradual growth (or death) of a flower, accompanied by other monitoring graphics, in a simulated ecosystem. The game can be played both cooperatively and competitively.

Figure 1. Water Eco Pod

Watching how their actions affect both the flower and – equally important – the interaction between the natural elements, they learn about the interactive processes of nature. They also, by this bodily experience, begin to internalize core systems-thinking concepts, such as feedback loop, interconnectedness and change over time.

Figure 2. Screen based ecosystem

[1] Hartshorn, Robert - Boren, Sue, "Experiential Learning of Mathematics: *Using Manipulative", ERIC Digest.* 1990

[2] Howden, H. "The role of manipulatives in learning mathematics". Insights into Open Education, 19(1), 1-11. (1986)