HCII 12th Anniversary Celebration

Construction kits—toys for building or assembling physical models—have historically played a powerful educational role in children's lives. These kits—geometric design sets, erector sets, architectural blocks, anatomical models, chemical modeling kits, and so forth—permit children to design and build 3-D models and to learn through tactile experience. Traditional construction kits also have striking limitations: They offer little direct communication with users—for example, a traditional kit cannot offer advice about building a model, so opportunities for student reflection may be lost. Traditional constructions—i.e., the models produced—also tend to be aesthetically and behaviorally limited. Through embedded computation, kit pieces can communicate with each other, with desktop machines, and with their users. Overall, integrating construction kits with computation can greatly increase these kits' expressiveness and educational power.

Computational Construction Kits

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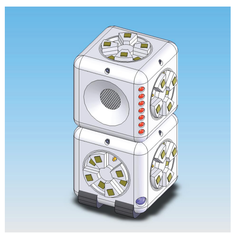
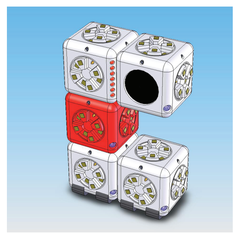
roBlocks

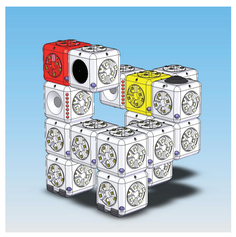
roBlocks are the basic modules of a computational construction kit created to scaffold learning of math, science and control theory concepts. By combining sensor, logic and actuator blocks, young kids can create simple reconfigurable robots that exhibit surprisingly complex behavior. roBlocks are self-describing, so they can provide helpful feedback to the user, and automatically adjust their functionality based on how they've been assembled.



A robot that drives toward light



A robot that yells at a bright light and turns away



A robot that drives toward a light source, makes noise when it's dark, and wags its tail when there's a light on and some body is touching it

The current roBlock design

Testing self-description

SENSOR BLOCKS

SOUND *LIGHT* *TOUCH* *MOTION* *DISTANCE*

ACTUATOR BLOCKS

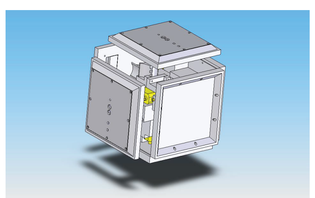
HINGE *BELT* *EXTENSION* *ROTATION* *SPEAKER*

LOGIC BLOCKS

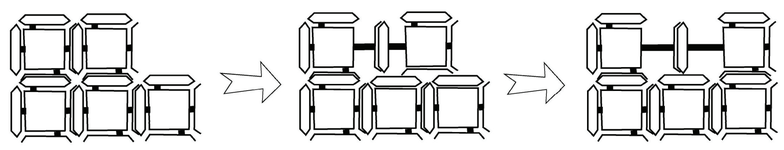
NOT *AND* *OR* *XOR* *NAND*

Espresso Blocks

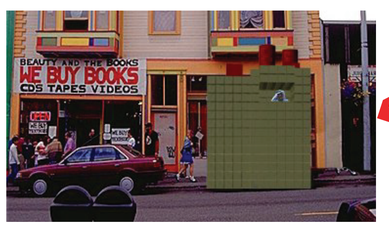
Espresso Blocks are robotic modules on the scale of a brick or concrete masonry unit that can work together to stack themselves to generate furnishings and structures. They support a new building typology, an architecture composed of machines that could reconfigure themselves throughout the day as desired. The reference implementation for this new technology is the live/work espresso stand, a structure composed of Espresso Blocks that configures itself into an espresso stand during the day and a bedroom at night.



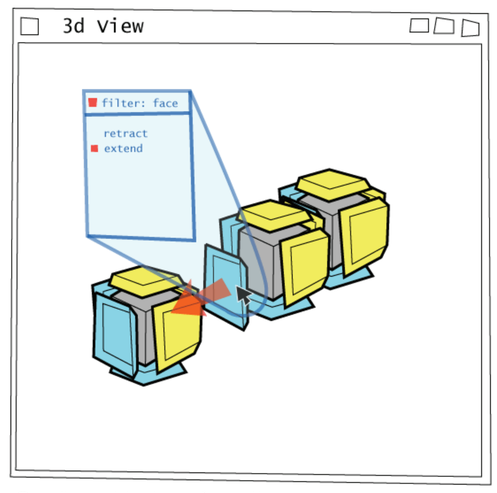
Espresso Block module



Block inchworm motion



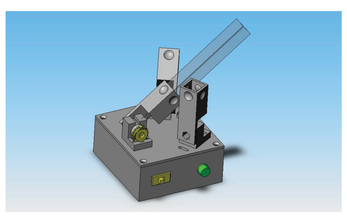
A live/work espresso stand



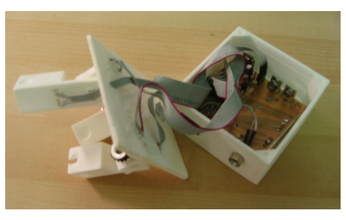
Creating a block configuration

Flexy

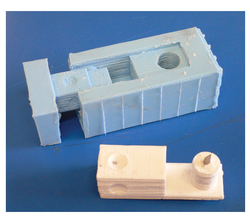
As children many of us played with construction kits such as wood blocks, Tinkertoys, Lego or Meccano. These kits allow us to create a 3D sketch of a physical form. By embedding electronics in construction kits we can enable a computer to respond to manipulations of the pieces. With a little imagination these 3D construction kit sketches can be mapped to a problem space to create a richer and more intuitive interaction than assigning meaning to mouse clicks and key combinations.



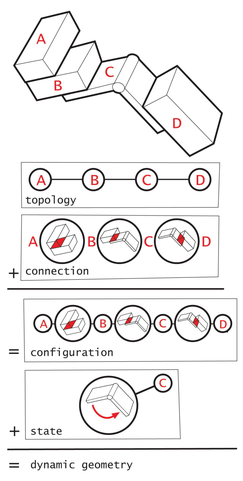
Flexy module

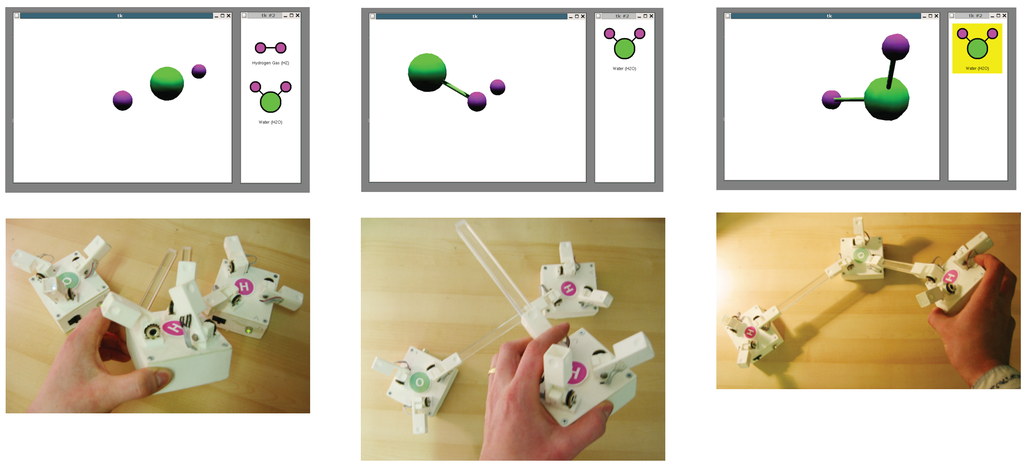


Module open to show circuit board



Socket and mold





Using Flexy to interact with the Molecule Explorer

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