THE WORLD NEEDS MORE COMPUTER SCIENCE!
WHAT TO DO?
Victor Winter, Department of Computer Science, University of Nebraska at Omaha
BRICKLAYER

- An API that enables the construction of computer programs whose execution produces LEGO artifacts.
- The output of a Bricklayer program is displayed using LEGO Digital Designer (LDD).
- Bricklayer provides an authentic introduction to the functional programming language SML.
TARGET AUDIENCE

- Bricklayer consists of a number of modules which contain functions for creating LEGO artifacts.
- Modules target audiences with different levels of sophistication.
- To date, Bricklayer programs have been written by students whose ages range from 8 on up.
VITRUVIA

- A web app complementing Bricklayer.
- Concepts
  - Demonstrations
  - Exercises
  - Tests (in development)
  - Bricklayer Assignments (where appropriate)
Vitruvia

Vitruvia is a web app that provides an introduction to a number of concepts used in Bricklayer.

Basics

<table>
<thead>
<tr>
<th>Concept 1: Cell Locations</th>
<th>This set of Vitruvia exercises develops an understanding of cell coordinates in the xz-plane. LDD permits the creation of three-dimensional structures in which the xz-plane corresponds to a (virtual) LEGO board.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concept 2: Boolean Functions</td>
<td>This set of Vitruvia exercises develop a basic understanding of Boolean functions whose inputs are cell coordinates.</td>
</tr>
</tbody>
</table>
| Concept 3: Basic Bricks   | This set of exercises develops an understanding of the specification and placement of basic LEGO bricks. A basic brick is defined by its shape (e.g., 2x4) and its color (e.g., RED). Basic bricks (all bricks for that matter) can be understood in terms of a composition of 1x1 bricks. For example, a 4x2 brick is the composition of eight 1x1 bricks having the proper configuration. By convention, Bricklayer assumes the position of a brick is defined by the cell coordinate of its lower left corner. In this context, an (informal) instruction is an English sentence specifying a brick dimension, type, and location. An example of an informal instruction is:  

*Put a 1x1 RED brick at location (0,0).*  

The Vitruvia exercises in Concept 3 establish a vocabulary for referencing basic LEGO bricks. |
| Concept 4: Brick Sequences | This set of Vitruvia exercises develops an understanding of the sequences of (informal) brick-placement instructions. Concept 4 is a direct extension of Concept 3 and focuses on the notion of instruction sequences. |
Concept 6 Exercise 2

Execute the following Level 1 program by placing tiles at the appropriate locations:

```plaintext
put2D_Zx2_RED(0,0);
put2D_Zx2_RED(2,2);
```

Display Co-ordinates: Off

- BLUE
- RED
- GRAY
- WHITE
- GREEN
- YELLOW
- EMPTY
APPRAOCH

- To date the most effective form of assignment is an Art Show.
- Students get to build anything they like.
- The LEGO artifacts created by students will be put on display for all students in the class to see.
Ages 8 on up

RESULTS
PROGRAMS WRITTEN BY 8 YEAR OLD CODERS
9-11 YEAR OLD CODERS
COLLEGE FRESHMEN WITHIN 3 WEEKS
COLLEGE FRESHMEN WITHIN 6 WEEKS
SOFTWARE AND CONTENT

- Freely available online:
  [http://faculty.ist.unomaha.edu/winter/Bricklayer/index.html](http://faculty.ist.unomaha.edu/winter/Bricklayer/index.html)

- Content and Assignments are under development and also available online.
The End