Research Directions in Block-Based Programming Languages

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Science Center Summer Research Seminar
Tuesday, June 1, 2010
Programming Language Issues

- Syntax = form of programs
- Semantics = meaning of programs
- Pragmatics = practical aspects of programs
Example: Absolute Value Function

Logo: to abs :n ifelse :n < 0 [output (0 - :n)] [output :n] end

Javascript: function abs (n) {if (n < 0) return -n; else return n;}

Java: public static int abs (int n) {if (n < 0) return -n; else return n;}

Python:
def abs(n):
    if n < 0:
        return -n
    else:
        return n

Scheme: (define abs (lambda (n) (if (< n 0) (- n) n)))

PostScript: /abs {dup 0 lt {0 swap sub} if} def
A Popular Block-Based Language: Scratch

http://scratch.mit.edu/
Another Block-Based Language: PicoBlocks
App Inventor For Android: Designer Window

![Designer Window](image)

- **Button**: A simple button
- **Canvas**: Surface for drawing graphics and manipulating sprites
- **Checkbox**: A checkbox
- **Image**: A picture
- **Label**: A piece of text
- **ListPicker**: Choose from a popup list of options. Note: The items designer property is now deprecated. Please use ElementsFromString.

**Viewer: Hello Kitty Shaker**

- **Design**
- **Preview**

*Pet the kitty!*
App Inventor For Android: Blocks Window

Block-based Programming Languages
Operator Precedence Example

PicoBlocks

Text (with parens)

10000 - (count * 200)

(10000 - count) * 200

AppInventor

PicoBlocks

Block-based Programming Languages
Absolute Value Function in PicoBlocks

**Definition (Text Mode)**

```plaintext
block abs :n
  ifelse :n < 0
    [output 0 - :n]
  [output :n]
end
```

**Invocation (Blocks Mode)**

```
print abs [-17]
```
Absolute Value Function in AppInventor

Definition

Invocation
Parameter Names in AppInventor
Parameter Names in AppInventor, Part 2
Some Problems with Blocks
Blocks $\leftrightarrow$ Text

block test1
  forever [ 
    if switch1?
      [toggle] 
  ]
end

block test2
  forever [ 
    waituntil not switch1?
    mwait 5 
    waituntil switch1?
    mwait 5
    toggle 
  ]
end
Goal: Tools for Constructing Blocks Languages

- JavaScriptBlocks
- PythonBlocks
- JavaBlocks
- etc.