Code.org curricula (Blockly-based)

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Code.org

Built with Blockly: a JavaScript library for visual languages

Code.org (and AppInventor.mit.edu)

Fine-grained activities within a CONSTRAINED environment

(initially less freedom … later full environment)

Initial language

NO local variables

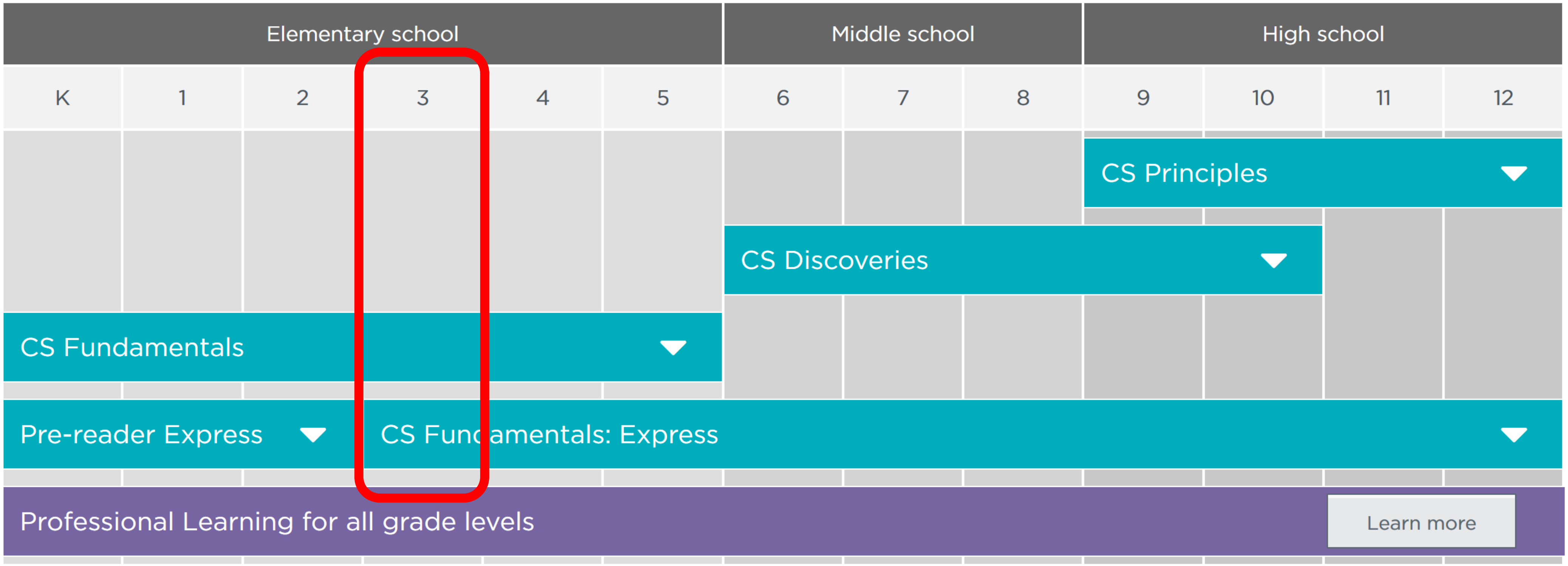
NO personal agent attributes

Procedures (NO return value)

Possibility of static data type enforcement

Puzzle-like connectors with different shapes: Actors, numbers, text, booleans

Complete curriculum from Elementary to High school (USA)



A course tailored to students of each year:

E.g. Course D for 3rd grade (K3): algorithms, nested loops, while loops, conditionals, and events. Beyond coding, students learn about digital citizenship.

Both "unplugged" and programming activities

Example: Course D for 3rd grade (K3 = 8-9 y old)

SEQUENCING

Lesson 1: Graph Paper Programming (*Unplugged*)

In this lesson, you will program your friend to draw pictures!

Lesson 2: Introduction to Online Puzzles **(Sequencing | Debugging | Loops | Angry Bird | Collector | Artist | Harvester)**

This lesson will give you practice in the skills you will need for this course.

Lesson 3: Relay Programming *(Unplugged | Relay Programming | Algorithms)*

Remember at the beginning of the course when you made drawings with code? In this lesson, you will be working with a team to do something very similar!

Lesson 4: Debugging with Laurel **(Debugging | Bug | Collector | Laurel)**

Have you ever run into problems while coding? In this lesson, you will learn about the secrets of debugging. Debugging is the process of finding and fixing problems in your code.

...continue Course D for 3rd grade (K3 = 8 y old)

EVENTS

Lesson 5: Events in Bounce **(Event | Bounce)**

Ever wish you could play video games in school? In this lesson, you will get to make your own!

Lesson 6: Build a Star Wars Game **(Events | Star Wars)**

Feel the force as you build your own Star Wars game in this lesson.

Lesson 7: Dance Party **(Timed Events | Music)**

Time to celebrate! You will program your own interactive dance party.

...continue Course D for 3rd grade (K3 = 8 y old)

LOOPS

Lesson 8: Loops in Ice Age (Loops | Scrat | Ice Age)

You'll use the repeat block to help Scrat reach the acorn as efficiently as possible.

Lesson 9: Drawing Shapes with Loops (Loops | Artist)

In this lesson, loops make it easy to make even cooler images with Artist!

Lesson 10: Nested Loops in Maze (Nested Loops | Loops | Bee | Maze)

Loops inside loops inside loops. What does this mean? This lesson will teach you what happens when you create a nested loop.

...continue Course D for 3rd grade (K3 = 8 y old)

CONDITIONALS

Lesson 11: Conditionals with Cards ***(Conditionals | Unplugged)***

It's time to play a game where you earn points only under certain conditions!

Lesson 12: If/Else with Bee **(Conditionals | Bee)**

It's time to program Bee to use them when collecting honey and nectar.

Lesson 13: While Loops in Farmer (While Loops | Loops | Farmer)

Loops are so useful in coding. New kind of loop: while loops!

Lesson 14: Until Loops in Maze (Until Loop | Maze | Angry Bird | Zombie)

You can do some amazing things when you use `until` loops!

Lesson 15: Harvesting with Conditionals (Conditional | Loop | Harvester)

It's not always clear when to use each conditional. Get practice deciding what to do.

...continue Course D for 3rd grade (K3 = 8 y old)

BINARY DATA

Lesson 16: Binary Images ***(Binary | Unplugged)***

Learn how computers store pictures using simple ideas like on and off.

Lesson 17: Binary Images with Artist **(Binary | Artist)**

In this lesson, you will learn how to make images using on and off

DIGITAL CITIZENSHIP

Lesson 18: Digital Citizenship ***(Common Sense Edu. | Unplugged)***

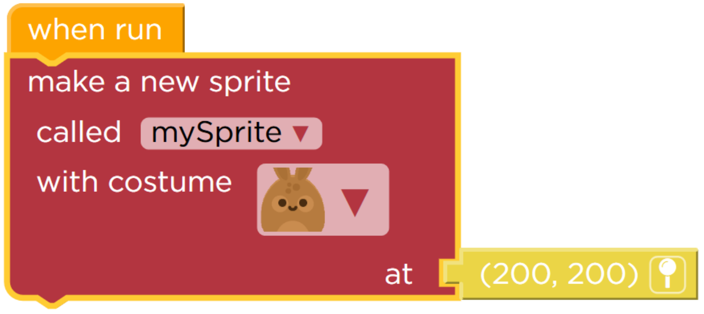
Some information is not safe to share online. This lesson will help you learn the difference between safe and private information.

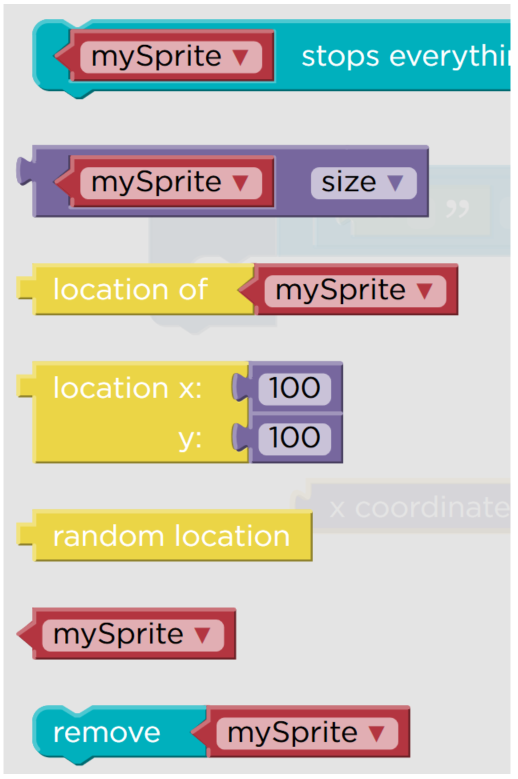
Lesson 19: End of Course Project **(Play Lab | Event)**

This capstone lesson takes students through the process of designing, developing, and showcasing their own projects!

Visual language
User interaction and common features

Visual choosers to simplify input: Sprite's "costumes", colours, angles, positions, sound/music, …



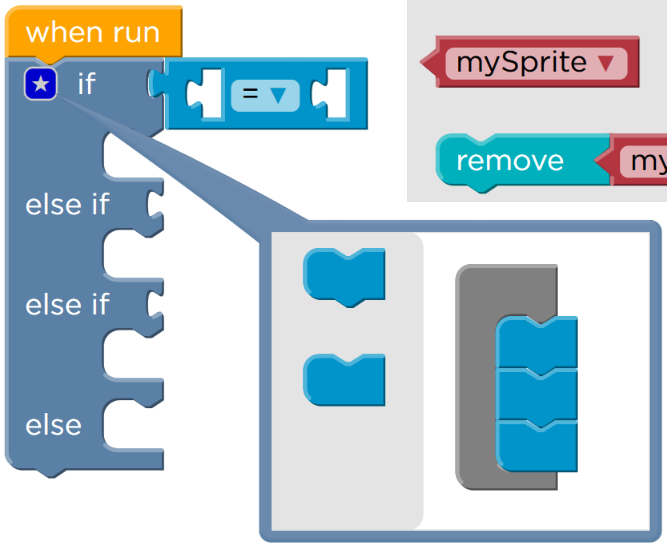


Typed connectors: positions, sprites, numbers, conditions, text

Extensible if (if, elif, elif, …, else)

Counted loops (with counter)

Show corresponding JavaScript code



Made with Blockly

A JavaScript library to build visual languages (initially by Google)

Easy way to define new types of blocks with:

- Typed inputs (int, string, object, list, boolean, . . .) and outputs
- Conversion of the resulting code to many programming languages (JavaScript by default, but also Lua, Python, PHP, Dart, . . .)
- You can also define new blocks visually by using Blockly

The resulting JavaScript can be evaluated to interact with the page

- Labyrinths, Harvesting robots, Games, Simulations, . . .

Used in: code.org, appinventor.mit.edu, programmailfuturo.it, . . .

Artist: turtle graphics

Single program, no events

Single agent (Pen), NO concurrency/events

New: PARAMETRIC procedures

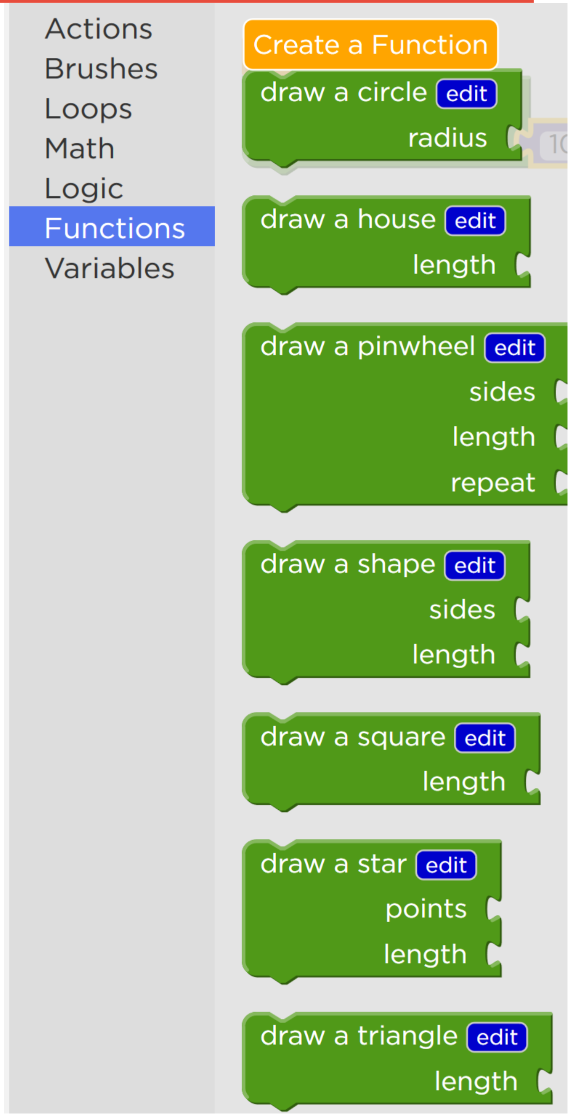
Automatic redraw/run when parameters change

Examples of editable procedures/drawings

RECURSION! (demo)

Useful tricks:

- pen-up => set alpha = 0
- pen-down => set alpha = 255



Many environments:

Sprite Lab: multiple interacting Actors

Single initial program (e.g. to create Sprites and scene)

(Multiple) actors reacting to simple events (but NO messages)

Concurrent execution of events

Multiple threads for same event (demo)

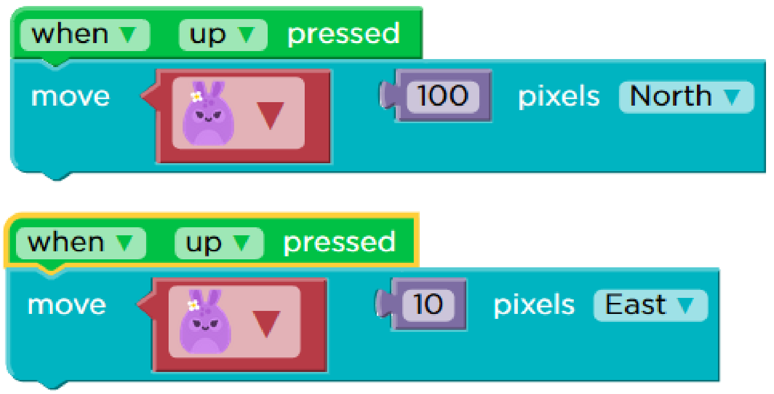
Simple procedures (without parameters!)

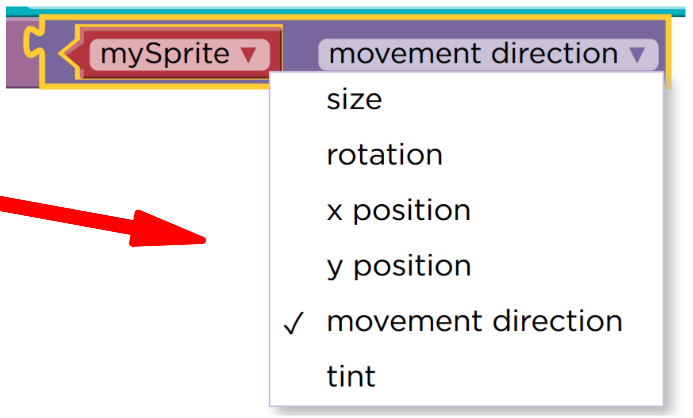
Simple “behaviors” common to all agents

Fixed Sprite properties

Global variables

NO lists

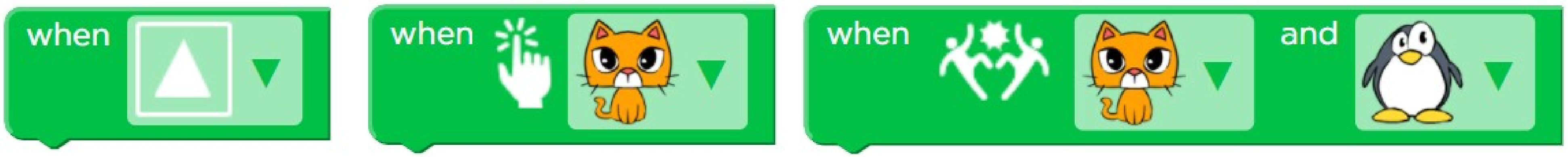




Pre-reader versions

Artist: single program, NO events, NO variables, NO if-then-else, fixed angles/distance, draw/jump/stickers, fixed loop

Play Lab: behaviors attached to agents (when up/touched/hit) NO variables, simple commands, NO if-then-else, fixed repetition



Dance Party: music-sync animation

Animated "dancers" with dance moves (clap, dab, gagnam, …)

Background effects (rain, disco lights, …)

Initial Setup + Events: keyboard / timing / music(demo)

Music-related events/conditions

  if dancer is clapping/if measure>8

  move dancers wrt bass/mid/treble

Dance-related conditions (if doing "clap")

Concurrency (multiple identical events)

NO messages (demo)

Procedures (NO functions)

Game Lab: build a "game" app

Single function called by the game refresh loop (NO Events!!!)

Animated sprites + Grouped sprites/movement

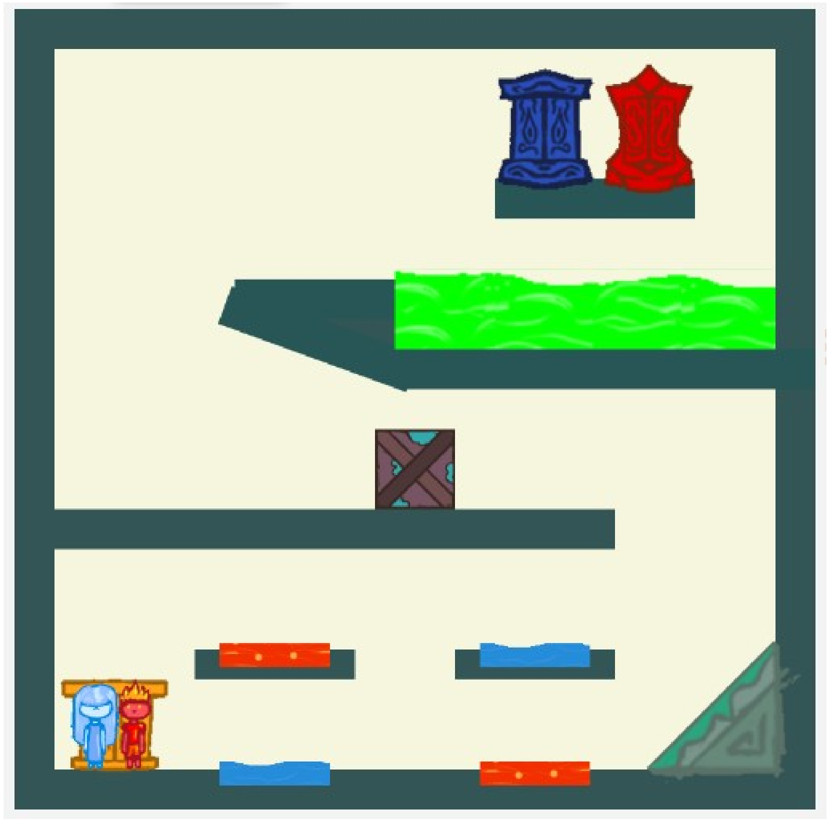
Drawing primitives

Sprite interaction primitives
    (collide, displace, bounce …)

Variables as game status
    (positions, points, lives)

You must implement ONLY the "paint"
    function to update the screen

(demo)



App Lab: build a “phone-like” app

Graphic editing of the App GUI (buttons, fields, labels, …)

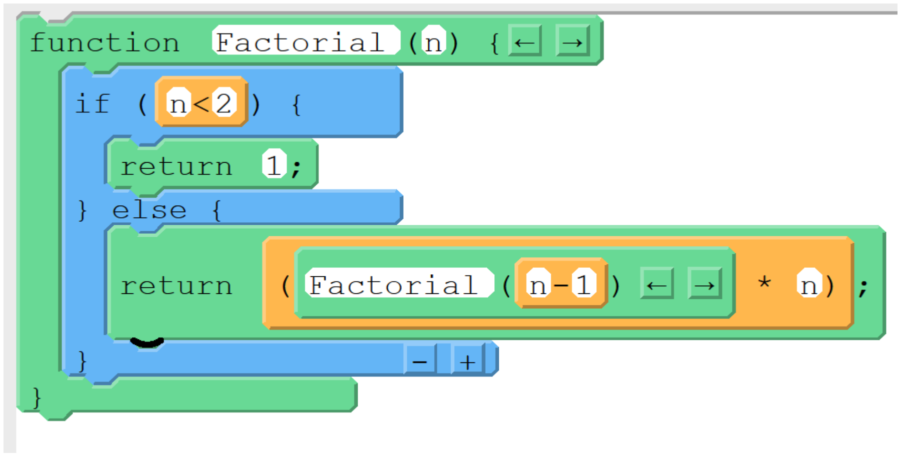
Setters/getters of all App widgets properties

Full JavaScript-like visual syntax

Full functions (args, local vars, return)

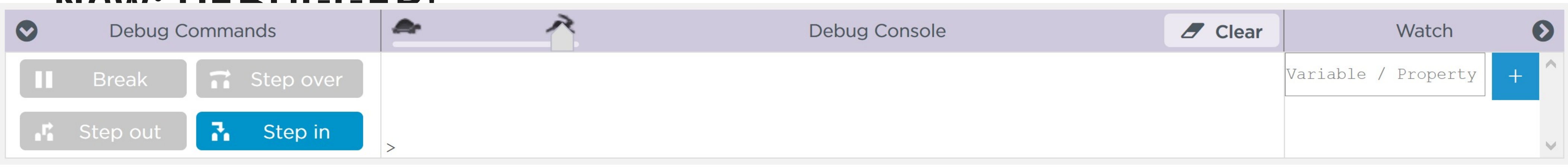
DATA store (dictionary OR tables)

Turtle graphics and Canvas



```
function Factorial (n) {←→
  if ( n<2 ) {
    return 1;
  } else {
    return ( Factorial ( n-1 ) ←→ * n) ;
  }–+
}
```

Now: DEBUGGER!

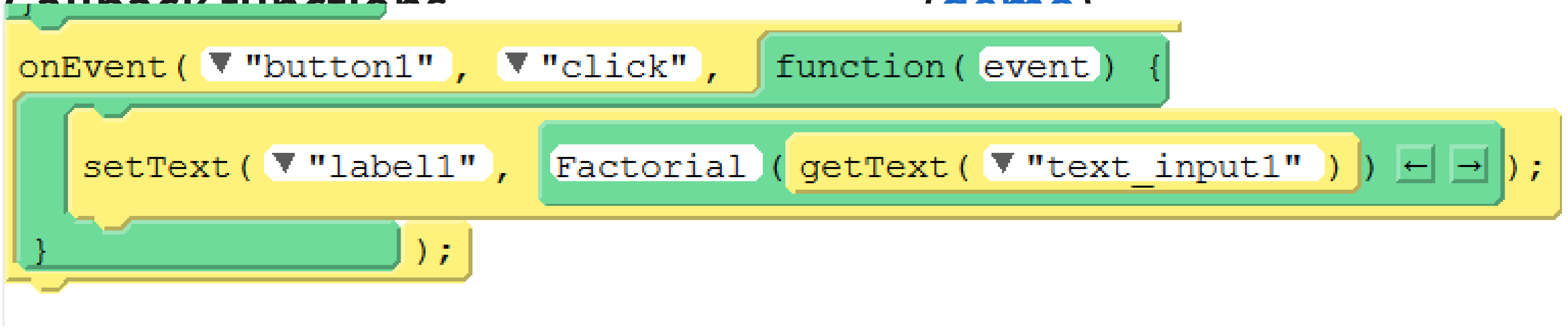


App Lab Events

Events:

GUI:	onEvent(widgetId, event, callback)
Data:	onRecordEvent(table, callback(record, event))
Timers:	setTimeout(ms, callback)
	timedLoop(ms, callback)

Callback functions (demo)



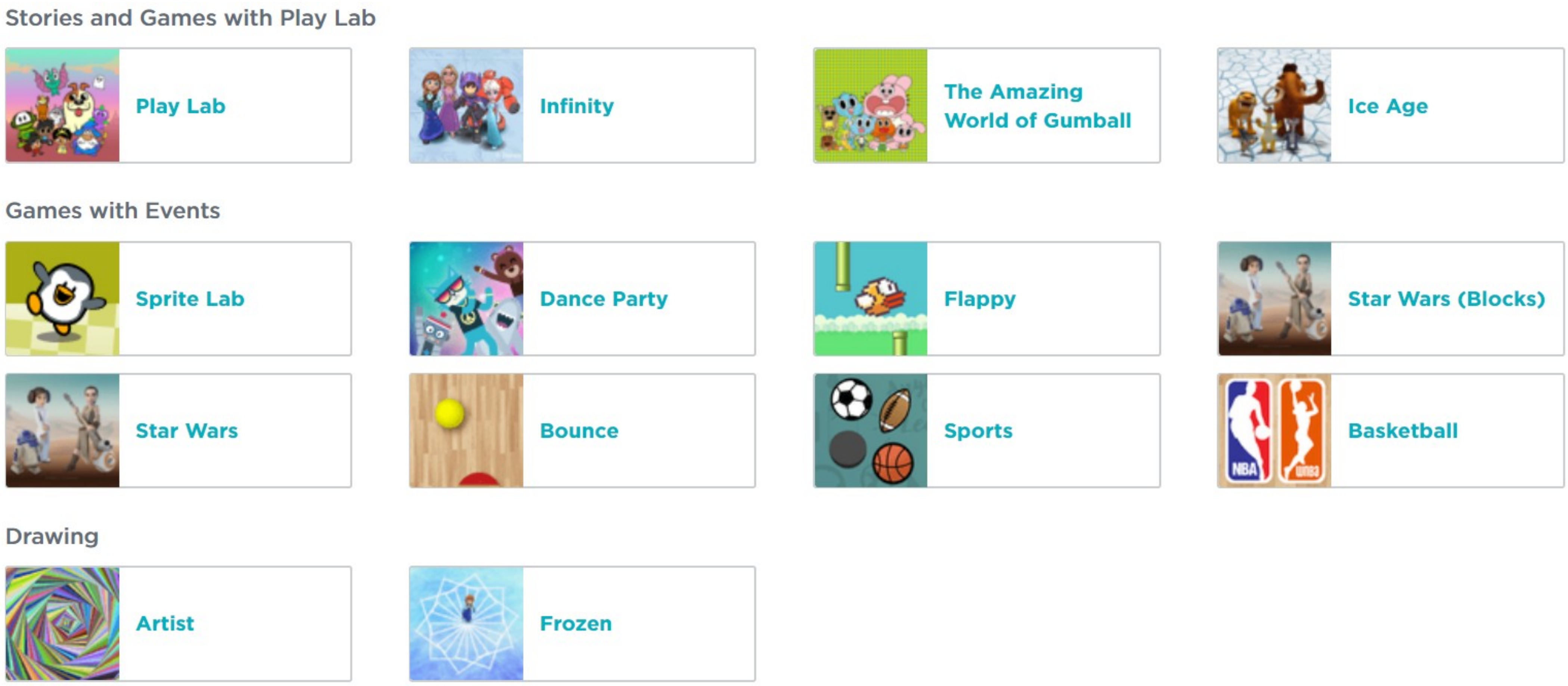
```
onEvent( "button1", "click", function( event ) {
  setText( "label1", Factorial ( getText( "text_input1" ) ) ← → );
} );
```

App Lab: custom libraries and datasets

You can export/import libraries of functions/blocks

You can export/import custom datasets

And many more …



Stories and Games with Play Lab

- Play Lab
- Infinity
- The Amazing World of Gumball
- Ice Age

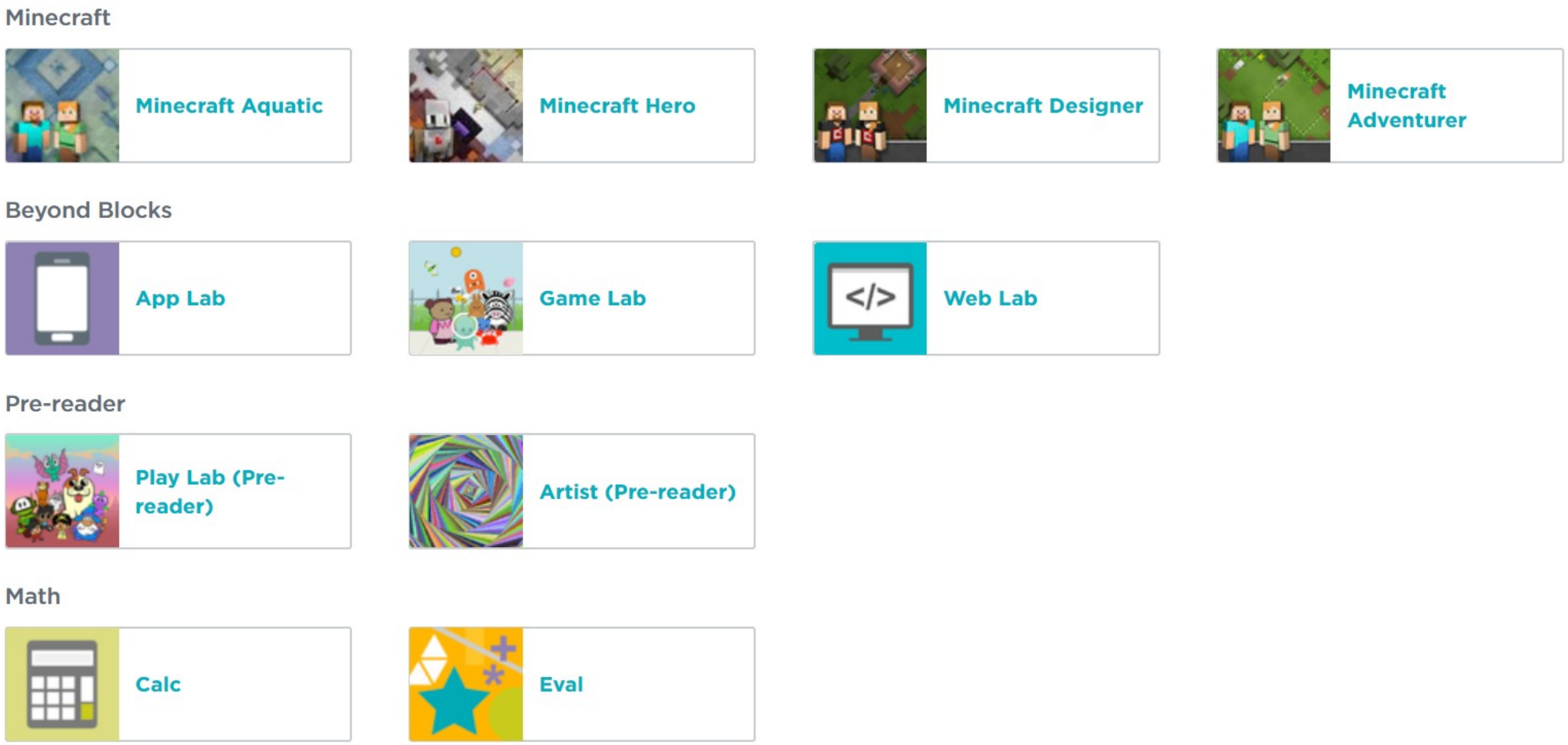
Games with Events

- Sprite Lab
- Dance Party
- Flappy
- Star Wars (Blocks)
- Star Wars
- Bounce
- Sports
- Basketball

Drawing

- Artist
- Frozen

And many more ...



Minecraft

- Minecraft Aquatic
- Minecraft Hero
- Minecraft Designer
- Minecraft Adventurer

Beyond Blocks

- App Lab
- Game Lab
- Web Lab

Pre-reader

- Play Lab (Pre-reader)
- Artist (Pre-reader)

Math

- Calc
- Eval