From Blocks to Text

UON Computer Science 4 Schools

Introduction to Coding and Computational Thinking Workshop

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Session Overview

- Presentation for about 20 minutes:
    - Comparing *Blocks* vs *Text* Languages
    - Examples of *Blocks*, *Hybrid* and *Text* Languages
- A Coding activity for about an hour
    - Coding concepts in an *Introductory Text Language*
    - *Sonic Pi*: Coding + Music

Presentation Overview

- Visual vs General-Purpose Languages
- Blocks vs Text
- Moving from Blocks to Text
- Hybrid Environments
- Introductory Text Languages
- Sonic Pi

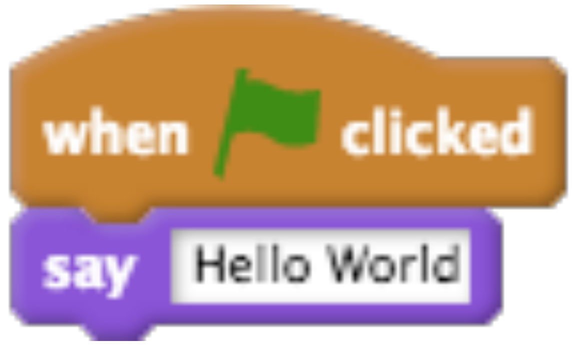
Visual vs General-Purpose Languages

- In ACARA Digital Technologies content descriptors:
  - Years 5 & 6: *"Implement digital solutions as simple **visual programs** involving branching, iteration (repetition), and user input (ACTDIP020)"*
  - Years 7 & 8: *"Implement and modify programs with user interfaces involving branching, iteration and functions in a **general-purpose programming language** (ACTDIP030)"*

Visual vs General-Purpose Languages

- *Visual Programming languages* involve using graphical elements (e.g: blocks) to write programs. The majority of these languages involve dragging and dropping blocks but there are some exceptions (e.g. flowcharts). I will refer to them as *Blocks languages* from now on.
- *General-Purpose Programming languages* are those where programs are (usually) written using text. I will refer to them as *Text languages* from now on.

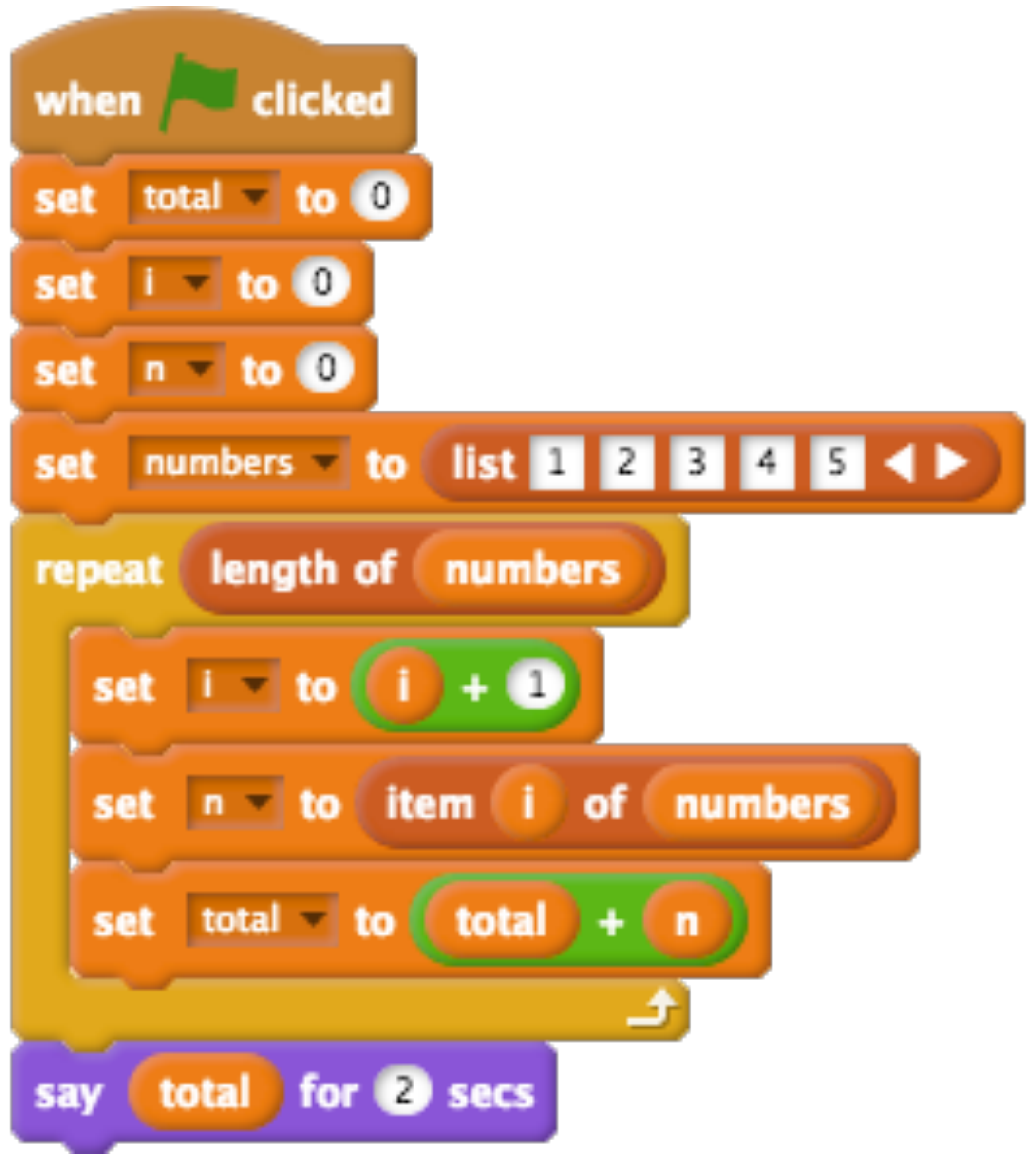
```
/* Hello World program */

#include<stdio.h>

main()
{
    printf("Hello World");
}
```



Blocks vs Text: Blocks

- Popular in K-12 and used for teaching CS in some Universities
- Are not usually used by professional Engineers and Scientists
- Very popular and a lot of current development / research work is put into creating *Blocks languages*
- *Scratch*, *Snap!*, *LEGO Mindstorms*… you may use others with your students

```
if __name__ == "__main__":
    totl = 0
    i = -1
    numbers = [1,2,3,4
    for i in rang(0, leng(numbers)):
       i = i + 1
        n = numbers[i]
    total = total + n
    print(total)
```



```
when [flag] clicked
set total to 0
set i to 0
set n to 0
set numbers to list 1 2 3 4 5
repeat length of numbers
    set i to i + 1
    set n to item i of numbers
    set total to total + n
say total for 2 secs
```

Blocks vs Text: Text

- Unlike *Blocks languages*, you have to be more careful about typos and syntax
- These languages are used by professional Engineers and Scientists in industry and research
- Used to develop the majority of software
- *Java*, *Python*, *C++*, *Swift*… the list goes on

Blocks vs Text: Why Blocks?

- No syntax errors
- Lower cognitive load
- Students can focus on *Computational Thinking*
- Can see all the functions in one place
  - Scratch blocks
  - Python API documentation

Blocks vs Text: Why Blocks?

- Not just for kids!
- Scratch is used for 2 weeks of a CS course at Harvard
- Unreal Blueprints can be used to code professional games
- NetLogo can be used for creating simulations for High School and University Science

Blocks vs Text: Why Text?

- Some cases where *Text languages* may be necessary
- Creating a website with a database (e.g. a Facebook-like website)
- Doing some serious Statistics / Data Science, e.g. with R
- Coding some *Physical Computing* devices, like Arduinos
- Students may want to work in or study Computing after school

Moving from Blocks to Text

- You may:
    - have students that want to move to *Text languages*
    - want to teach a *Text language* for something a *Block language* cannot do
    - show students that *Text languages* can be approachable for beginners

Hybrid Languages

- Switch between *Blocks* and *Text* in one environment
- Could help as a bridge from *Blocks* to *Text*[1]
- Some examples are:
  - PencilCode
  - Code.org's AppLab

[1] Blanchard, J. (2017, August). Hybrid Environments: A Bridge from Blocks to Text. In Proceedings of the 2017 ACM Conference on International Computing Education Research (pp. 295-296). ACM.

Introductory Text Languages

- Languages that make learning *Text* Coding less complex:
    - jsLogo (Logo)
    - Khan Academy's Computer Programming (JavaScript)
    - Swift Playgrounds (Swift)
    - Sonic Pi (Ruby)

Sonic Pi

- Sonic Pi is a:
  - Programming environment
  - Educational tool
  - Musical instrument
- Learning to write code in *Sonic Pi* involves learning to write *Ruby* code

Sonic Pi - Quick Demonstration

- Sonic Pi interface
- Playing notes
- Sleeping
- Live loops

Sonic Pi - Activity

- This session's activity is an introduction to a *Text language*
- You will learn about similar concepts to those in yesterday's *Coding in Scratch Activity*
- We will be using Sonic Pi for this activity, which is installed on the lab computers
- If you finish early, feel free to write your own compositions or ask us any questions