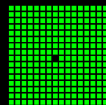


Scratch,

the most strongly-type-safe programming language

2017-08-26, BornHack @ Bornholm

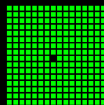


Overview

- About me (very shortly)
- Background:
 - Why Scratch? Coding Pirates ...
- The most strongly-type-safe and why it's ideal to teach to code
- But isn't this language just for kids?
- Demo of games made by young “hackers”

Note: Slides are released under the CC BY-SA license

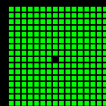
- Creative Commons Attribution-ShareAlike (“copyleft”)



About me (very shortly)



- Ramón Soto Mathiesen (Spaniard + Dane)
- MSc. Computer Science **DIKU/Pisa** and minors in Mathematics **HCØ**
- **CompSci @ SPISE MISU ApS**
 - “*Stay Pure, Isolating Side-Effects*” -- Michael Werk Ravnsmed dixit
 - “*Make Illegal States Unrepresentable*” -- Yaron Minsky dixit
 - “**If I have seen further it is by standing on the shoulders of giants**”
-- **Isaac Newton** (Yeah Science, ... Mostly mathematics)
 - **Elm (JS** due to ports) with a bit of **Haskell** and a bit of **F#** (fast prototyping)
- Elm / Haskell / TypeScript / F# / OCaml / Lisp / C++ / C# / JavaScript
- Founder of **Meetup for F#unctional Copenhageners** (MF#K)
- Volunteer at **Coding Pirates** (Captain at Valby Vigerslev Library Department):
- Blog: <http://blog.stermon.com/> and Twitter: [@genTauro42](https://twitter.com/genTauro42)

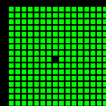


Background:

Why Scratch? Coding Pirates ...



- Is a free and Open Source visual programming language developed by the MIT Media Lab
 - Online client: <https://scratch.mit.edu/>
 - Scratch @ GitHub: <https://github.com/LLK>
- First time I saw it and began to use it was when I became a volunteer at Coding Pirates
 - <https://codingpirates.dk/>



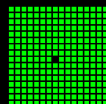
Background:

Why Scratch? Coding Pirates ...



- Coding Pirates is a non-profit organization that tries to help kids understand technology so they are able to create and not just consume
- There are many Departments in Denmark
 - <https://codingpirates.dk/afdelinger/>
 - Bornholm also has two: Rønne and Nexø
- In Copenhagen, we organize Hackathons every 2 months
 - Next one is Valby: <https://members.codingpirates.dk/activity/338/>

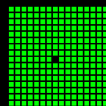
Note: Valbys 75 Hackathon tickets were all purchased on a single day



Background: Why Scratch? Coding Pirates ...



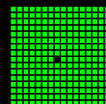
Girls coding Scratch @ Hackathon, Hvidovre



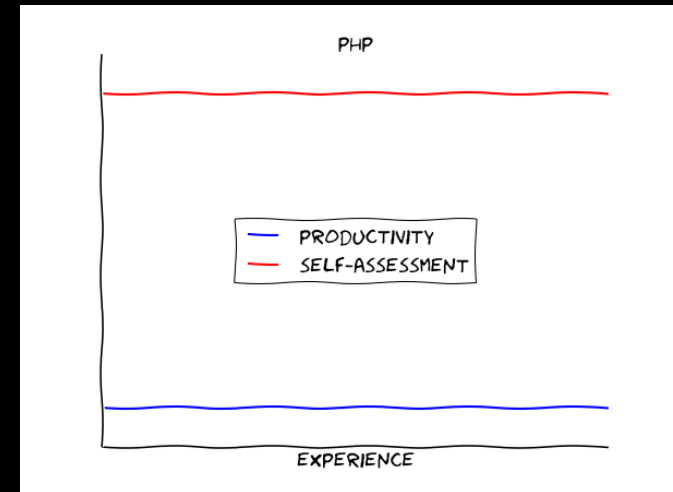
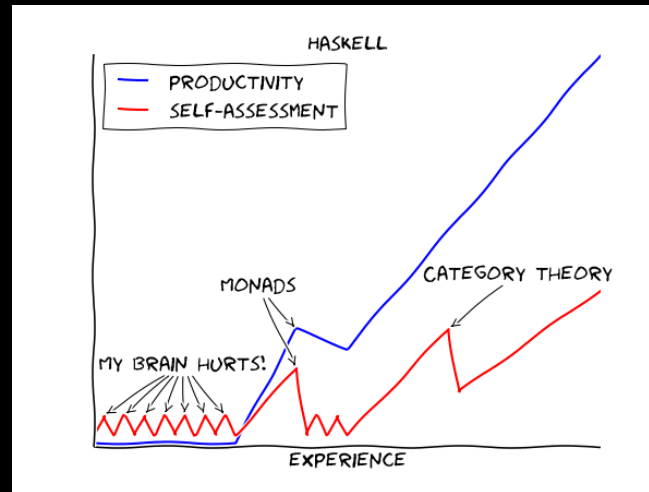
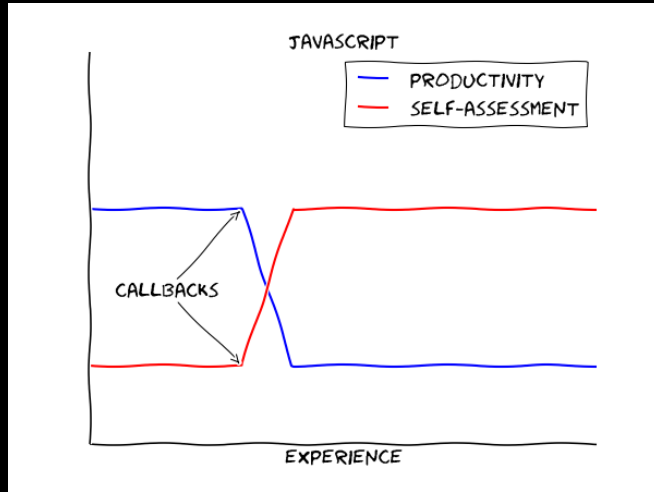
The most strongly-type-safe and why it's ideal to teach to code



(Short demo, what it actually look like)

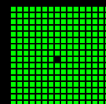


The most strongly-type-safe and why it's ideal to teach to code



- There is no focus on syntax or programming paradigm

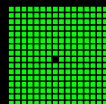
Link: [Learning Curves \(for different programming languages\)](#)



The most strongly-type-safe and why it's ideal to teach to code



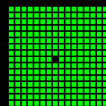
- Focus is on composition in order to increase creativity



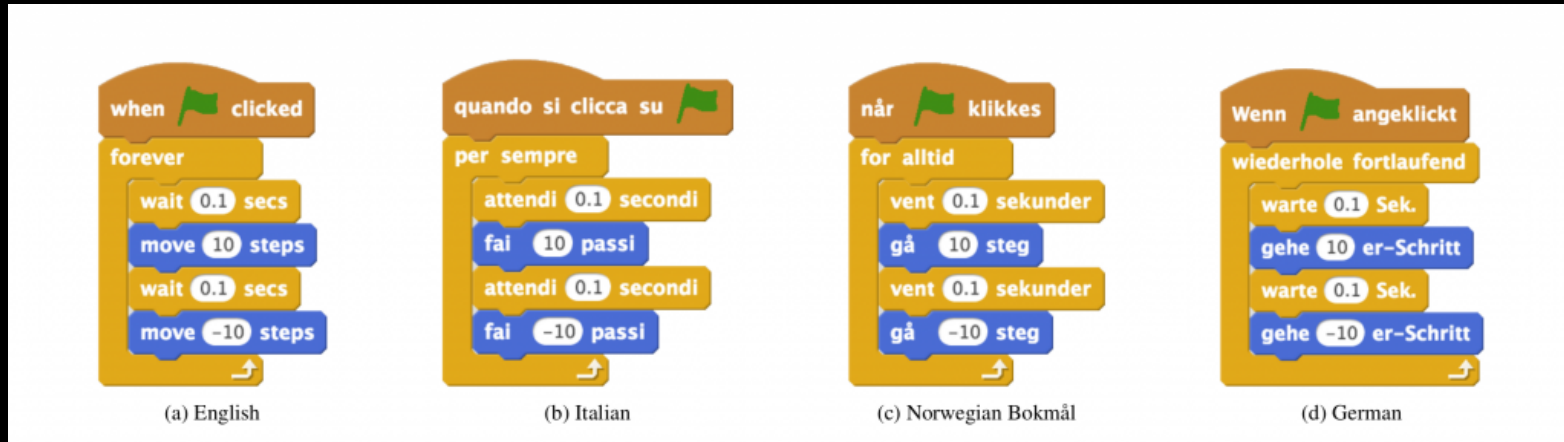
The most strongly-type-safe and why it's ideal to teach to code



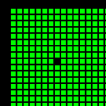
- Easy to get started
- Example: +6 year old kids can in a couple of hours have a working game that they can share with their friends just by going through the intro guide and some help from volunteers



The most strongly-type-safe and why it's ideal to teach to code



- Possibility to set the language for the Project Editor in more than 40 languages:
 - https://wiki.scratch.mit.edu/wiki/How_to_Translate_Scratch



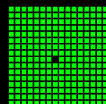
The most strongly-type-safe and why it's ideal to teach to code



- Technical stuff under the hood:

- A **Virtual Machine** that maintains state of an **Abstract Syntax Tree** (AST) by listening to events emitted by the **Scratch Blocks**
- A **Scratch Block** contains all the important information for execution and storage. Example:

```
{ "_blocks":  
  { "Q]PK~y]@BTV8Y~FfISeo":  
    { "id": "Q]PK~y]@BTV8Y~FfISeo",  
      "opcode": "event_whenkeypressed",  
      "inputs": {  },  
      "fields":  
        { "KEY_OPTION":  
          { "name": "KEY_OPTION",  
            "value": "space" }  
        },  
      "next": null,  
      "topLevel": true,  
      "parent": null,  
      "shadow": false,  
      "x": -69.33333333333333,  
      "y": 174 } },  
    "_scripts": [ "Q]PK~y]@BTV8Y~FfISeo" ]  
  }  
}
```

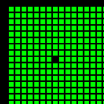


But isn't it just for kids? Yes ... and no



A screenshot of the Scribe Online web interface. The browser address bar shows a URL from online.scribesoft.com. The main window is titled "Create Map for File Data" and has a name field containing "insert files". The design canvas shows a flow: a blue "Query filestorage" connector leads to a red "For Each Result" loop connector. A tooltip is visible over the loop connector, showing properties: Name: FileStream_Create, Label: Create, Connection: File Stream, and an Error/Warnings section with a red icon and the text "Target Entity not selected.". The right-hand pane shows configuration for the Source (FILES - MySQL) and Targets (File Stream). The Control section contains a sequence of connectors: Continue, For Each Child, For Each Result, If, Loop, Loop Exit, and Map Exit. The Comments section has a Comment and Group connector. At the bottom right are "Save Map", "OK", and "Cancel" buttons.

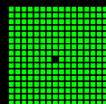
- Enterprise (Middlelayer DTS in Cloud) : Scribe Online



But isn't it just for kids? Yes ... and no

A screenshot of a Scratch script editor showing a complex implementation of a 0-indexed array. The code is organized into several functions: 'add', 'delete', 'insert', 'length', and 'replace'. Each function uses a series of 'when green flag clicked' blocks to initialize variables and perform operations on an array. The 'add' function appends an element, 'delete' removes an element, 'insert' adds an element at a specific index, 'length' returns the number of elements, and 'replace' swaps an element at a given index. The code uses Scratch's 'when green flag clicked' blocks to trigger these operations, and it includes a small text box explaining that the code demonstrates operations on a 0-indexed array.

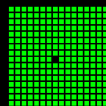
- 0-indexed Array datastructure implementation



There are some flaws as well



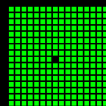
- Current online client is based on Flash (Adobe AIR)
 - No HiDPI for me :(
 - Even though there is hope with the new 3.0 client based on HTML5
 - <https://llk.github.io/scratch-gui/>
 - Only two translations though (Spanish and French)



There are some flaws as well



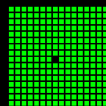
- Complex game can become very verbose and difficult to debug
- Creativity is limited to make games or storylines
- No built-in revision control instead
 - Based on saving to other names, difficult to test and revert



There are some flaws as well



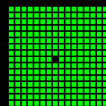
- Limit on cloning of sprites:
 - <https://wiki.scratch.mit.edu/wiki/Cloning>
 - Ex: MineScratch 2D → only 300 (more or less 17 x 17 grid)
- Block can be hidden out of screen
 - Always right click and format (“Clean Up”)
 - Note: I was taught this trick by one of the Hvidovre Hackathon girls



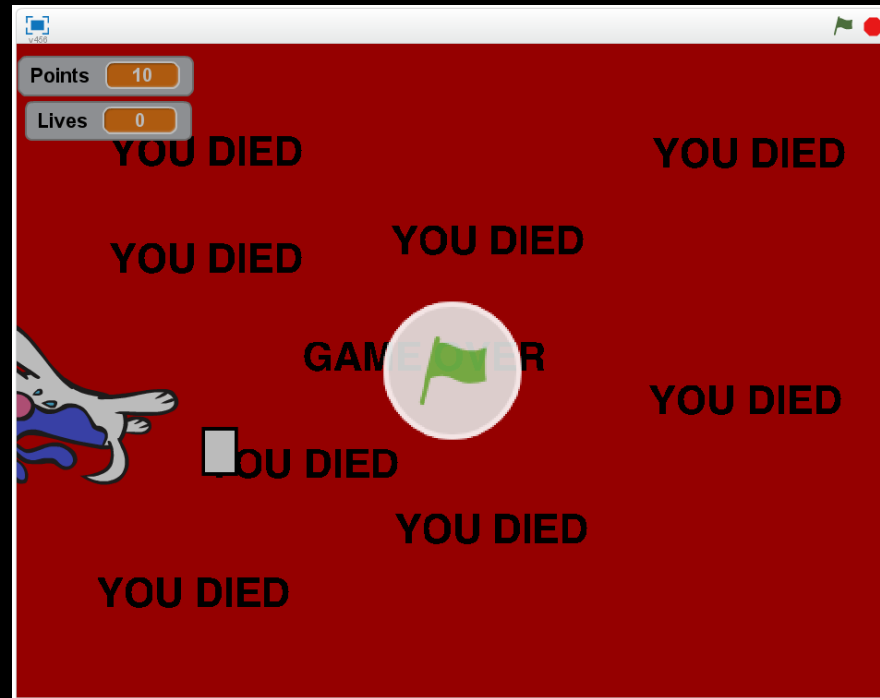
There are some flaws as well



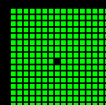
- Older kids tend to find it boring after a couple of seasons. Next steps should be:
 - Stencyl: Scratch on steroids with physics engine, easy 2D platform games, possibility to add Java Snippets, ...
 - <http://www.stencyl.com/>
 - Unity: Easy to create real (pro) games with programming (JavaScript, C#, ...
 - <https://unity3d.com/>



Demo of games made by young “hackers”



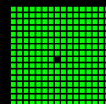
- Find mælken (currently not working)



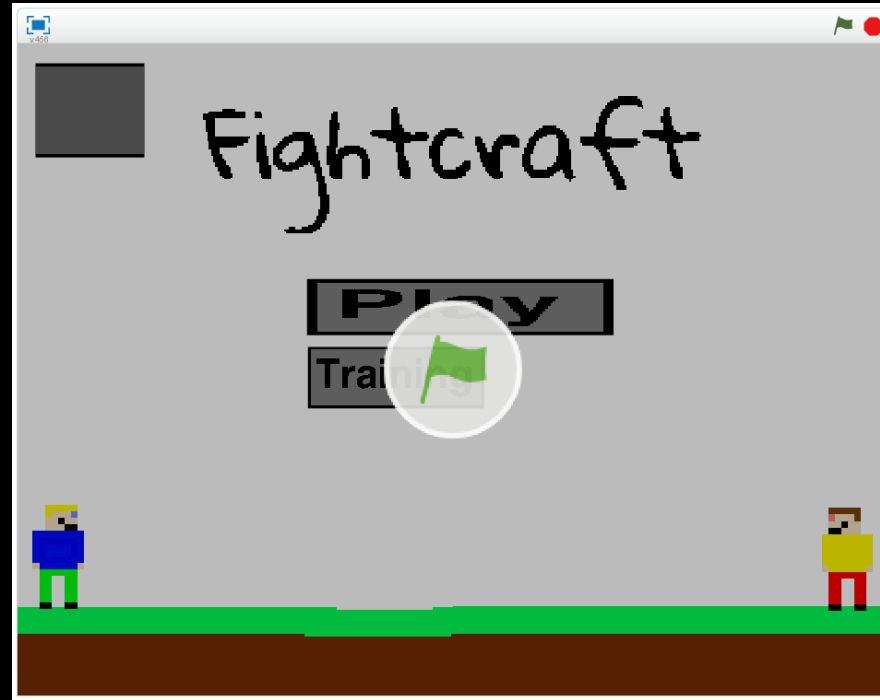
Demo of games made by young “hackers”



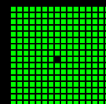
- Football Keeper (currently not working)



Demo of games made by young “hackers”



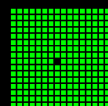
– Fightcraft 1.0



Demo of games made by young “hackers”

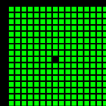


– Musik



Summary

- Composition over syntax/paradigm
- Easy to get started (+6 years)
- Project Editor translated to many languages
- Scratch Blocks → Abstract Syntax Tree (AST) → Virtual Machine (VM)
- Used in Enterprise and you can create complex datastructures if you take the time
- There are some flaws and think about alternatives to get to the next level
- There should be a few Coding Pirates volunteers around (T-shirt) if you want to know more about volunteering, just poke us, we probably be around the bar :)



Q & A

Any Questions?

