How we used Python to introduce teenagers to the fun of programming

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Problem

CRITEO R&D EMPLOYEES WORLDWIDE

- Women: 10%
- Men: 90%

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Stereotypes vs. reality

- Women under-representation is a fairly recent phenomenon
- Many women programmers throughout history
- We want the young people to embark!
A day to discover computer science jobs

- Meet women engineers
- Visit our Criteo Paris office
- Have fun & get some swag
- Actually write some code
Preparing the coding part

- Discover computer science
- Motivate career choice in computer science
The time constraint

1h30
No bugs

- Setup and check all the computers
- Prepare code
Mentoring

- Pair programming
- Unblocker
- Questions
Goals
Aims
Objectives
Aspirations
Destinations
Introductions
Have fun & Be creative

- Music, games, images and video, robots
- Immediate feedback
Discover a real programming language

- Reads like english
- Multi-purpose
- Rich ecosystem
- Used by professionals
Discover computer science topics

- Robots
- Games
- Video & pictures processing
- Data processing
- Artificial intelligence
- ...
Apply what you already know

- High school Maths
- High school Physics
- English!
Progress

- It feels good to learn
- Step-by-step discoveries
Color-switch alike game

Go!
Have fun & Be creative

• Have fun
  -> Play Games
  -> Win the Game
  -> Be the best at your game!

• Be creative:
  -> change the game’s set up
  -> change the rules
  -> change the graphics
  ...

Go!
Discover a real programming language

- Simple functions
  - for loops
  - if conditions

```python
from kivy.animation import Animation
from kivy.properties import NumericProperty

class AnimBall(Widget):
    r = NumericProperty(0)
    g = NumericProperty(0)
    b = NumericProperty(1)

def __init__(self, **kwargs):
    super(AnimBall, self).__init__(**kwargs)
    size = Window.width / 50 + Window.height / 50
    self.width = size
    self.height = size
    self.x = (Window.width / 2 - self.width / 2)
    self.y = (Window.height / 2 - self.height / 2)
    color = RandomColor()
    self.r, self.g, self.b = color.update_color()
    self.add_rectangles(10)

    def on_touch_down(self, *args):
        initial_y = Window.height / 5 - self.height
        initial_x = (Window.width / 2 - self.width)
        y = Window.height / 10 + self.y
        max_y = 2*Window.height - self.height / 2
        if self.y + y < max_y:
            Animation.cancel_all(self)
            animation = Animation(x=initial_x, y=initial_y, duration=0.3, t='in_cubic')
            animation += Animation(x=initial_x, y=initial_y, duration=0.3, t='in_cubic')
            animation.start(self)

    def add_rectangles(self, self, nb_rectangles):
        # add nb rectangles
        self.add_widget(ClockRect())

# It's here the file to modify for the ex_4

# 1 the objective is to modify add_rectangles to add multiple rectangles
# use a loop: for
# use range()
```
Discover a real programming language

- Simple functions
  - for loops
  - if conditions

- Using libraries: Kivy
  - Learn to look for information on the web!
  - read the documentation
Discover computer science topics

- Create games:
  - Action on clicks
  - Animation
Discover computer science topics

- Create games:
  - Action on clicks
  - Animation
  - Graphics
Discover computer science topics

- Create games:
  - Action on clicks
  - Animation
  - Graphics
  - Frame displays
  - Widget interactions (master and slave)
Discover computer science topics

- Create games:
  - Action on clicks
  - Animation
  - Graphics
  - Frame displays
  - Widget interactions (master and slave)
  - Progress
  - Game hacking
Apply what you already know

- **Physics**
  - Use positions to check collisions
  - Increase the speed

- **Math**
  - Use variables to automate changes

- **Logic**
  - Realistic animation
  - Scoring rules

- **Geometry and drawings**
  - Create the widgets graphics
Progress

- Workshop + presentation
- Increase difficulty
- Discover different parts of the game
- Let’s hack and play the game!
Crazy filters
Get creative

- Teens love Snapchat & Instagram
- Even basic image processing is fun
- Use the webcam for immediate feedback
Python

- Powered by Kivy & Numpy
- Boosted with OpenCV
- GUI to ease testing
- Commented in french

```python
from ui.crazyfiltersapp import CrazyFiltersApp

if __name__ == '__main__':
    CrazyFiltersApp().run()
```

```
Dans ce module, tu trouveras des définitions
Il est recommandé de lire le Readme ou d'aller avant de se lancer dans le code.

import os
import numpy as np
import cv2
```
Image processing

- Digital images
- Use RGB color system to create custom colorizations
From simple to complex

- Draw rectangles
- Draw flags
- Combine effects
- Use OpenCV...
  ... AI inside !!!

```
image_array[:, :, CANAL_VERT] = 0
image_array[:, :, CANAL_BLEU] = 0
image_array[0:10, :, :] = 0
h, w, c = image_array.shape
image_array[:, (w - 10):w, :] = 255
image_array[:, 10:20, :] = 255
image_array = 255 - image_array
```
Maths to the rescue

- The image coordinate system
- How do you draw a star?

```python
angle = -np.pi / 2 + rotate
px = max_radius * np.cos(angle)
py = max_radius * np.sin(angle)
list_of_points = [(px, py)]
for _ in range(nb_branch):
    angle += np.pi / nb_branch
    px = min_radius * np.cos(angle)
    py = min_radius * np.sin(angle)
    list_of_points.append((px, py))
    angle += np.pi / nb_branch
    px = max_radius * np.cos(angle)
    py = max_radius * np.sin(angle)
    list_of_points.append((px, py))
return list_of_points
```
Feedback
Students

« avoir passé une journée chez Criteo m'a apporté bien plus que je ne l'imaginais. »

« j'ai particulièrement aimé cette joie qui nous a été communiquée, jointe à l'envie de créer et de programmer en découvrant de nouvelles choses. »
Teachers

- Exercises are not easy!
Take-aways

- Close mentoring
- Competition helps creativity
- Don’t hide code difficulty
We’re doing it again soon!

- Contact CGénial if you want to participate

Checkout our code on [https://github.com/criteo/je-code-crazy-filters](https://github.com/criteo/je-code-crazy-filters)