

Why should all kids learn programming?

@Felienne



How Do Kids Program in the Wild?

@Felienne



Do Kids Program in the Wild?

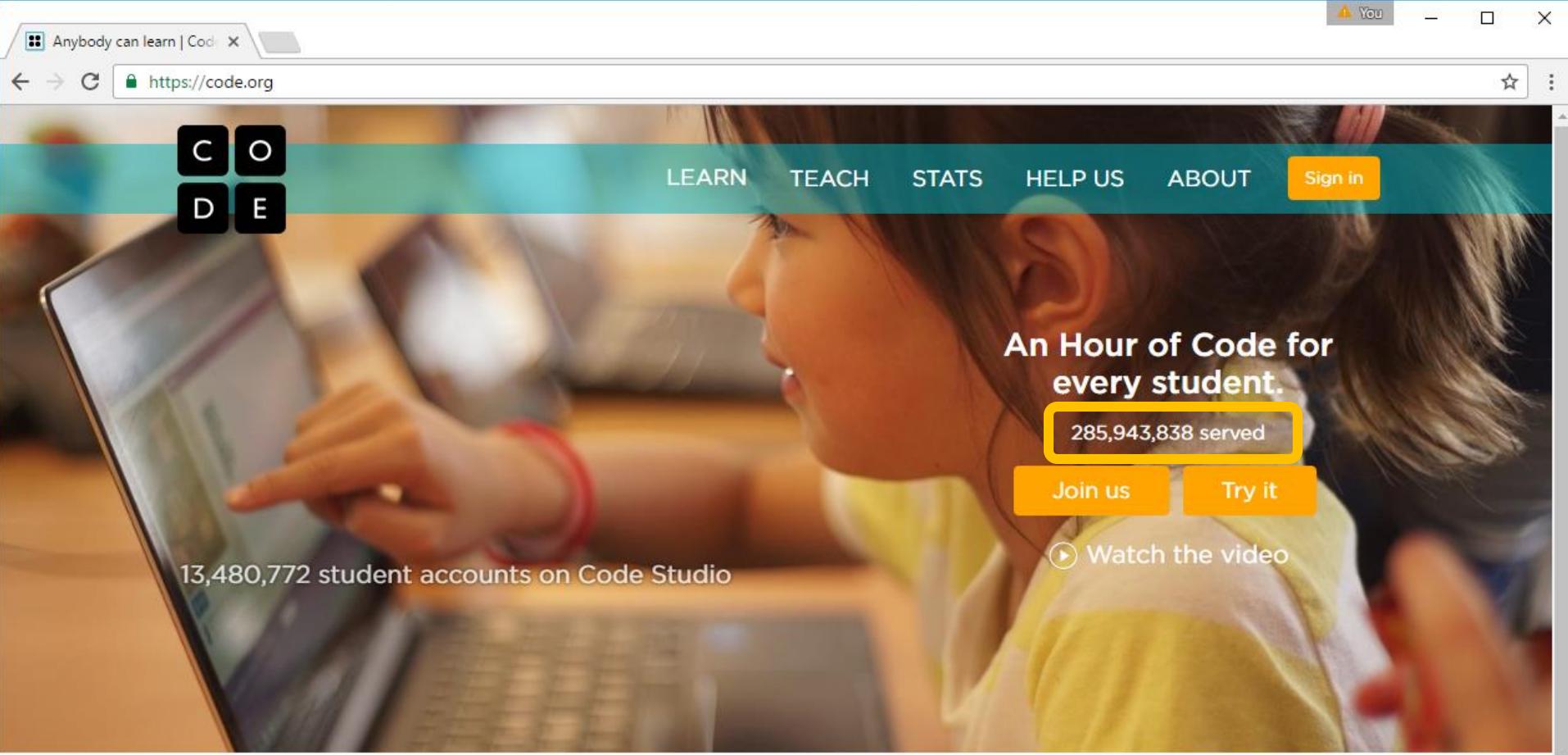
@Felienne



Do Kids Program in the Wild?

YES!





13,480,772 student accounts on Code Studio

Every student in every school should have the opportunity to learn computer science

[Take the diversity pledge](#)

I agree ▾

Join 2,233,252 others

The image shows a desert landscape from the Star Wars universe. In the foreground, there's a small white droid (R2-D2). Behind it, two characters are standing: a young girl in a blue dress and a boy in a brown robe, both holding lightsabers. The background features rolling hills under a clear sky.

Hour of Code
Anybody can learn. Start today

A large, friendly-looking cartoon bee with large eyes and a smiling mouth is the central figure. It has yellow and black stripes on its body. To its right is a small, brown dog-like animal. The background is a colorful, abstract design with a blue arrow pointing to the right and a rainbow.

Students
Explore our courses

A teacher with long brown hair, wearing a grey shirt, is leaning over a desk to help a young girl who is looking at a computer screen. They appear to be in a classroom setting with other students and equipment in the background.

Educators
Teach your students

A map of the United States where the state of Kentucky is highlighted in yellow. The map is dark grey with state boundaries and names.

Advocates
Support diversity in computing

Scratch - Imagine, Program, Share

https://scratch.mit.edu

Scratch Maak Ontdek Overleg Over Help Zoeken Word Scratcher Inloggen

Create stories, games, and animations
Share with others around the world

PROBEER HET BEKIJK VOORBEI WORD LID VAN SCRATCH (it's free)

A creative learning community with 17.603.341 projects shared

OVER SCRATCH | VOOR ONDERWIJZERS | VOOR OUDERS

Uitgelichte projecten

- Famous Scientists -Star-Dusty-
- Paw Pals Halloween
- Learning Mandarin | amy482004
- Web Hunt
- Cameo Creator -little-

Uitgelichte studio's

- Songs Made In Scratch
- Scratchers Around The World
- KEEP CALM AND TAKE LYRICS LITERALLY
- Learn Creatively
- Codeca

Projecten beheerd door Fuzzbutt

Meer leren

The image shows the Scratch website homepage. At the top, there's a banner with the text "Create stories, games, and animations" and "Share with others around the world". Below this are three circular icons: one with a cat and the text "PROBEER HET", another with a blue character and "BEKIJK VOORBEI", and a third with a yellow character and "WORD LID VAN SCRATCH (it's free)". To the right, a code editor window shows a script starting with "when green flag clicked" and "repeat (10) [move (10) steps, change color by (25), play drum (4) for (0.2) beats]". Below the banner, it says "A creative learning community with 17.603.341 projects shared" with a yellow button-like background. There are links for "OVER SCRATCH", "VOOR ONDERWIJZERS", and "VOOR OUDERS". The main content area has two sections: "Uitgelichte projecten" and "Uitgelichte studio's", each displaying five thumbnail images of user-created Scratch projects.



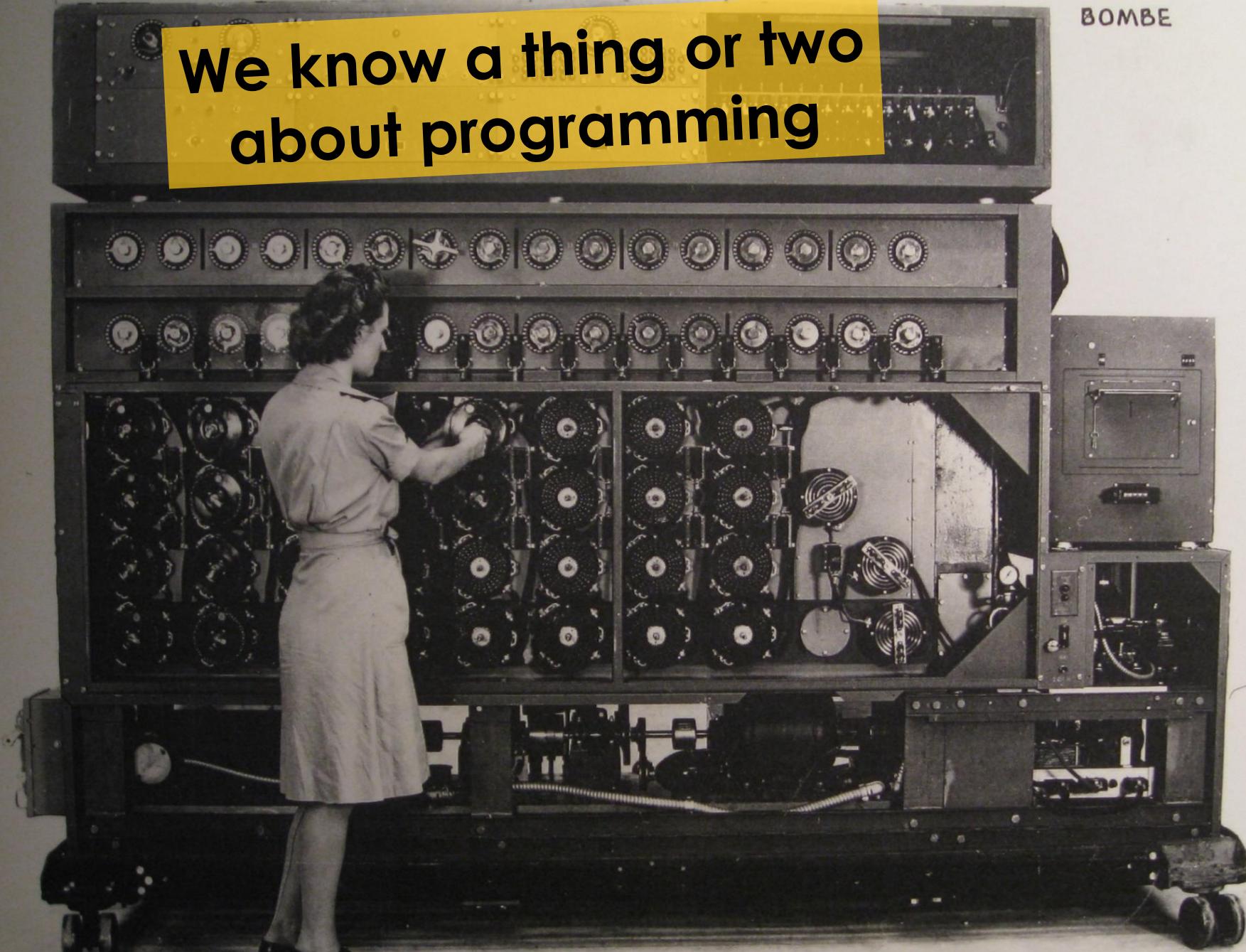
Just a toy?

Or do they write
good code?

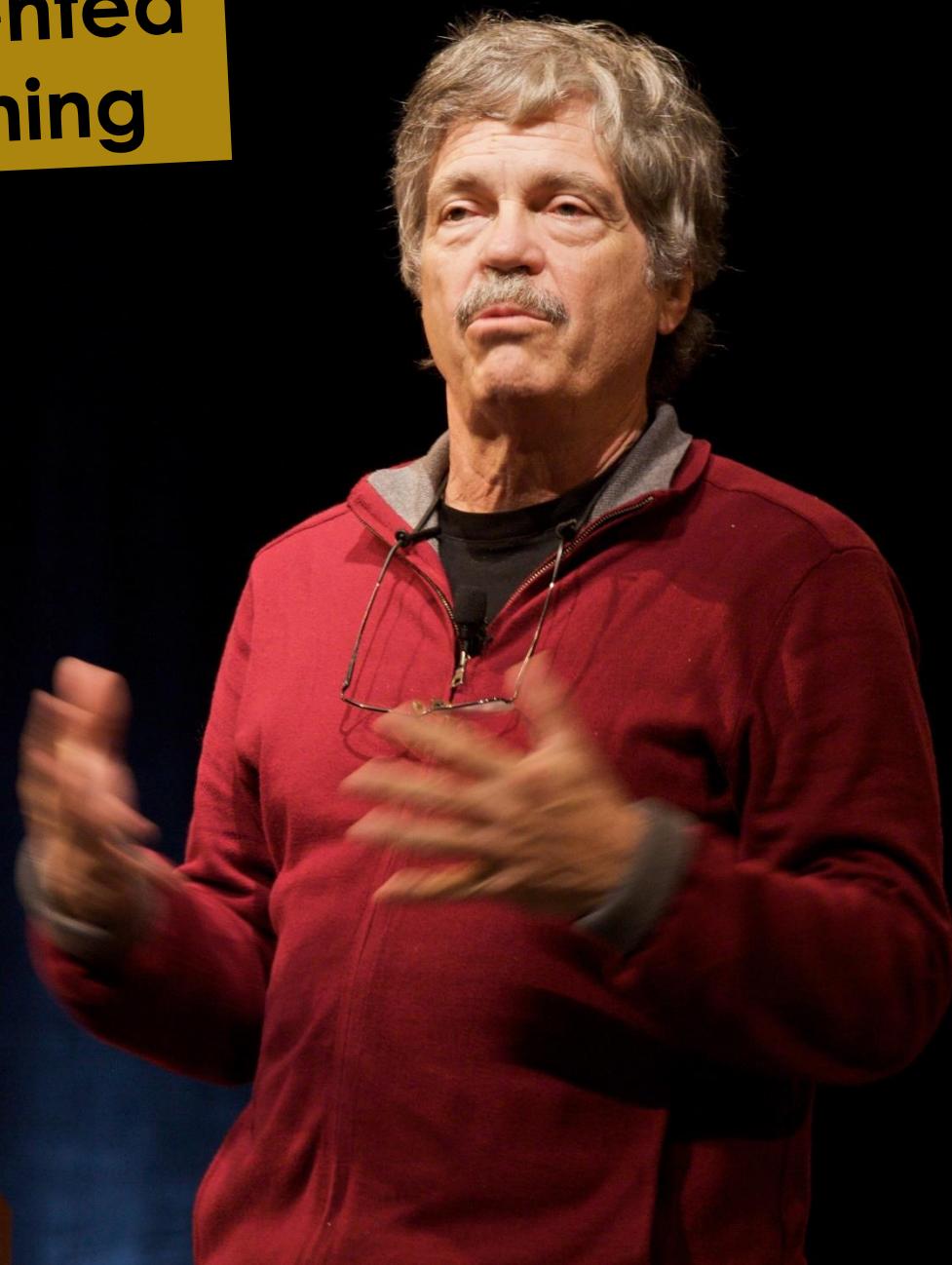


BOMBE

We know a thing or two
about programming



Object oriented programming



AWN
TING

A close-up portrait of a middle-aged man with a beard and receding hairline. He is smiling warmly at the camera. He is wearing a grey blazer over a pink collared shirt.

**Smells and
refactorings**



Does code
smells matter?

The Scratch programming language

The image shows the Scratch 2.0 programming environment. At the top, a yellow banner displays the title "The Scratch programming language". Below the banner, the browser address bar shows the URL <https://scratch.mit.edu/projects/107811926/#editor>. The Scratch interface includes a toolbar with icons for file operations, a stage area with a cat sprite and an apple backdrop, and a script editor on the right.

Project Information:
Title: Cat loves apple
Author: Felienne (unshared)
Views: v446

Stage Area:
The stage features a green grassy hill backdrop and a red apple sprite positioned on the ground. A cat sprite is running across the stage from left to right. The cat's position is indicated by coordinates X: 192 Y: -180.

Sprites Panel:
Sprites listed: Stage (2 backdrops), Cat, Apple.

Scripts Panel:
The Scripts panel is divided into categories: Motion, Looks, Sound, Pen, Data, Events, Control, Sensing, Operators, and More Blocks. The Looks category is currently selected. The script editor on the right contains the following scripts:

- For the Cat sprite:
 - when space key pressed: move (10) steps
 - when green flag clicked:
 - wait until touching [Apple v?]
 - play sound [meow v?]
- For the Apple sprite:
 - when green flag clicked:
 - change color effect by (25)
 - set color effect to (0)
 - clear graphic effects
 - change size by (10)

8 Cat loves apple on Scratch X

https://scratch.mit.edu/projects/107811926/#editor

SCRATCH File ▾ Edit ▾ Tips About

Saved Felienne v446

Cat loves apple by Felienne (unshared)

Sprites

x: 192 y: -180

Stage 2 backdrops

New backdrop:

Sprites

New sprite:

Backpack

Scripts Costumes Sounds

Motion Looks Events Control

Sound Pen Sensing Operators

Data More Blocks

when space key pressed
move (10) steps

when green flag clicked
wait until touching Apple ?
play sound meow

say Hello! for (2) secs

say Hello!

think Hmm... for (2) secs

think Hmm...

show

hide

switch costume to [costume2]

next costume

switch backdrop to [blue sky]

change color effect by (25)

set color effect to (0)

clear graphic effects

change size by (10)

Share See project page

x: -185 y: -109

Cat loves apple on Scratch X

<https://scratch.mit.edu/projects/107811926/#editor>

SCRATCH File ▾ Edit ▾ Tips About

Saved Felienne ▾

Scripts Costumes Sounds

Motion Looks Events Control

Sound Sensing Operators Data More Blocks

when space key pressed
move (10) steps

when green flag clicked
wait until touching Apple ?
play sound meow

Scripts

Stage 2 backdrops

Sprites New sprite: Stage

Backpack

Apple

Cat

X: 192 Y: -180

Change color effect by (25)

Set color effect to (0)

Clear graphic effects

Change size by (10)

When space key pressed: Move (10) steps

When green flag clicked: Wait until touching Apple? Play sound meow

Show

Hide

Switch costume to costume2

Next costume

Switch backdrop to blue sky

Change color effect by (25)

Set color effect to (0)

Clear graphic effects

Change size by (10)

Each sprite can have scripts

The image shows a Scratch project titled "Cat loves apple" by Felienne (unshared). The stage features a green hill backdrop and a blue sky. A yellow speech bubble in the center contains the text "Each sprite can have scripts". A large yellow arrow points from this text down to the script editor area. On the stage, a cat sprite is running towards a red apple sprite. The cat's position is at X: -215 Y: -180. The apple's position is at X: 190 Y: -120.

Scripts **Costumes** **Sounds**

Motion **Events**
Looks **Control**
Sound **Sensing**
Pen **Operators**
Data **More Blocks**

```
when green flag clicked
  wait until touching Cat
  say You found me!
```

Sprites

New sprite:

Stage
2 backdrops

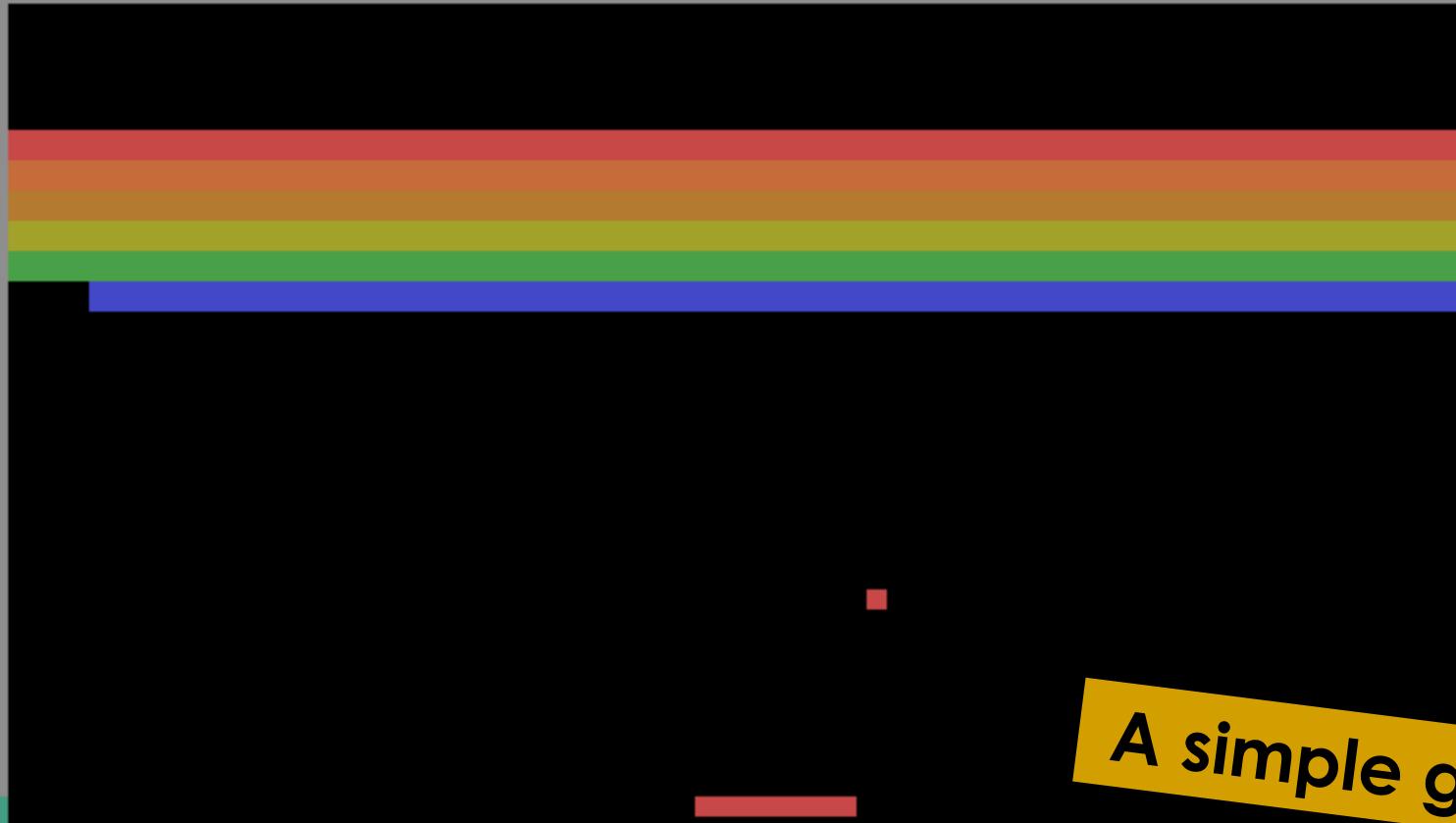
New backdrop:

Backpack



**Do code smells
matter to kids?**

□ □ □ □ □



A simple game

One 'good' version

The image shows a Scratch project titled "PongN on Scratch" by Felienne (shared). The stage features a brick wall backdrop and a yellow ball sprite. A blue paddle sprite is positioned at the bottom. A yellow arrow points from the bottom-left towards the paddle.

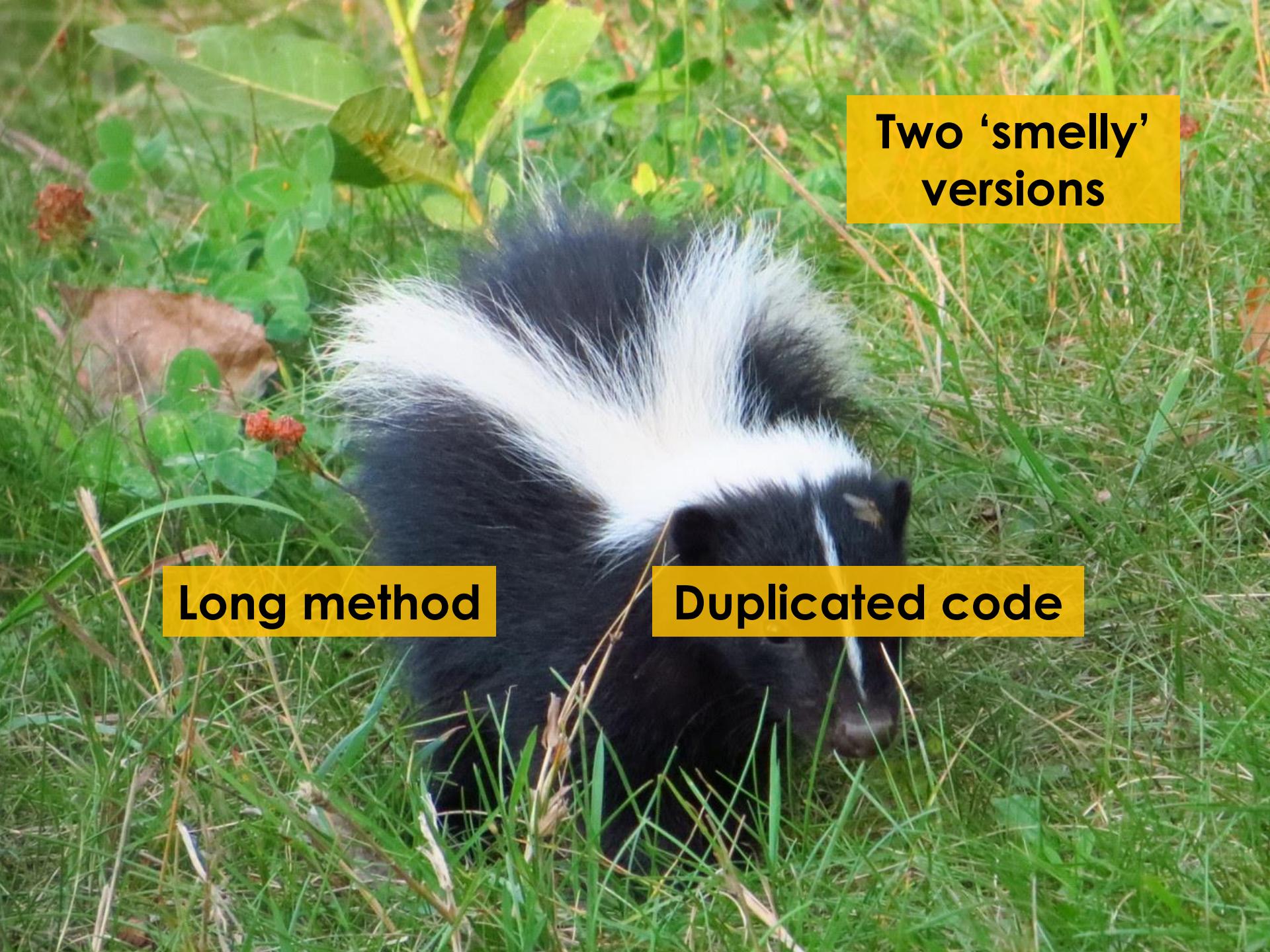
The Scripts tab displays three scripts:

- Ball Script:** A forever loop that checks if the ball is touching the paddle. If so, it plays a "pop" sound, changes direction, moves 10 steps, and updates the score variable "punten" by 1.
- Paddle Script:** A forever loop that checks if the ball is on an edge. If yes, it bounces the ball back into play.
- Score Script:** A script triggered by a green flag click. It waits until the score reaches 5, then says "Gefeliciteerd!" for 1 second, plays a "cheer" sound until done, and sets the score back to 0.

The Stage area shows the ball in motion and the paddle ready to receive it. The Scripts palette on the right lists various Scratch blocks categorized by color.

A close-up photograph of a skunk in its natural habitat. The skunk is facing towards the right of the frame, its dark body contrasting with its characteristic white stripe running from its nose through its eye and down its back. Its bushy tail is raised and curled slightly. The background is a lush green field with various plants, including some with red flowers and large green leaves.

**Two ‘smelly’
versions**

A black and white skunk is standing in a field of green grass. It has a thick coat of dark fur with a prominent white stripe running from its head down its back. The skunk is facing towards the right side of the frame. In the background, there are some green plants and a few fallen leaves.

**Two ‘smelly’
versions**

Long method

Duplicated code

Version N

PongN on Scratch https://scratch.mit.edu/projects/96072836/#editor SCRATCH File ▾ Edit ▾ Tips About Save now See project page

Scenes Stage 1 backdrop New backdrop:

Sprites Bal Batje Lijn New sprite:

Score punten 2

Stage 1 backdrop

Scripts Costumes Sounds

Motion

- Events
- Control
- Sensing
- Operators
- More Blocks

Looks Sound Pen Data

move 10 steps
turn (15) degrees
turn (15) degrees
point in direction (90)
point towards
go to x: 137 y: 110
go to [mouse-pointer]
glide 1 secs to x: 137 y: 110
change x by 10
set x to 0
change y by 10
set y to 0

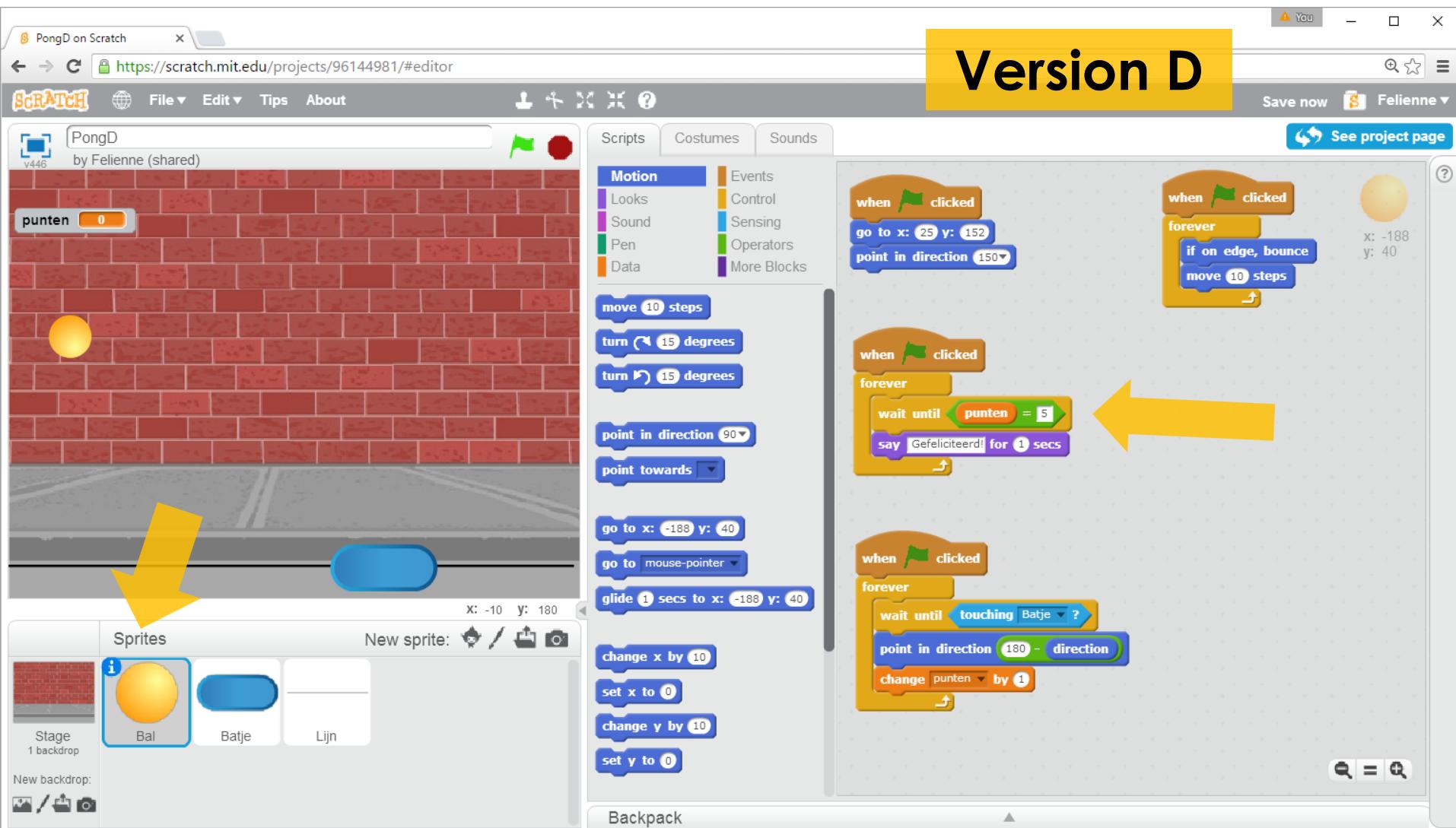
when green flag clicked
go to x: 25 y: 152
point in direction 150
when green flag clicked
forever
wait until touching Batje
play sound [pop v]
point in direction (180) - direction
move 10 steps
change [punten v] by 1
when green flag clicked
forever
if on edge, bounce
move 10 steps
when green flag clicked
forever
wait until [punten = 5]
say [Gefeliciteerd!] for 1 secs
play sound [cheer v] until done
set [punten v] to 0

x: 137 y: 110

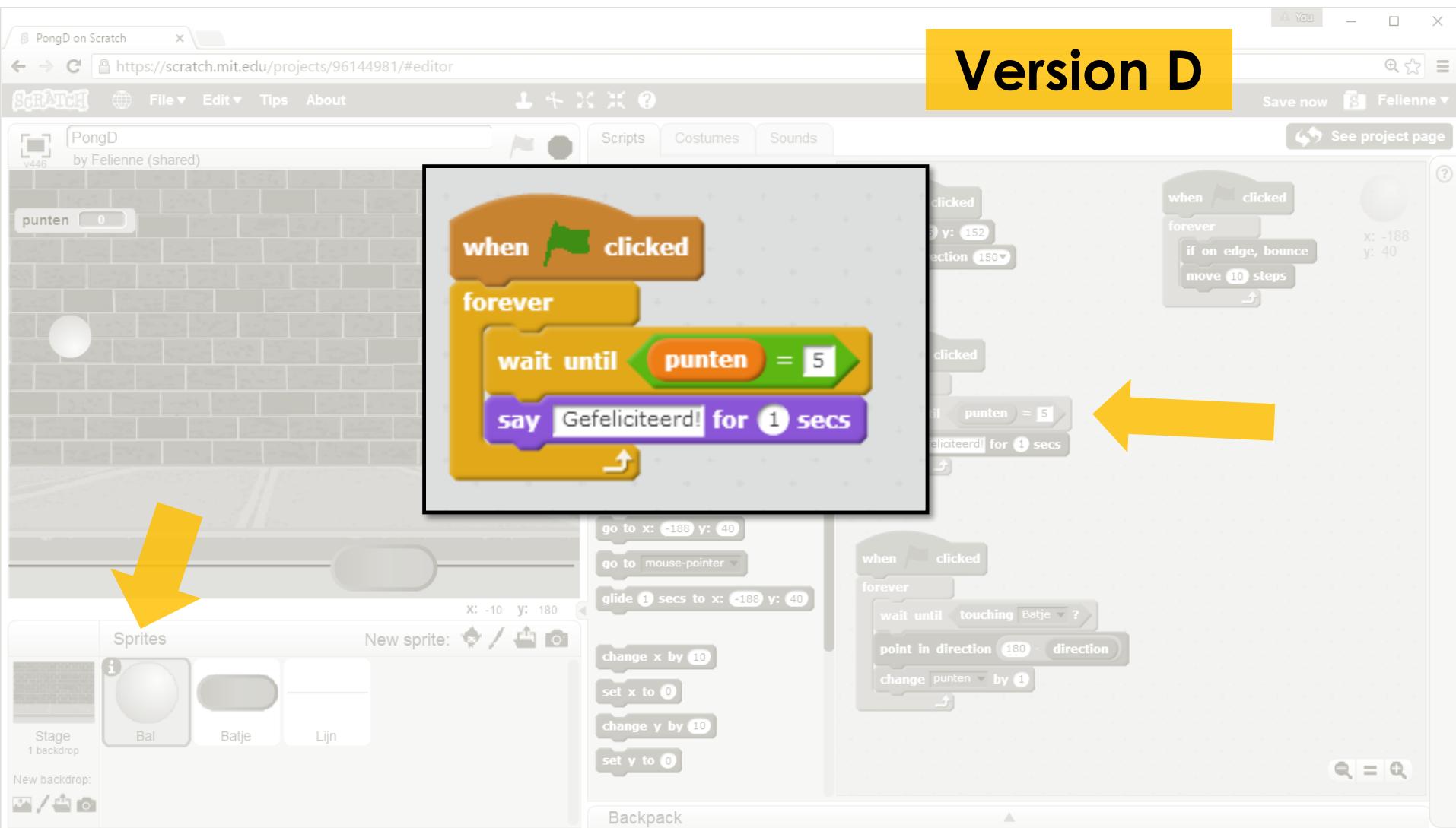
Backpack



Version D



Version D



Version D

PongD on Scratch https://scratch.mit.edu/projects/96144981/#editor SCRATCH File ▾ Edit ▾ Tips About

Scripts Costumes Sounds

Motion

- Events
- Control
- Sensing
- Operators
- More Blocks

Looks Sound Pen Data

Blocks:

- when left arrow key pressed
change x by -15
- when right arrow key pressed
change x by 15
- when green flag clicked
forever
wait until punten = 5
play sound cheer
- when green flag clicked
forever
wait until touching Bal ?
play sound pop
- move 10 steps
- turn (15) degrees
- turn (15) degrees
- point in direction (90)
- point towards
- go to x: 75 y: -157
- go to mouse-pointer
- glide 1 secs to x: 75 y: -157
- change x by 10
- set x to 0
- change y by 10
- set y to 0

Variables:

- punten 0

Sprites:

- Stage 1 backdrop
- New backdrop:
- Bal
- Batje
- Lijn

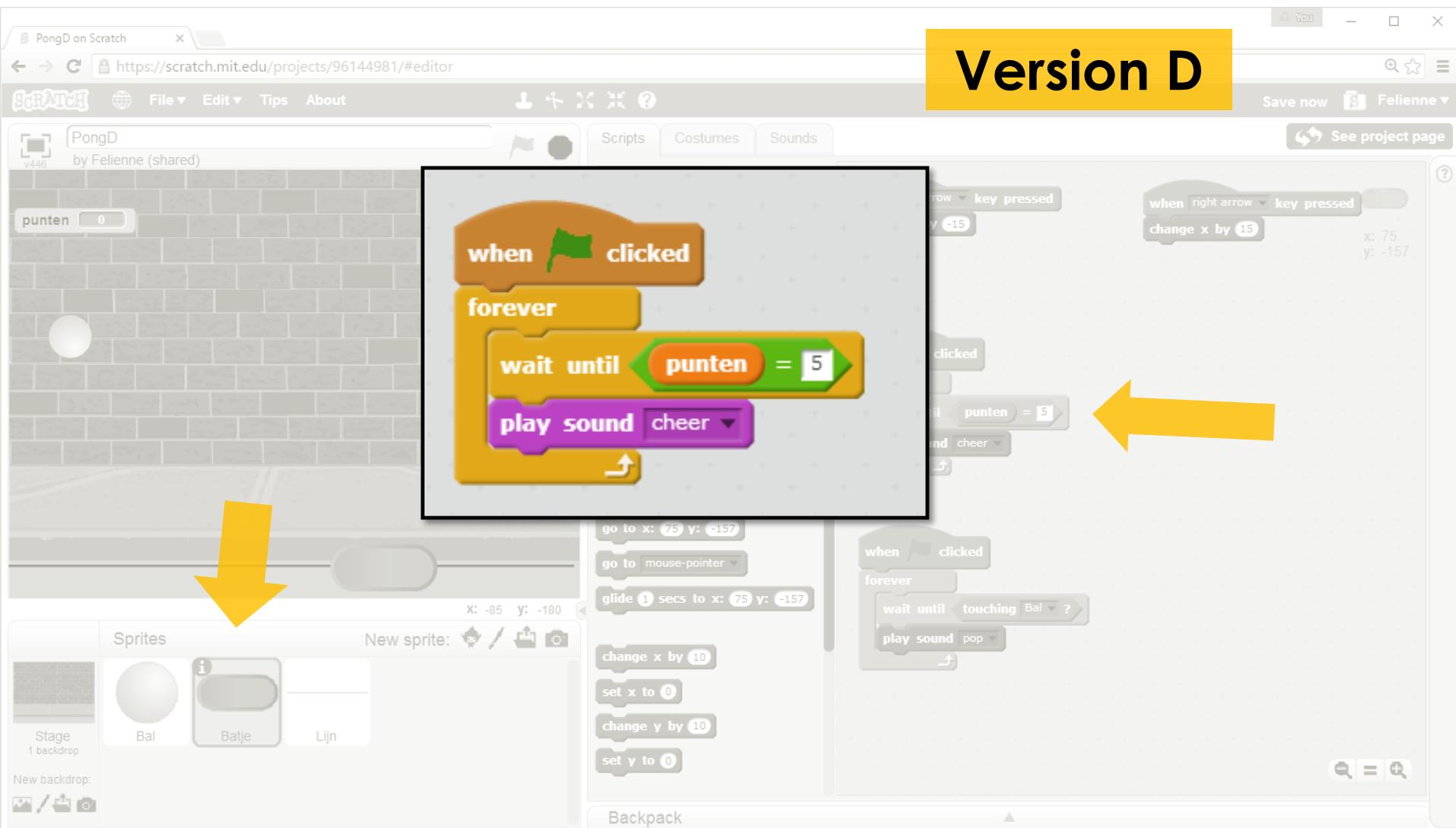
Backpack:

Save now See project page

x: 75 y: -157

A yellow arrow points from the bottom of the stage area down to the "Sprites" section. A large yellow arrow points from the "when green flag clicked" script in the Scripts tab to the "when green flag clicked" script in the Scripts tab.

Version D



Version D

PongD on Scratch

https://scratch.mit.edu/projects/96144981/#editor

SCRATCH

PongD by Felienne (shared)

punten 0

Brick wall backdrop

Bal

Batje

Lijn

Stage 1 backdrop

New backdrop:

Scripts

Costumes

Sounds

Motion

- Events
- Control
- Sensing
- Operators
- More Blocks

Looks

Sound

Pen

Data

move 10 steps

turn (15) degrees

turn (15) degrees

point in direction (90)

point towards

go to x: -4 y: 25

go to [mouse-pointer]

glide 1 secs to x: -4 y: 25

change x by 10

set x to 0

change y by 10

set y to 0

when green flag clicked

forever

wait until [punten = 5]

set [punten v] to [0]

play sound [cheer v] until done

when green flag clicked

forever

wait until [touching [Bal v] ?]

set [punten v] to [0]

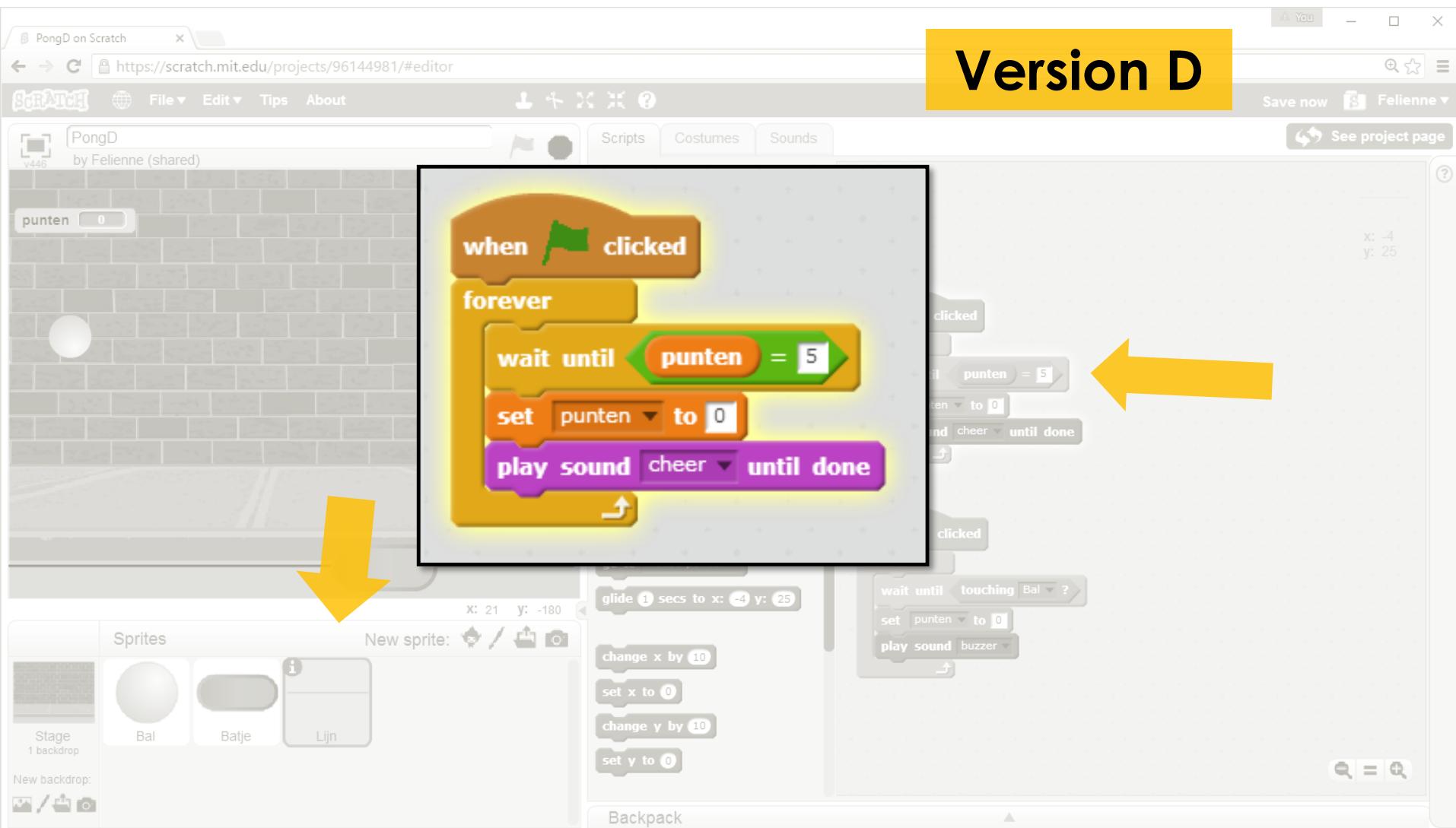
play sound [buzzer v]

x: -4
y: 25

Save now See project page

Version D

Version D



Version N

PongN on Scratch https://scratch.mit.edu/projects/96072836/#editor SCRATCH File ▾ Edit ▾ Tips About Save now See project page

Scenes

Sprites

Stage
1 backdrop

Costumes

Sounds

Scripts

Motion

- Events
- Control
- Sensing
- Operators
- More Blocks

Looks

Sound

Pen

Data

Variables

Control

Sensing

Operators

More Blocks

Events

when green flag clicked

- go to x: 25 y: 152**
- point in direction 150**

when green flag clicked

forever

- wait until touching Batje ?**
- play sound pop**
- point in direction 180 - direction**
- move 10 steps**
- change punten by 1**

when green flag clicked

forever

- if on edge, bounce**
- move 10 steps**

when green flag clicked

forever

- wait until punten = 5**
- say Gefeliciteerd! for 1 secs**
- play sound cheer until done**
- set punten to 0**

Batje

Lijn

Bal

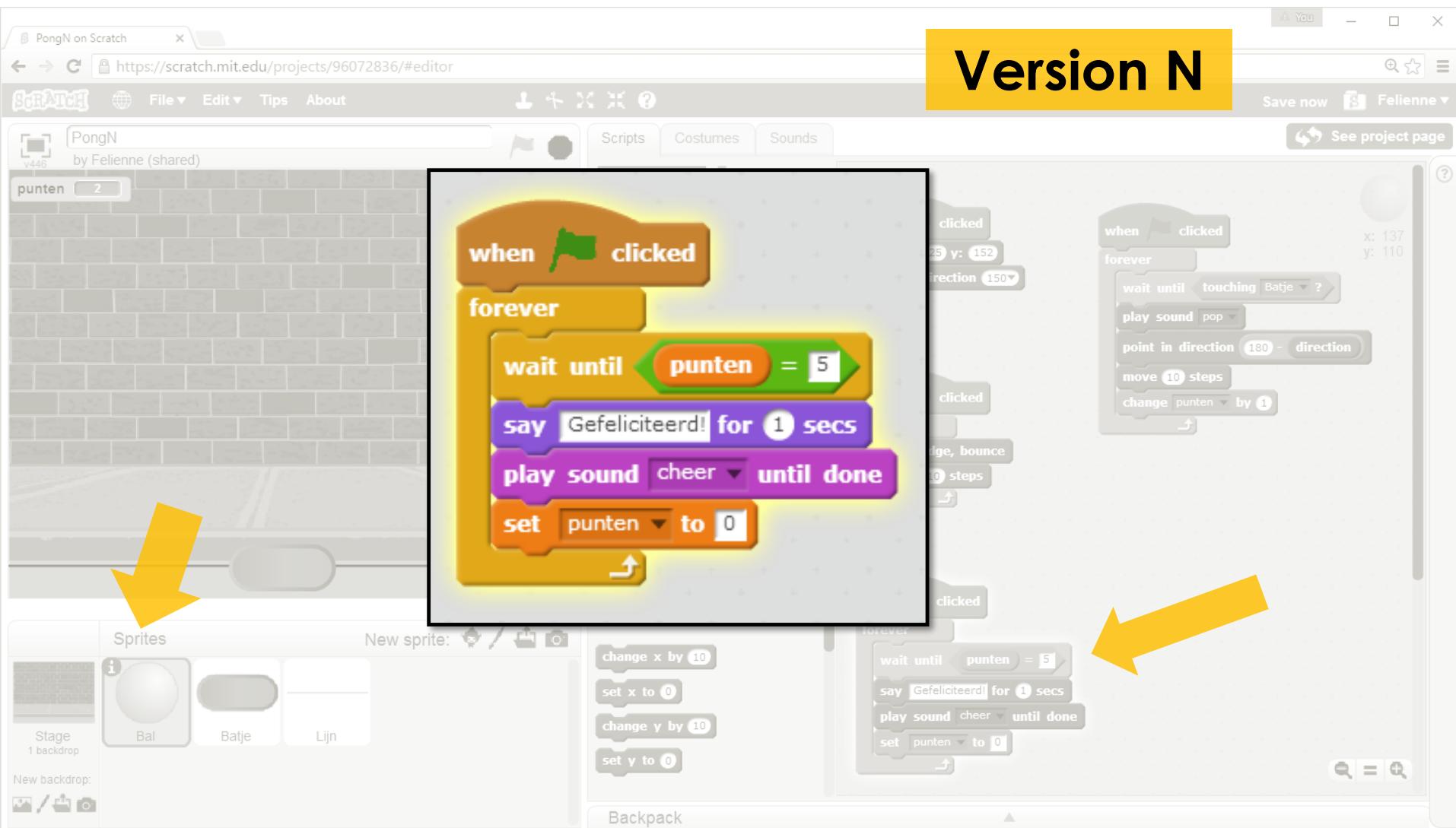
x: -8 y: -180

Backpack

x: 137 y: 110

Version N

Version N



Version L

The image shows a Scratch project titled "PongS on Scratch" by Felienne (shared). The stage features a red brick wall backdrop and a grey court. A yellow ball sprite is positioned near the center. A blue bat-like sprite, labeled "Batje" in the sprites list, is located at the bottom left. The score is displayed as "punten 0".

The Scripts tab is open, showing the script for the ball:

```
when green flag clicked
  go to x: 25 y: 152
  point in direction 150
forever
  if on edge, bounce
    move 10 steps
  if touching Batje then
    play sound [pop v]
    point in direction 180 - direction
    move 10 steps
    change punten by 1
  else
    if touching Lijn then
      set punten to 0
      play sound [buzzer v]
    else
      if punten = 5 then
        say [Gefeliciteerd!] for 1 secs
        play sound [cheer v] until done
        set punten to 0
  end
end
```

The Costumes tab shows three costumes: a red brick wall, a grey court, and a yellow ball.

The Sounds tab shows a single sound effect named "pop".

A yellow arrow points from the bottom left towards the "Batje" sprite in the sprites list.

A baby is sitting cross-legged on a dark brown carpet, facing a red laptop. The baby is wearing a purple sleeveless dress with a colorful floral pattern. The background consists of yellow vertical blinds. A yellow rectangular box contains the text.

**Do code smells
matter to kids?**

A baby with dark hair tied up in a bun is sitting cross-legged on a dark carpet. They are wearing a purple sleeveless dress with a floral pattern. An open laptop with a red frame is positioned to their left, its screen glowing brightly. The background features a yellow wall with vertical stripes and a white baseboard. A yellow rectangular box is overlaid on the upper right side of the image, containing the text "tl;dr" on top and "Yes" below it.

tl;dr
Yes

A baby with dark hair tied up in a bun is sitting cross-legged on a dark carpet. They are wearing a purple sleeveless dress with a floral pattern. A red laptop is open in front of them, and they are looking down at it with a neutral, slightly curious expression. The background consists of vertical yellow and blue stripes, possibly from a train or a wall.

tl;dr
Yes

**Kids performed
significantly better
on the non-smelly
program**

A baby with dark hair tied up in a bun is sitting cross-legged on a carpeted floor, looking intently at a laptop screen. The laptop is open and positioned to the left of the baby. The background features vertical yellow and blue stripes, possibly from a train or a wall. A red object is partially visible on the far left.

tl;dr
Yes

But, differences tasks are impacted differently

A baby with dark hair tied up in a bun is lying on a dark brown carpet, facing a red Sony VAIO laptop. The baby is wearing a purple and white patterned onesie. The laptop is open, and the baby is looking intently at the screen. In the background, there is a yellow wall with vertical blinds. A yellow rectangular box with a black border is positioned in the upper right corner of the image, containing the text.

**Let's take a
closer look!**

A baby with dark hair tied up in a bun is lying on a dark carpet, facing a red VAIO laptop. The laptop is open, and the baby appears to be looking at it. The background shows a window with yellow vertical blinds.

**Let's take a
closer look!**

**Understanding
seems affected
more by the Long
Method smell**

A baby with dark hair tied up in a bun is lying on a dark brown carpet, facing a red VAIO laptop. The laptop is open, and the baby appears to be looking at it. The background shows a window with yellow vertical blinds.

**Let's take a
closer look!**

**Modification is
hampered most
by Duplication**

**Smells are bad!
(also for kids)**



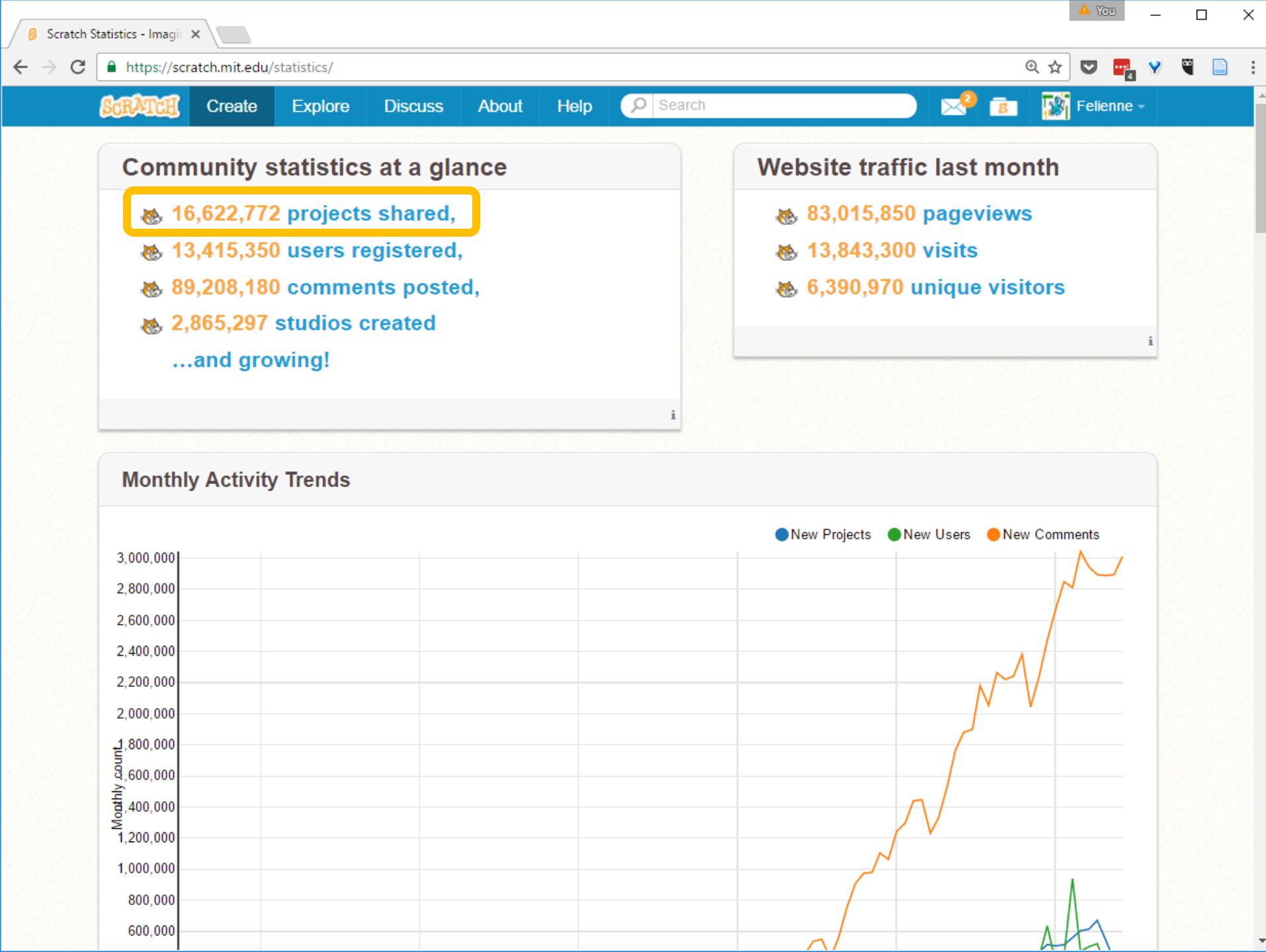
A black and white skunk is walking through a field of green grass and some fallen leaves. It has a thick coat of dark fur with a prominent white stripe running from its head down its back. Its tail is bushy and white. The skunk is looking towards the right of the frame.

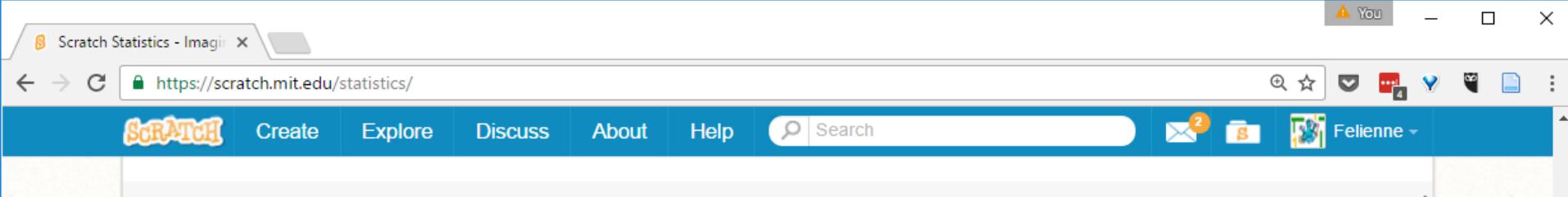
**Smells are bad!
(also for kids)**

**Are smells
common?**

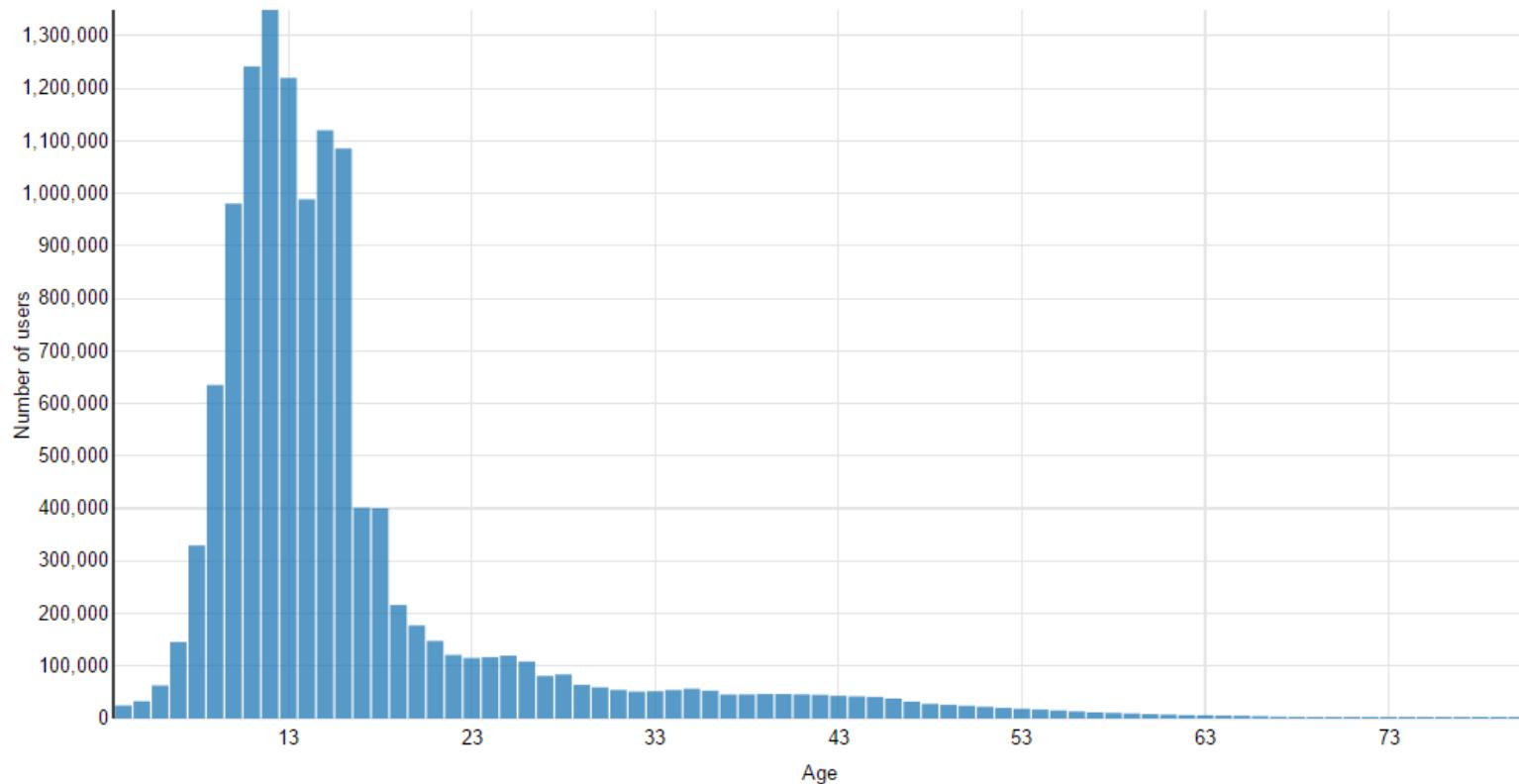
An aerial photograph of the Massachusetts Institute of Technology (MIT) campus in Cambridge, Massachusetts. The image shows the large, L-shaped main building complex, the Great Dome, and various other academic buildings. The campus is surrounded by a mix of residential and commercial buildings, including the iconic Kresge Auditorium. A river runs along the right side of the campus. In the top left corner, there is a yellow diagonal banner with the text "Thanks MIT" in black, bold, sans-serif font.

Thanks MIT



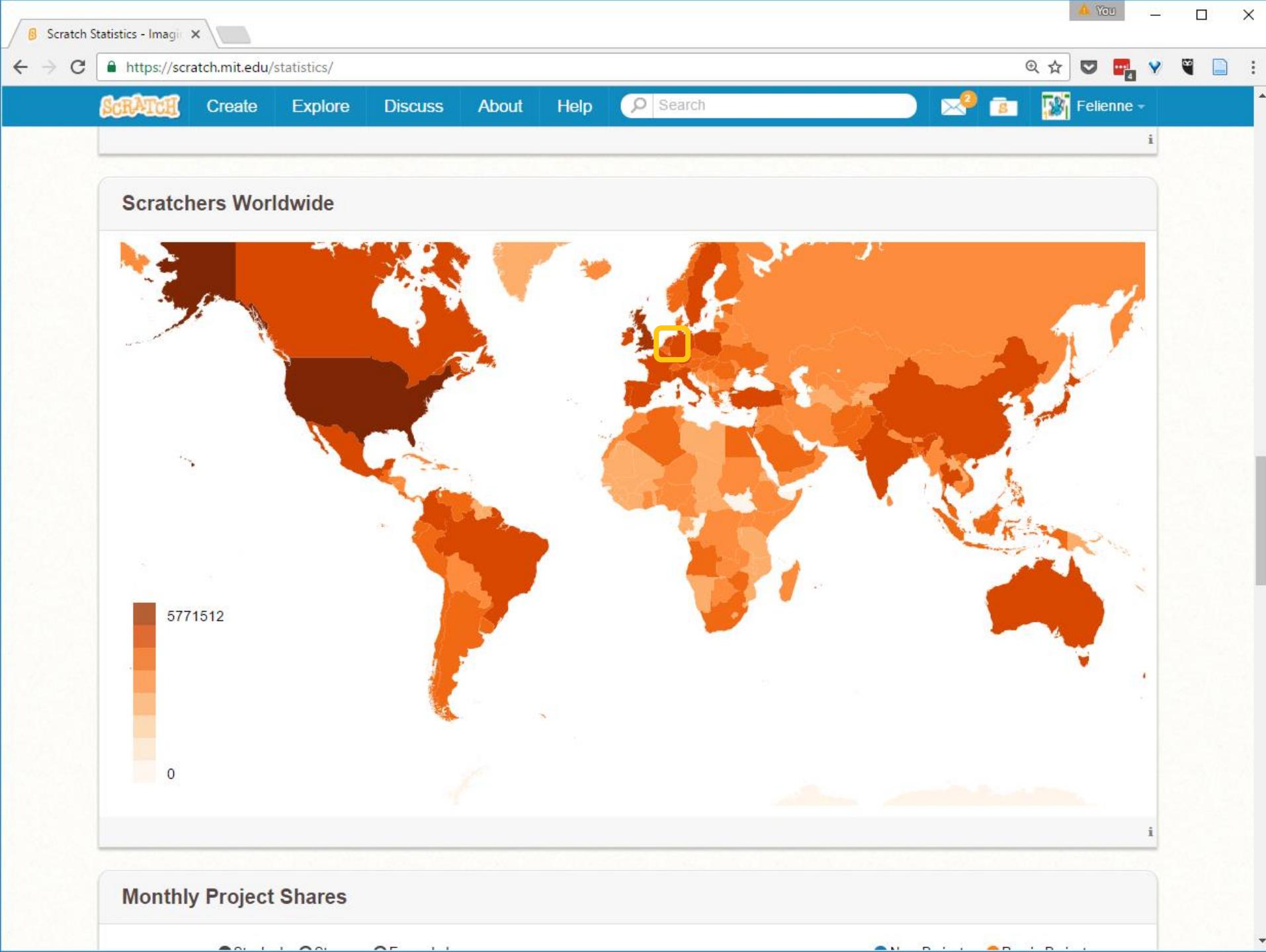


Age Distribution of New Scratchers



Scratchers Worldwide





What do kids do in Scratch?



THE ART
OF WAR
BY
SUN TZU
FOREWORD BY
JAMES CLAVELL

**Let's look at
some programs!**



**Downloaded all
shared programs
for 24 hours**



250.000 JSON files

```
"scale": 0.30000000000000016,
"direction": 74.99999999999999,
"rotationStyle": "leftRight",
"isDraggable": false,
"indexInLibrary": 2,
"visible": true,
"spriteInfo": {
},
{
    "objName": "Gerrie",
    "scripts": [[284.35, 7.7, [[["whenKeyPressed", "left arrow"], ["changeXposBy:", -10], ["lookLike:", "links"]]], [287.1, 108.05, [[["whenKeyPressed", "down arrow"], ["changeYposBy:", -10]]], [20.25, 5, [[["whenKeyPressed", "right arrow"], ["changeXposBy:", 10], ["lookLike:", "rechts"]]], [20.2, 106.7, [[["whenKeyPressed", "up arrow"], ["changeYposBy:", 10]]], [19.95, 188.4, [[["whenIReceive", "hap"], ["changeSizeBy:", 10]]], [25.55, 280.5, [[["whenGreenFlag"], ["setSizeTo:", 80], ["doForever", [[["doIf", ["touching:", "Fish3"], [{"setSizeTo:", 20}, {"broadcast:", "raakRodeVis"}]]]]], [268.45, 277.1, [[["whenIReceive", "hap"], ["changeSizeBy:", 10], {"say:duration:elapsed:from:", "Jammie", 1}]]], "sounds": [{"soundName": "pop", "soundID": -1, "md5": "83a9787d4cb6f3b7632b4ddfeb74367.wav", "sampleCount": 258, "rate": 11025, "format": ""}], "costumes": [{"costumeName": "rechts", "baseLayerID": -1, "baseLayerMD5": "f3dd9cb79cce497a90900241cf726367.svg", "bitmapResolution": 1, "rotationCenterX": 75, "rotationCenterY": 75}, {"costumeName": "links", "baseLayerID": -1, "baseLayerMD5": "65dfdfab2f2156f86eab155f09b33ba9.svg", "bitmapResolution": 1, "rotationCenterX": 74, "rotationCenterY": 75}], "variables": [{"name": "x", "value": 100, "type": "number"}, {"name": "y", "value": 100, "type": "number"}, {"name": "size", "value": 100, "type": "number"}, {"name": "color", "value": "#000000", "type": "color"}], "blocks": [{"id": 1, "x": 100, "y": 100, "type": "script", "script": "when green flag clicked\n  set [x v] to [100]\n  set [y v] to [100]\n  set [size v] to [100]\n  set [color v] to [#000000]\n  forever\n    if [key pressed v]\n      then\n        if [left arrow v] then\n          change [xpos by] by [-10]\n        else if [right arrow v] then\n          change [xpos by] by [10]\n        else if [up arrow v] then\n          change [ypos by] by [10]\n        else if [down arrow v] then\n          change [ypos by] by [-10]\n        end\n        if [hap v] then\n          change [size by] by [10]\n        end\n      end\n    end\n  end"}, {"id": 2, "x": 100, "y": 150, "type": "script", "script": "when I receive [hap v]\n  change [size by] by [10]"}, {"id": 3, "x": 100, "y": 200, "type": "script", "script": "when I receive [hap v]\n  broadcast [raakRodeVis v]"}, {"id": 4, "x": 100, "y": 250, "type": "script", "script": "when I receive [hap v]\n  say [Jammie v] for [1] second"}, {"id": 5, "x": 100, "y": 300, "type": "script", "script": "when I receive [hap v]\n  touch [Fish3 v]\n  set [size to] 20"}, {"id": 6, "x": 100, "y": 350, "type": "script", "script": "when I receive [hap v]\n  set [color to] [#000000]"}, {"id": 7, "x": 100, "y": 400, "type": "script", "script": "when I receive [hap v]\n  set [y to] [100]"}, {"id": 8, "x": 100, "y": 450, "type": "script", "script": "when I receive [hap v]\n  set [x to] [100]"}, {"id": 9, "x": 100, "y": 500, "type": "script", "script": "when I receive [hap v]\n  set [size to] [100]"}], "events": [{"name": "when green flag clicked", "x": 100, "y": 100}, {"name": "when I receive [hap v]", "x": 100, "y": 150}, {"name": "when I receive [hap v]", "x": 100, "y": 200}, {"name": "when I receive [hap v]", "x": 100, "y": 250}, {"name": "when I receive [hap v]", "x": 100, "y": 300}, {"name": "when I receive [hap v]", "x": 100, "y": 350}, {"name": "when I receive [hap v]", "x": 100, "y": 400}, {"name": "when I receive [hap v]", "x": 100, "y": 450}, {"name": "when I receive [hap v]", "x": 100, "y": 500}], "variables": [{"name": "x", "value": 100, "type": "number"}, {"name": "y", "value": 100, "type": "number"}, {"name": "size", "value": 100, "type": "number"}, {"name": "color", "value": "#000000", "type": "color"}], "blocks": [{"id": 1, "x": 100, "y": 100, "type": "script", "script": "when green flag clicked\n  set [x v] to [100]\n  set [y v] to [100]\n  set [size v] to [100]\n  set [color v] to [#000000]\n  forever\n    if [key pressed v]\n      then\n        if [left arrow v] then\n          change [xpos by] by [-10]\n        else if [right arrow v] then\n          change [xpos by] by [10]\n        else if [up arrow v] then\n          change [ypos by] by [10]\n        else if [down arrow v] then\n          change [ypos by] by [-10]\n        end\n        if [hap v] then\n          change [size by] by [10]\n        end\n      end\n    end\n  end"}, {"id": 2, "x": 100, "y": 150, "type": "script", "script": "when I receive [hap v]\n  change [size by] by [10]"}, {"id": 3, "x": 100, "y": 200, "type": "script", "script": "when I receive [hap v]\n  broadcast [raakRodeVis v]"}, {"id": 4, "x": 100, "y": 250, "type": "script", "script": "when I receive [hap v]\n  say [Jammie v] for [1] second"}, {"id": 5, "x": 100, "y": 300, "type": "script", "script": "when I receive [hap v]\n  touch [Fish3 v]\n  set [size to] 20"}, {"id": 6, "x": 100, "y": 350, "type": "script", "script": "when I receive [hap v]\n  set [color to] [#000000]"}, {"id": 7, "x": 100, "y": 400, "type": "script", "script": "when I receive [hap v]\n  set [y to] [100]"}, {"id": 8, "x": 100, "y": 450, "type": "script", "script": "when I receive [hap v]\n  set [x to] [100]"}, {"id": 9, "x": 100, "y": 500, "type": "script", "script": "when I receive [hap v]\n  set [size to] [100]"}], "events": [{"name": "when green flag clicked", "x": 100, "y": 100}, {"name": "when I receive [hap v]", "x": 100, "y": 150}, {"name": "when I receive [hap v]", "x": 100, "y": 200}, {"name": "when I receive [hap v]", "x": 100, "y": 250}, {"name": "when I receive [hap v]", "x": 100, "y": 300}, {"name": "when I receive [hap v]", "x": 100, "y": 350}, {"name": "when I receive [hap v]", "x": 100, "y": 400}, {"name": "when I receive [hap v]", "x": 100, "y": 450}, {"name": "when I receive [hap v]", "x": 100, "y": 500}]}]
```



```
10519701,68-60,0,sprite,"Sprite3",1,0,"whenIReceive","POWNE!!!!"
10519701,68-60,0,sprite,"Sprite3",1,1,"say:duration:elapsed:from:", "its a magic powne flying through the sky on a magic program :D",10
10519701,68-60,0,sprite,"Sprite3",1,2,"broadcast:","SKY HIE!"
10519701,108-143,1,sprite,"Sprite4",1,0,"whenIReceive","SKY HIE!"
10519701,108-143,1,sprite,"Sprite4",1,1,"say:duration:elapsed:from:", "Shoot it down!",5
10519701,108-143,1,sprite,"Sprite4",1,2,"wait:elapsed:from:",1
10519701,108-143,1,sprite,"Sprite4",1,3,"nextCostume"
10519701,129-121,2,sprite,"Sprite1",1,0,"whenGreenFlag"
10519701,129-121,2,sprite,"Sprite1",1,1,"broadcast:","POWNE!!!!"
10541430,22-17,0,stage,"stage",1,0,"whenGreenFlag"
10541430,22-17,0,stage,"stage",1,1,"setVar:to:","x",0
10541430,22-17,0,stage,"stage",3,3,"changeVar:by:","x",-15
10541430,22-17,0,stage,"stage",1,2,"doForever"
10541430,21-14,1,sprite,"Tree_3",1,0,"whenGreenFlag"
10541430,21-14,1,sprite,"Tree_3",1,1,"show"
10541430,21-14,1,sprite,"Tree_3",1,2,"goBackByLayers:",100
10541430,21-14,1,sprite,"Tree_3",1,3,"ypos:",0
10541430,21-14,1,sprite,"Tree_3",1,4,"setSizeTo:",100
10541430,21-14,1,sprite,"Tree_3",7,10,"readVariable","x"
10541430,21-14,1,sprite,"Tree_3",6,9,"*",0.1
10541430,21-14,1,sprite,"Tree_3",5,8,"%",800
10541430,21-14,1,sprite,"Tree_3",4,7,"+",-400
10541430,21-14,1,sprite,"Tree_3",3,6,"xpos:"
10541430,21-14,1,sprite,"Tree_3",1,5,"doForever"
10541430,21-14,2,sprite,"Tree_2",1,0,"whenGreenFlag"
10541430,21-14,2,sprite,"Tree_2",1,1,"show"
10541430,21-14,2,sprite,"Tree_2",1,2,"goBackByLayers:",100
10541430,21-14,2,sprite,"Tree_2",1,3,"ypos:",85
10541430,21-14,2,sprite,"Tree_2",1,4,"setSizeTo:",307.692
10541430,21-14,2,sprite,"Tree_2",7,10,"readVariable","x"
10541430,21-14,2,sprite,"Tree_2",6,9,"*",0.6
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10541430,21-14,2,sprite,"Tree_2",3,6,"xpos:"
10541430,21-14,2,sprite,"Tree_2",1,5,"doForever"
10541430,14-18,3,sprite,"Scratch Cat",1,0,"whenGreenFlag"
10541430,14-18,3,sprite,"Scratch Cat",3,2,"wait:elapsed:from:",0.02
10541430,14-18,3,sprite,"Scratch Cat",3,3,"nextCostume"
10541430,14-18,3,sprite,"Scratch Cat",1,1,"doForever"
10541430,83-290,4,sprite,"Scratch Cat",1,0,"setSizeTo:",50
10541430,83-290,4,sprite,"Scratch Cat",1,1,"gotoX:y:",-195,-123
10541430,83-290,4,sprite,"Scratch Cat",1,2,"clearPenTrails"
10541430,83-290,4,sprite,"Scratch Cat",1,3,"lookLike:","Walk1"
10541430,83-290,4,sprite,"Scratch Cat",3,5,"stampCostume"
10541430,83-290,4,sprite,"Scratch Cat",3,6,"changeXposBy:",55
10541430,83-290,4,sprite,"Scratch Cat",3,7,"nextCostume"
10541430,83-290,4,sprite,"Scratch Cat",1,4,"doRepeat",8
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10541430,83-290,4,sprite,"Scratch Cat",1,9,"gotoX:y:",0,55
10541430,21-14,5,sprite,"grass3",1,0,"whenGreenFlag"
10541430,21-14,5,sprite,"grass3",1,1,"ypos:",0
10541430,21-14,5,sprite,"grass3",6,6,"readVariable","x"
```

Flattened
into csv



```
10519701,68-60,0,sprite,"Sprite3",1,0,"whenIReceive","POWNE!!!!"
10519701,68-60,0,sprite,"Sprite3",1,1,"say:duration:elapsed:from:", "its a magic powne flying through the sky on a magic program :D",10
10519701,68-60,0,sprite,"Sprite3",1,2,"broadcast:","SKY HIE!"
10519701,108-143,1,sprite,"Sprite4",1,0,"whenIReceive","SKY HIE!"
10519701,108-143,1,sprite,"Sprite4",1,1,"say:duration:elapsed:from:", "Shoot it down!",5
10519701,108-143,1,sprite,"Sprite4",1,2,"wait:elapsed:from:",1
10519701,108-143,1,sprite,"Sprite4",1,3,"nextCostume"
10519701,129-121,2,sprite,"Sprite1",1,0,"whenGreenFlag"
10519701,129-121,2,sprite,"Sprite1",1,1,"broadcast:","POWNE!!!!"
10541430,22-17,0,stage,"stage",1,0,"whenGreenFlag"
10541430,22-17,0,stage,"stage",1,1,"setVar:to:","x",0
10541430,22-17,0,stage,"stage",3,3,"changeVar:by:","x",-15
10541430,22-17,0,stage,"stage",1,2,"doForever"
10541430,21-14,1,sprite,"Tree_3",1,0,"whenGreenFlag"
10541430,21-14,1,sprite,"Tree_3",1,1,"show"
10541430,21-14,1,sprite,"Tree_3",1,2,"goBackByLayers:",100
10541430,21-14,1,sprite,"Tree_3",1,3,"ypos:",0
10541430,21-14,1,sprite,"Tree_3",1,4,"setSizeTo:",100
10541430,21-14,1,sprite,"Tree_3",7,10,"readVariable","x"
10541430,21-14,1,sprite,"Tree_3",6,9,"*",0.1
10541430,21-14,1,sprite,"Tree_3",5,8,"%",800
10541430,21-14,1,sprite,"Tree_3",4,7,"+",-400
10541430,21-14,1,sprite,"Tree_3",3,6,"xpos:"
10541430,21-14,1,sprite,"Tree_3",1,5,"doForever"
10541430,21-14,2,sprite,"Tree_2",1,0,"whenGreenFlag"
10541430,21-14,2,sprite,"Tree_2",1,1,"show"
10541430,21-14,2,sprite,"Tree_2",1,2,"goBackByLayers:",100
10541430,21-14,2,sprite,"Tree_2",1,3,"ypos:",85
10541430,21-14,2,sprite,"Tree_2",1,4,"setSizeTo:",307.692
10541430,21-14,2,sprite,"Tree_2",7,10,"readVariable","x"
10541430,21-14,2,sprite,"Tree_2",6,9,"*",0.6
10541430,21-14,2,sprite,"Tree_2",5,8,"%",3200
10541430,21-14,2,sprite,"Tree_2",4,7,"+",-1600
10541430,21-14,2,sprite,"Tree_2",3,6,"xpos:"
10541430,21-14,2,sprite,"Tree_2",1,5,"doForever"
10541430,14-18,3,sprite,"Scratch Cat",1,0,"whenGreenFlag"
10541430,14-18,3,sprite,"Scratch Cat",3,2,"wait:elapsed:from:",0.02
10541430,14-18,3,sprite,"Scratch Cat",3,3,"nextCostume"
10541430,14-18,3,sprite,"Scratch Cat",1,1,"doForever"
10541430,83-290,4,sprite,"Scratch Cat",1,0,"setSizeTo:",50
10541430,83-290,4,sprite,"Scratch Cat",1,1,"gotoX:y:",-195,-123
10541430,83-290,4,sprite,"Scratch Cat",1,2,"clearPenTrails"
10541430,83-290,4,sprite,"Scratch Cat",1,3,"lookLike:","Walk1"
10541430,83-290,4,sprite,"Scratch Cat",3,5,"stampCostume"
10541430,83-290,4,sprite,"Scratch Cat",3,6,"changeXposBy:",55
10541430,83-290,4,sprite,"Scratch Cat",3,7,"nextCostume"
10541430,83-290,4,sprite,"Scratch Cat",1,4,"doRepeat",8
10541430,83-290,4,sprite,"Scratch Cat",1,8,"setSizeTo:",120
10541430,83-290,4,sprite,"Scratch Cat",1,9,"gotoX:y:",0,55
10541430,21-14,5,sprite,"grass3",1,0,"whenGreenFlag"
10541430,21-14,5,sprite,"grass3",1,1,"ypos:",0
10541430,21-14,5,sprite,"grass3",6,6,"readVariable","x"
```

Flattened
into csv

Available on GitHub!

<https://github.com/TUDelftScratchLab/ScratchDataset>

What we found...



THE ART
OF WAR
BY
SUN TZU
FOREWORD BY
JAMES CLAVEL

**Many programs
are small...**



Median program

Drawing for dummies #2

https://scratch.mit.edu/projects/98977220/#editor

SCRATCH File ▾ Edit ▾ Tips About

Drawing for dummies by sampdubs

v449

Scripts Costumes Sounds

Motion

- Events
- Control
- Sensing
- Operators
- More Blocks

Looks Sound Pen Data

when green flag clicked

hide

when I receive flower prettiness

set color effect to pick random 0 to 100

set brightness effect to pick random -20 to 20

set size to pick random 70 to 90 %

repeat (20)

stamp

turn (18) degrees

when I receive Draw

set x to -160

switch costume to leaf 1

repeat (4)

set y to pick random -100

broadcast flower prettiness

change x by 80

next costume

when space key pressed

clear

set color effect to 0

set size to 100 %

go to x: -160 y: 0

change x by 10

set x to 0

change y by 10

set y to 0

if on edge, bounce

Stage 1 backdrop

New backdrop:

leaf

x: 240 y: 180

Backpack

Median program

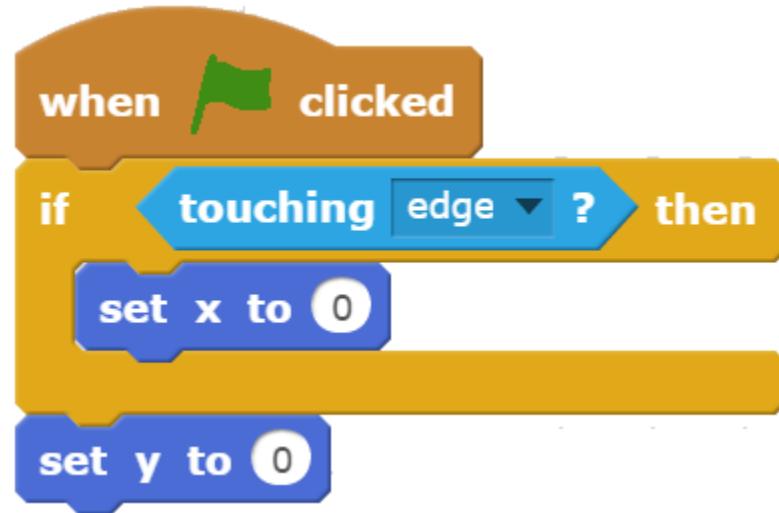
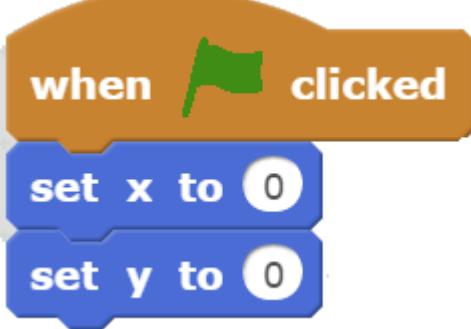
This image shows a Scratch project titled "Median program". The stage features a blue and white striped backdrop with a large, colorful flower and a single red leaf. Two scripts are present:

- Flower Script:** Triggers when the green flag is clicked. It hides the flower and then repeats 20 times to stamp a red flower at various angles.
- Leaf Script:** Triggers when the space key is pressed. It clears the screen, sets the color effect to 0, and moves the leaf to the center. It then repeats 4 times to move the leaf in a circular path.

The Scratch interface includes a script palette on the left with categories like Motion, Looks, Sound, Pen, and Data, and a backpack palette at the bottom.

**2 sprites
5 scripts
29 blocks**

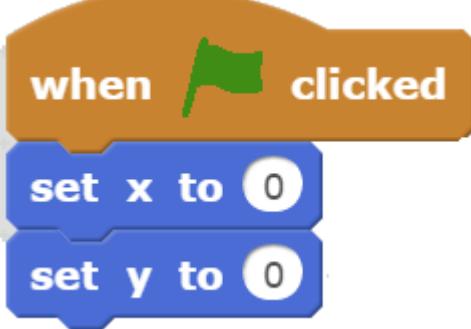
**Most programs
are simple...**



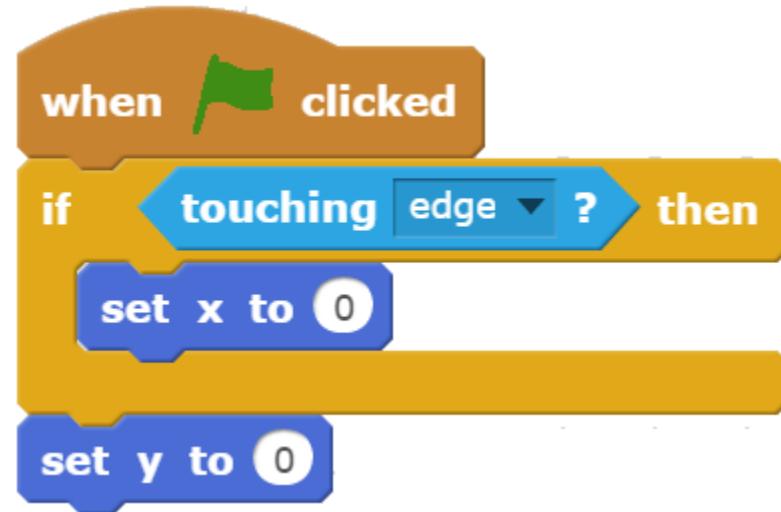
**Cyclomatic
complexity: 1**

**Cyclomatic
complexity: 2**

Most programs are simple...



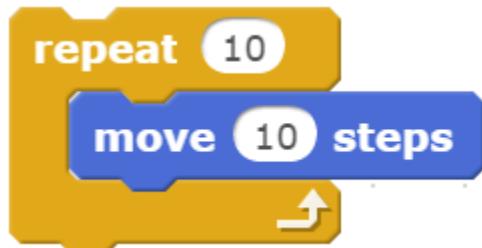
78%



Cyclomatic
complexity: 1

Cyclomatic
complexity: 2

Loops

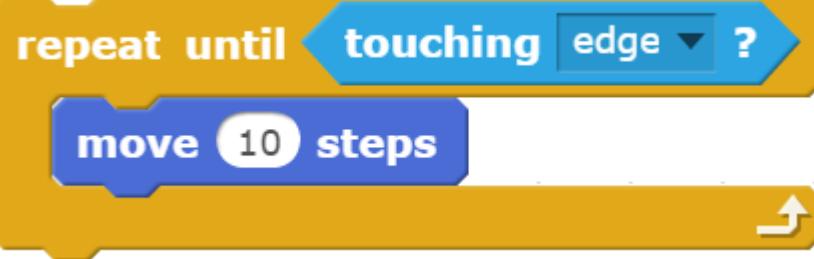


Loops



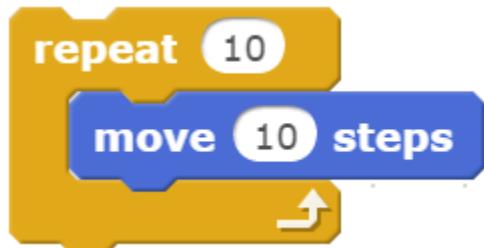
in 77% of projects

Loops



12%

52%



36%

Interaction

when space ▾ key pressed

when this sprite clicked

key space ▾ pressed?

ask What's your name? and wait

mouse down?

mouse x

mouse y

when loudness ▾ > 10

video motion ▾ on this sprite ▾

Interaction

In 56% of projects



Variables

set **x** to **0**

if **x = 0** then

change **x** by **1**

show variable **x**

hide variable **x**

Variables



In 33% of
projects

>4 in 7% of
projects

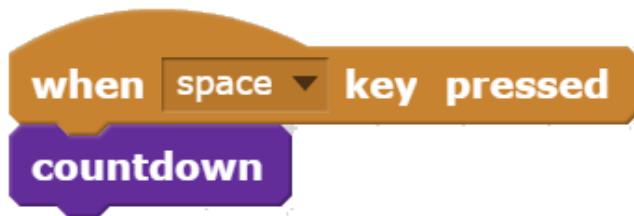
Procedures

```
when space key pressed  
countdown
```

```
define countdown  
set y to 10  
repeat (10)  
  say y for 1 secs  
  change y by -1
```

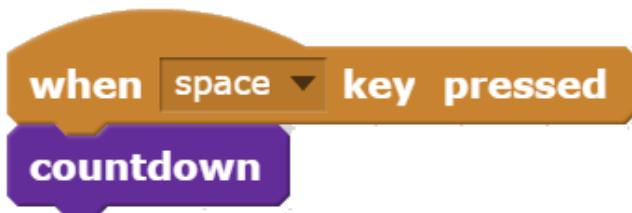
Procedures

In 8% of projects



Procedures

In 8% of projects



62% only invoked once



**Many programs
are small & simple**



But....



transparent paper minec X

https://scratch.mit.edu/projects/89117721/#editor

ScrATCH File ▾ Edit ▾ Tips About

transparent paper by Shuyan121 v449

Paper MINECRAFT

New Game Load Game Example Worlds Help...?

X: 240 y: 180

Stage 1 backdrop New backdrop:

selected Creative... Menu1 Splash_s... Save Game Random! Menu2 Commands Pseudora... Stare Sn snow

Scripts Costumes Sounds

Motion Events

Looks Control

Sound Sensing

Pen Operators

Data More Blocks

Make a Block

Save Basic Player Data

Get Level Stats

Save Inventory

Save Containers

Load Inventory 1 1

Load Containers 1

Read String

Clear Down Level

Get Save Level Chunk Index

Restore Level Chunk

Save Level Chunk

Save Game

Read Raw

Load Basic Player Data

Load Preset World

when I receive Green Flag

go to x: 0 y: 0

hide list _SAVE_LIST

delete all of SaveChunks

Show Example World List

hide

when I receive Save Game

wait until not key o pressed?

Save Game

switch costume to Saved

wait until key o pressed?

delete all of _SAVE_LIST

hide list _SAVE_LIST

hide

wait until not key o pressed?

define Save Game

if _CHUNK_SEED > 0 then

Save Level Chunk

switch costume to Saving

show

go to front

when I receive Load Game

Load Game

when I receive Load Example

Load Game not

hide list DEBUG

delete all of DEBUG

show list DEBUG

300 variables 300 procedures 100 events

A black and white skunk is standing in a field of green grass. It has a thick coat of dark fur with a prominent white stripe running from its nose through its eyes and down its back. Its bushy tail is also white. The skunk is facing towards the right of the frame.

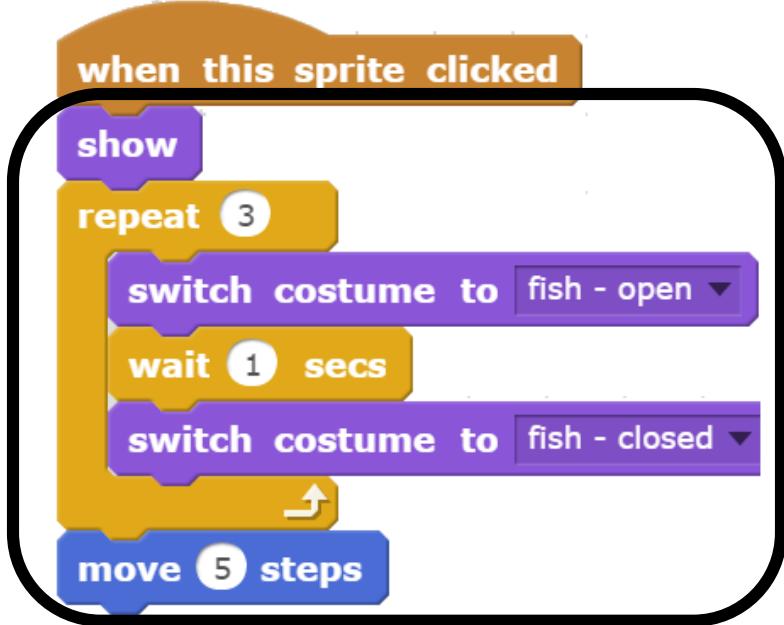
**And what
about smells?**

Duplicated Code

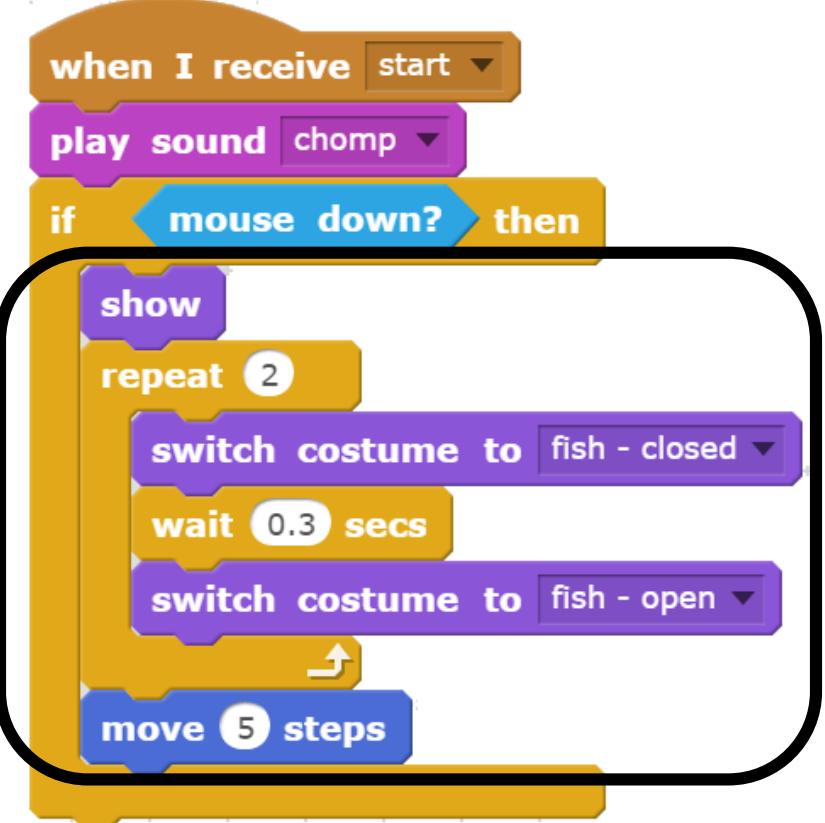
```
when this sprite clicked
show
repeat (3)
  switch costume to fish - open ▾
  wait (1) secs
  switch costume to fish - closed ▾
  move (5) steps
```

```
when I receive start
play sound chomp ▾
if mouse down? then
  show
  repeat (2)
    switch costume to fish - closed ▾
    wait (0.3) secs
    switch costume to fish - open ▾
    move (5) steps
```

Duplicated Code

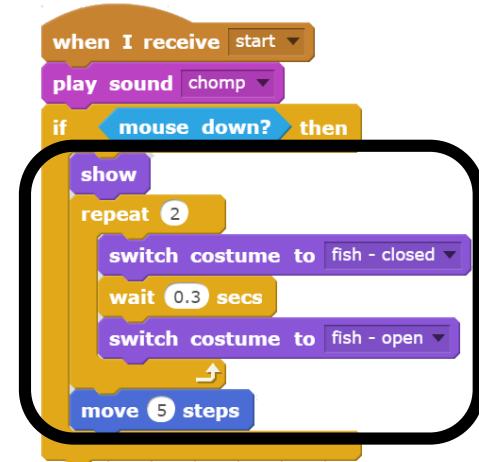


```
when this sprite clicked
  show
  repeat (3)
    switch costume to [fish - open v]
    wait (1) secs
    switch costume to [fish - closed v]
  end
  move (5) steps
```



```
when I receive [start v]
  play sound [chomp v]
  if [mouse down?] then
    show
    repeat (2)
      switch costume to [fish - closed v]
      wait (0.3) secs
      switch costume to [fish - open v]
    end
    move (5) steps
```

Duplicated Code



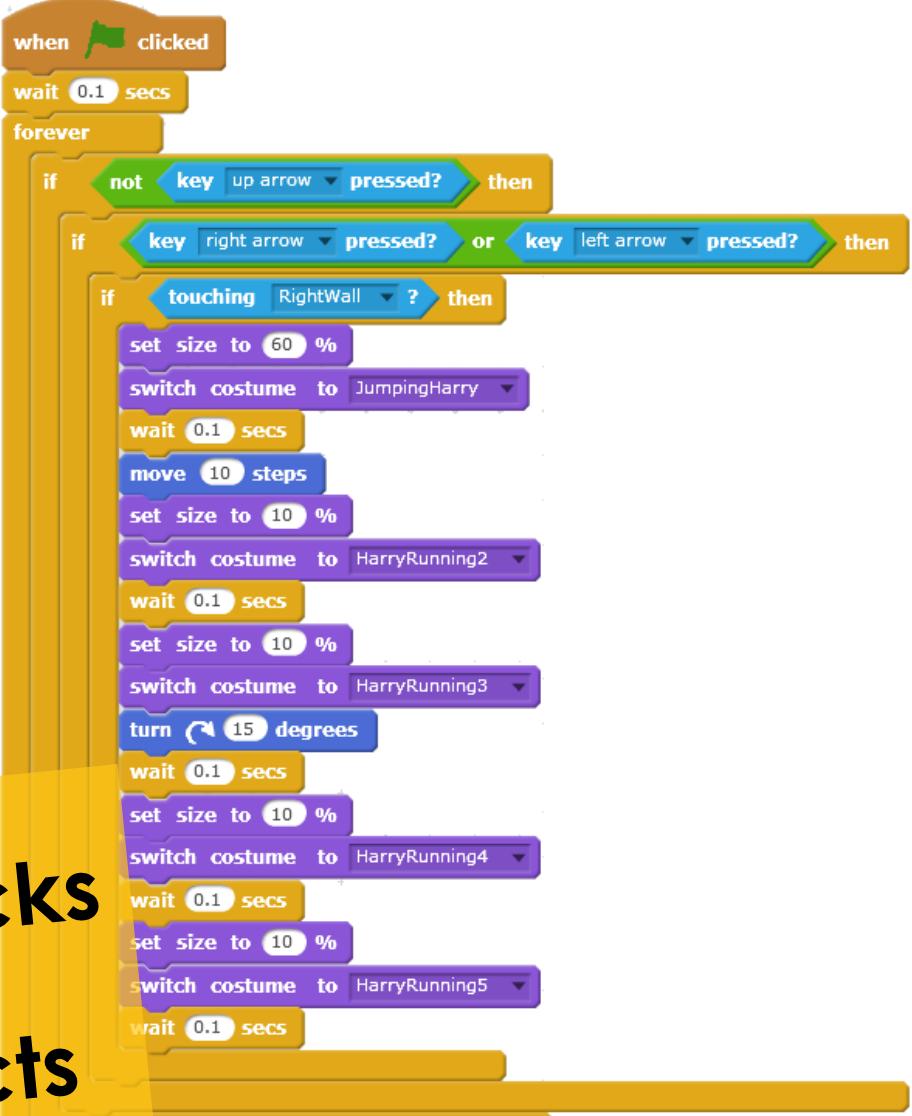
Across sprites: in **26%** of the projects
Within sprites: in **10%** of the projects

Large Script

```
when green flag clicked
  wait [0.1] secs
  forever
    if [not key up arrow pressed?]
    then
      if [key right arrow pressed? or key left arrow pressed?]
      then
        if [touching RightWall ?]
        then
          set size to [60%]
          switch costume to [JumpingHarry]
          wait [0.1] secs
          move [10] steps
          set size to [10%]
          switch costume to [HarryRunning2]
          wait [0.1] secs
          set size to [10%]
          switch costume to [HarryRunning3]
          turn [15] degrees
          wait [0.1] secs
          set size to [10%]
          switch costume to [HarryRunning4]
          wait [0.1] secs
          set size to [10%]
          switch costume to [HarryRunning5]
          wait [0.1] secs
        end
      end
    end
    if [key up arrow pressed?]
    then
      set size to [60%]
      switch costume to [JumpingHarry]
    else
      set size to [40%]
      switch costume to [StandingHarry]
    end
  end
end
```

Large Script

scripts with >18 blocks
in 30% of the projects



A Scratch script titled "when green flag clicked". It starts with a "wait 0.1 secs" block. A "forever" loop follows, containing an "if" block that checks if the up arrow key is not pressed. If it's not pressed, it checks if the right or left arrow key is pressed. If either is pressed, it checks if the character is touching a "RightWall". If so, it sets the size to 60%, switches to costume "JumpingHarry", waits 0.1 secs, moves 10 steps, sets size to 10%, switches to costume "HarryRunning2", waits 0.1 secs, sets size to 10%, switches to costume "HarryRunning3", turns 15 degrees, waits 0.1 secs, sets size to 10%, switches to costume "HarryRunning4", waits 0.1 secs, sets size to 10%, switches to costume "HarryRunning5", and waits 0.1 secs. Finally, it checks if the up arrow key is pressed. If it is, it sets the size to 60%, switches to costume "JumpingHarry", and ends the "if" block with an "else" branch that sets the size to 40% and switches to costume "StandingHarry".

```
when green flag clicked
  wait [0.1] secs
  forever
    if [not key up arrow v pressed?]
      then
        if [key right arrow v pressed? or key left arrow v pressed?]
          then
            if [touching RightWall v?]
              then
                set size to (60%) [switch costume to JumpingHarry v]
                wait [0.1] secs
                move (10) steps
                set size to (10%) [switch costume to HarryRunning2 v]
                wait [0.1] secs
                set size to (10%) [switch costume to HarryRunning3 v]
                turn (15) degrees
                wait [0.1] secs
                set size to (10%) [switch costume to HarryRunning4 v]
                wait [0.1] secs
                set size to (10%) [switch costume to HarryRunning5 v]
                wait [0.1] secs
      else
        if [key up arrow v pressed?]
          then
            set size to (60%) [switch costume to JumpingHarry v]
        else
          set size to (40%) [switch costume to StandingHarry v]
```

Dead Code

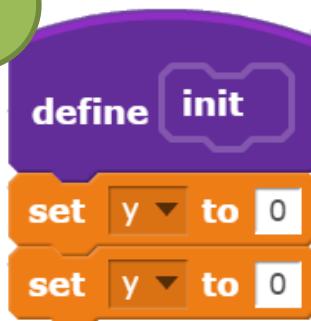
1



2



3



4



Dead Code

1

```
when green flag clicked
if [space key pressed?]
then
  broadcast [start v]
```

2

```
when space key pressed
move (10) steps
```

3

```
when green flag clicked
init
define [init v]
set [y] to (0)
set [y] to (0)
```

4

```
when this sprite clicked
broadcast [gameOver v]
when this sprite clicked
say [2 slides to go!] v
```

Dead Code

24%

1



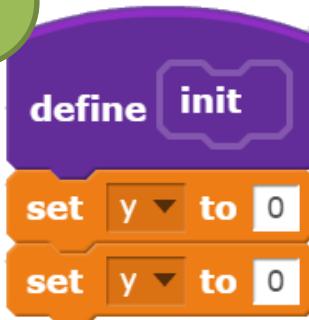
24%

2



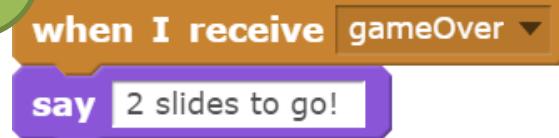
1%

3



8%

4



Dead Code

Any: 28% of the projects

24%

1



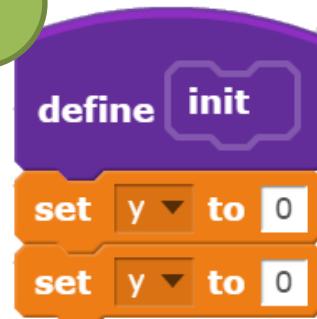
24%

2



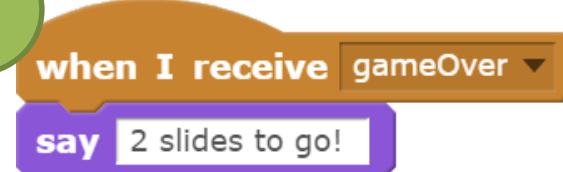
1%

3



8%

4



Giga Platformer on Scratch

<https://scratch.mit.edu/projects/114617114/#editor>

In summary...

Programs are simple

The image shows a Scratch project titled "Giga Platformer" by Felienne (shared). The stage features a green landscape with hills and a blue sky. Two characters are present: "Giga" (a red-haired character) and "Muur" (a brown wall). The "Scripts" tab is selected, displaying two scripts:

- Giga's Script:** A "when green flag clicked" script that runs a "forever" loop. Inside the loop, it checks if the right arrow key is pressed. If so, it checks if Giga is touching the "Muur" backdrop. If yes, it plays the "pop" sound. Otherwise, it checks if Giga's x position is greater than 0. If yes, it broadcasts "schuiven maar". Otherwise, it changes Giga's x position by 3 and points it back to 90 degrees.
- Muur's Script:** A "when I receive giga is af" script that stops all other scripts when Giga touches the wall.

The "Costumes" and "Sounds" tabs are also visible in the top menu bar.

But....



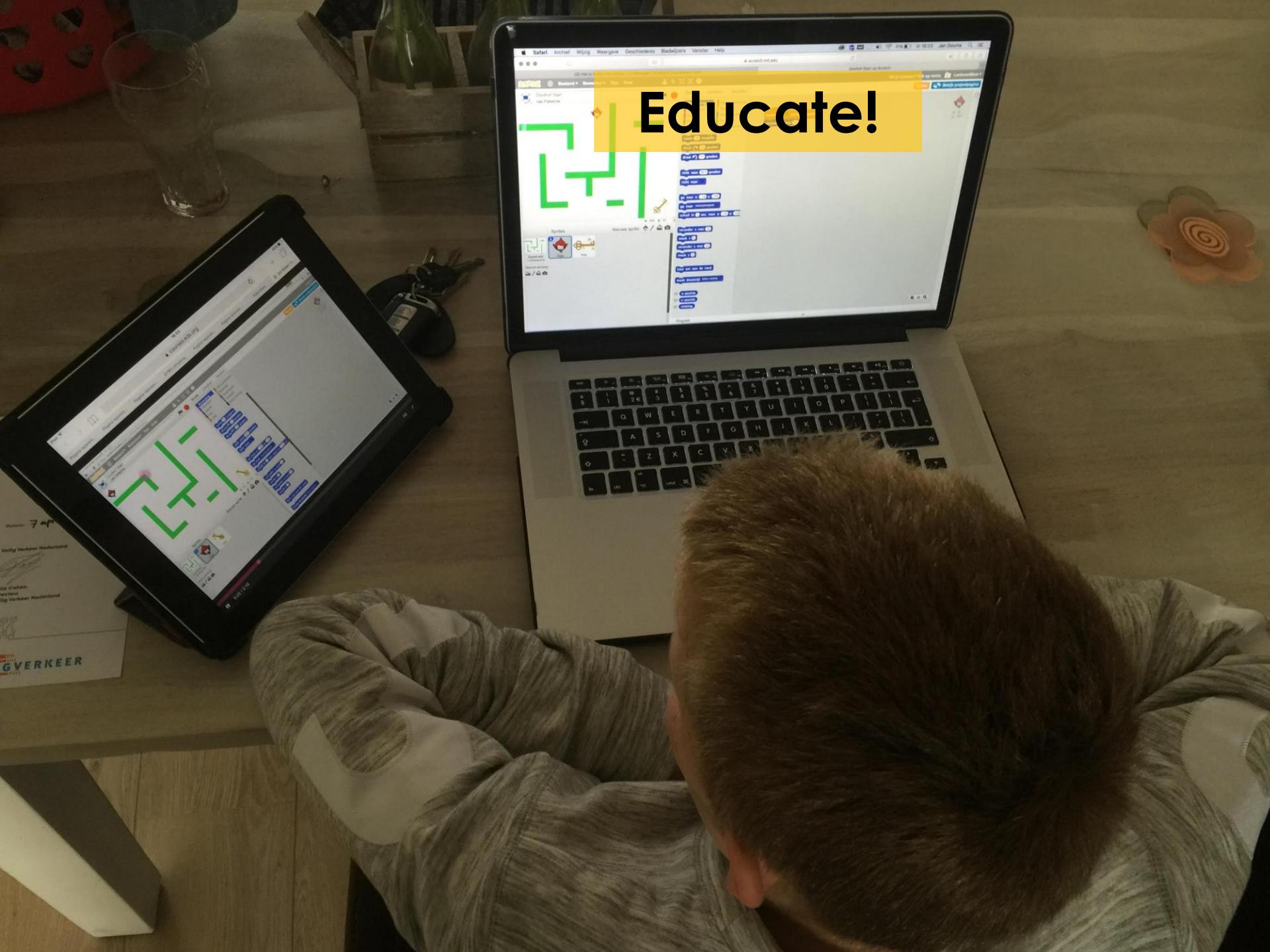
A close-up photograph of a black and white skunk walking through tall green grass. The skunk has a thick coat of dark fur with prominent white stripes running from its head down its back and tail. It is looking towards the camera. In the upper right corner of the image, there is a yellow rectangular banner with the text "Smells are common" written in a bold, black, sans-serif font.

Smells are common

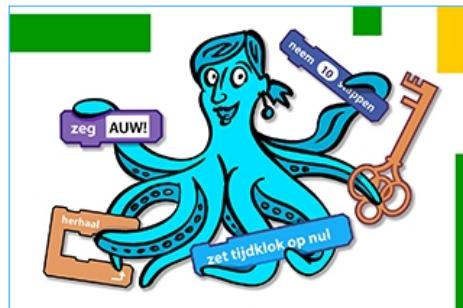


Now what?

Educate!



Home > All Subjects > Computer Science > Scratch: Programmeren voor kinderen (8+)



Scratch: Programmeren voor kinderen (8+)

In deze gratis cursus leer je spelenderwijs programmeren. Maak je eigen games met Scratch, terwijl je leert hoe je op een nette manier programmeert



Self-Paced

Enroll Now

I would like to receive email from Delft University of Technology (TU Delft) and learn about other offerings related to Scratch: Programmeren voor kinderen (8+).

About this course

1 Reviews 4.5/5

Programmeren is steeds belangrijker in onze wereld. En jong geleerd is oud gedaan. Deze MOOC bevat filmpjes en opdrachten waarmee kinderen zelf kunnen leren programmeren.

Iedere week maken we samen een game: een doolhof, een aquarium, een Flappy Bird spel en een soort Super Mario

[See more](#)

What you'll learn

- Programmeren in Scratch
- Algemene programmeerconcepten (lussen, variabelen, datastructuren)

Over 3000
kids enrolled

Meet the instructor



Length: 6 weken

Effort: 2-6 uur per week

Institution: DelftX

Subject: Computer Science

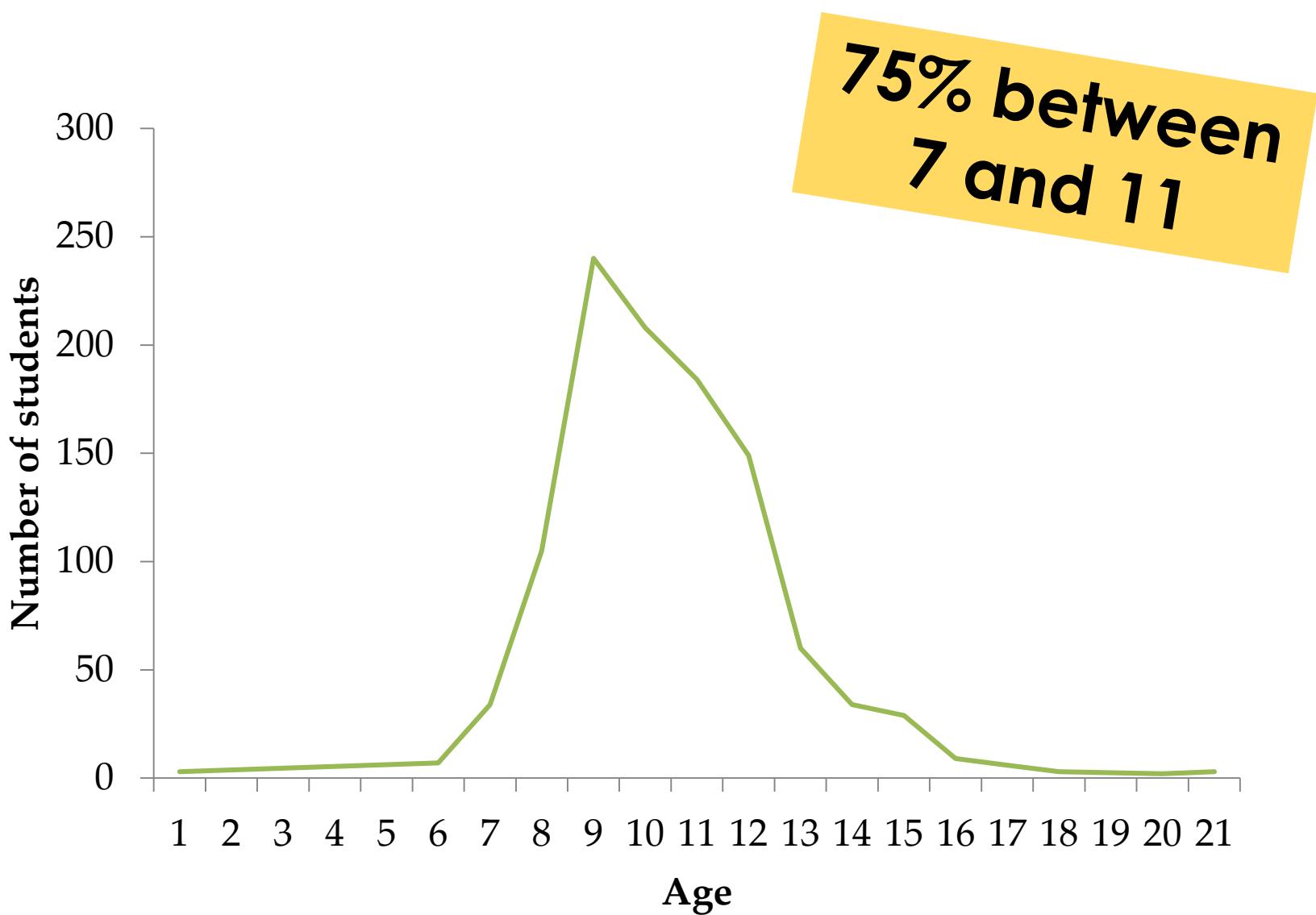
Level: Introductory

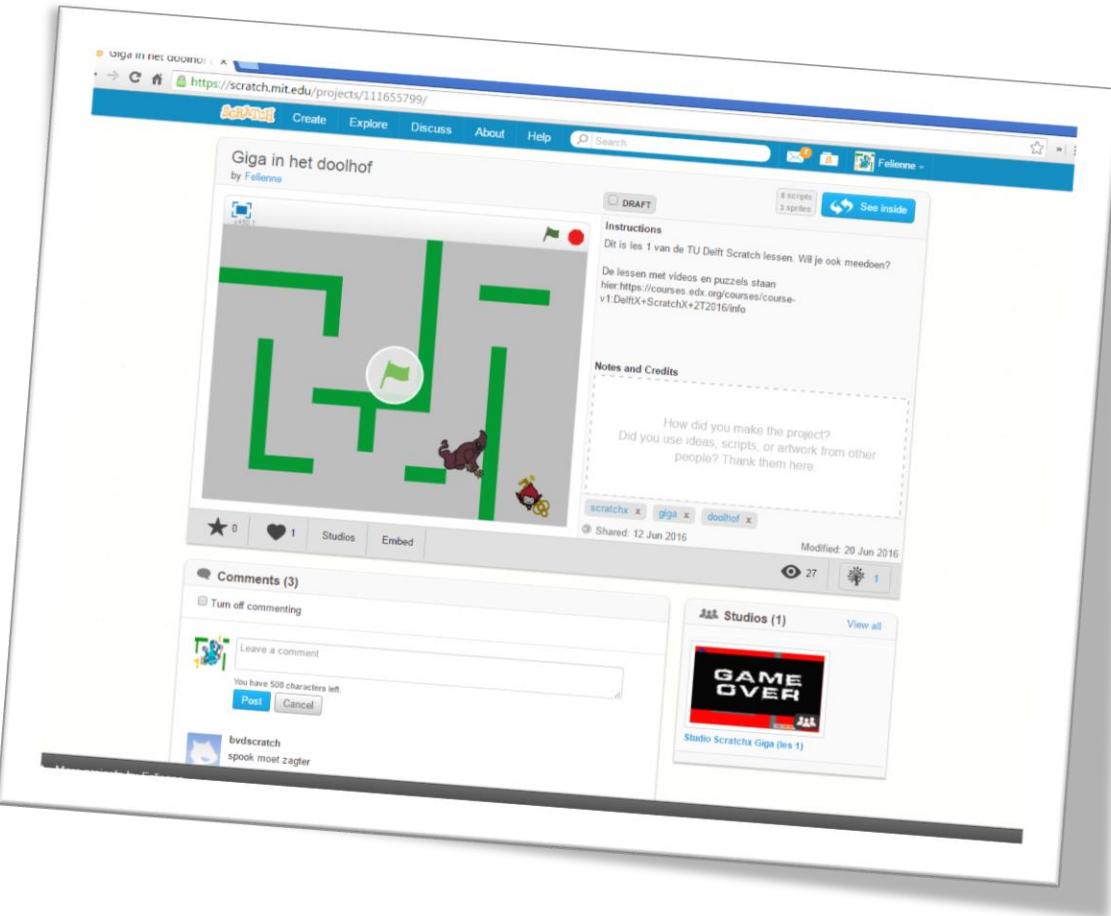
Languages: Nederlands

Video Nederlands
Transcripts:

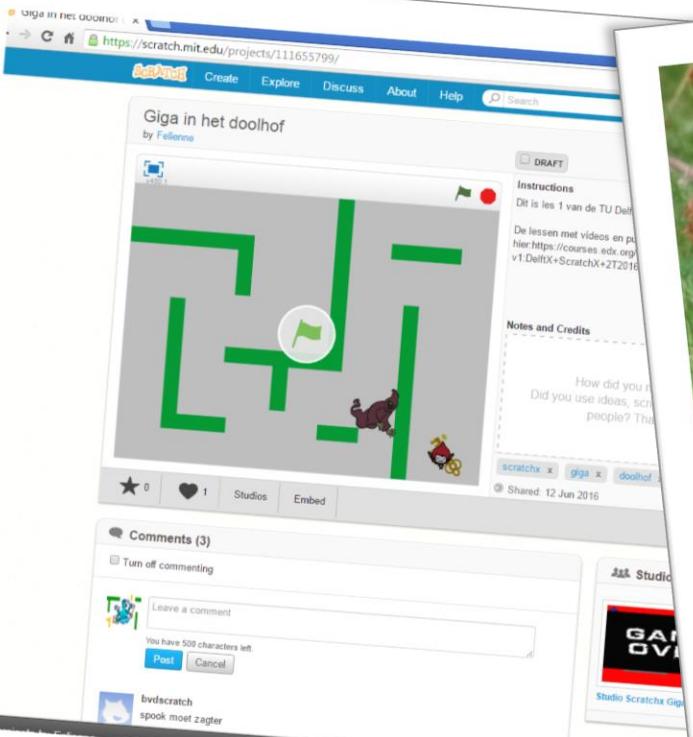
Share this course with a friend







What kids thought they learned



**What they
really learned**

The course includes tests

About programming and smells!

◀ Previous Next ▶

Deel 4

[Bookmark this page](#)

[VIEW UNIT IN STUDIO](#)

Vraag 20

1/1 point (graded)

Kijk naar dit programma:



Je duwt op de groene vlag. Wat is de x op het einde van het programma?

10

100

110 ✓

The course includes tests

[SUBMISSION HISTORY](#)[STAFF DEBUG INFO](#)

En wat moet er af?

1 point possible (graded)

Maar, je kunt ook een blokje weghalen. Welk blokje en waar?

1

Press ESC then TAB or click outside of the code editor to exit

Unanswered

Submit

Show Answer

About programming and smells!

**Are smells harder
to learn?**



A black and white skunk is standing in a field of green grass. It is facing towards the right side of the frame. The skunk has a thick, bushy tail with a prominent white stripe running from its base to its tip. Its body is mostly black, with a white patch on its shoulder area. The background consists of various green plants and some fallen leaves.

**Are smells harder
to learn?**

Nope!

Smells are not harder than Coding!

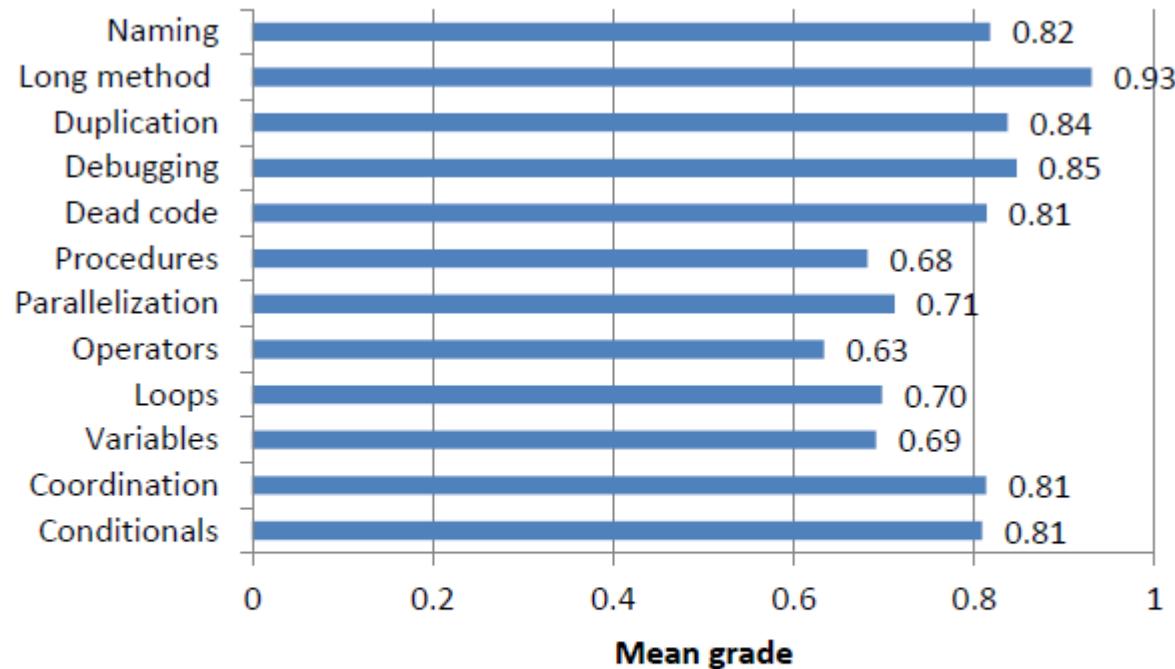


Fig. 4. Mean grade of all student answers (first attempts) to all questions corresponding to different programming and software engineering concepts

Smells are not harder than Coding!

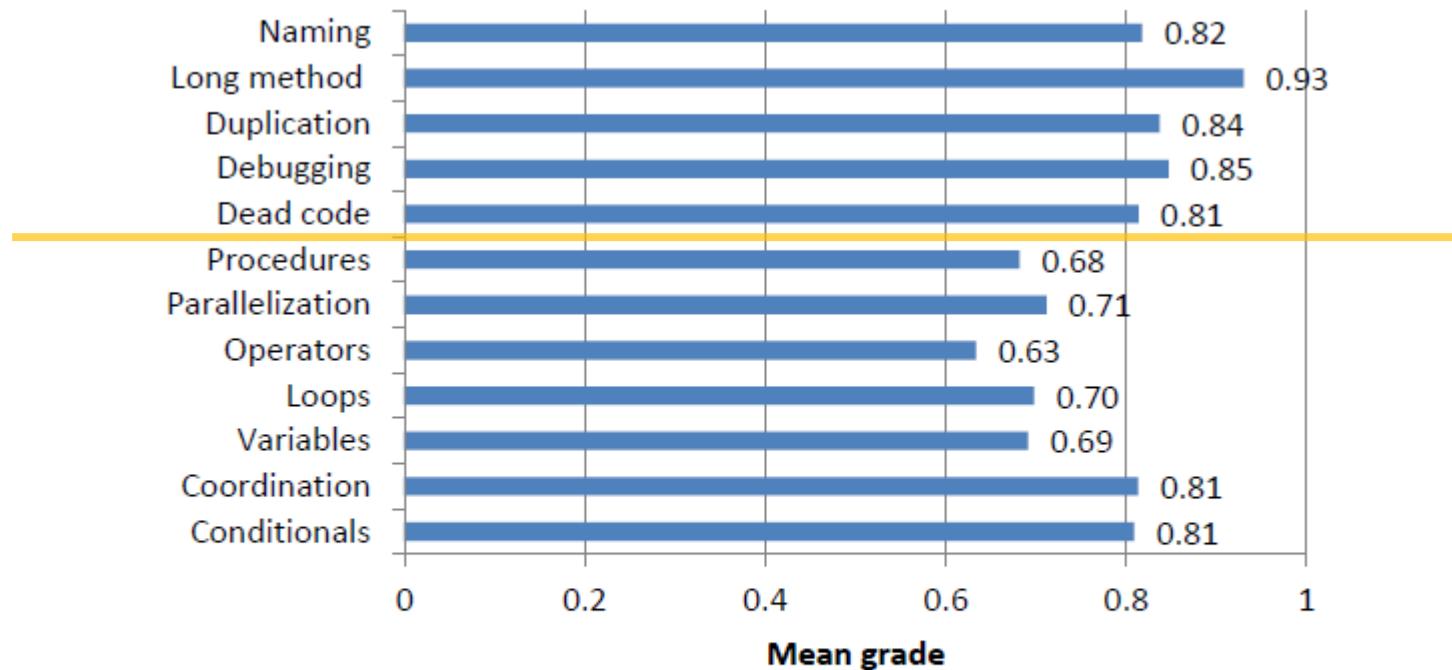
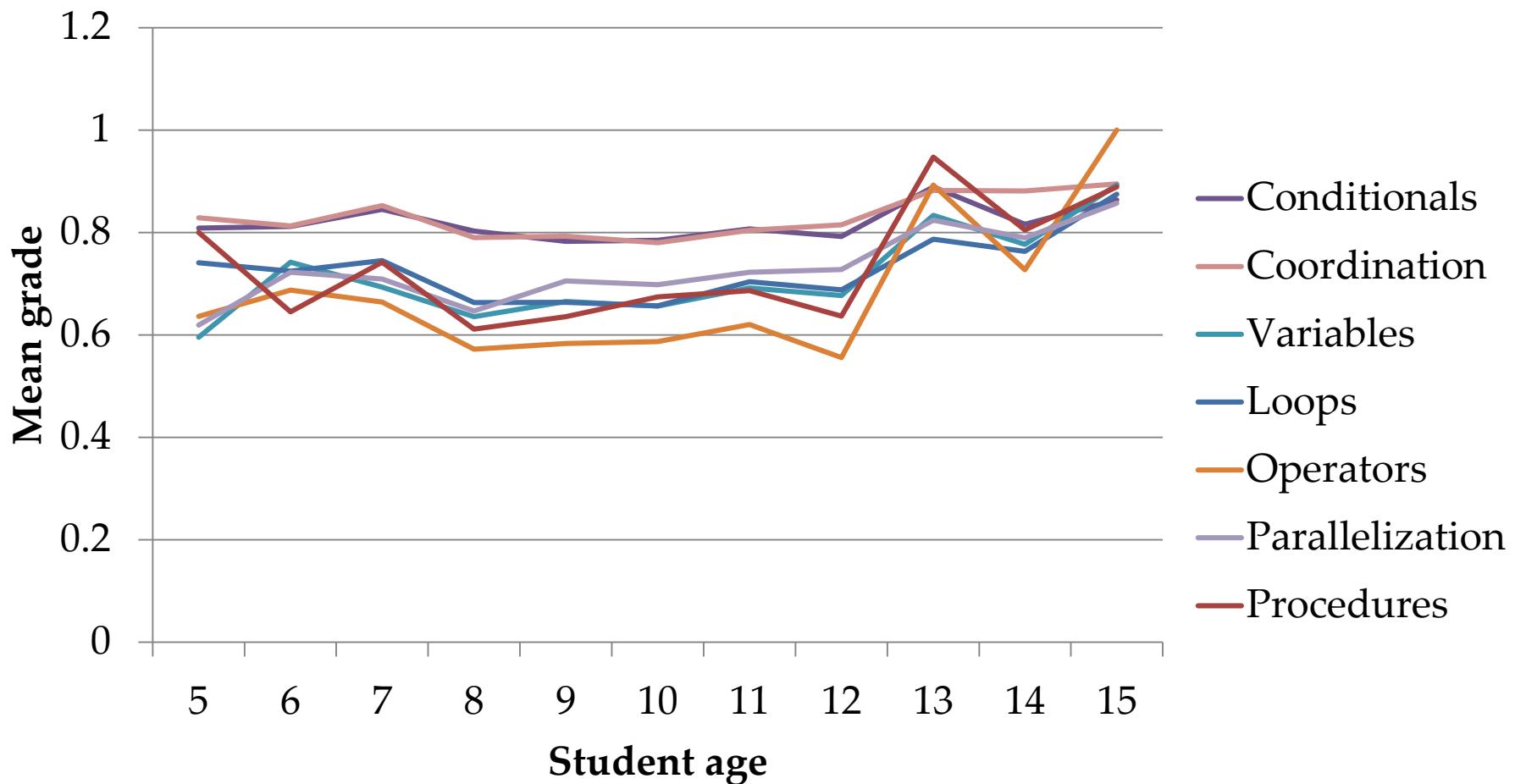


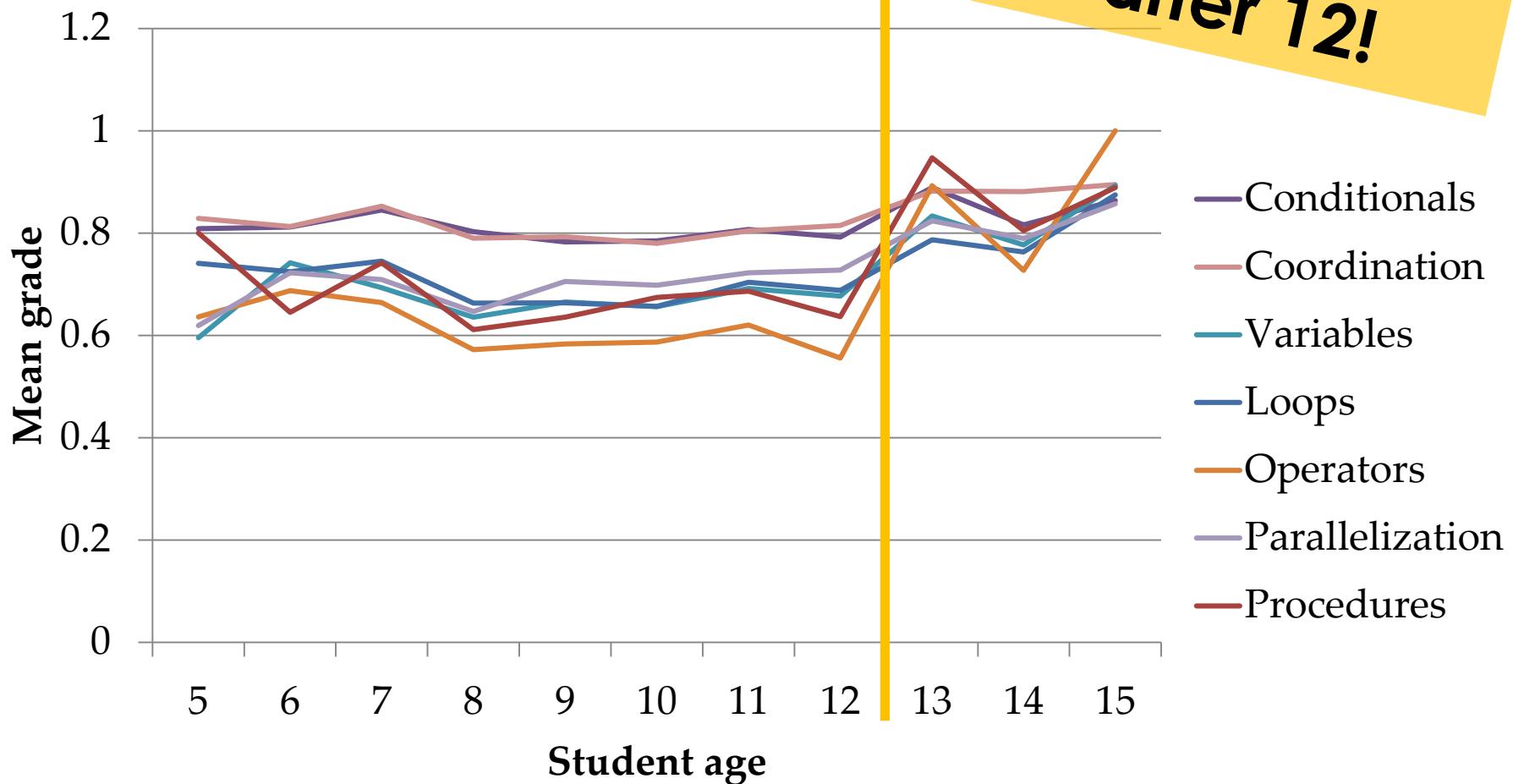
Fig. 4. Mean grade of all student answers (first attempts) to all questions corresponding to different programming and software engineering concepts

Some coding concepts are harder though



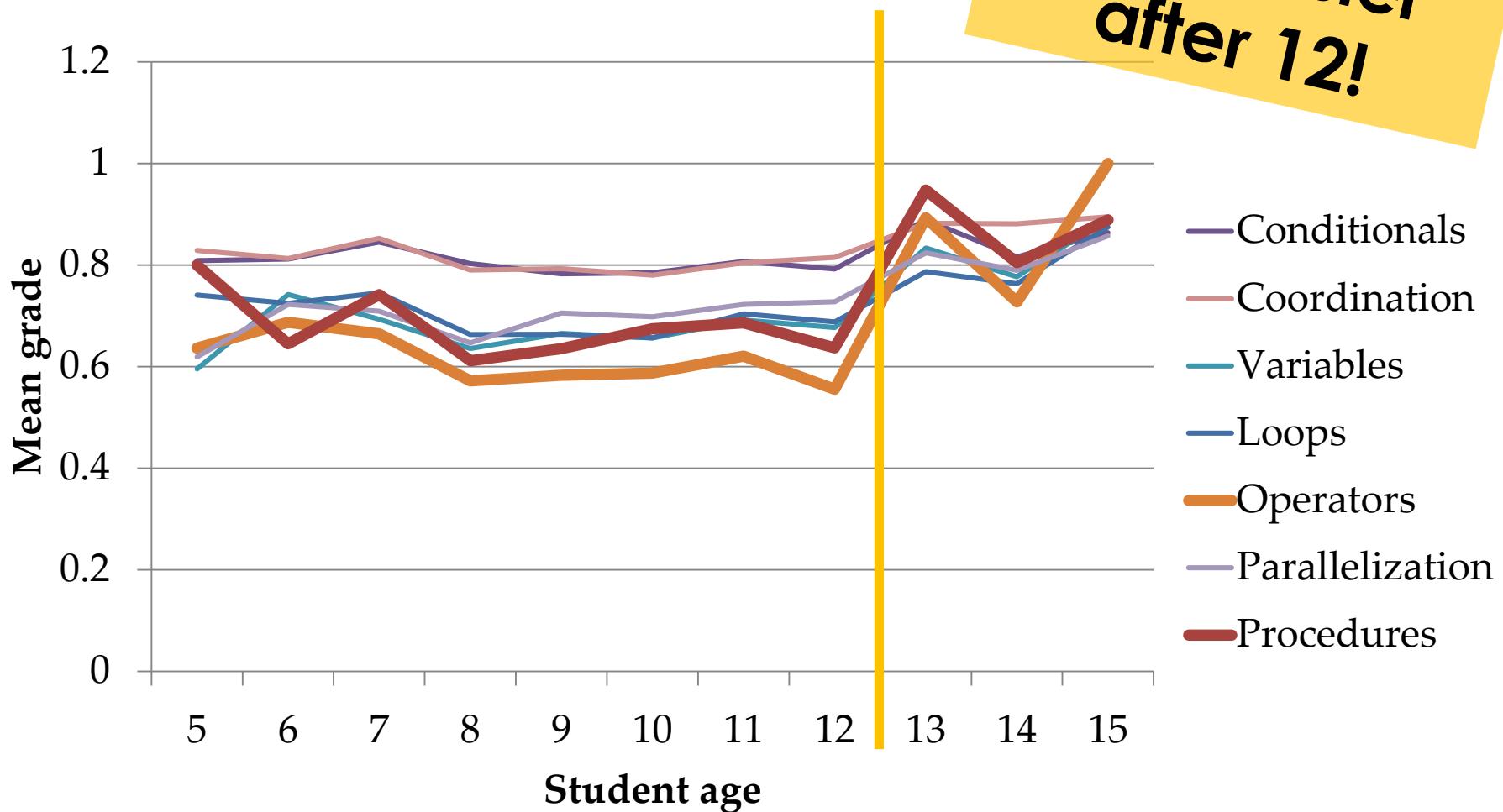
Some coding concepts are harder though

Get easier
after 12!



Some coding concepts are harder though

Get easier
after 12!



How Do Kids Program in the Wild?

@Felienne







Scratch - Creative Projects

Create stories, games, and animations
Share with others around the world

A creative learning community with 17,883,341 projects shared

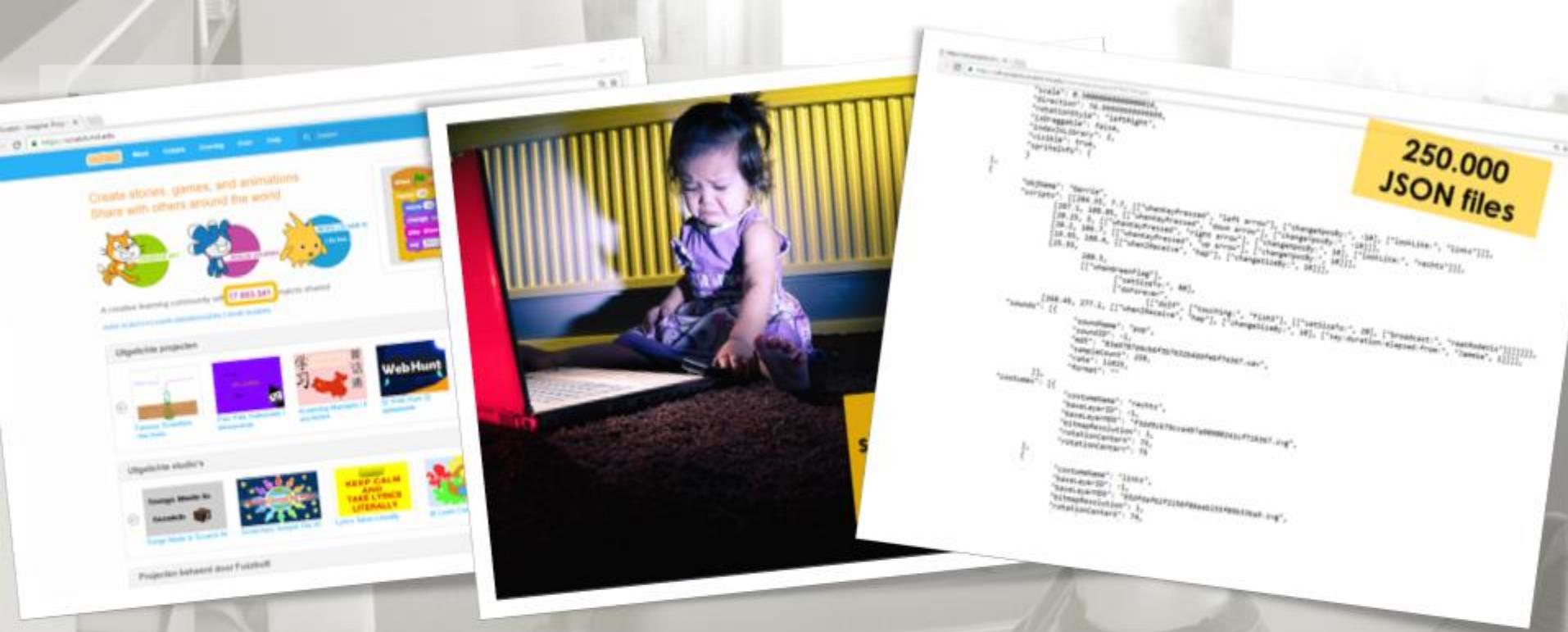
Join the Scratch community! Create, share, and learn!

Scratch projects

Scratch studios

Projection behind door Futuroflex

A screenshot of the Scratch website. The top navigation bar includes links for Home, Tutorials, Learning, Help, and Log In. Below the header, there's a call to action: "Create stories, games, and animations Share with others around the world". It also displays a statistic: "A creative learning community with 17,883,341 projects shared". Below this, there's a section titled "Join the Scratch community! Create, share, and learn!" followed by a "Log In" button. The main content area is divided into two sections: "Scratch projects" and "Scratch studios". The "Scratch projects" section shows several thumbnail images of different projects, including "Piano Transition", "Dance Party", "Web Hunt", "Keep Calm and Carry On", and "Orange Juice Science". The "Scratch studios" section shows thumbnails for "Orange Juice Science", "Keep Calm and Carry On", and "Litter Never Leaves". At the bottom left, there's a note: "Projection behind door Futuroflex".



250,000
JSON files





250.000
JSON files





250.000
JSON files



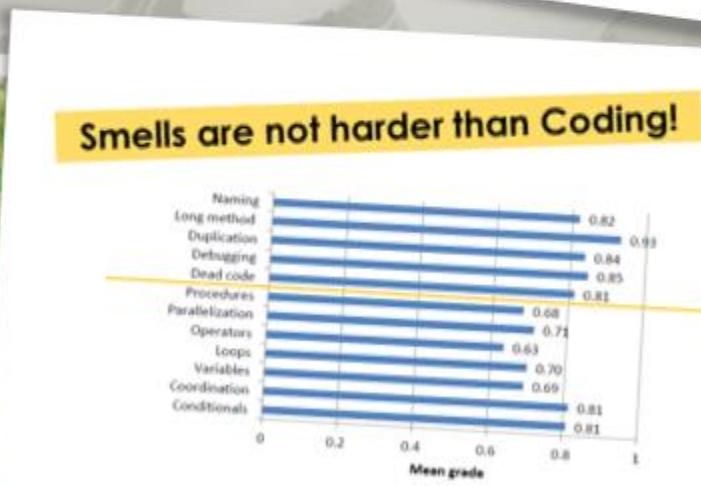
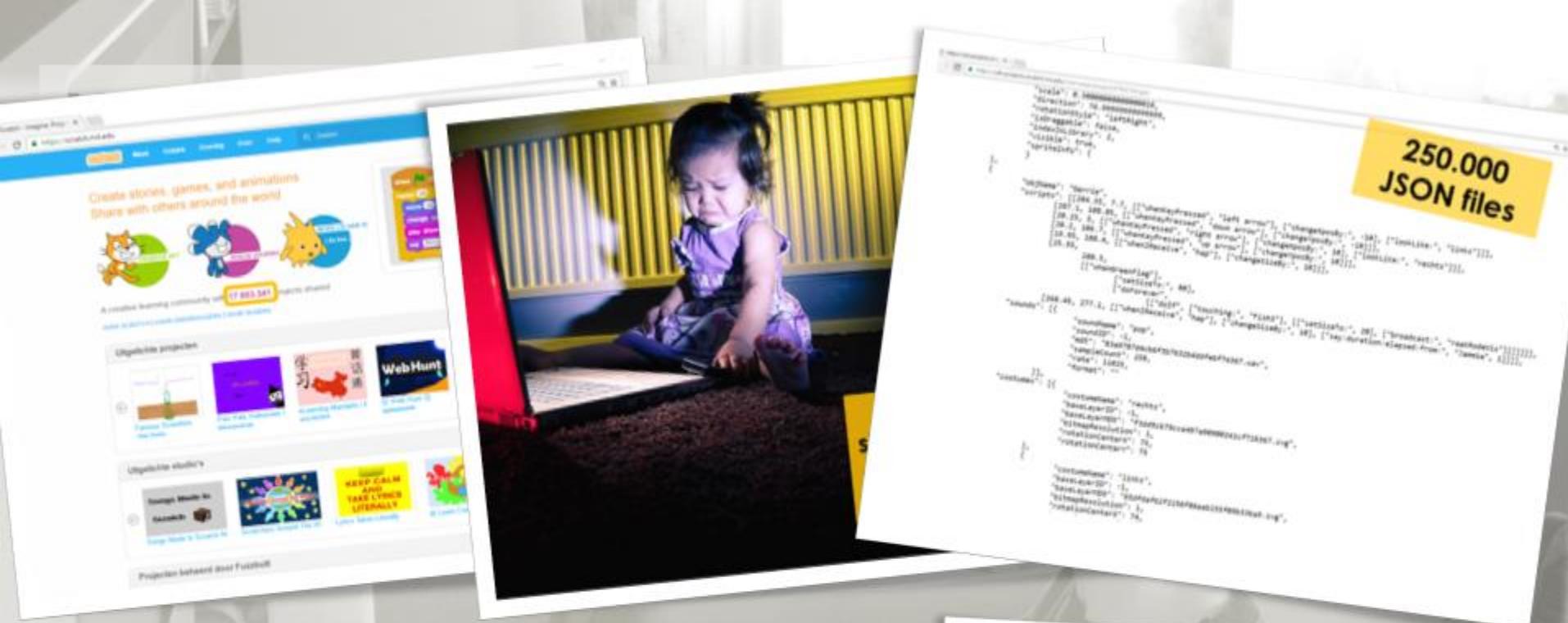


Fig. 4. Mean grade of all student answers (first attempts) to all questions corresponding to different programming and software engineering concepts

How do kids program in the wild?

@Felienne

More info?

- www.felienne.com/onderzoek-naar-scratch
- github.com/TUDelftScratchLab

Fig. 4. Mean grade of all student answers (first attempts) to all questions corresponding to different programming and software engineering concepts

Want to connect?

- mail@felienne.com

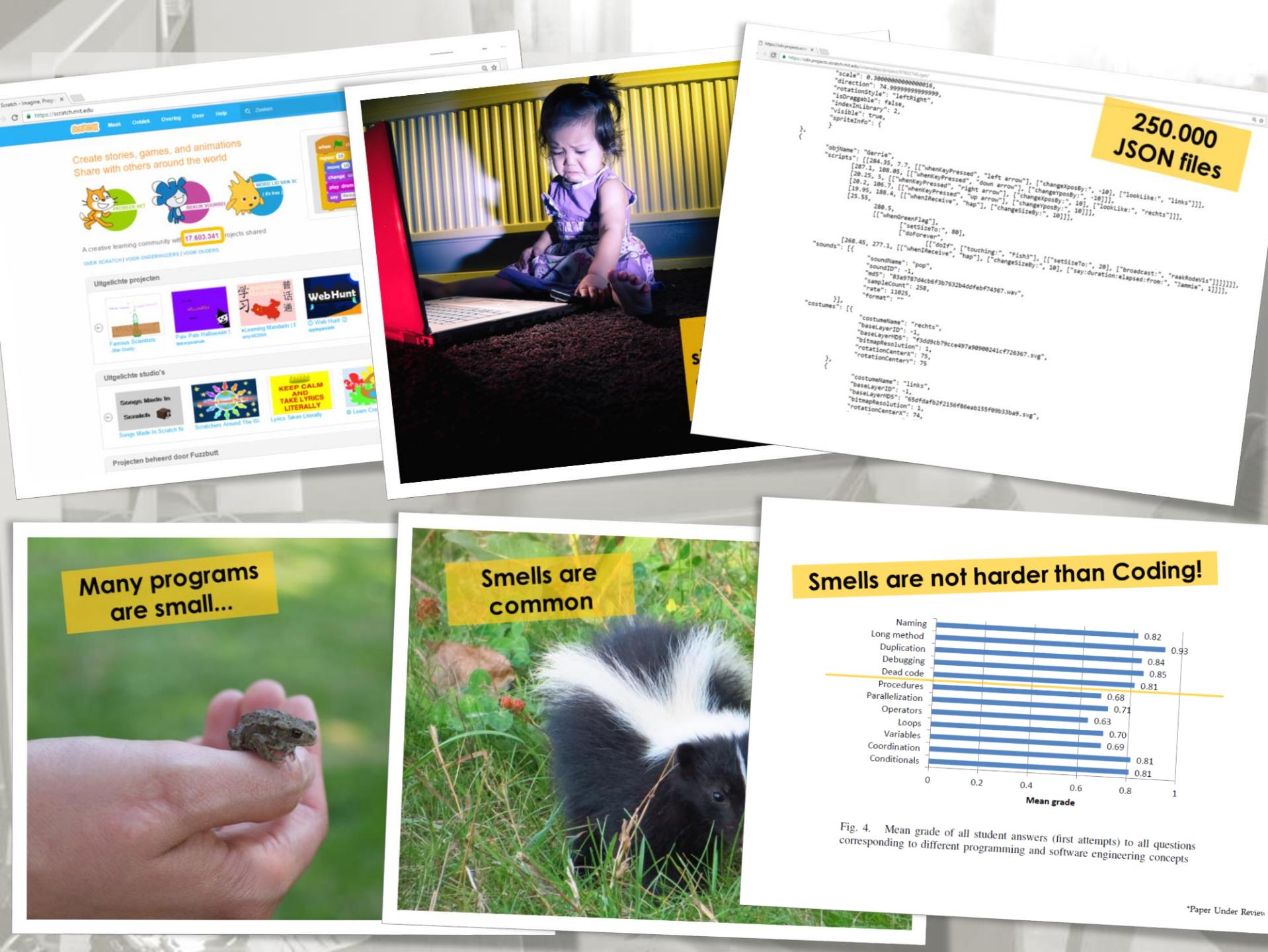


Fig. 4. Mean grade of all student answers (first attempts) to all questions corresponding to different programming and software engineering concepts

