
How Do Kids Program in the Wild?
@Felienne


Do Kids Program in the Wild?
@Felienne


Do Kids Program in the Wild?
YES!

Anybody can learn | Cod

https://code.org

C O
D E

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An Hour of Code for every student.

285,943,838 served

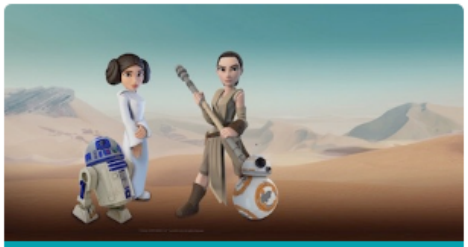
Join us Try it

Watch the video

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



Hour of Code
Anybody can learn. Start today



Students
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Educators
Teach your students



Advocates
Support diversity in computing

Scratch - Imagine, Progra

https://scratch.mit.edu

Maak Ontdek Overleg Over Help Zoeken Word Scratcher Inloggen

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





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 S
tinkerpixierule



♦Learning Mandarin | E
amy482004



Web Hunt
applepiesleth



Cameo Creator
-little-

Uitgelichte studio's



Songs Made In Scratch N



Scratchers Around The W



Lyrics Taken Literally



✪ Learn Creatively ✪


Codeca

Projecten beheerd door Fuzzbutt

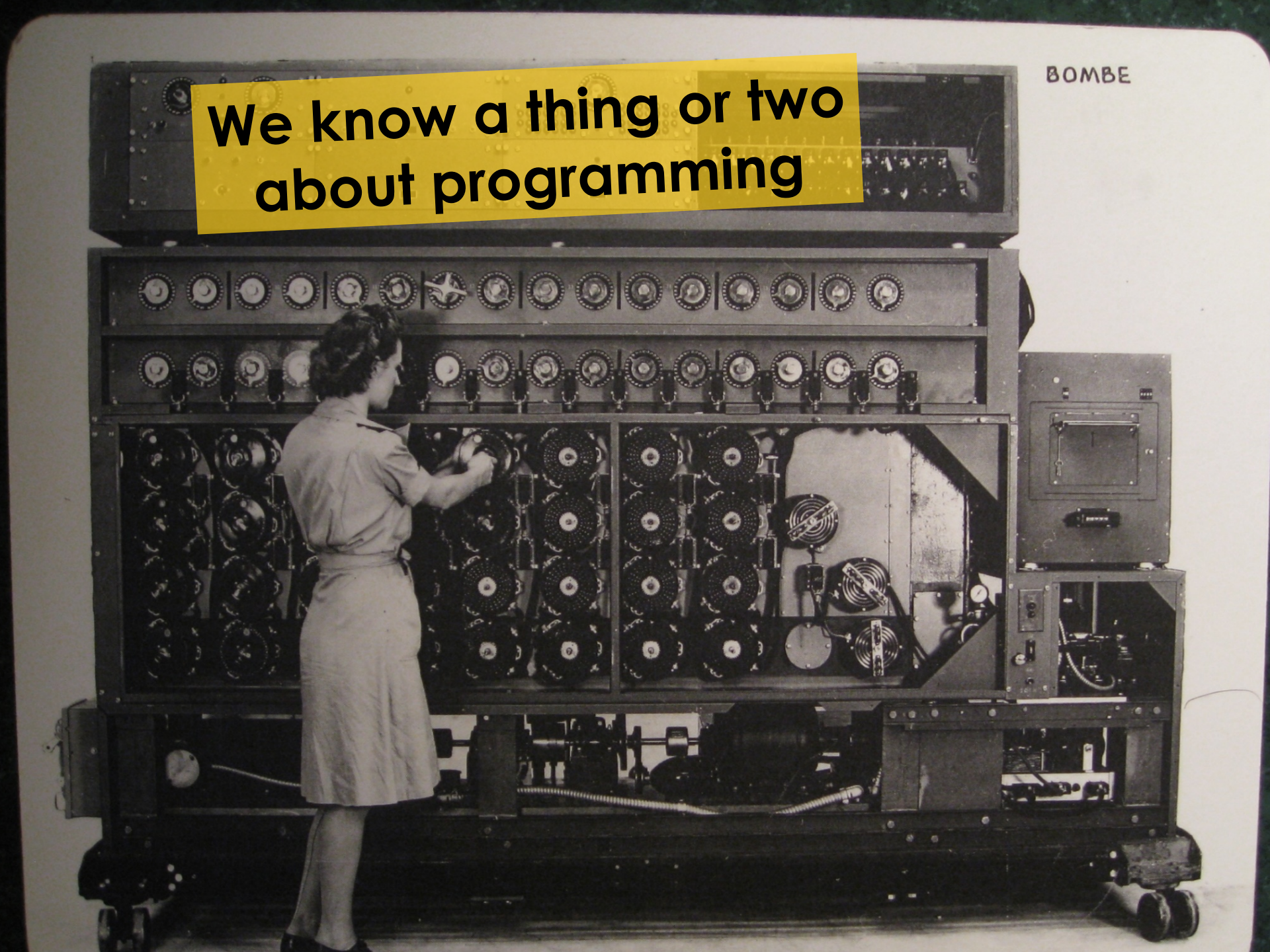
Meer leren


Just a toy?
11

Or do they write good code?



We know a thing or two about programming

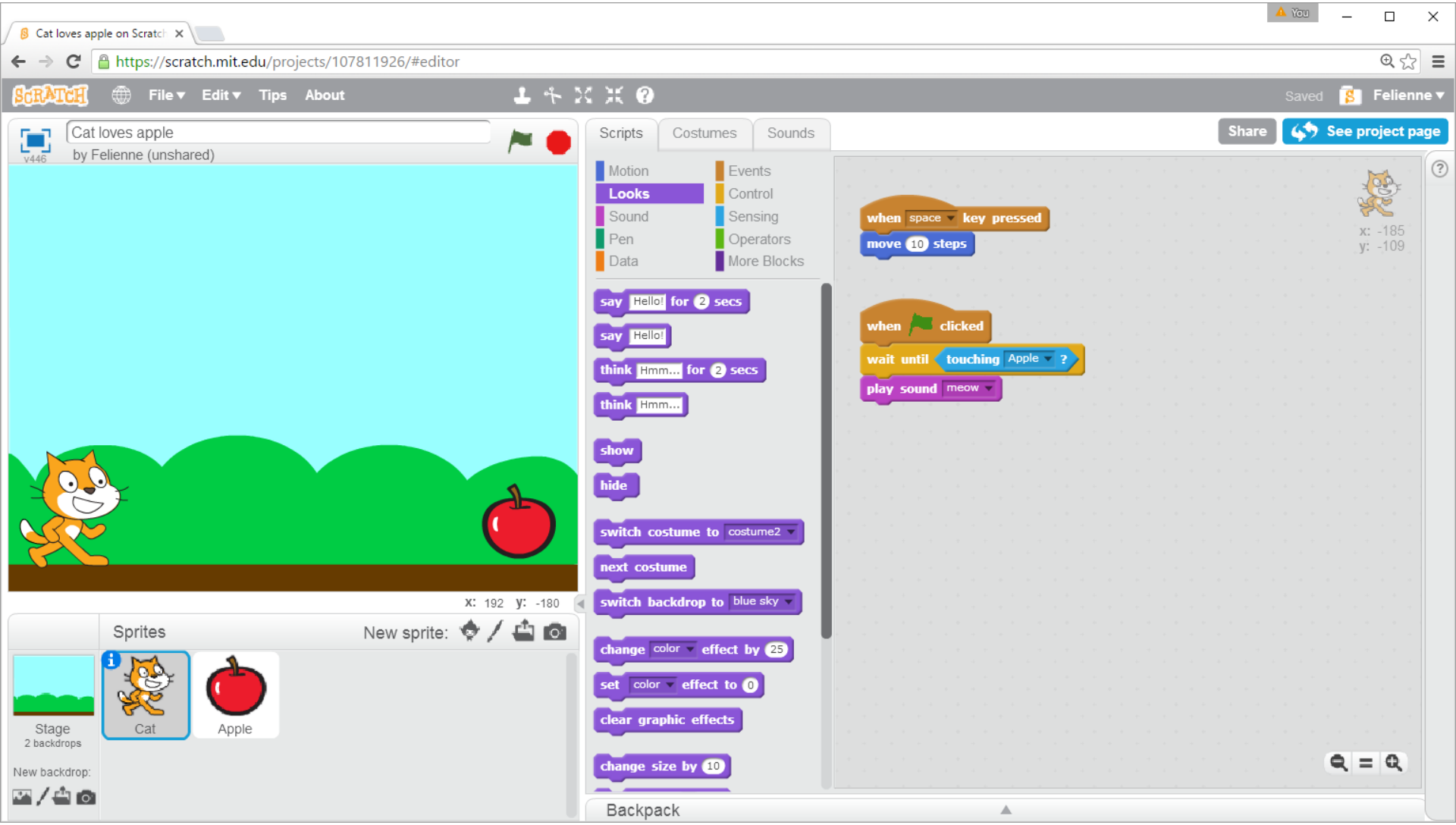


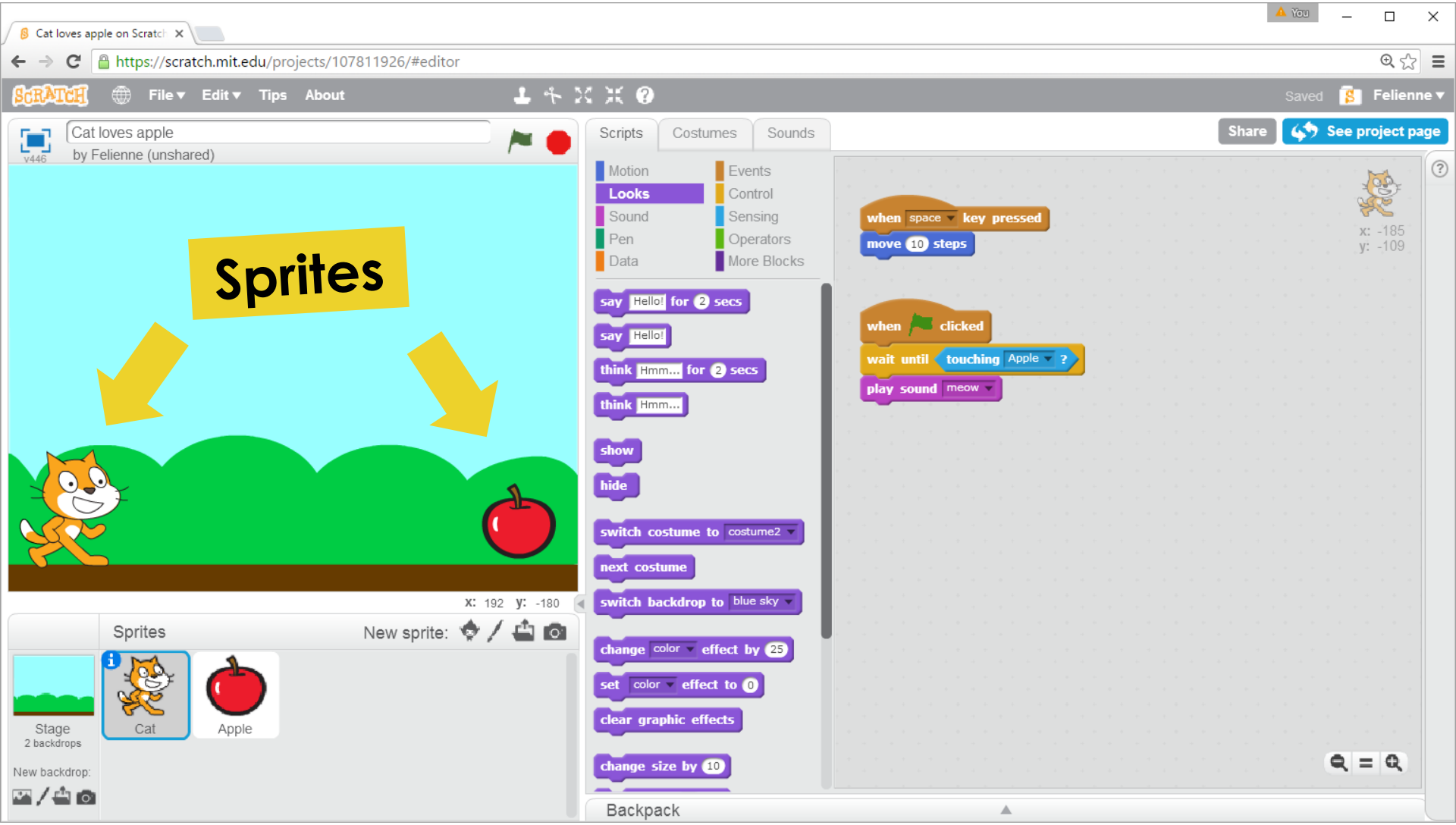

Object oriented
programming
AWN
TING

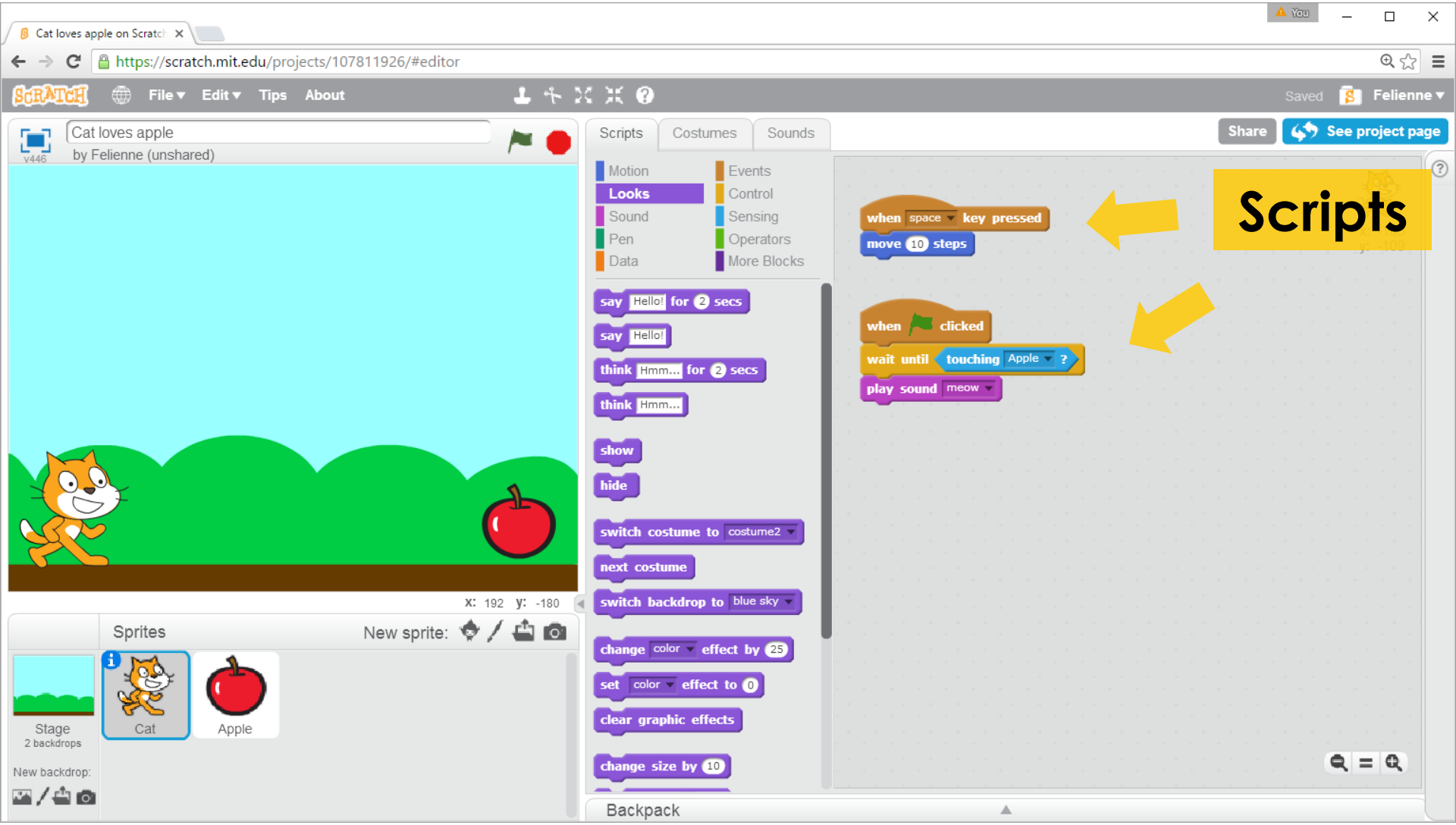

Smells and
refactorings

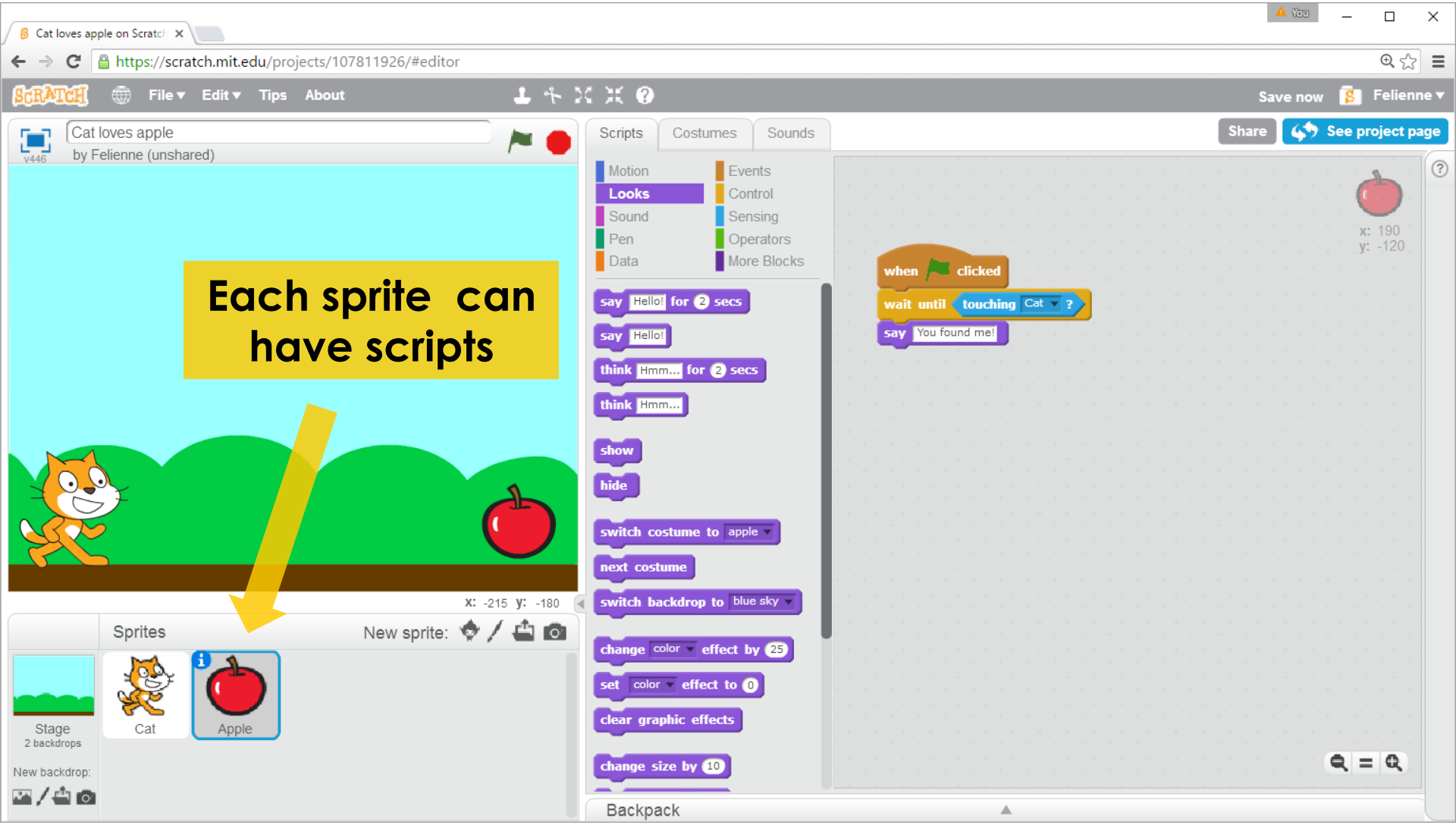

Does code
smells matter?

The Scratch programming language

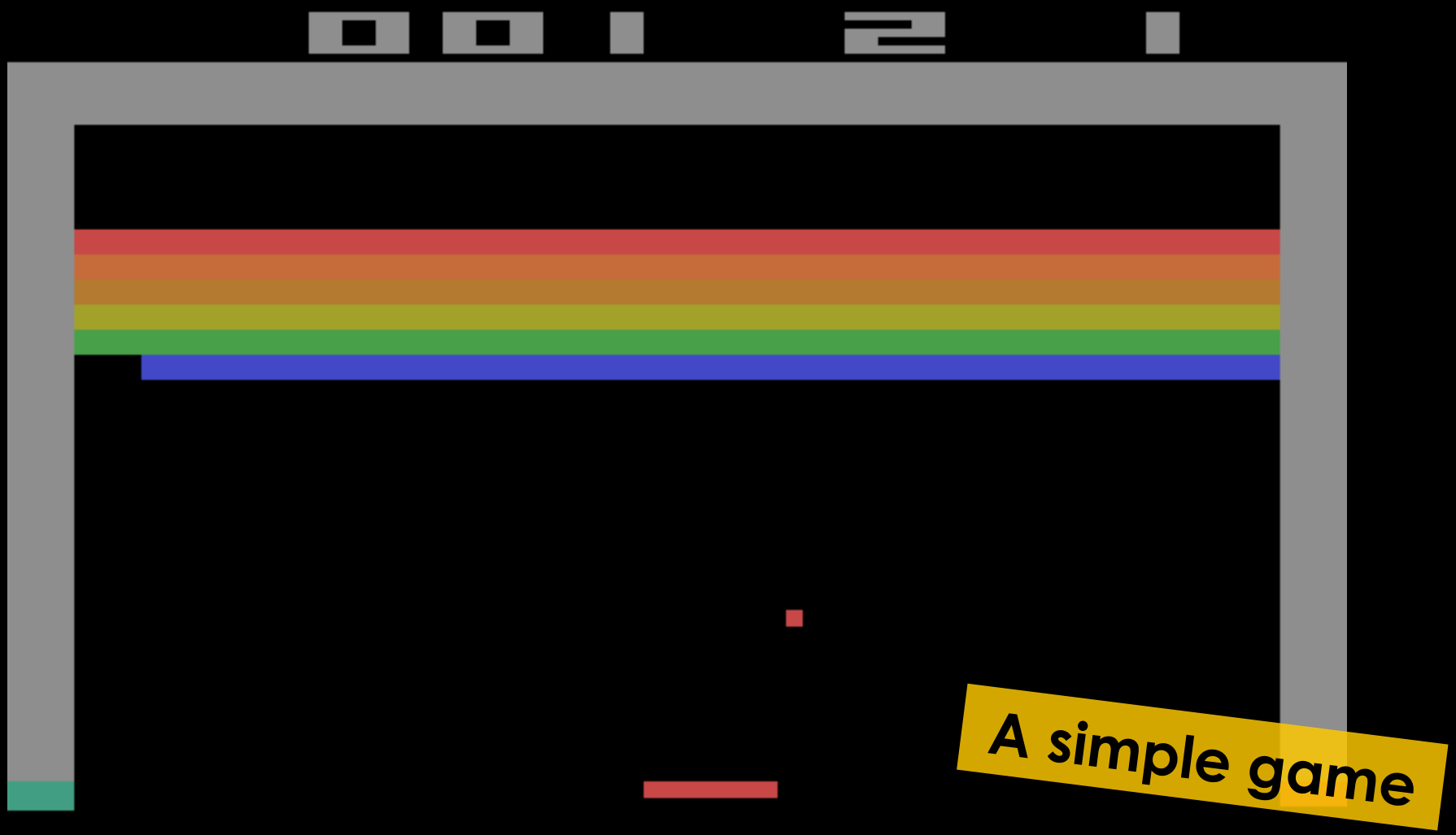


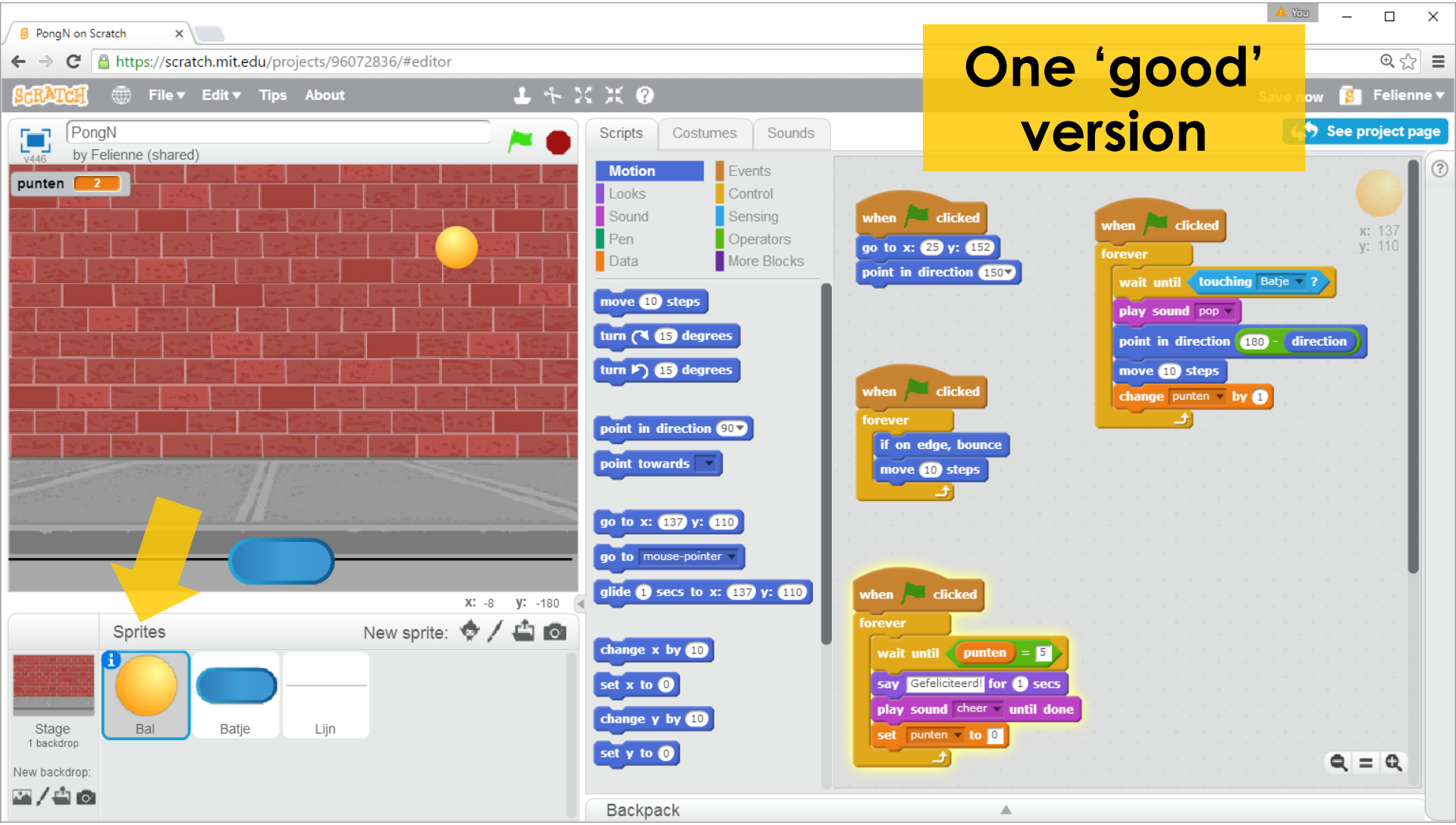

Cat loves apple on Scratch
https://scratch.mit.edu/projects/107811926/#editor
File
Edit
Tips
About
Saved
Felienne
Cat loves apple
by Felienne (unshared)
Sprites
Scripts
Costumes
Sounds
Share
See project page
Motion
Looks
Sound
Pen
Data
Events
Control
Sensing
Operators
More Blocks
when space key pressed
move 10 steps
when 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
x: -185
y: -109
x: 192 y: -180
Sprites
New sprite:
Stage
2 backdrops
New backdrop:
Cat
Apple
Backpack


Cat loves apple on Scratch
https://scratch.mit.edu/projects/107811926/#editor
File
Edit
Tips
About
Saved
Felienne
Cat loves apple
by Felienne (unshared)
Scripts
Costumes
Sounds
Share
See project page
Motion
Looks
Sound
Pen
Data
Events
Control
Sensing
Operators
More Blocks
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
when space key pressed
move 10 steps
when clicked
wait until touching Apple ?
play sound meow
Scripts
x: 192 y: -180
Sprites
New sprite:
Stage
2 backdrops
New backdrop:
Cat
Apple
Backpack


Cat loves apple on Scratch
https://scratch.mit.edu/projects/107811926/#editor
File
Edit
Tips
About
Save now
Felienne
Cat loves apple
by Felienne (unshared)
Each sprite can have scripts
Scripts
Costumes
Sounds
Share
See project page
Motion
Looks
Sound
Pen
Data
Events
Control
Sensing
Operators
More Blocks
say Hello! for 2 secs
say Hello!
think Hmm... for 2 secs
think Hmm...
show
hide
switch costume to apple
next costume
switch backdrop to blue sky
change color effect by 25
set color effect to 0
clear graphic effects
change size by 10
when clicked
wait until touching Cat ?
say You found me!
x: 190
y: -120
x: -215 y: -180
Sprites
New sprite:
Stage
2 backdrops
New backdrop:
Cat
Apple
Backpack

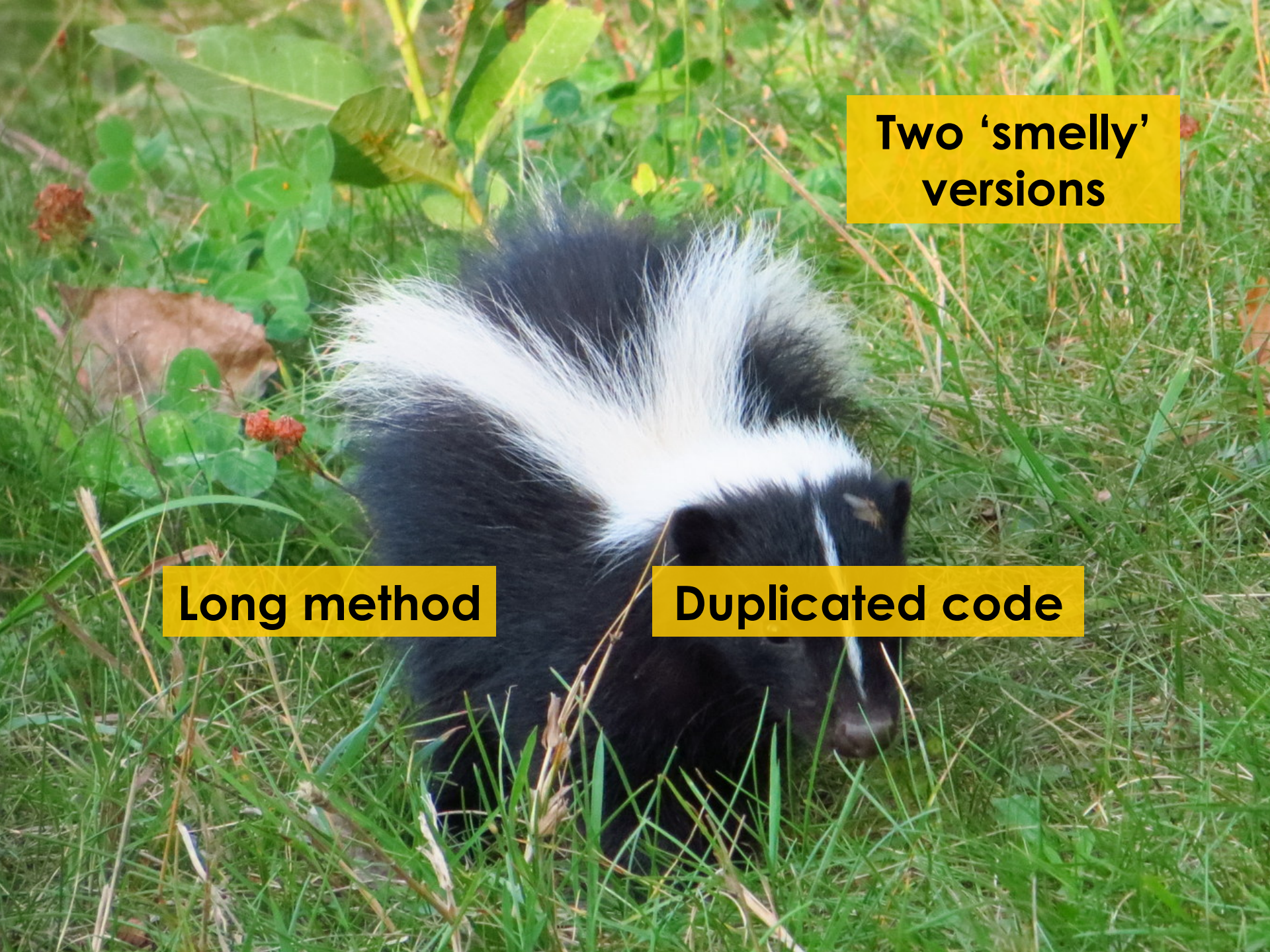

Do code smells
matter to kids?

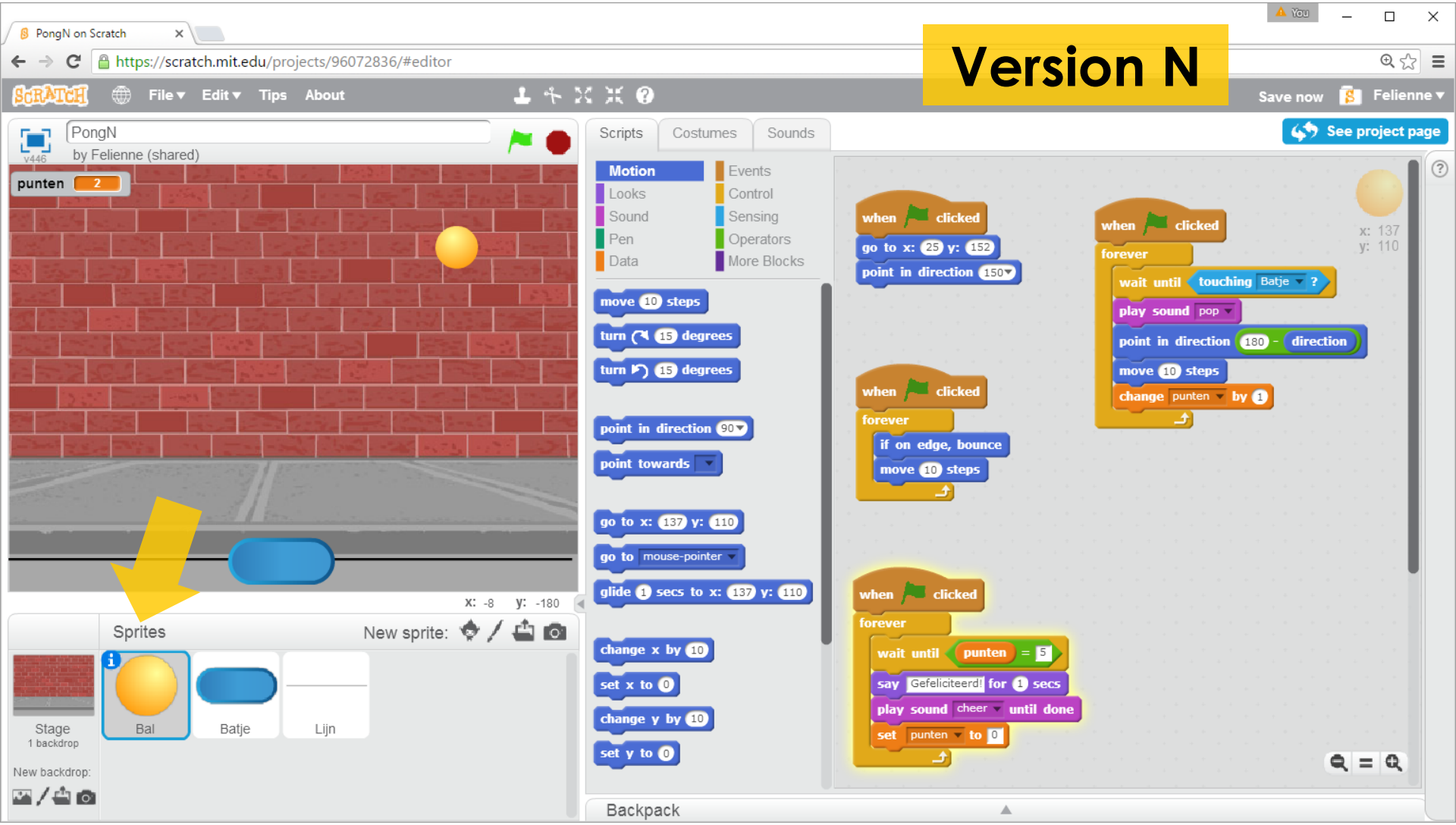

A simple game

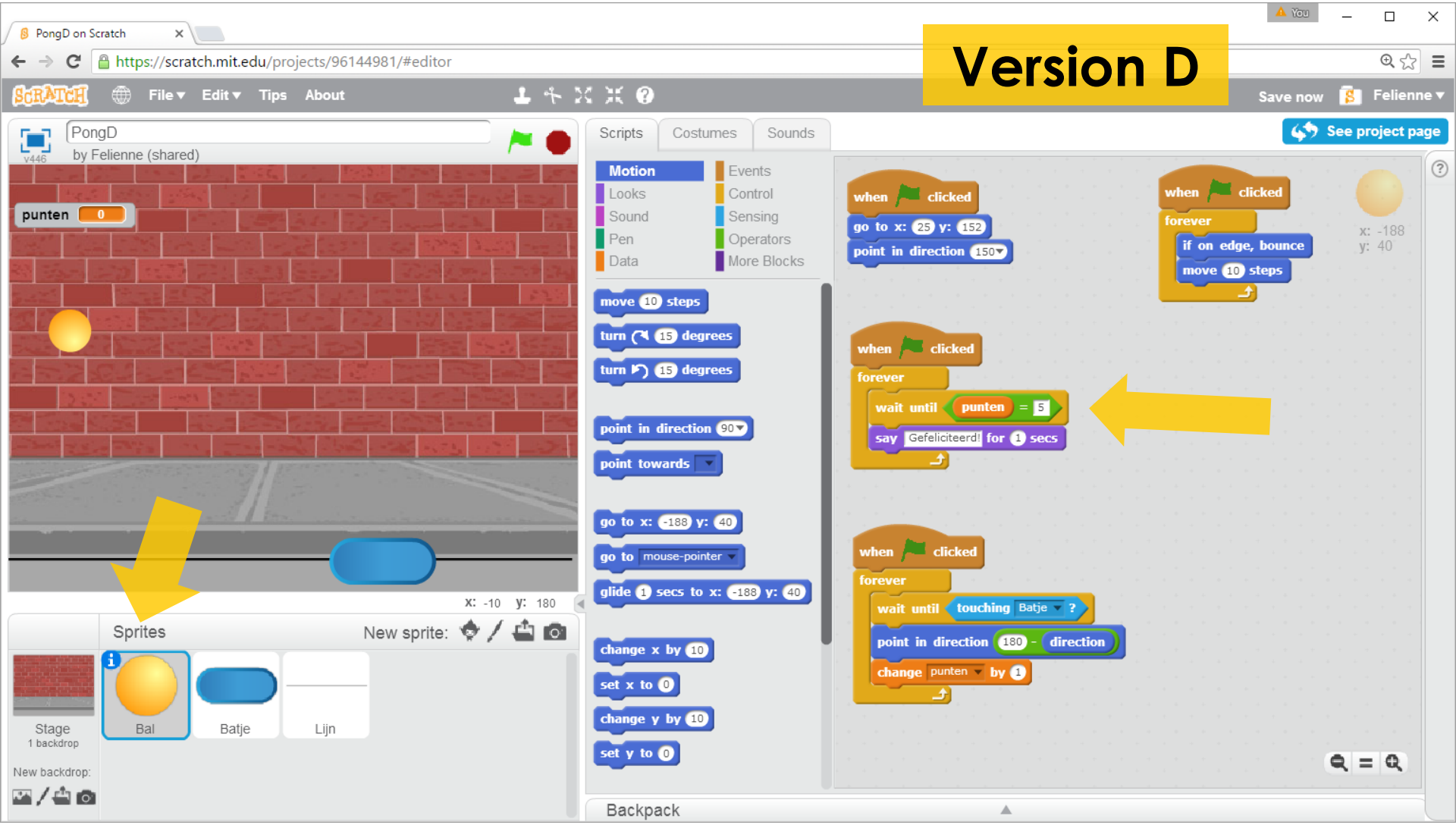


One 'good' version

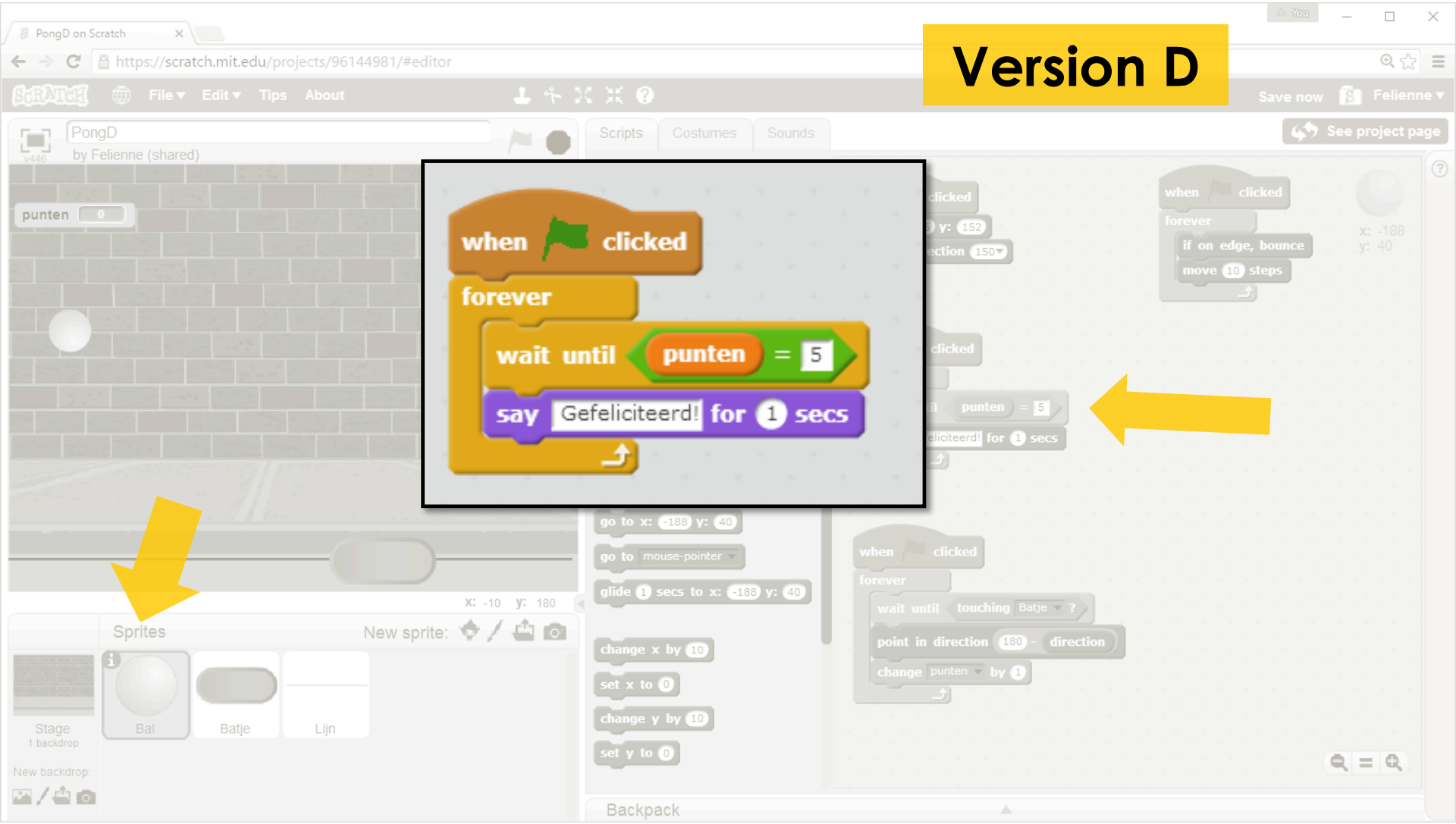

Two ‘smelly’ versions

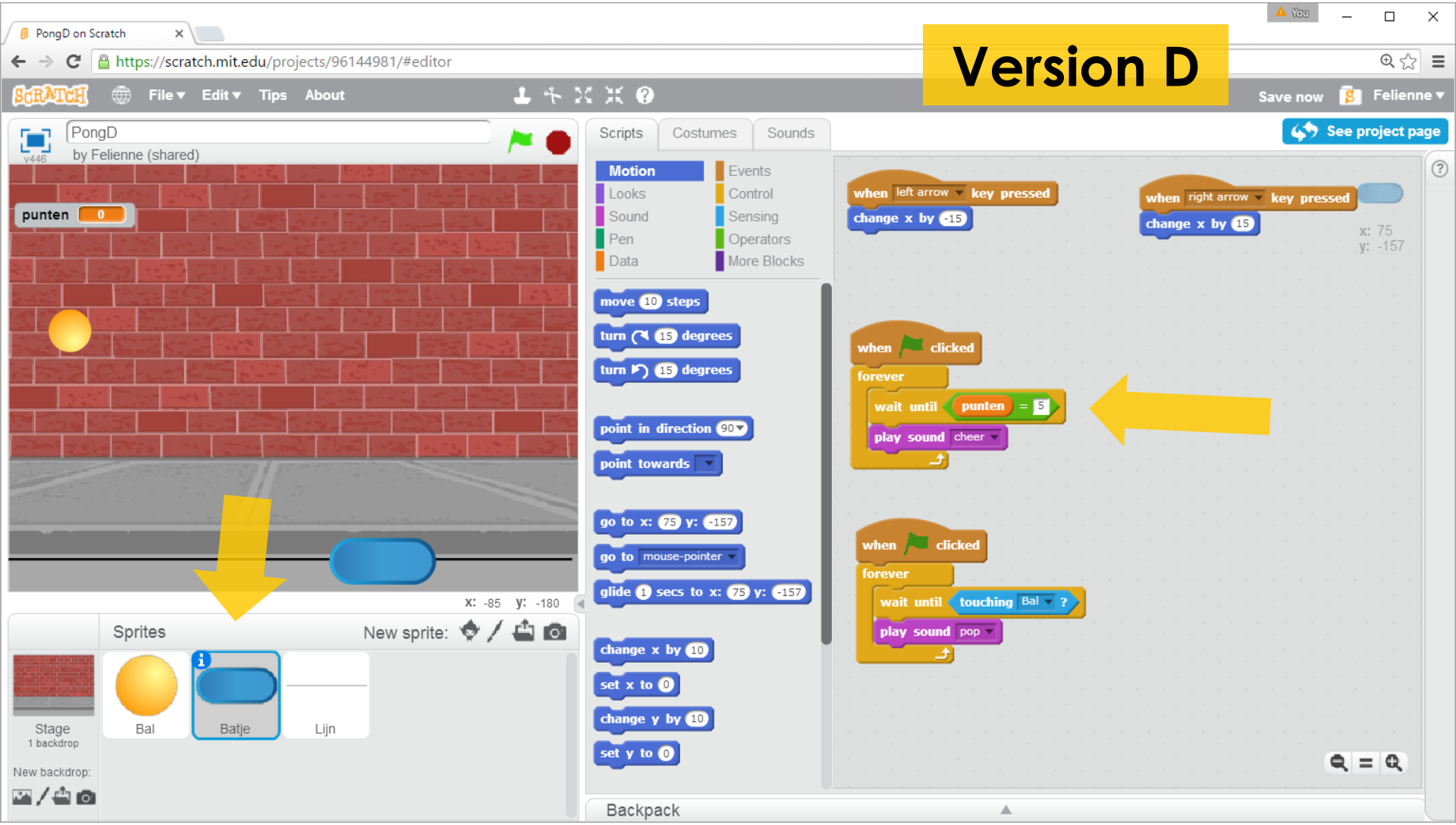

Two ‘smelly’ versions
Long method
Duplicated code


Version N
PongN on Scratch
https://scratch.mit.edu/projects/96072836/#editor
File
Edit
Tips
About
Save now
Felienne
PongN
by Felienne (shared)
punten 2
Scripts
Costumes
Sounds
See project page
Motion
Looks
Sound
Pen
Data
Events
Control
Sensing
Operators
More Blocks
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 clicked
go to x: 25 y: 152
point in direction 150
when clicked
forever
if on edge, bounce
move 10 steps
when clicked
forever
wait until touching Batje ?
play sound pop
point in direction 180 - direction
move 10 steps
change punten by 1
x: 137
y: 110
when clicked
forever
wait until punten = 5
say Gefeliciteerd! for 1 secs
play sound cheer until done
set punten to 0
x: -8 y: -180
Sprites
New sprite:
Stage
1 backdrop
New backdrop:
Bal
Batje
Lijn
Backpack

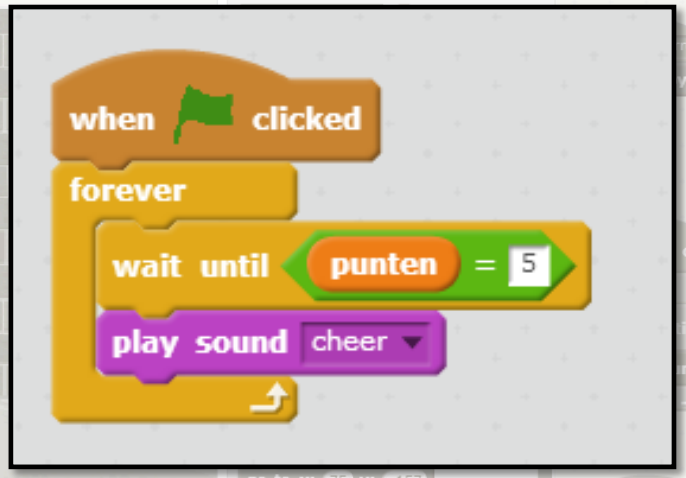

PongD on Scratch
https://scratch.mit.edu/projects/96144981/#editor
Version D
File
Edit
Tips
About
Save now
Felienne
PongD
by Felienne (shared)
punten 0
Scripts
Costumes
Sounds
See project page
Motion
Looks
Sound
Pen
Data
Events
Control
Sensing
Operators
More Blocks
move 10 steps
turn 15 degrees
turn 15 degrees
point in direction 90
point towards
go to x: -188 y: 40
go to mouse-pointer
glide 1 secs to x: -188 y: 40
change x by 10
set x to 0
change y by 10
set y to 0
when clicked
go to x: 25 y: 152
point in direction 150
when clicked
forever
if on edge, bounce
move 10 steps
x: -188
y: 40
when clicked
forever
wait until punten = 5
say Gefeliciteerd! for 1 secs
when clicked
forever
wait until touching Batje ?
point in direction 180 - direction
change punten by 1
x: -10 y: 180
Sprites
New sprite:
Stage
1 backdrop
New backdrop:
Bal
Batje
Lijn
Backpack

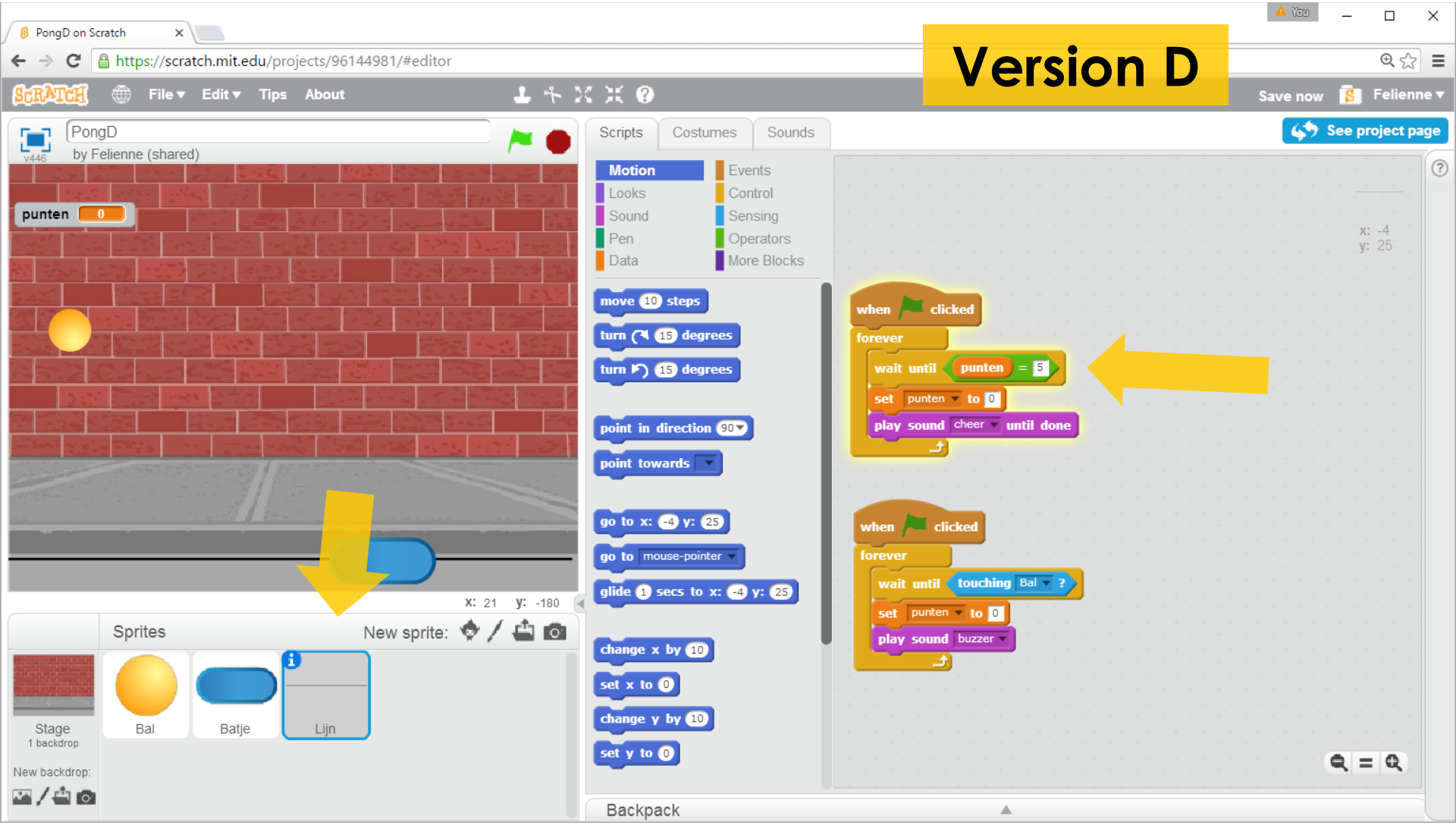
Version D


when clicked
forever
wait until punten = 5
say Gefeliciteerd! for 1 secs
PongD on Scratch
https://scratch.mit.edu/projects/96144981/#editor
File
Edit
Tips
About
Save now
Felienne
PongD
by Felienne (shared)
Scripts
Costumes
Sounds
See project page
punten 0
Sprites
New sprite:
Stage
1 backdrop
Bal
Batje
Lijn
New backdrop:
Backpack

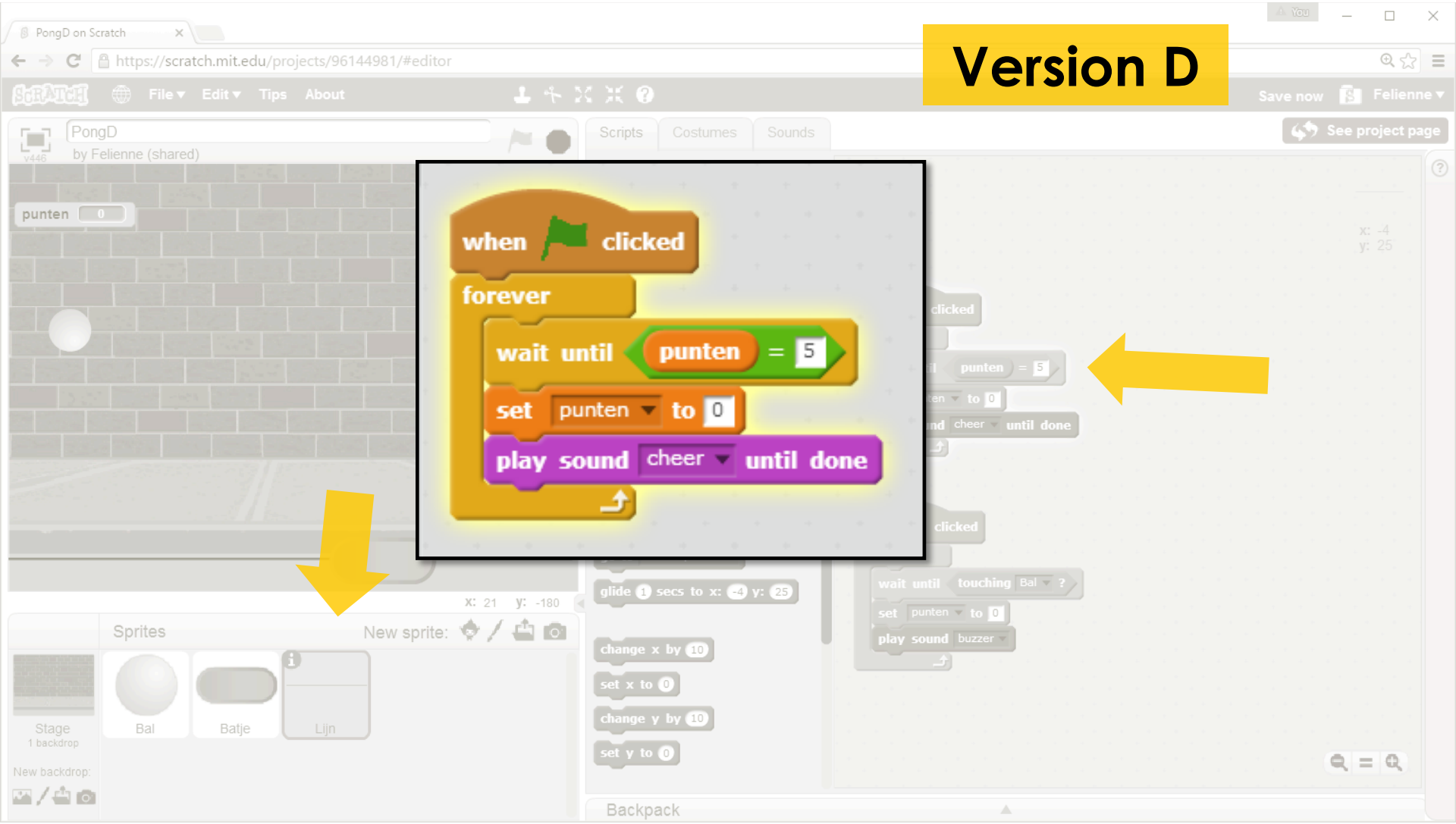

Version D
PongD on Scratch
https://scratch.mit.edu/projects/96144981/#editor
File
Edit
Tips
About
Save now
Felienne
PongD
by Felienne (shared)
punten 0
Scripts
Costumes
Sounds
See project page
Motion
Looks
Sound
Pen
Data
Events
Control
Sensing
Operators
More Blocks
move 10 steps
turn 15 degrees
turn 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
when left arrow key pressed
change x by -15
when right arrow key pressed
change x by 15
x: 75
y: -157
when clicked
forever
wait until punten = 5
play sound cheer
when clicked
forever
wait until touching Bal ?
play sound pop
x: -85 y: -180
Sprites
New sprite:
Stage
1 backdrop
New backdrop:
Bal
Batje
Lijn
Backpack

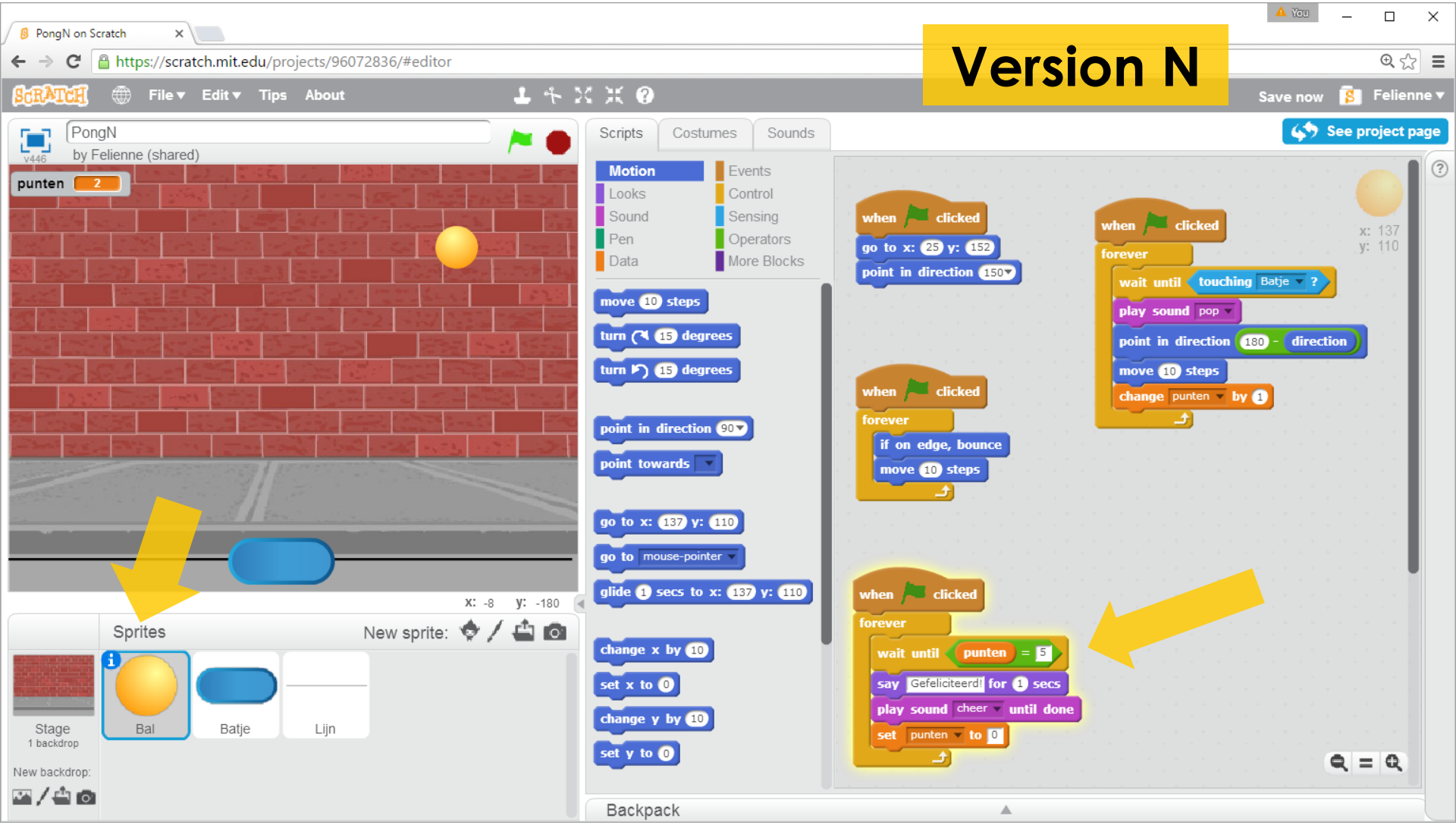
Version D



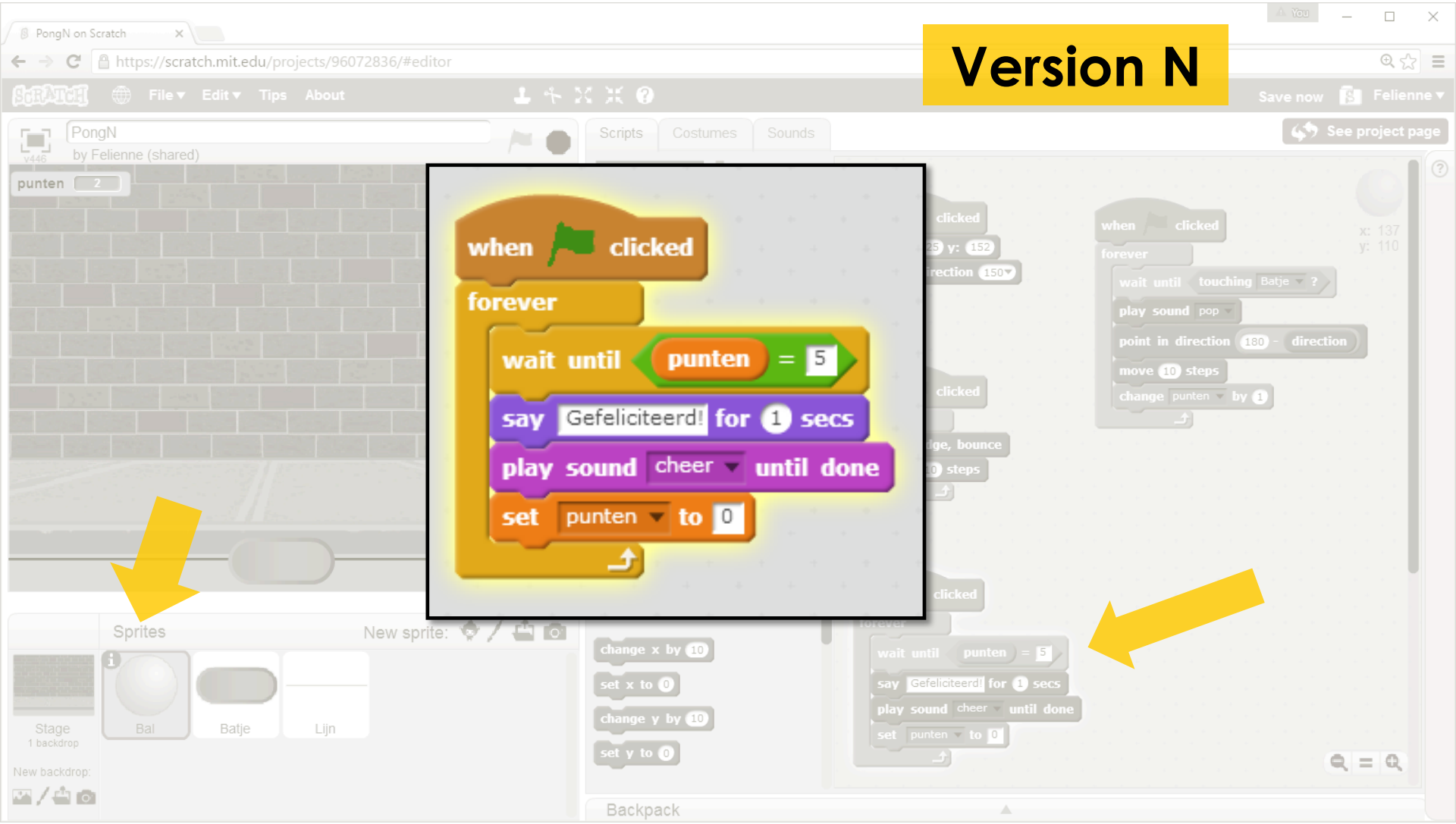

PongD on Scratch
https://scratch.mit.edu/projects/96144981/#editor
Version D
File
Edit
Tips
About
Save now
Felienne
PongD
by Felienne (shared)
punten 0
Scripts
Costumes
Sounds
See project page
Motion
Looks
Sound
Pen
Data
Events
Control
Sensing
Operators
More Blocks
move 10 steps
turn 15 degrees
turn 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 clicked
forever
wait until punten = 5
set punten to 0
play sound cheer until done
when clicked
forever
wait until touching Bal ?
set punten to 0
play sound buzzer
x: -4
y: 25
x: 21 y: -180
Sprites
New sprite:
Stage
1 backdrop
New backdrop:
Bal
Batje
Lijn
Backpack

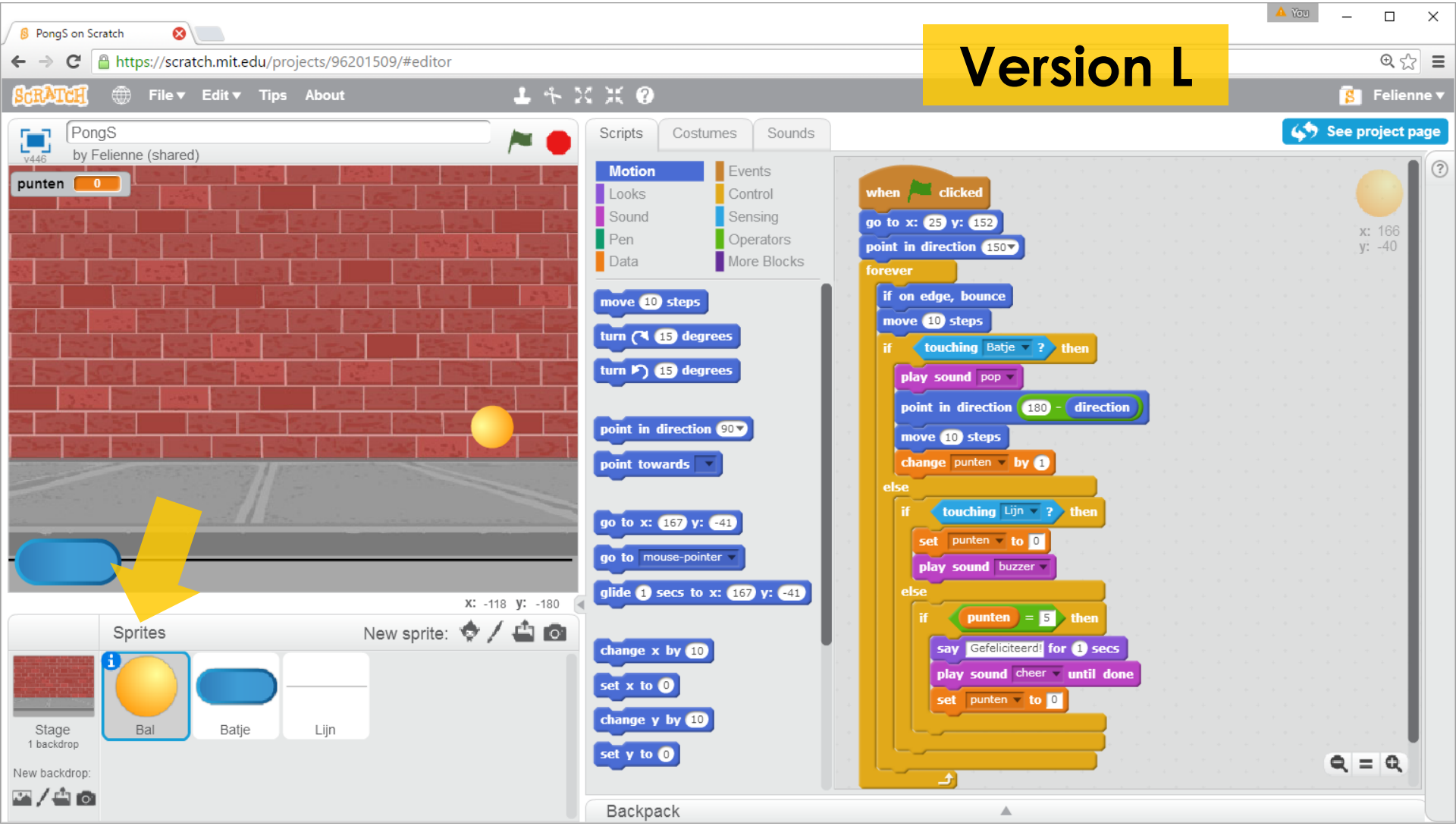
Version D


when clicked
forever
wait until punten = 5
set punten to 0
play sound cheer until done


Version N
PongN on Scratch
https://scratch.mit.edu/projects/96072836/#editor
File
Edit
Tips
About
Save now
Felienne
PongN
by Felienne (shared)
punten 2
Scripts
Costumes
Sounds
See project page
Motion
Looks
Sound
Pen
Data
Events
Control
Sensing
Operators
More Blocks
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 clicked
go to x: 25 y: 152
point in direction 150
when clicked
forever
if on edge, bounce
move 10 steps
when clicked
forever
wait until touching Batje ?
play sound pop
point in direction 180 - direction
move 10 steps
change punten by 1
x: 137
y: 110
when clicked
forever
wait until punten = 5
say Gefeliciteerd! for 1 secs
play sound cheer until done
set punten to 0
x: -8 y: -180
Sprites
New sprite:
Stage
1 backdrop
New backdrop:
Bal
Batje
Lijn
Backpack

Version N


when clicked
forever
wait until punten = 5
say Gefeliciteerd! for 1 secs
play sound cheer until done
set punten to 0
PongN on Scratch
https://scratch.mit.edu/projects/96072836/#editor
File
Edit
Tips
About
Save now
Felienne
PongN
by Felienne (shared)
Scripts
Costumes
Sounds
See project page
punten 2
Sprites
New sprite:
Stage
1 backdrop
New backdrop:
Bal
Batje
Lijn
change x by 10
set x to 0
change y by 10
set y to 0
when clicked
forever
wait until touching Batje ?
play sound pop
point in direction 180 - direction
move 10 steps
change punten by 1
Backpack


Version L
PongS on Scratch
https://scratch.mit.edu/projects/96201509/#editor
File
Edit
Tips
About
Felienne
PongS
by Felienne (shared)
See project page
punten 0
Scripts
Costumes
Sounds
Motion
Looks
Sound
Pen
Data
Events
Control
Sensing
Operators
More Blocks
move 10 steps
turn 15 degrees
turn 15 degrees
point in direction 90
point towards
go to x: 167 y: -41
go to mouse-pointer
glide 1 secs to x: 167 y: -41
change x by 10
set x to 0
change y by 10
set y to 0
when 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
point in direction 180 - direction
move 10 steps
change punten by 1
else
if touching Lijn ? then
set punten to 0
play sound buzzer
else
if punten = 5 then
say Gefeliciteerd! for 1 secs
play sound cheer until done
set punten to 0
x: 166
y: -40
x: -118 y: -180
Sprites
New sprite:
Stage
1 backdrop
Bal
Batje
Lijn
New backdrop:
Backpack

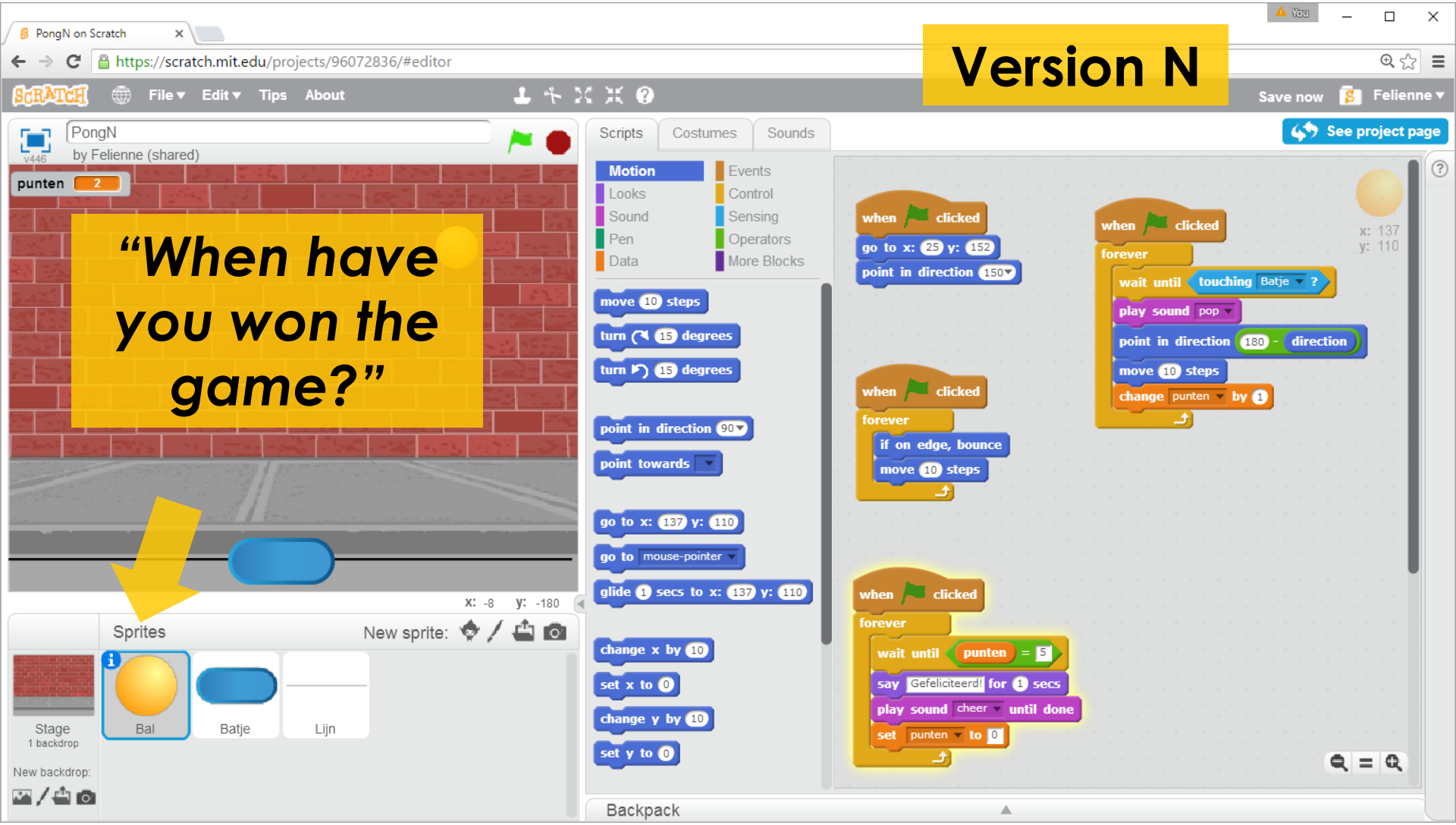

Do code smells
matter to kids?


tl;dr
Yes

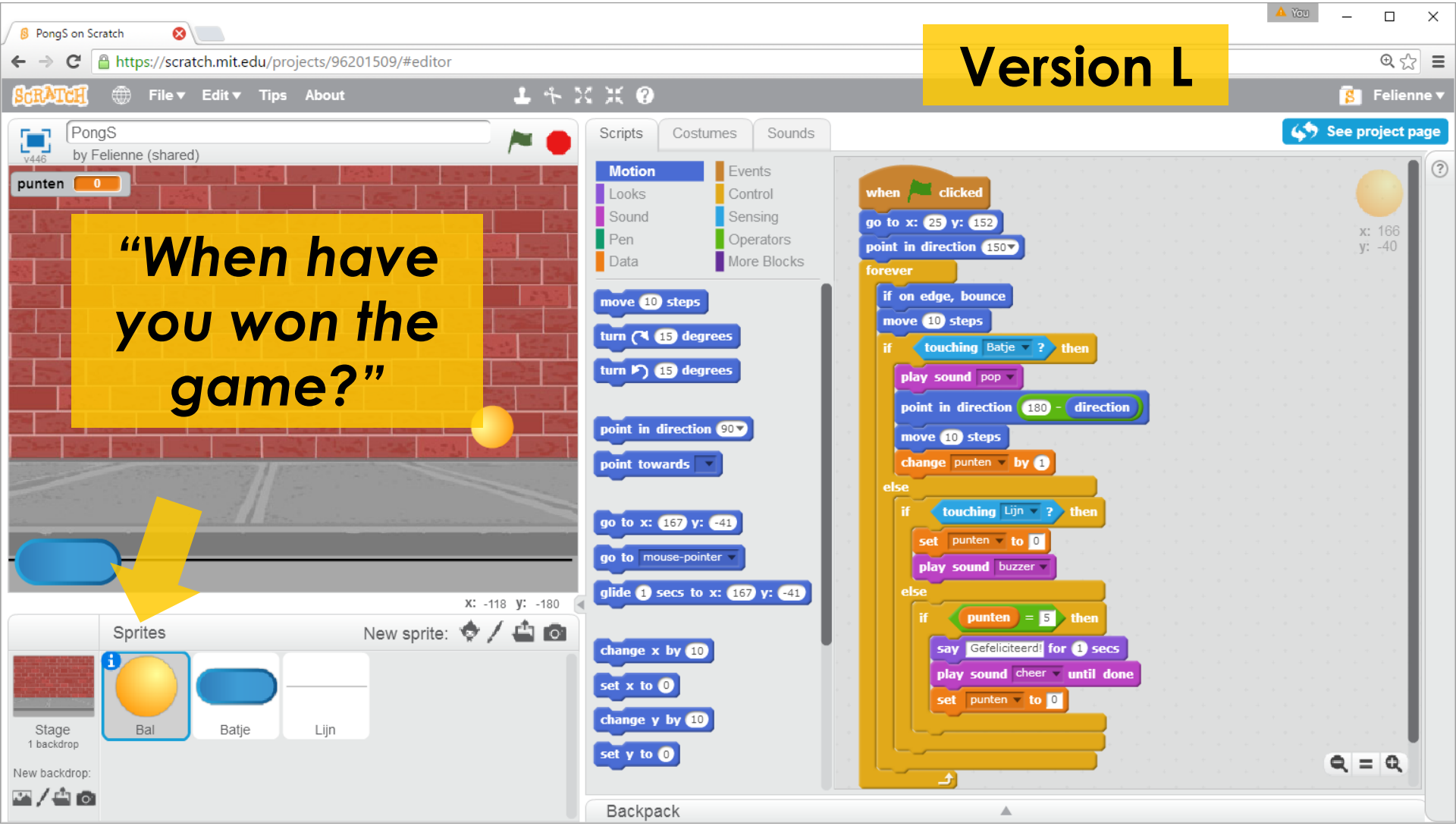

tl;dr
Yes
Kids performed significantly better on the non-smelly program


tl;dr
Yes
But, differences tasks are impacted differently

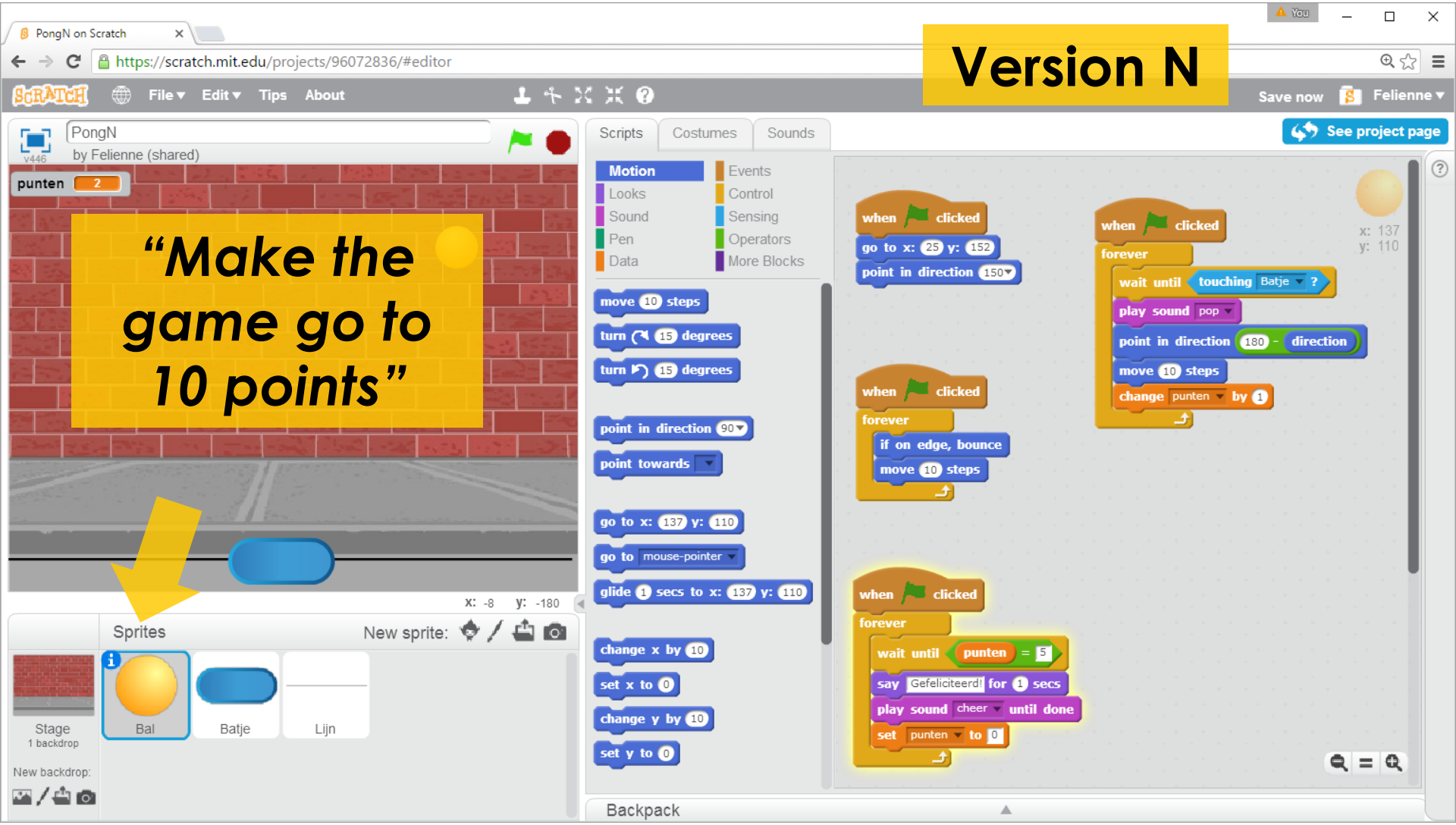

Let's take a closer look!

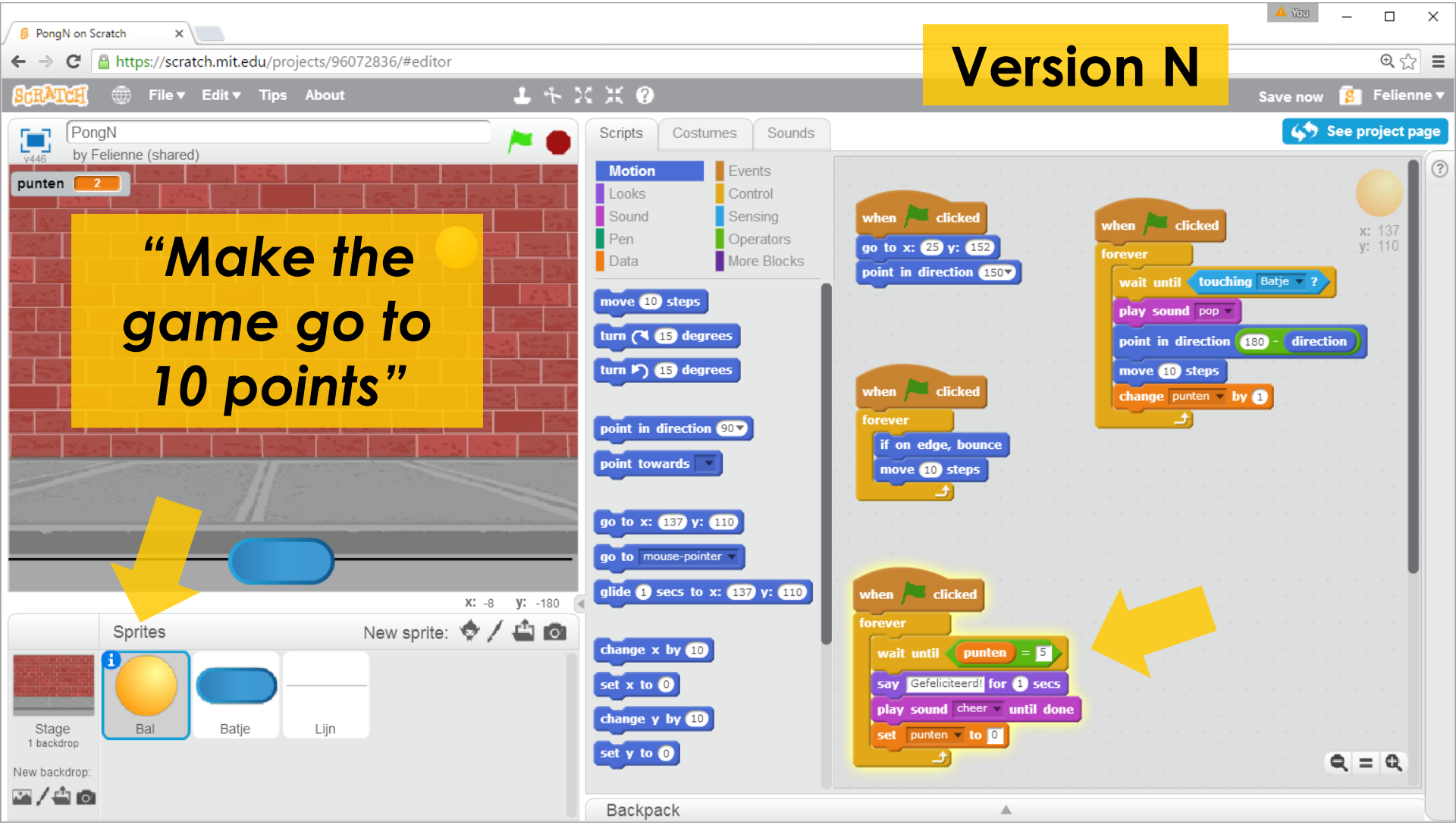

PongN on Scratch
https://scratch.mit.edu/projects/96072836/#editor
Version N
File
Edit
Tips
About
Save now
Felienne
PongN
by Felienne (shared)
punten 2
"When have you won the game?"
Scripts
Costumes
Sounds
See project page
Motion
Looks
Sound
Pen
Data
Events
Control
Sensing
Operators
More Blocks
move 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 clicked
go to x: 25 y: 152
point in direction 150
when clicked
forever
if on edge, bounce
move 10 steps
when clicked
forever
wait until touching Batje ?
play sound pop
point in direction 180 - direction
move 10 steps
change punten by 1
when clicked
forever
wait until punten = 5
say Gefeliciteerd! for 1 secs
play sound cheer until done
set punten to 0
x: 137
y: 110
x: -8 y: -180
Sprites
New sprite:
Stage
1 backdrop
New backdrop:
Bal
Batje
Lijn
Backpack

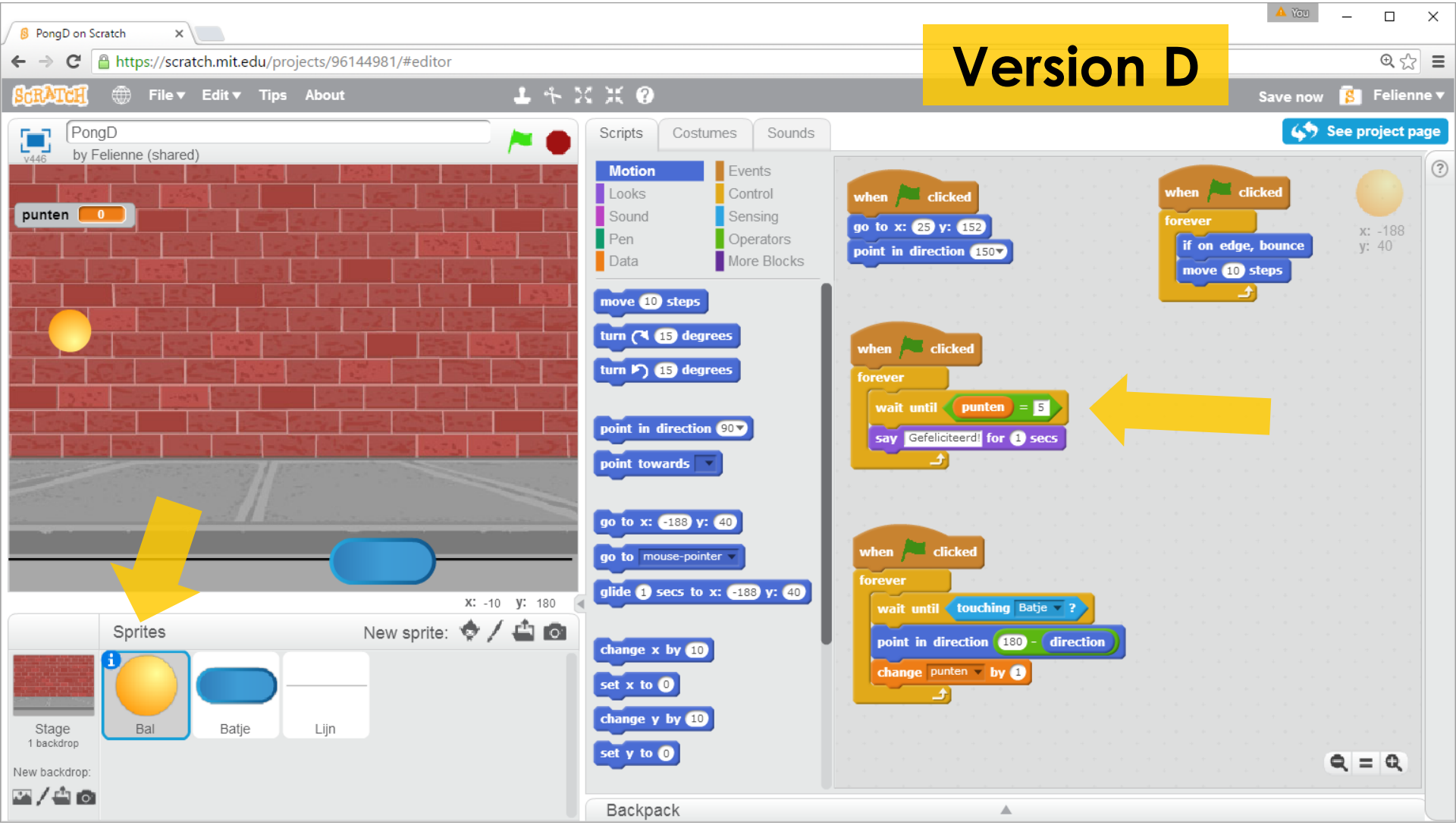
Version L

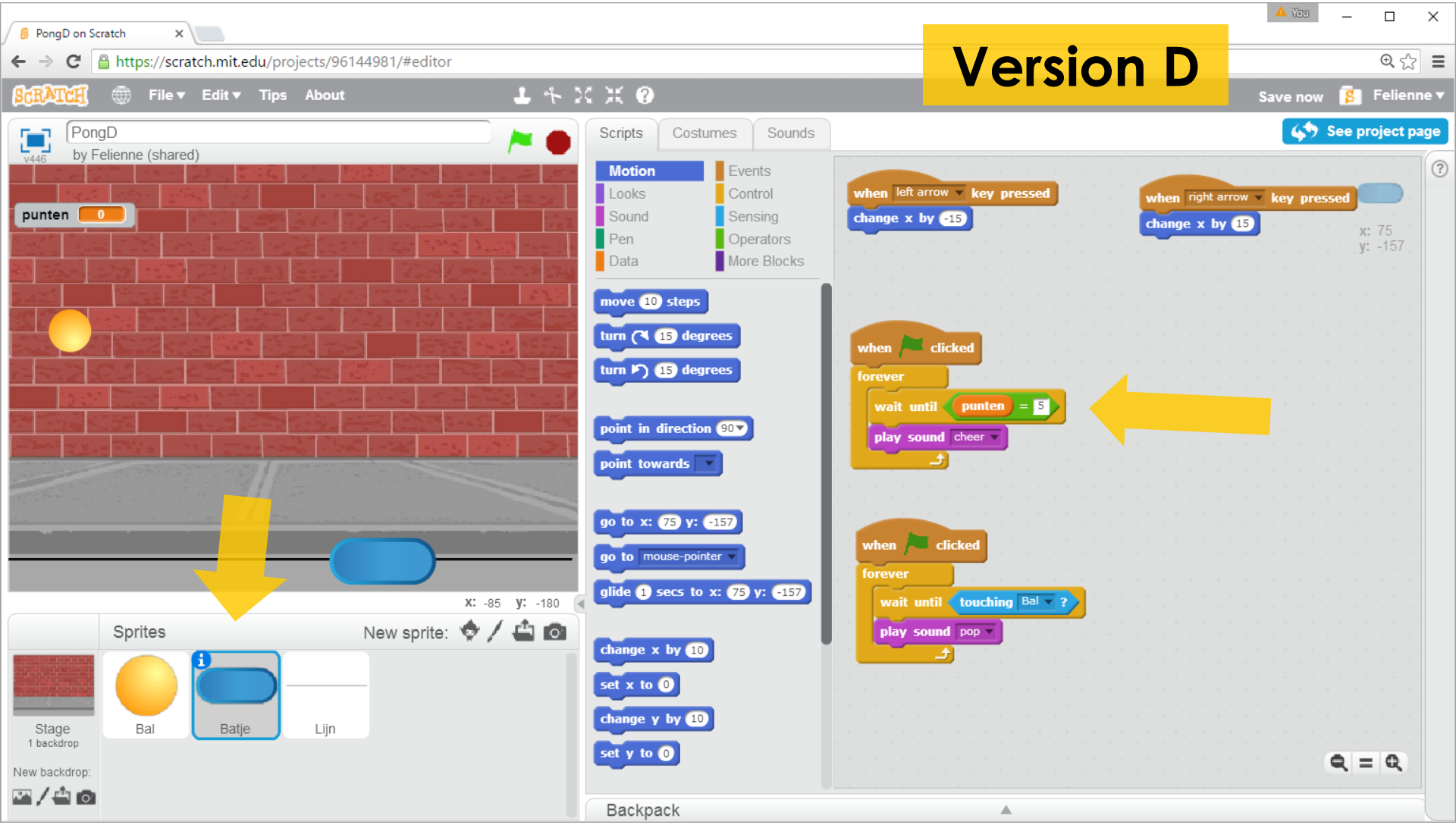

PongS on Scratch
https://scratch.mit.edu/projects/96201509/#editor
File
Edit
Tips
About
Felienne
PongS
by Felienne (shared)
See project page
punten 0
"When have you won the game?"
Scripts
Costumes
Sounds
Motion
Looks
Sound
Pen
Data
Events
Control
Sensing
Operators
More Blocks
move 10 steps
turn 15 degrees
turn 15 degrees
point in direction 90
point towards
go to x: 167 y: -41
go to mouse-pointer
glide 1 secs to x: 167 y: -41
change x by 10
set x to 0
change y by 10
set y to 0
when 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
point in direction 180 - direction
move 10 steps
change punten by 1
else
if touching Lijn ? then
set punten to 0
play sound buzzer
else
if punten = 5 then
say Gefeliciteerd! for 1 secs
play sound cheer until done
set punten to 0
x: 166
y: -40
x: -118 y: -180
Sprites
New sprite:
Stage
1 backdrop
Bal
Batje
Lijn
New backdrop:
Backpack

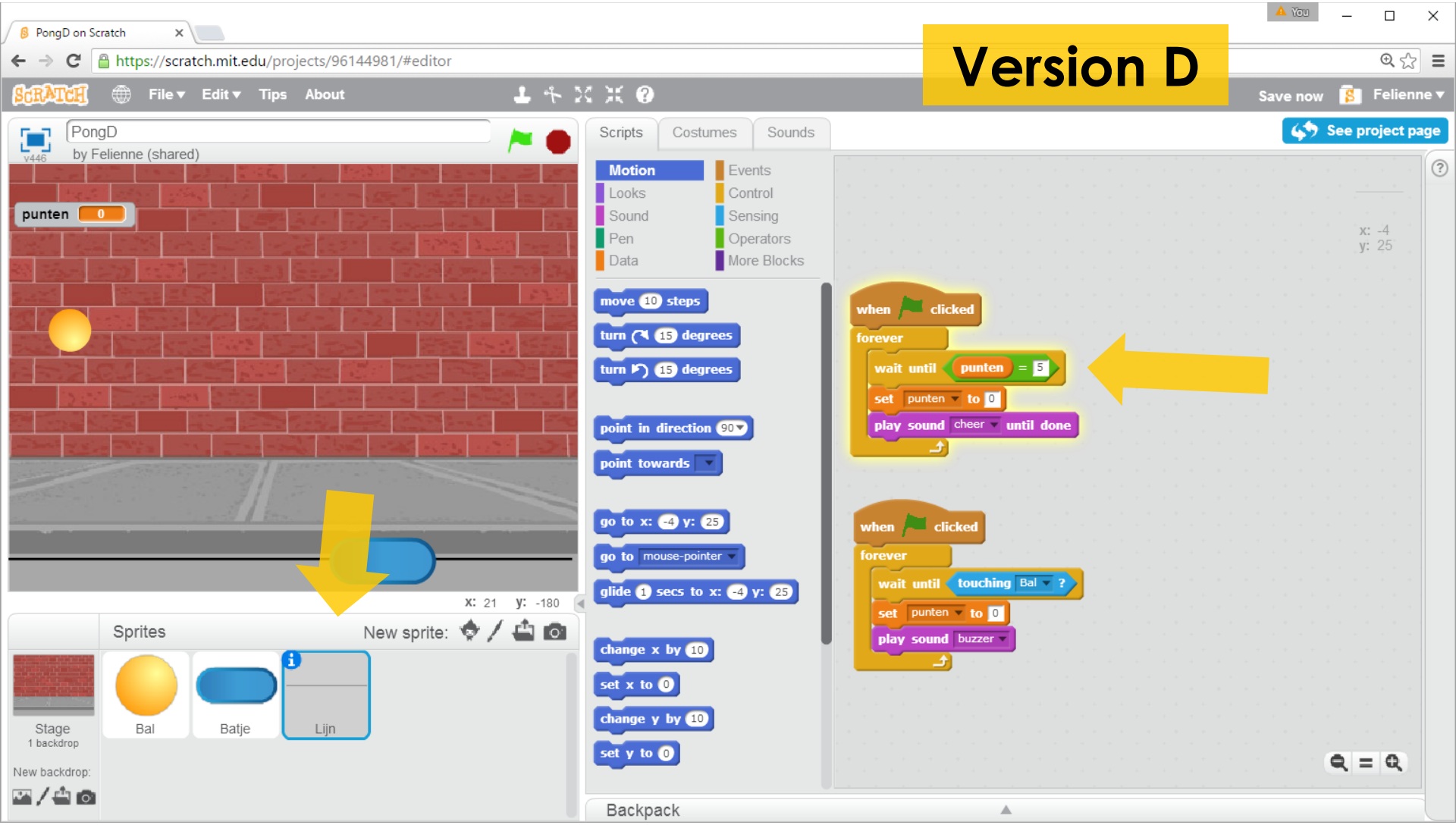

Let's take a closer look!
Understanding seems affected more by the Long Method smell


PongN on Scratch
https://scratch.mit.edu/projects/96072836/#editor
Version N
File
Edit
Tips
About
Save now
Felienne
PongN
by Felienne (shared)
punten 2
"Make the game go to 10 points"
Scripts
Costumes
Sounds
See project page
Motion
Looks
Sound
Pen
Data
Events
Control
Sensing
Operators
More Blocks
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 clicked
go to x: 25 y: 152
point in direction 150
when clicked
forever
if on edge, bounce
move 10 steps
when clicked
forever
wait until touching Batje ?
play sound pop
point in direction 180 - direction
move 10 steps
change punten by 1
x: 137
y: 110
when clicked
forever
wait until punten = 5
say Gefeliciteerd! for 1 secs
play sound cheer until done
set punten to 0
x: -8 y: -180
Sprites
New sprite:
Stage
1 backdrop
New backdrop:
Bal
Batje
Lijn
Backpack


PongN on Scratch
https://scratch.mit.edu/projects/96072836/#editor
Version N
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See project page
Motion
Looks
Sound
Pen
Data
Events
Control
Sensing
Operators
More Blocks
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 clicked
go to x: 25 y: 152
point in direction 150
when clicked
forever
if on edge, bounce
move 10 steps
when clicked
forever
wait until touching Batje ?
play sound pop
point in direction 180 - direction
move 10 steps
change punten by 1
x: 137
y: 110
when clicked
forever
wait until punten = 5
say Gefeliciteerd! for 1 secs
play sound cheer until done
set punten to 0
x: -8 y: -180
Sprites
New sprite:
Stage
1 backdrop
New backdrop:
Bal
Batje
Lijn
Backpack


PongD on Scratch
https://scratch.mit.edu/projects/96144981/#editor
Version D
File
Edit
Tips
About
Save now
Felienne
PongD
by Felienne (shared)
punten 0
Scripts
Costumes
Sounds
See project page
Motion
Looks
Sound
Pen
Data
Events
Control
Sensing
Operators
More Blocks
move 10 steps
turn 15 degrees
turn 15 degrees
point in direction 90
point towards
go to x: -188 y: 40
go to mouse-pointer
glide 1 secs to x: -188 y: 40
change x by 10
set x to 0
change y by 10
set y to 0
when clicked
go to x: 25 y: 152
point in direction 150
when clicked
forever
if on edge, bounce
move 10 steps
x: -188
y: 40
when clicked
forever
wait until punten = 5
say Gefeliciteerd! for 1 secs
when clicked
forever
wait until touching Batje ?
point in direction 180 - direction
change punten by 1
x: -10 y: 180
Sprites
New sprite:
Stage
1 backdrop
New backdrop:
Bal
Batje
Lijn
Backpack


Version D
PongD on Scratch
https://scratch.mit.edu/projects/96144981/#editor
File
Edit
Tips
About
Save now
Felienne
PongD
by Felienne (shared)
punten 0
Scripts
Costumes
Sounds
See project page
Motion
Looks
Sound
Pen
Data
Events
Control
Sensing
Operators
More Blocks
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
when left arrow key pressed
change x by -15
when right arrow key pressed
change x by 15
x: 75
y: -157
when clicked
forever
wait until punten = 5
play sound cheer
when clicked
forever
wait until touching Bal ?
play sound pop
x: -85 y: -180
Sprites
New sprite:
Stage
1 backdrop
New backdrop:
Bal
Batje
Lijn
Backpack


PongD on Scratch
https://scratch.mit.edu/projects/96144981/#editor
Version D
File
Edit
Tips
About
Save now
Felienne
PongD
by Felienne (shared)
punten 0
Scripts
Costumes
Sounds
See project page
Motion
Looks
Sound
Pen
Data
Events
Control
Sensing
Operators
More Blocks
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 clicked
forever
wait until punten = 5
set punten to 0
play sound cheer until done
when clicked
forever
wait until touching Bal ?
set punten to 0
play sound buzzer
x: -4
y: 25
x: 21 y: -180
Sprites
New sprite:
Stage
1 backdrop
New backdrop:
Bal
Batje
Lijn
Backpack


Let's take a closer look!
Modification is hampered most by Duplication


Smells are bad!
(also for kids)


Smells are bad!
(also for kids)
Are smells
common?


Thanks MIT

Scratch Statistics - Imagi

https://scratch.mit.edu/statistics/

Create | Explore | Discuss | About | Help | Search | Felienne

Community statistics at a glance

- 16,622,772 projects shared,
- 13,415,350 users registered,
- 89,208,180 comments posted,
- 2,865,297 studios created

...and growing!

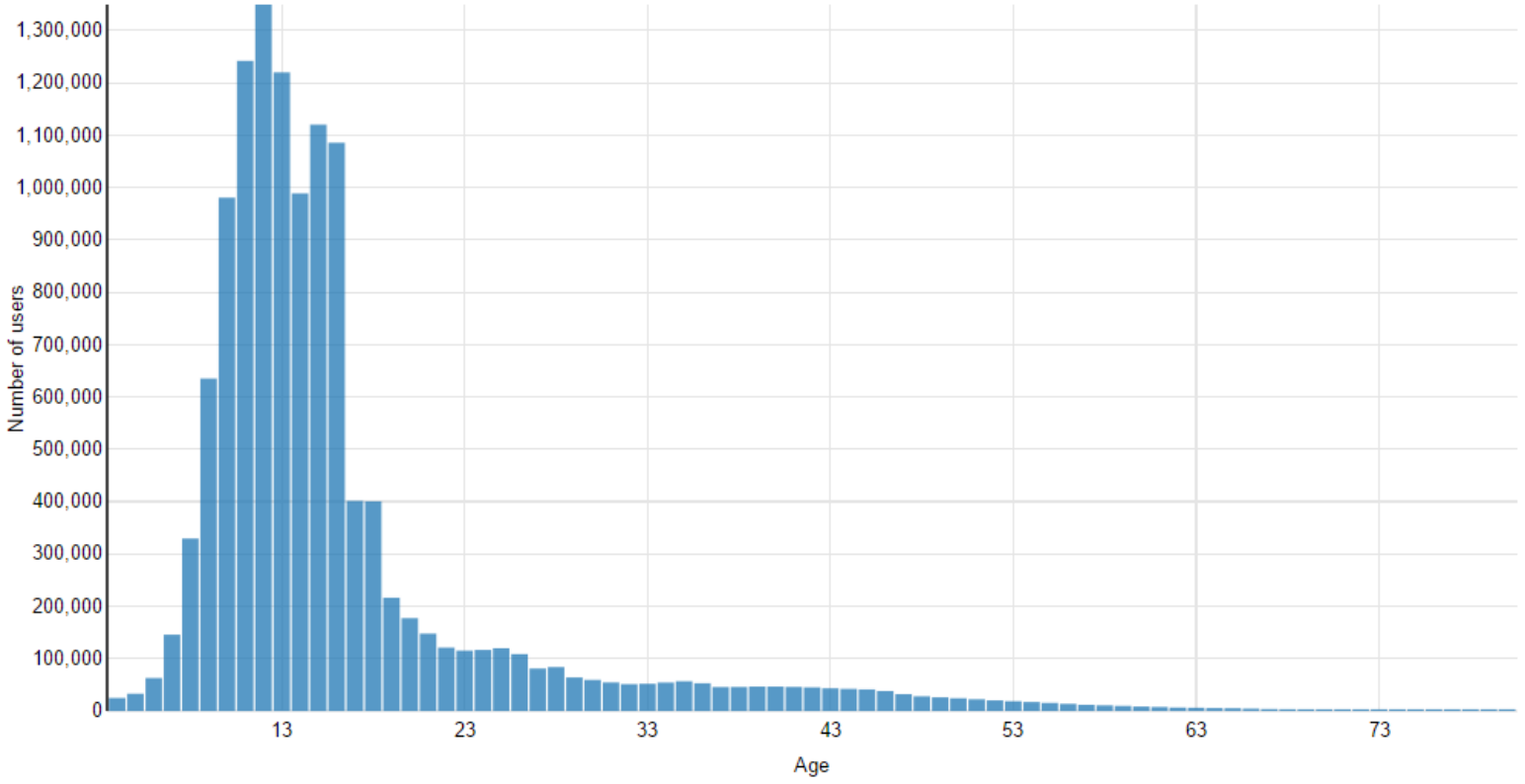
Website traffic last month

- 83,015,850 pageviews
- 13,843,300 visits
- 6,390,970 unique visitors

Monthly Activity Trends



Age Distribution of New Scratchers



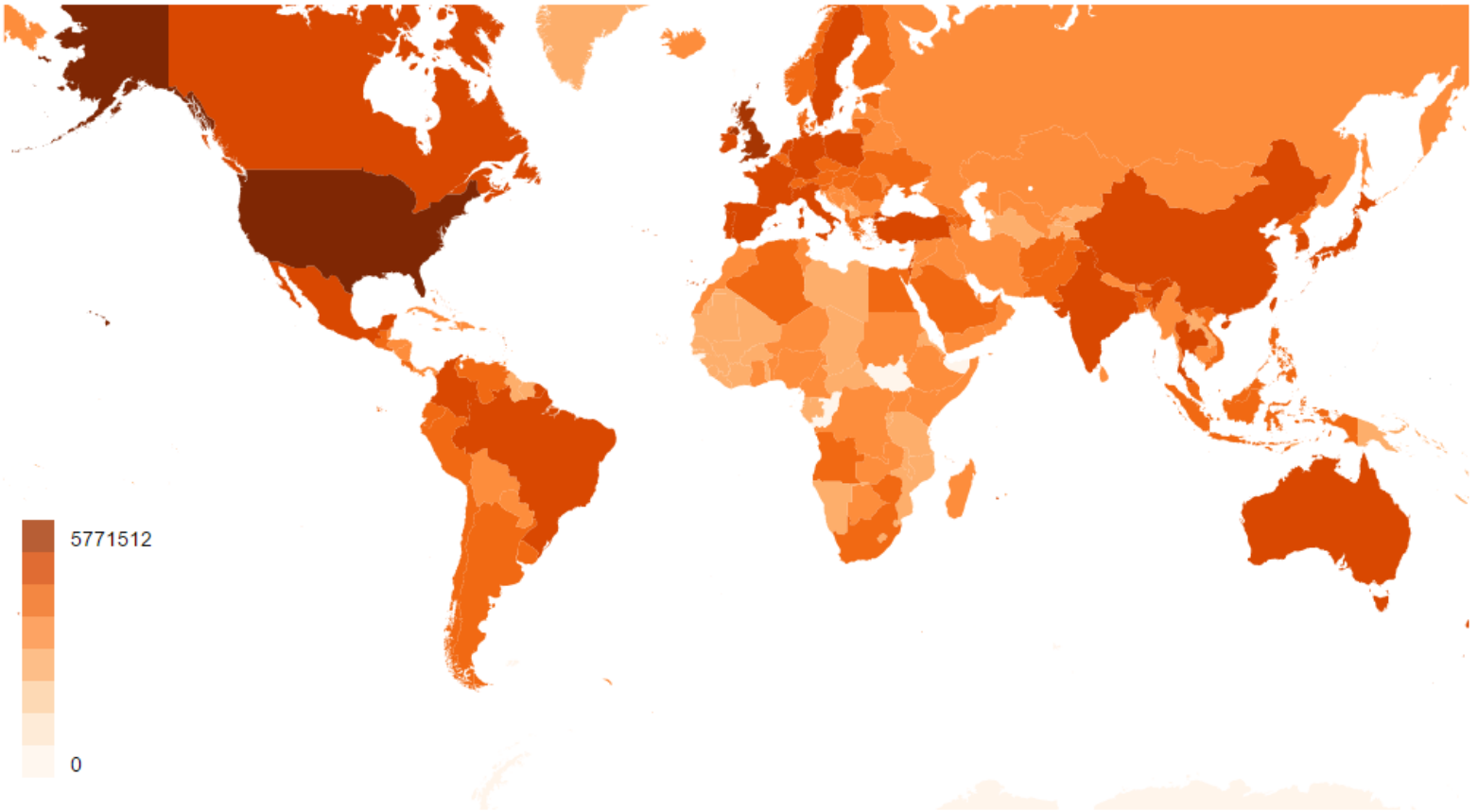
Scratchers Worldwide

Scratch Statistics - Imagi

https://scratch.mit.edu/statistics/

Create Explore Discuss About Help Search Felienne

Scratchers Worldwide



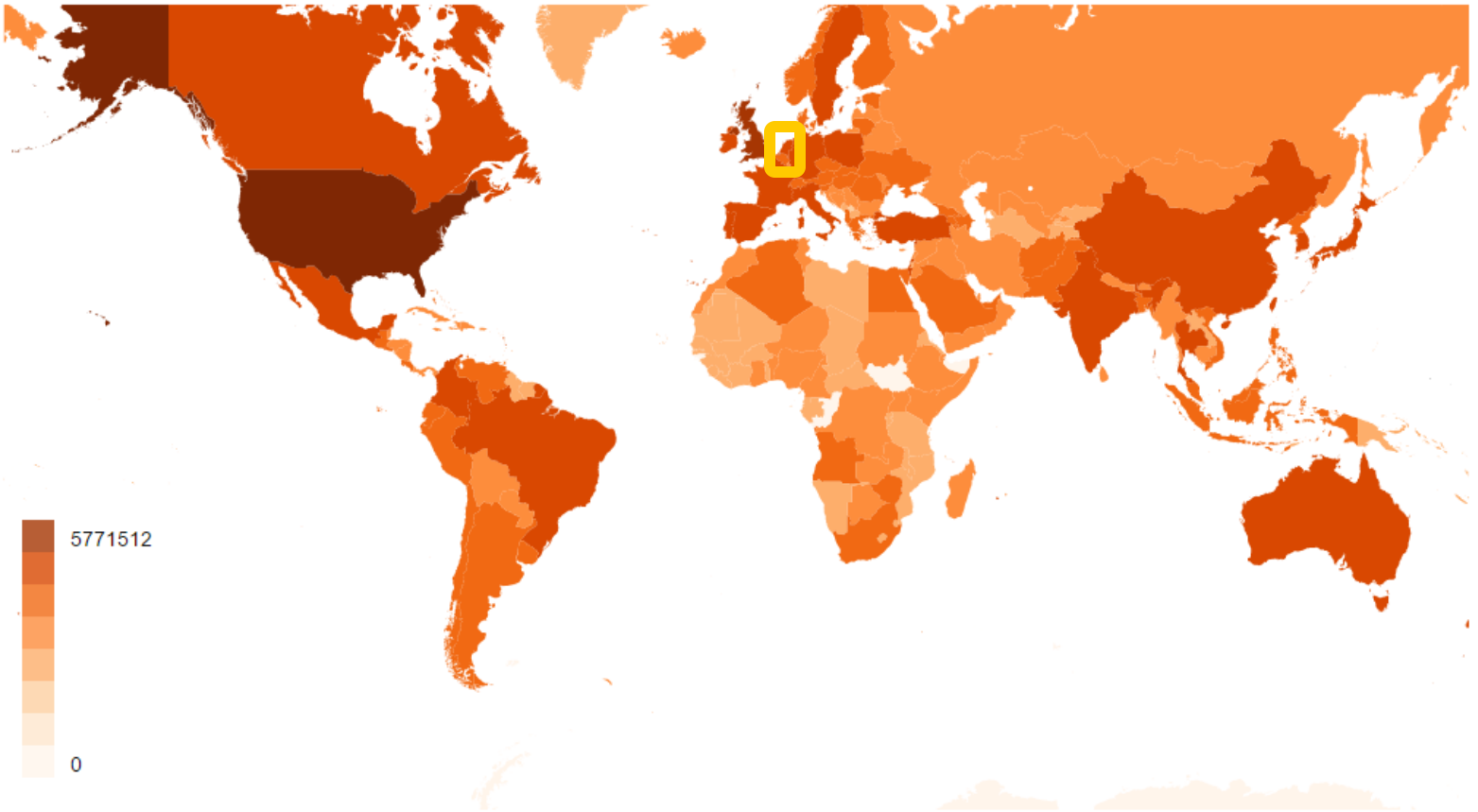
Monthly Project Shares

Scratch Statistics - Imagi

https://scratch.mit.edu/statistics/

Create Explore Discuss About Help Search Felienne

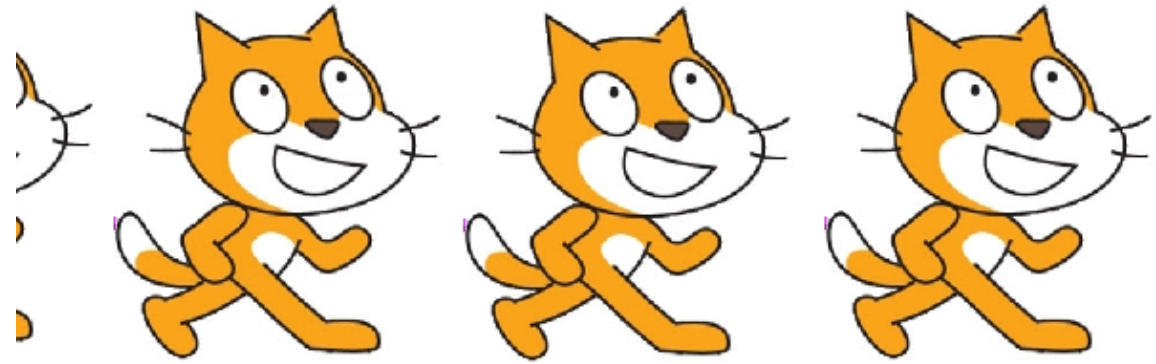
Scratchers Worldwide



Monthly Project Shares


What do kids do in Scratch?

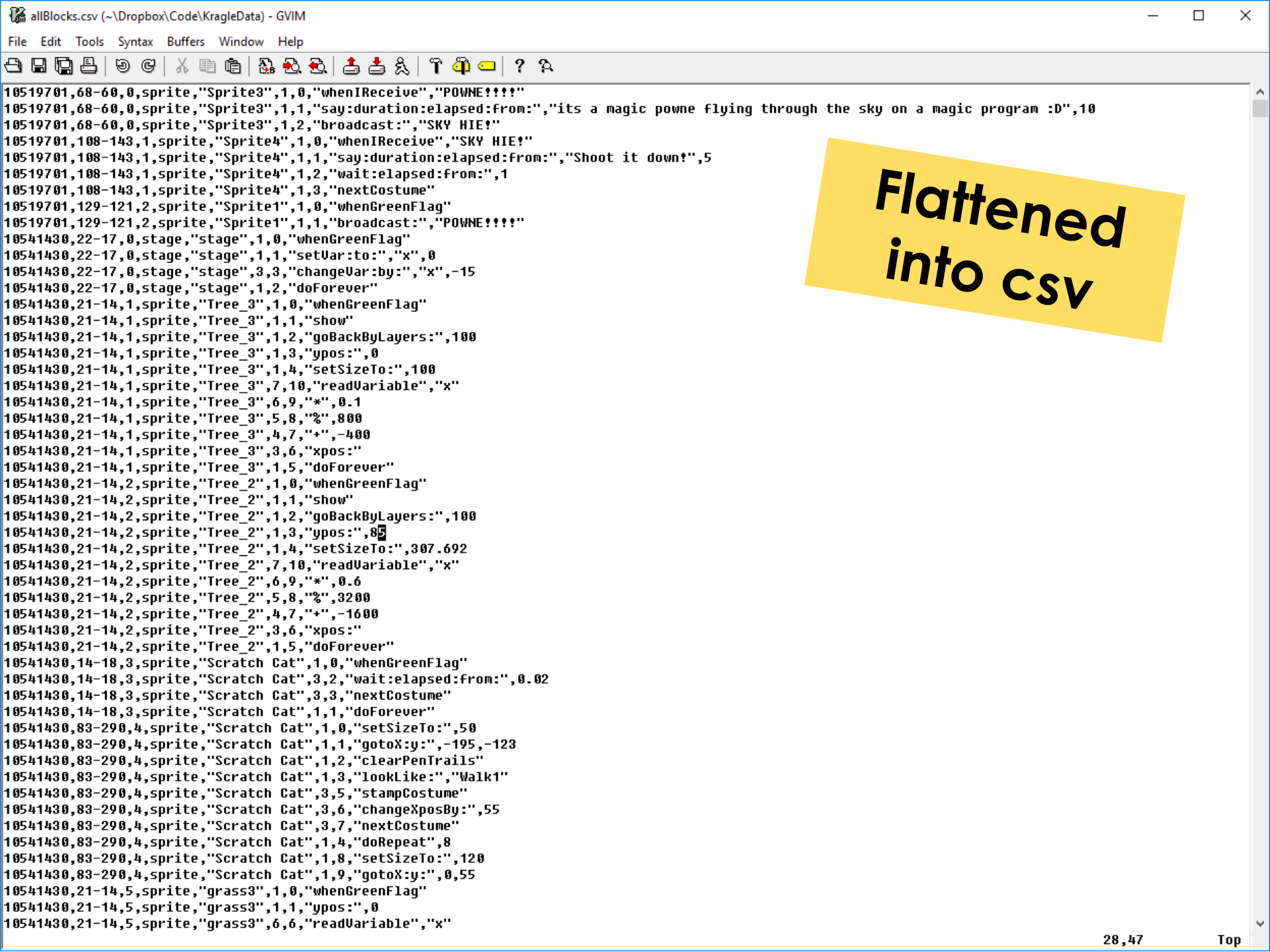
Let's look at some programs!

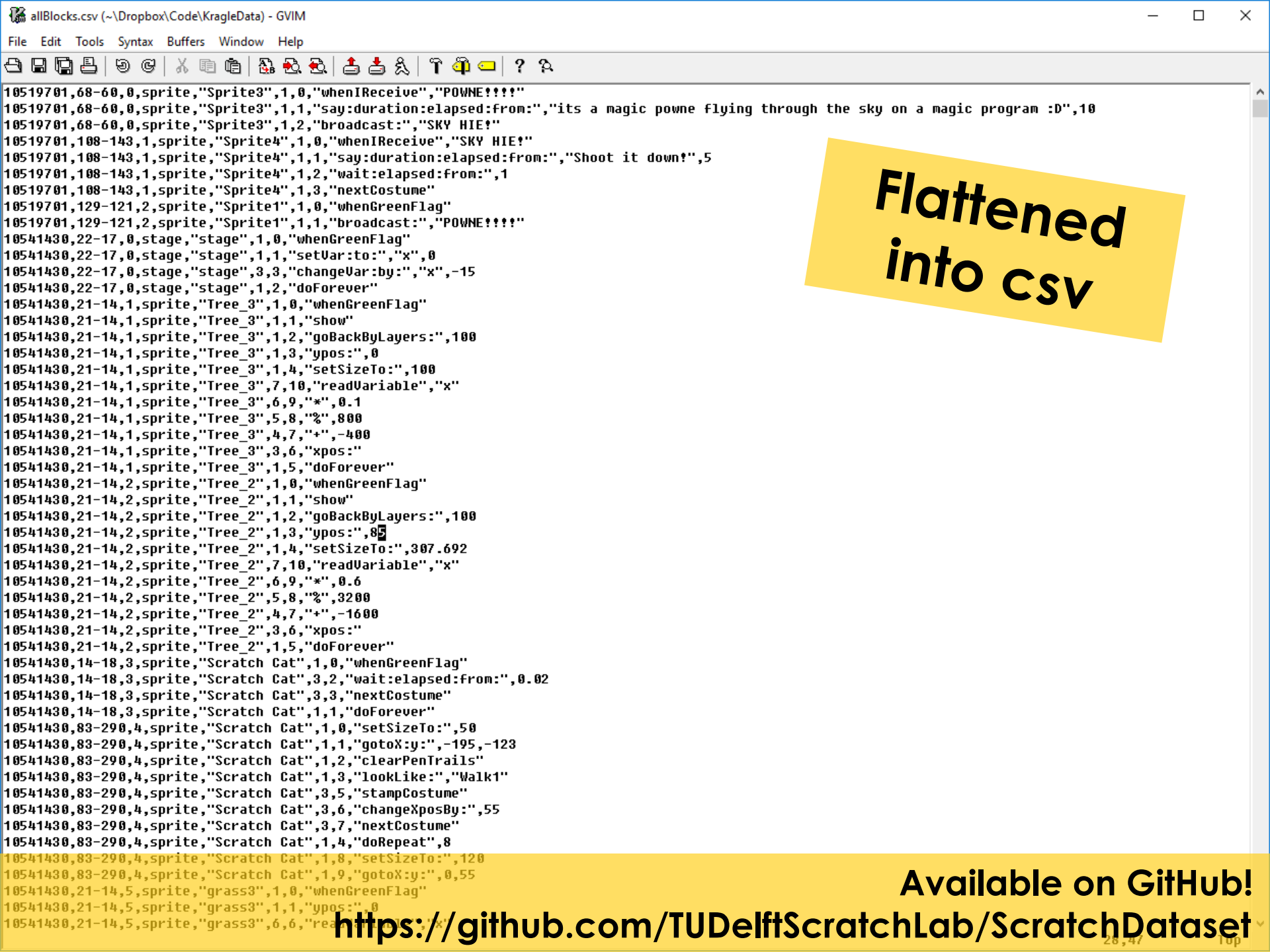





Downloaded all
shared programs
for 24 hours


https://cdn.projects.scrat
https://cdn.projects.scratch.mit.edu/internalapi/project/97802745/get/
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[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,
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["setSizeTo:", 80],
["doForever",
[["doIf", ["touching:", "Fish3"], [["setSizeTo:", 20], ["broadcast:", "raakRodeVis"]]]]]]],
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250.000
JSON files

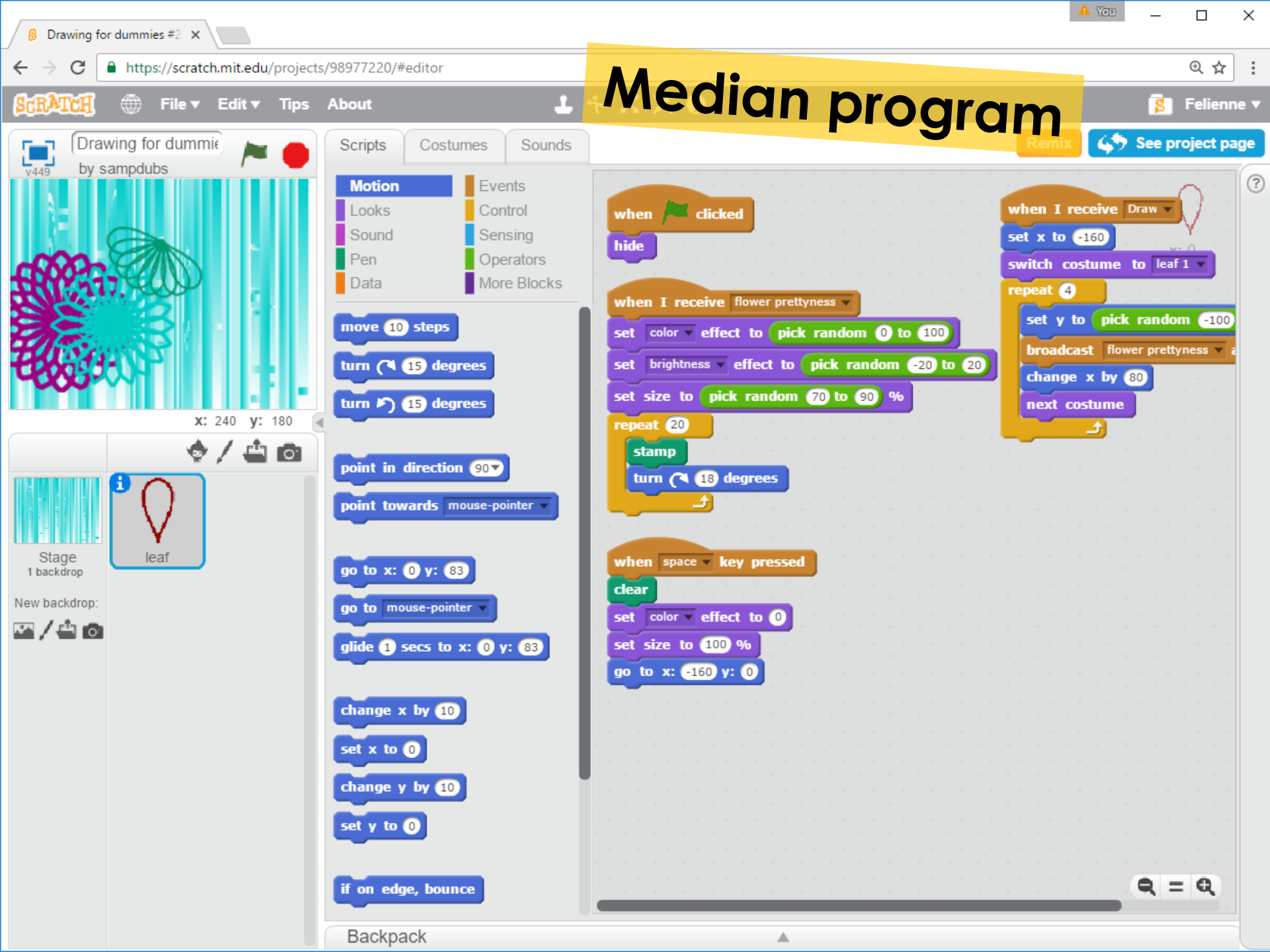

allBlocks.csv (~\Dropbox\Code\KragleData) - GVIM
File Edit Tools Syntax Buffers Window Help
10519701,68-60,0,sprite,"Sprite3",1,0,"whenIReceive","POWNE!!!!"
10519701,68-60,0,sprite,"Sprite3",1,1,"say:duration:elapsed:from:","its a magic powne flying through the sky on a magic program :D",10
10519701,68-60,0,sprite,"Sprite3",1,2,"broadcast:","SKY HIE!"
10519701,108-143,1,sprite,"Sprite4",1,0,"whenIReceive","SKY HIE!"
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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!!!!"
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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
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10541430,21-14,2,sprite,"Tree_2",1,1,"show"
10541430,21-14,2,sprite,"Tree_2",1,2,"goBackByLayers:",100
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10541430,83-290,4,sprite,"Scratch Cat",3,5,"stampCostume"
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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"
28,47 Top
Flattened into csv


allBlocks.csv (~\Dropbox\Code\KragleData) - GVIM
File Edit Tools Syntax Buffers Window Help
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
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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"
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10541430,21-14,1,sprite,"Tree_3",7,10,"readVariable","x"
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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"
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10541430,14-18,3,sprite,"Scratch Cat",3,2,"wait:elapsed:from:",0.02
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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"
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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

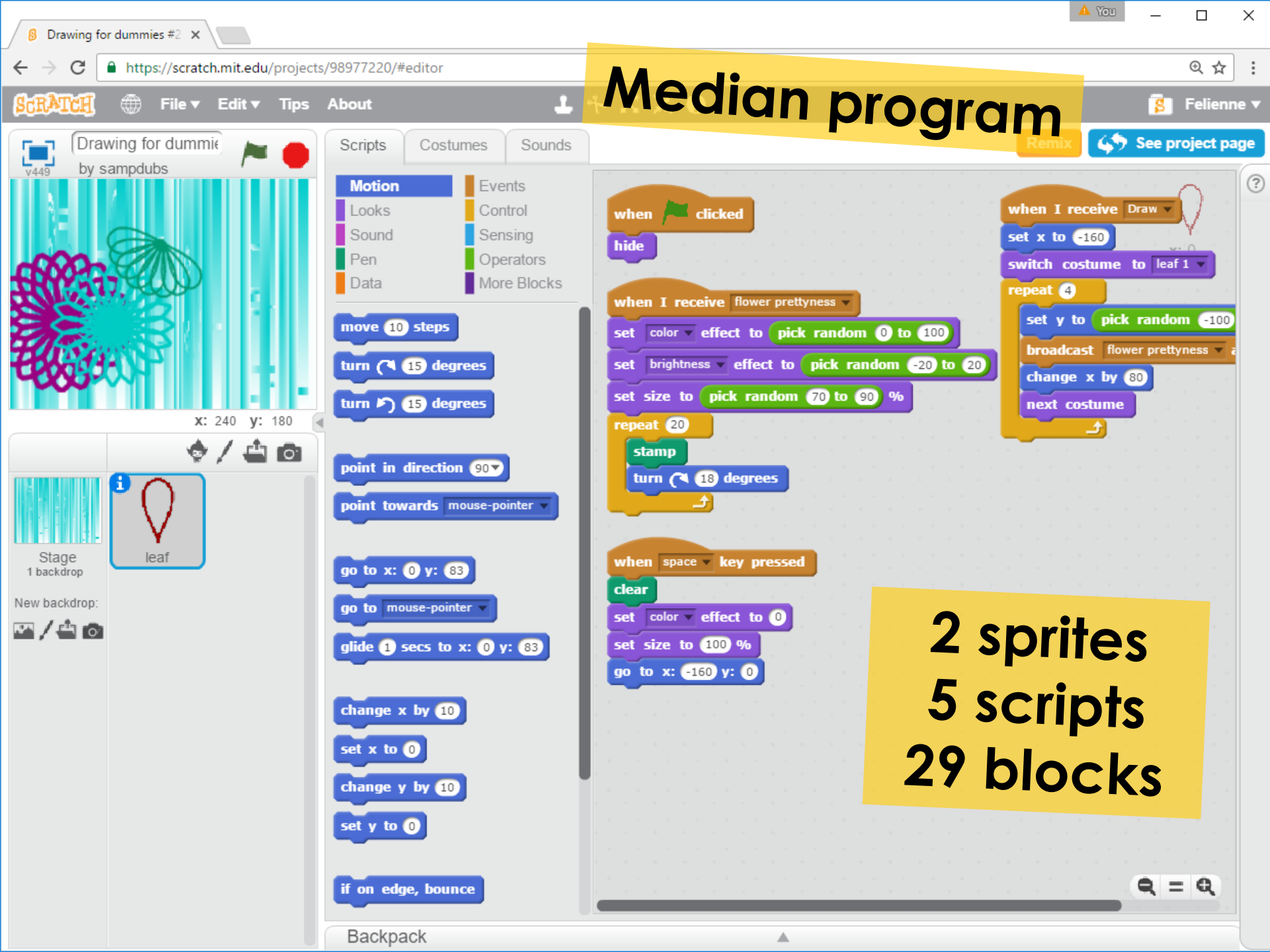

What we found...
THE ART OF WAR
BY
SUN TZU


Many programs
are small...

Median program

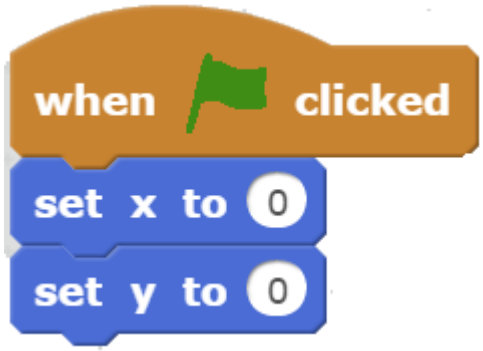


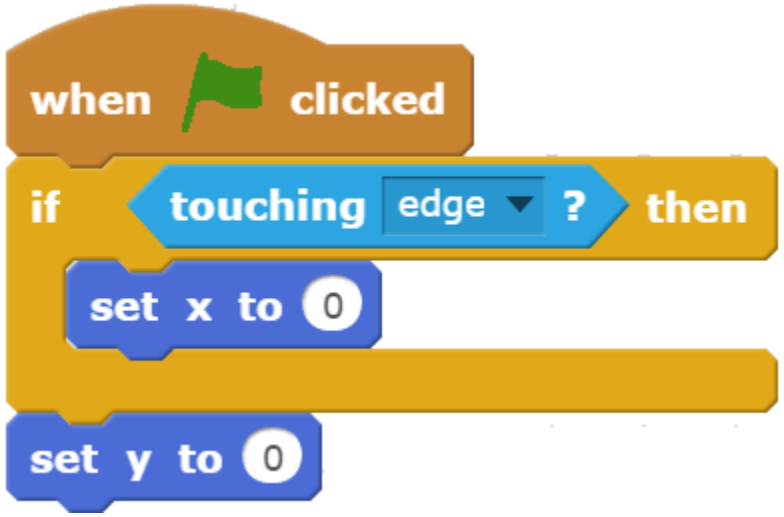
Median program



2 sprites
5 scripts
29 blocks

Most programs are simple...

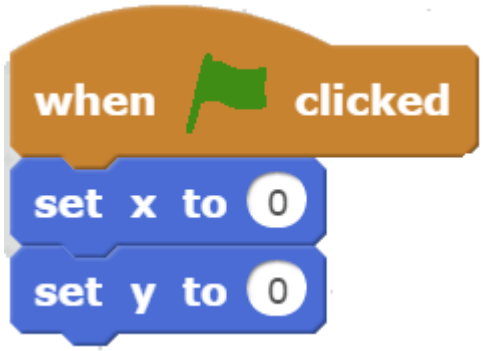




Cyclomatic complexity: 1

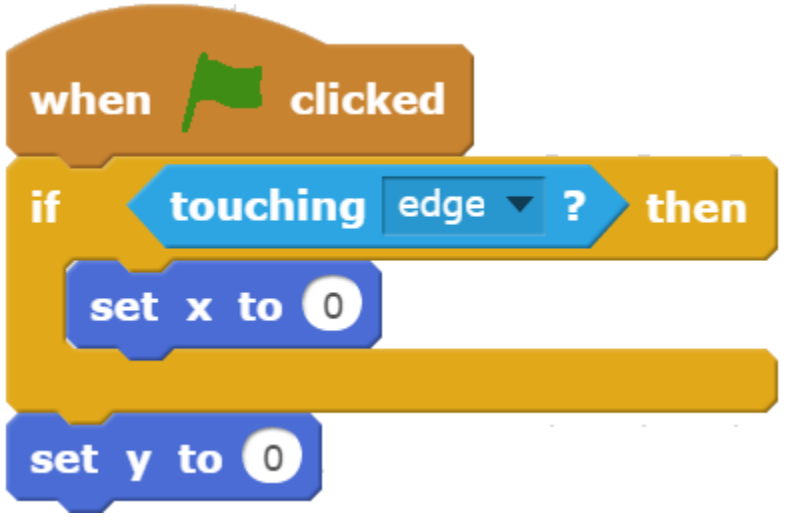
Cyclomatic complexity: 2

Most programs are simple...



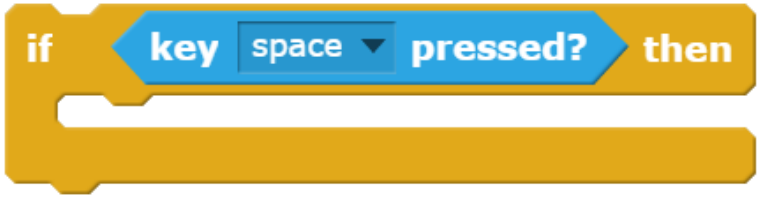
78%

Cyclomatic complexity: 1



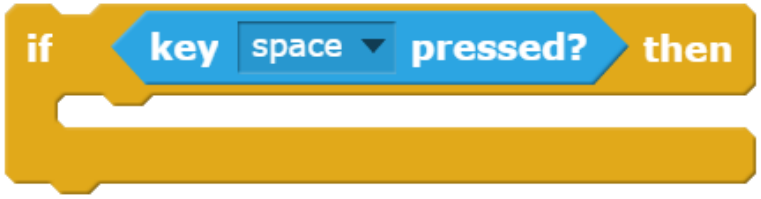
Cyclomatic complexity: 2

Conditional statements





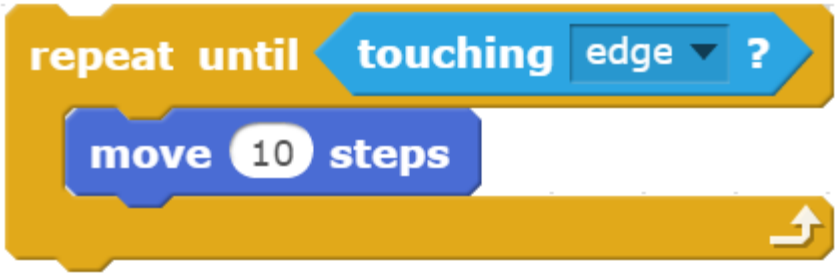
Conditional statements





in 78% of the projects

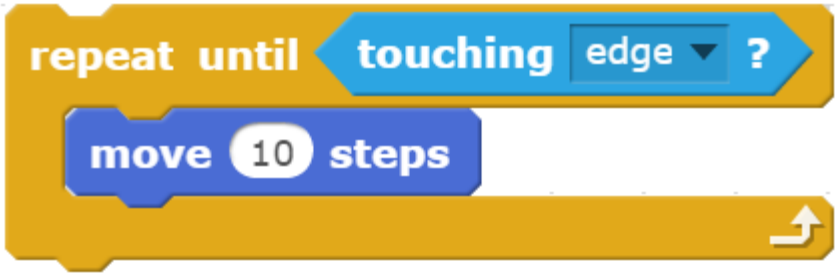
Loops


repeat until
touching
edge
?
move
10
steps


forever
move
10
steps


repeat
10
move
10
steps

Loops

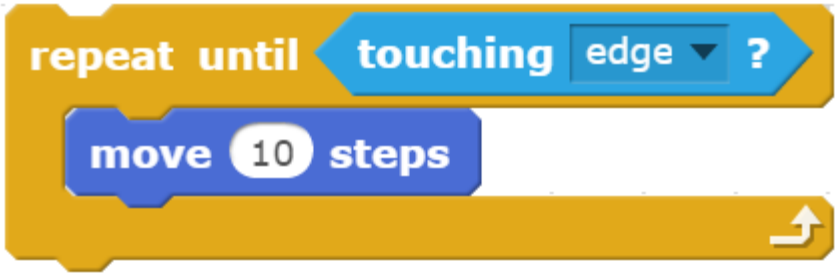






in 77% of projects

Loops



12%

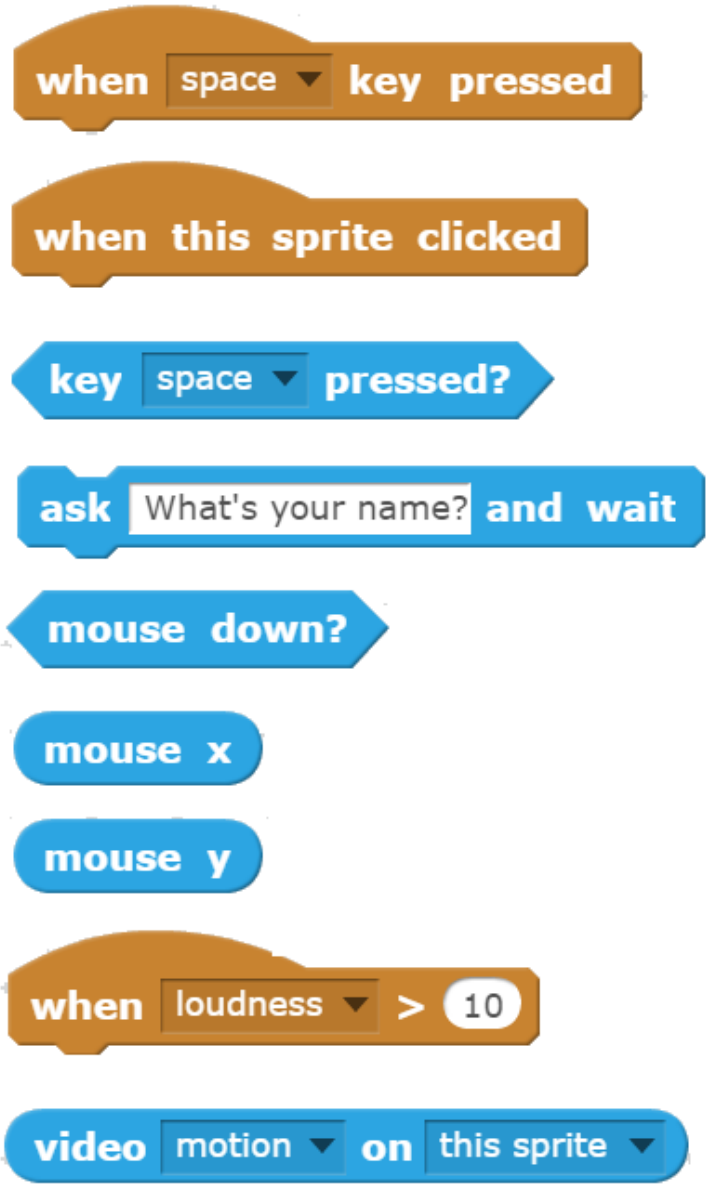
52%



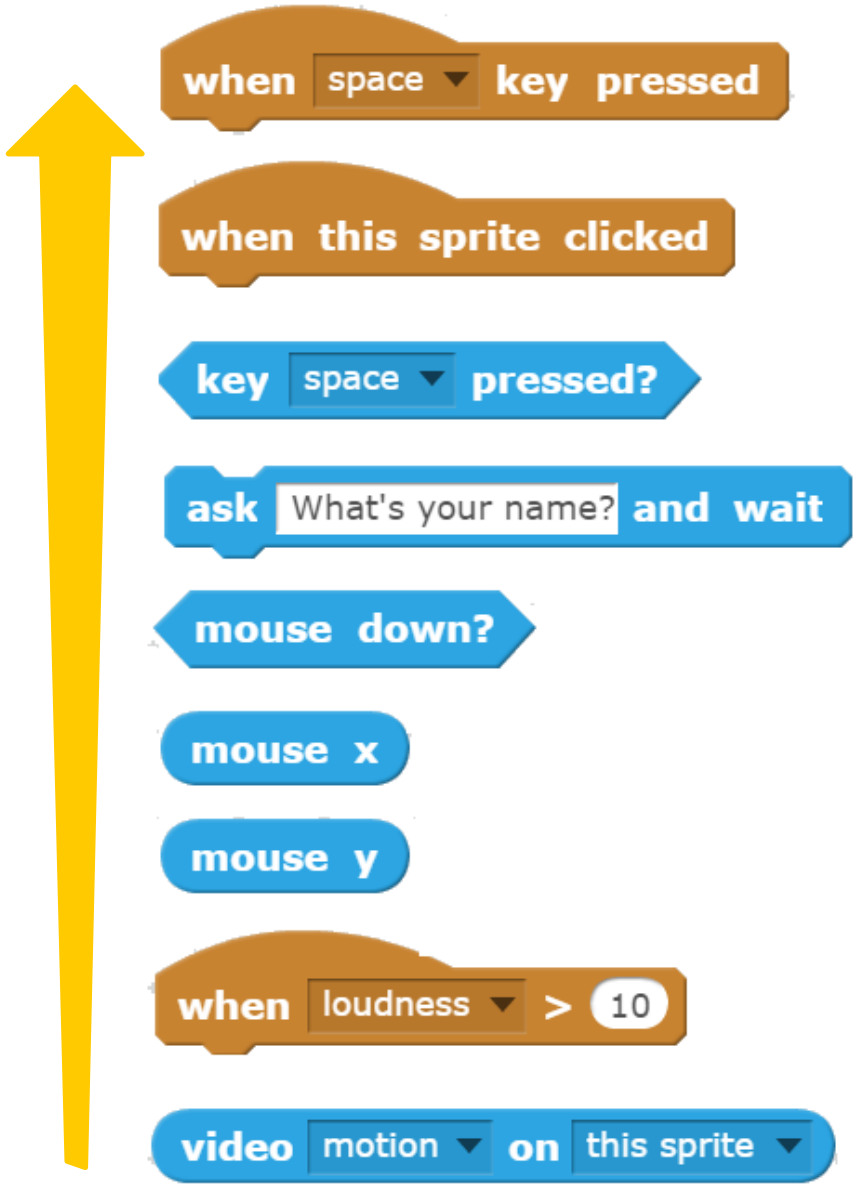


36%

Interaction



Interaction



In 56% of projects

Events


broadcast
gameOver


when I receive
gameOver


broadcast
gameOver
and wait

Events







In 30% of projects

Variables


set x to 0
if x = 0 then
change x by 1
show variable x
hide variable x

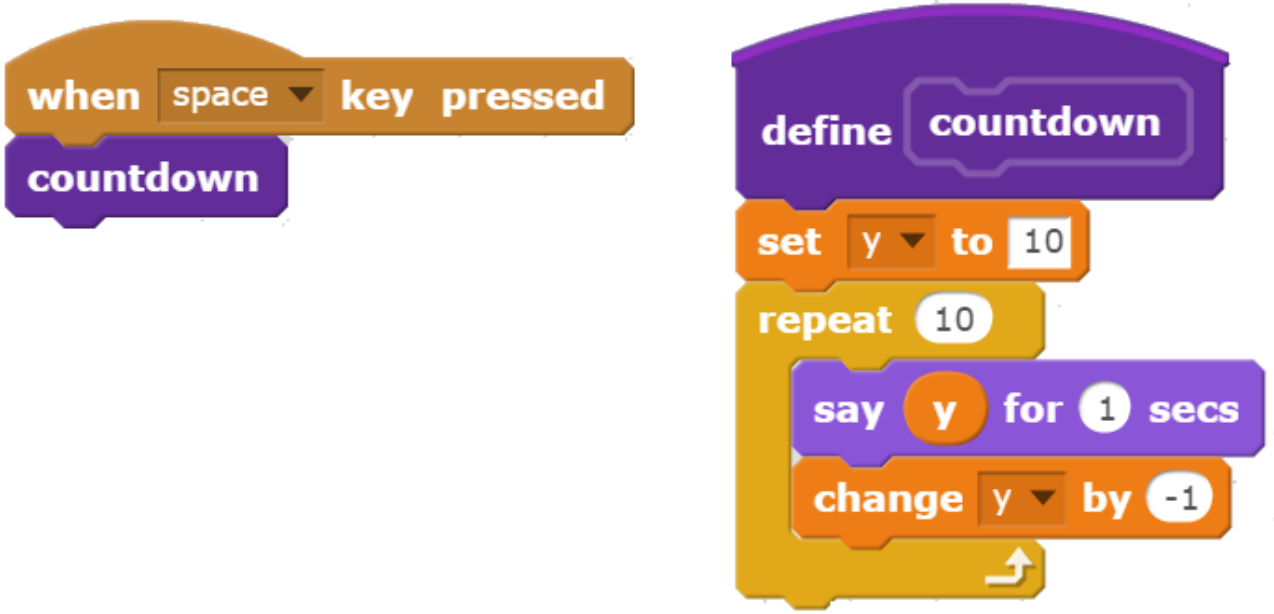
Variables



In 33% of projects

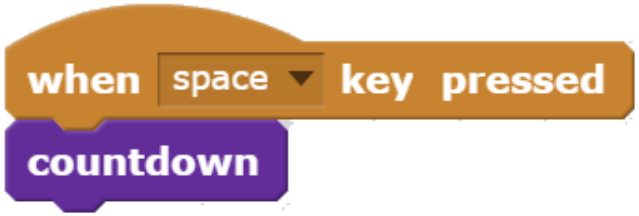
>4 in 7% of projects

Procedures


when space key pressed
countdown
define countdown
set y to 10
repeat 10
say y for 1 secs
change y by -1

Procedures

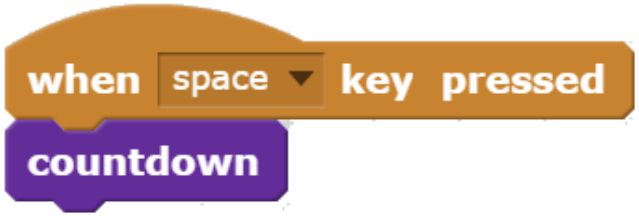
In 8% of projects





Procedures

In 8% of projects

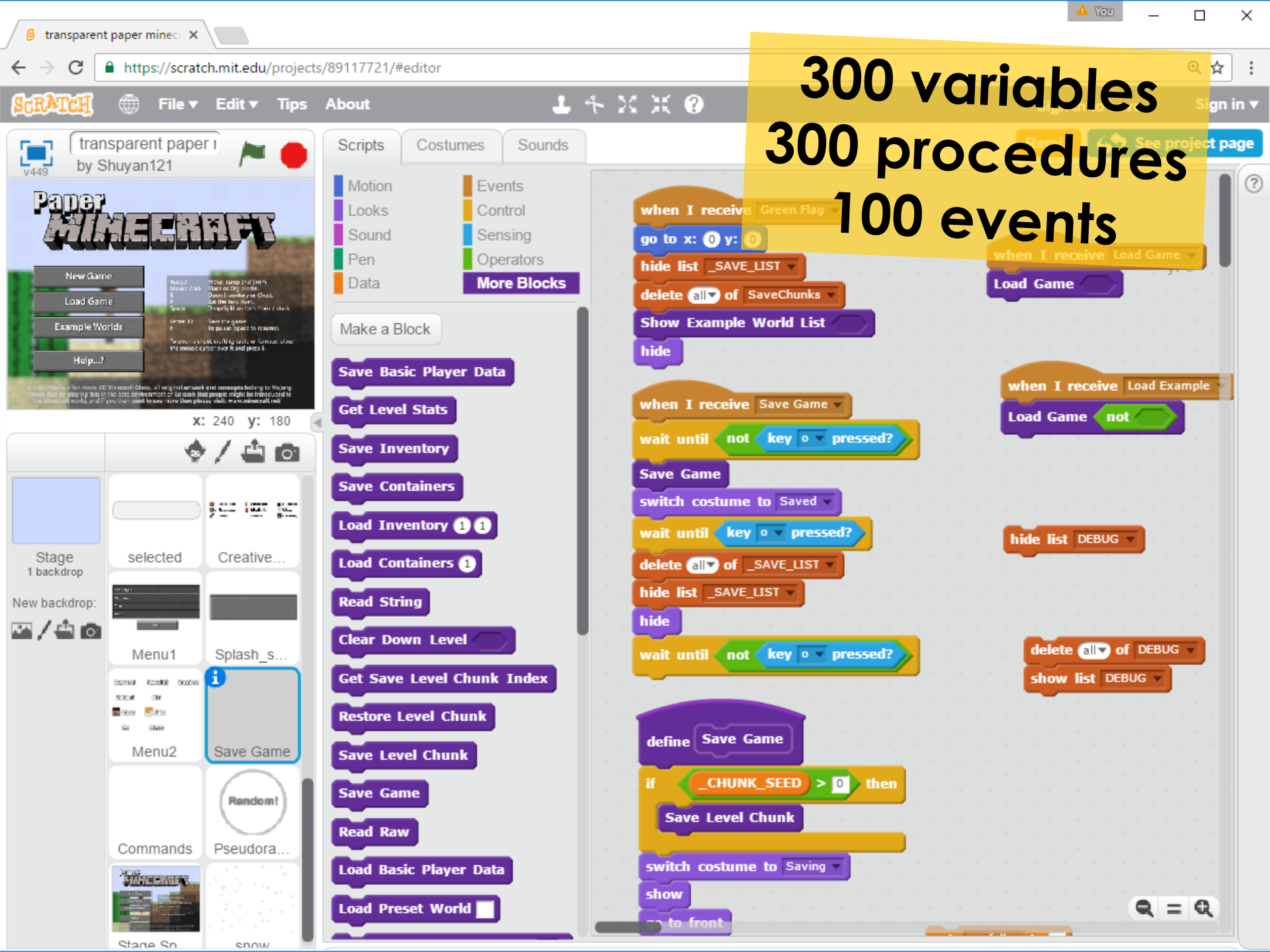




62% only invoked once

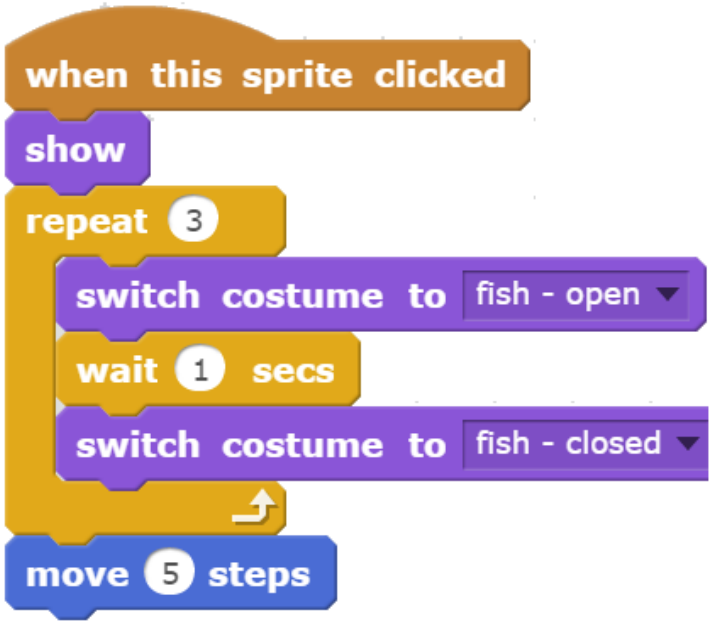

Many programs
are small & simple


But....


transparent paper mine
https://scratch.mit.edu/projects/89117721/#editor
File
Edit
Tips
About
Sign in
transparent paper
by Shuyan121
v449
Paper MINECRAFT
New Game
Load Game
Example Worlds
Help...?
x: 240 y: 180
Scripts
Costumes
Sounds
Motion
Looks
Sound
Pen
Data
Events
Control
Sensing
Operators
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
Stage
1 backdrop
New backdrop:
selected
Creative...
Menu1
Splash_s...
Menu2
Save Game
Commands
Pseudora...
Random!
Stage Sp
snow
300 variables
300 procedures
100 events
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 Load Game
Load Game
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?
when I receive Load Example
Load Game not
hide list DEBUG
delete all of DEBUG
show list DEBUG
define Save Game
if _CHUNK_SEED > 0 then
Save Level Chunk
switch costume to Saving
show
go to front

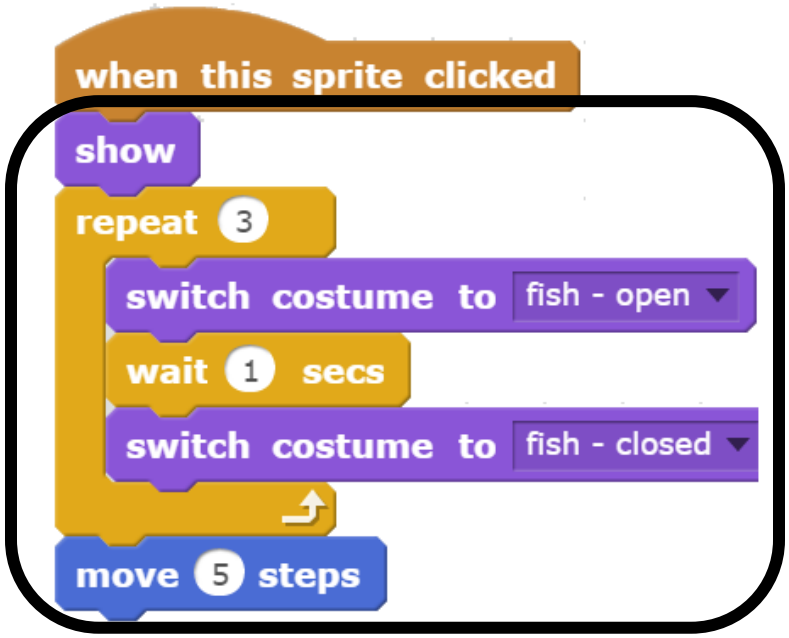

And what
about smells?

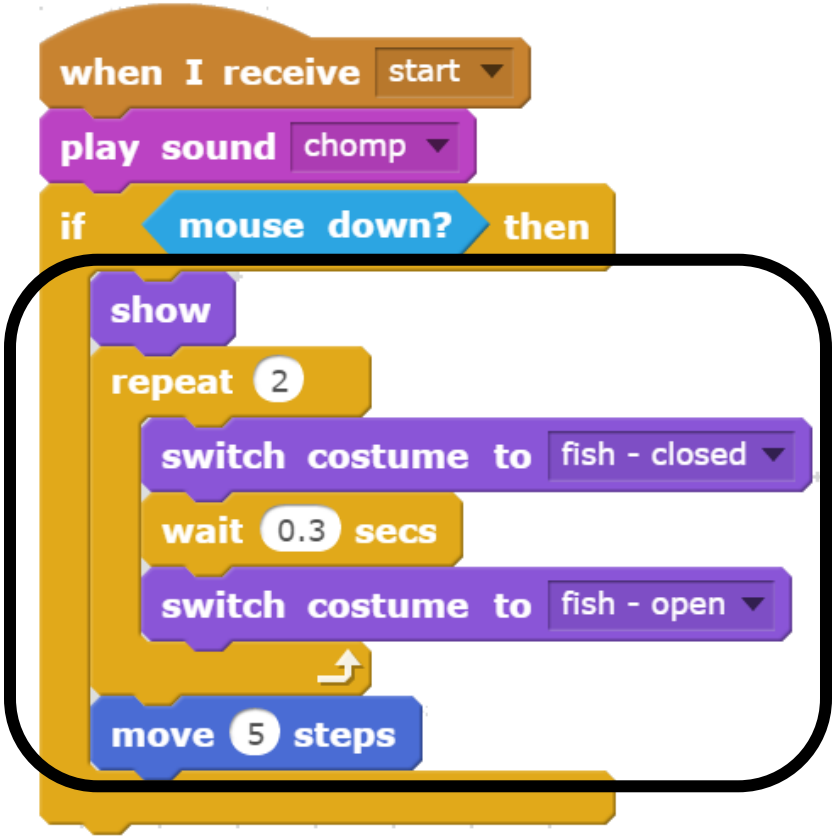
Duplicated Code



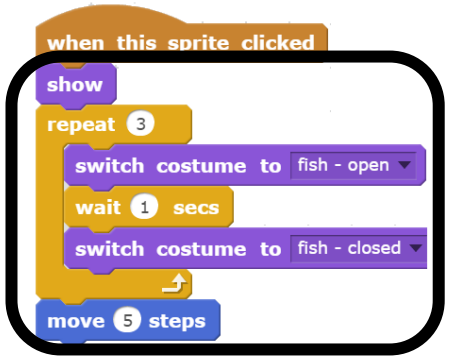


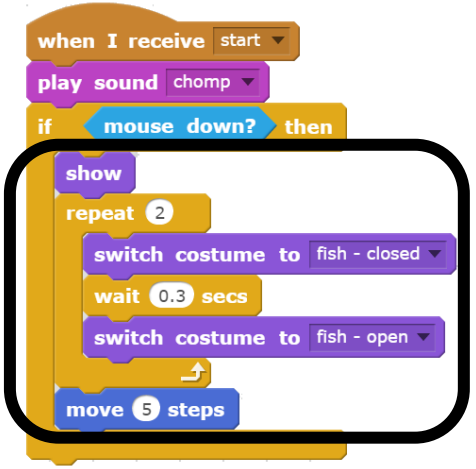
Duplicated Code





Duplicated Code

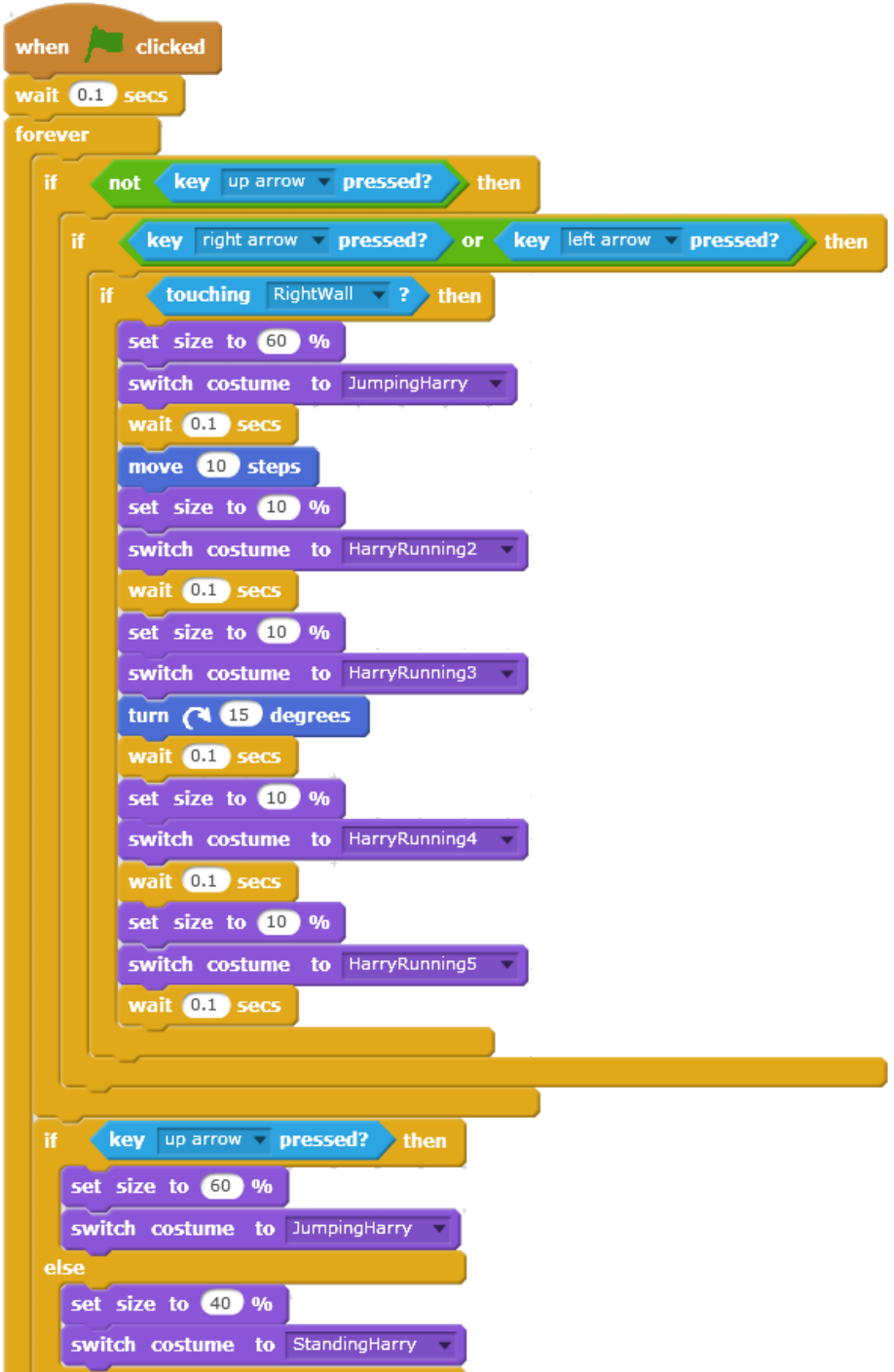




Across sprites: in **26%** of the projects

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

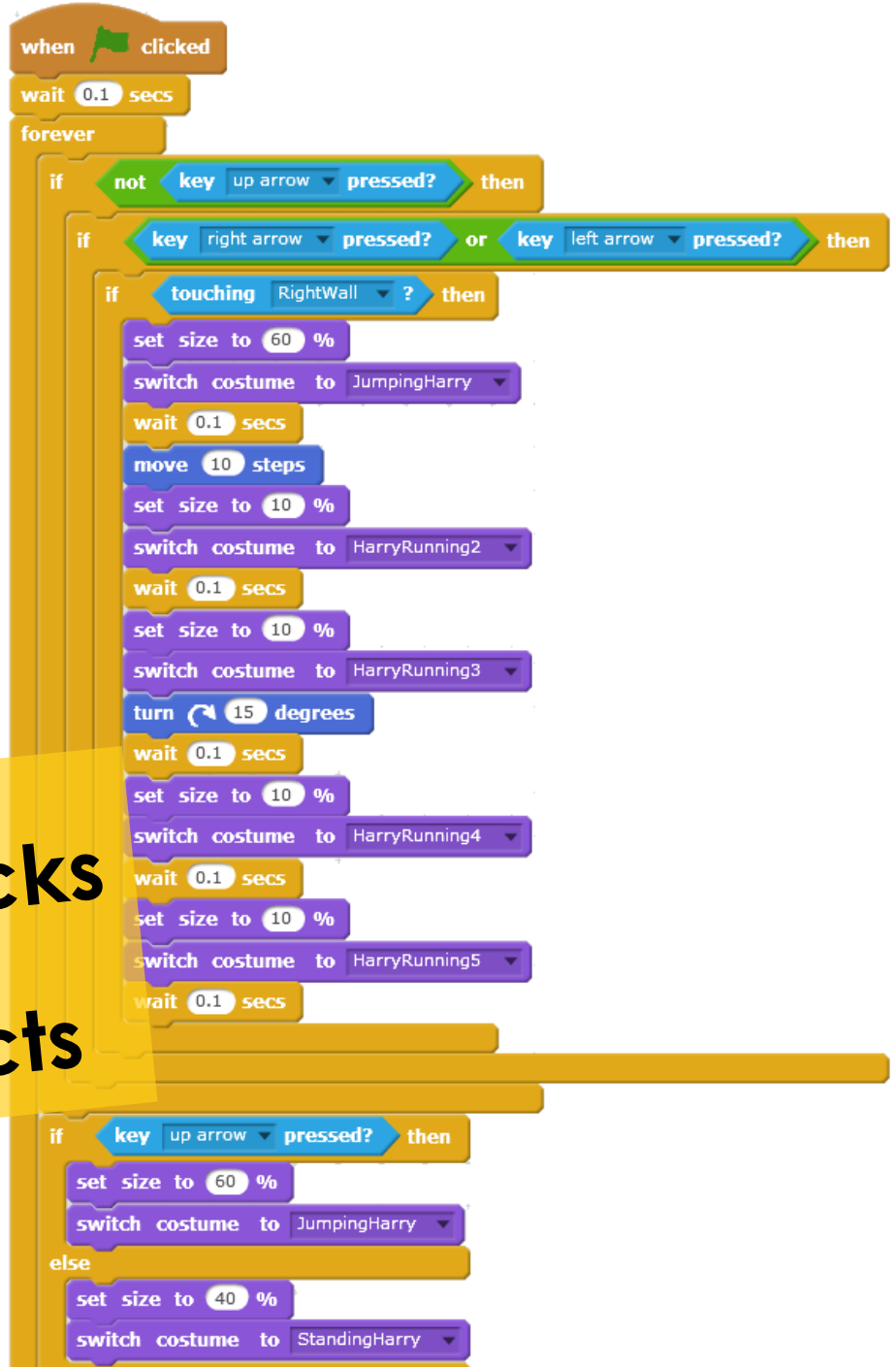
Large Script



Large Script

scripts with >18 blocks

in 30% of the projects

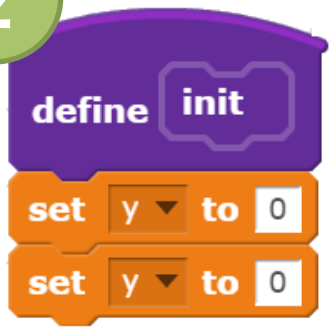


Dead Code

1



2



3

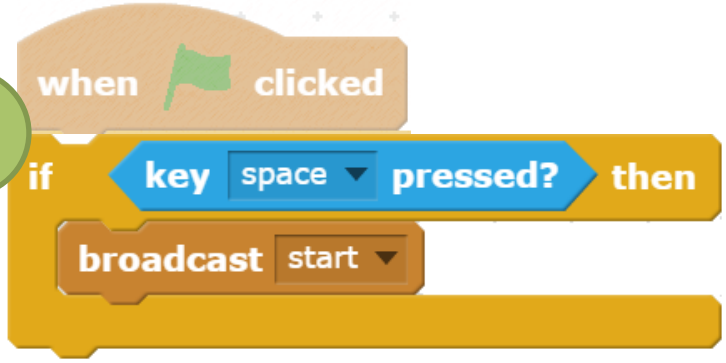


4

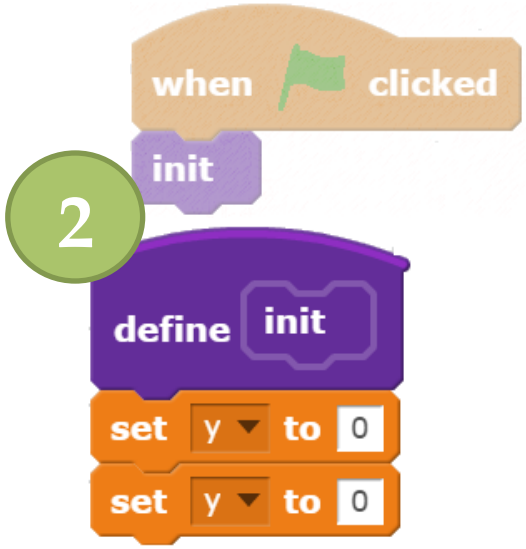


Dead Code

1



2



3



4



Dead Code

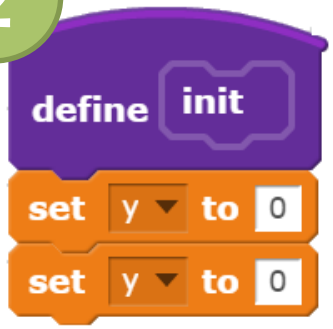
24%

1



1%

2



24%

3



8%

4



Dead Code

Any: 28% of the projects

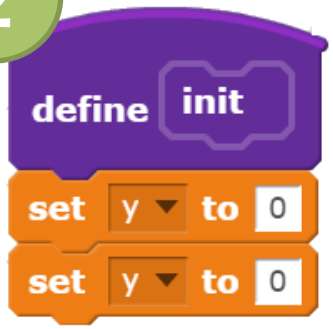
24%

1



1%

2



24%

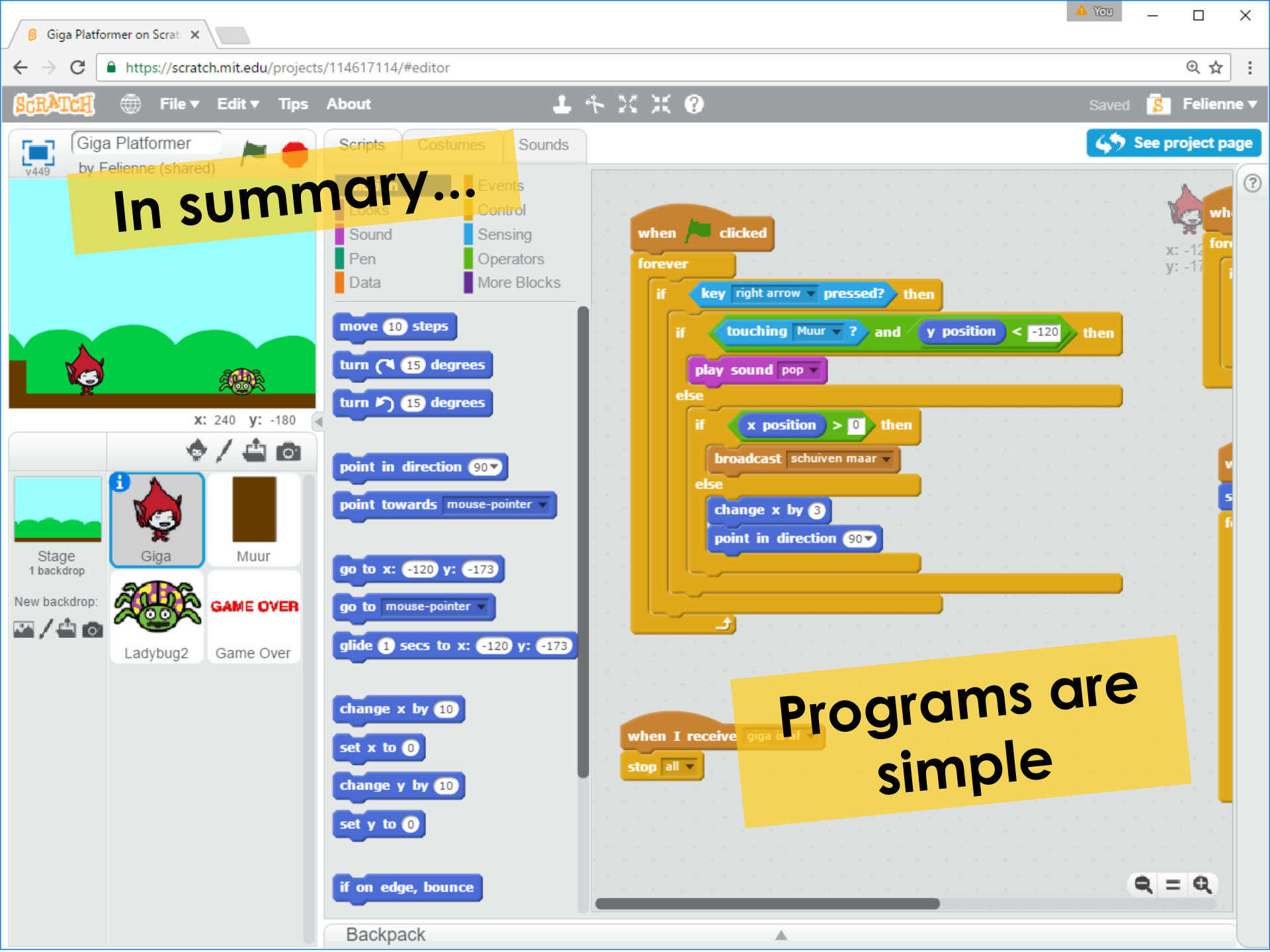
3



8%

4

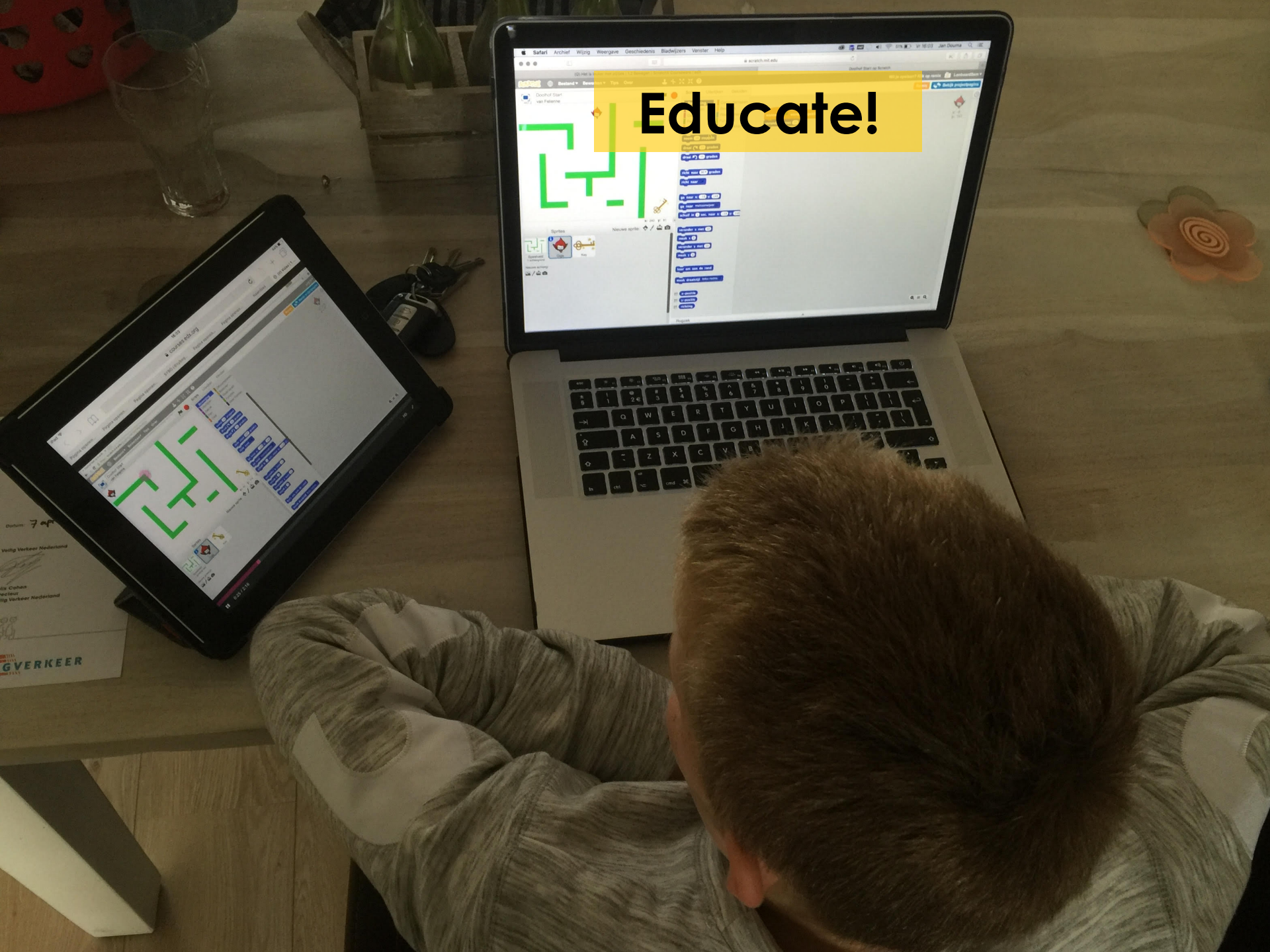



Giga Platformer on Scrat
https://scratch.mit.edu/projects/114617114/#editor
File
Edit
Tips
About
Saved
Felienne
Giga Platformer
by Felienne (shared)
v449
Scripts
Costumes
Sounds
See project page
In summary...
Events
Control
Sound
Sensing
Pen
Operators
Data
More Blocks
move 10 steps
turn 15 degrees
turn 15 degrees
point in direction 90
point towards mouse-pointer
go to x: -120 y: -173
go to mouse-pointer
glide 1 secs to x: -120 y: -173
change x by 10
set x to 0
change y by 10
set y to 0
if on edge, bounce
x: 240 y: -180
Stage
1 backdrop
New backdrop:
Giga
Muur
Ladybug2
GAME OVER
Game Over
when clicked
forever
if key right arrow pressed? then
if touching Muur ? and y position < -120 then
play sound pop
else
if x position > 0 then
broadcast schuiven maar
else
change x by 3
point in direction 90
when I receive
stop all
Programs are simple
Backpack


But....


Smells are common


Now what?

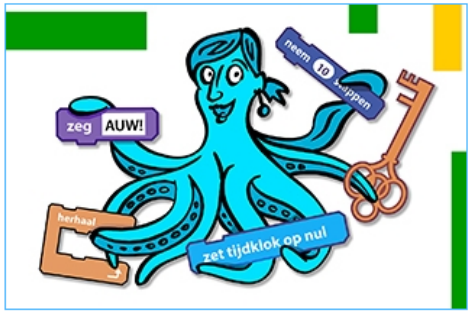

Educate!

Scratch: Programmer

https://www.edx.org/course/scratch-programmeren-voor-kinderen-8-delftx-scratchx-0

edX Courses Programs Schools & Partners About Search: Sign In Register

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

TU Delft

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

Over 3000 kids enrolled

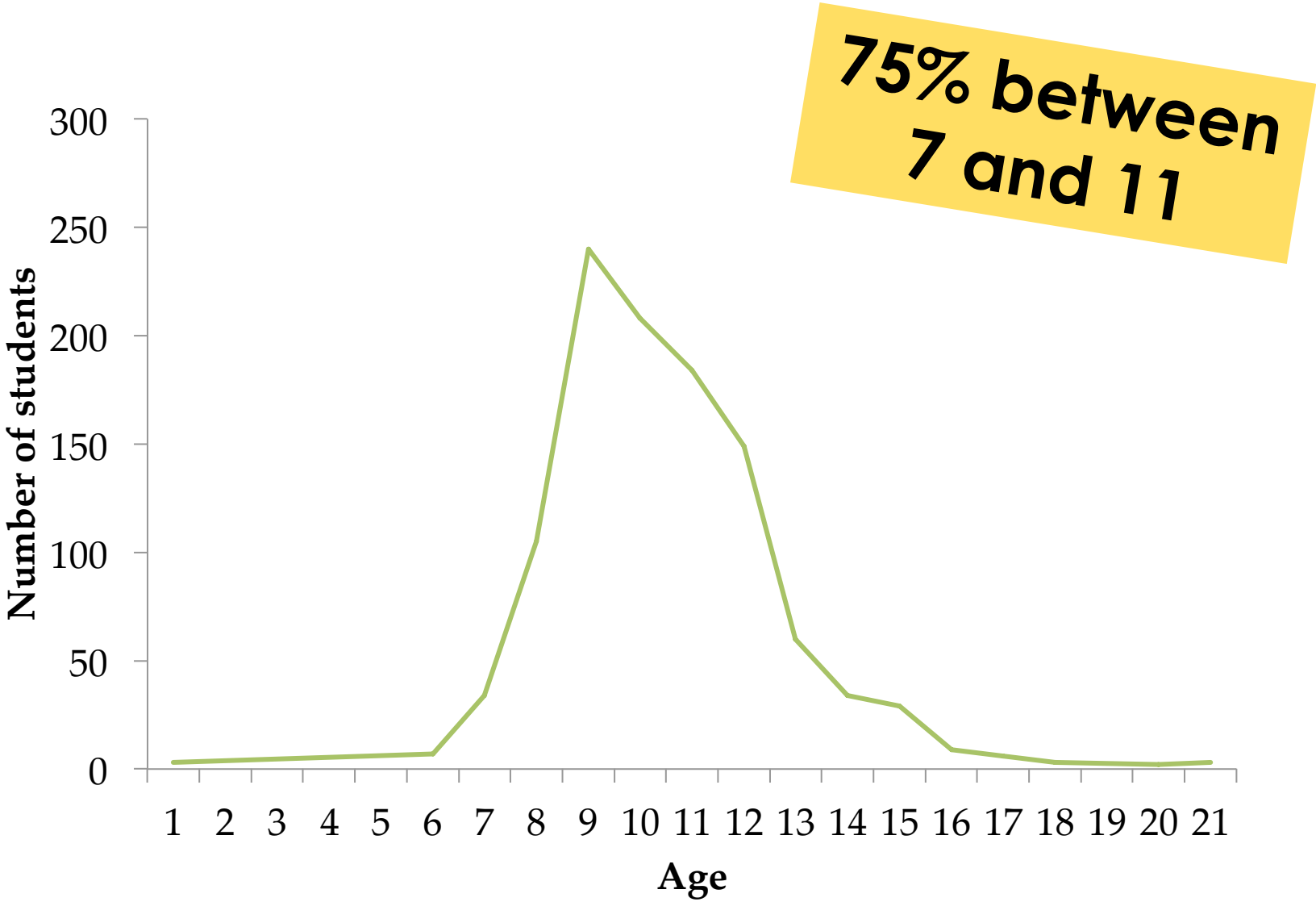
What you'll learn

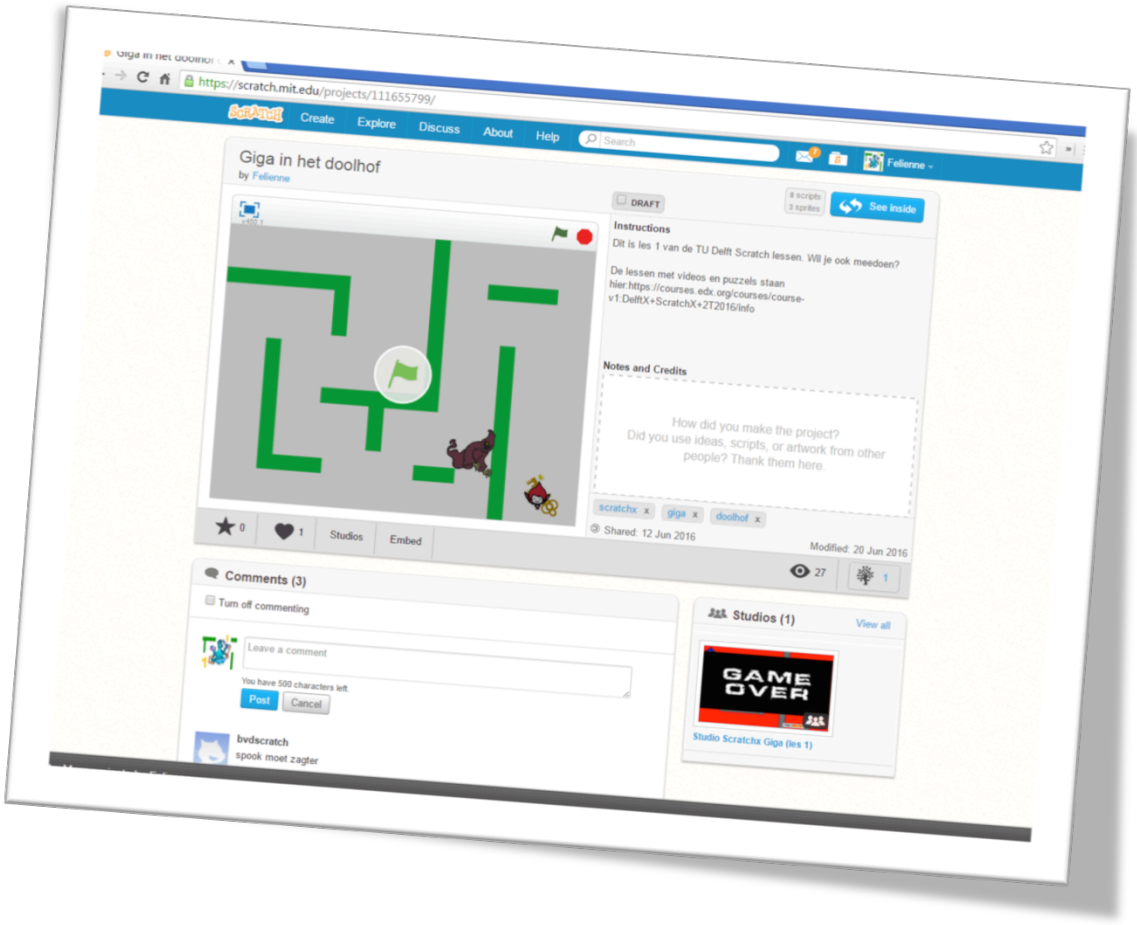
- Programmeren in Scratch
- Algemene programmeerconcepten (lussen, variabelen, datastructuren)

Meet the instructor

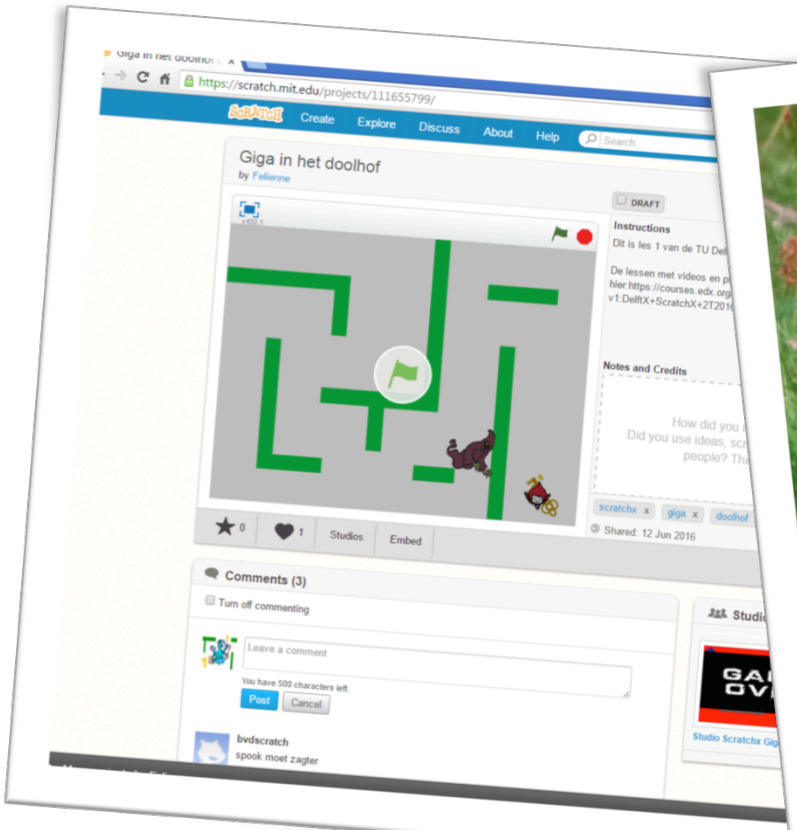
Length:	6 weken
Effort:	2-6 uur per week
Institution:	DelftX
Subject:	Computer Science
Level:	Introductory
Languages:	Nederlands
Video Transcripts:	Nederlands

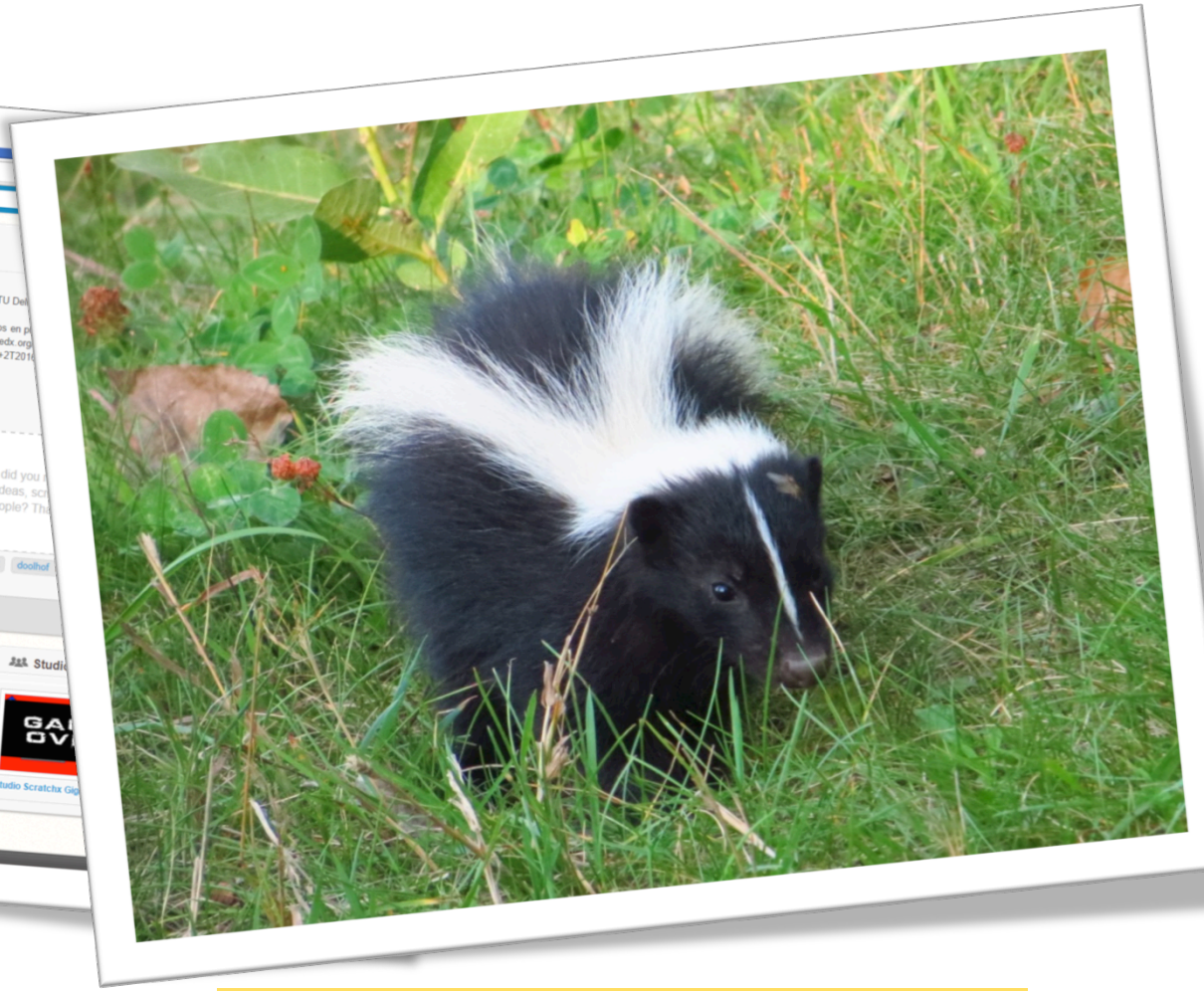
Share this course with a friend


75% between 7 and 11
300
250
200
150
100
50
0
Number of students
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
Age



What kids thought they learned





What they really learned

The course includes tests

About programming and smells!

Previous | Next

Deel 4

VIEW UNIT IN STUDIO

Bookmark this page

Vraag 20

1/1 point (graded)

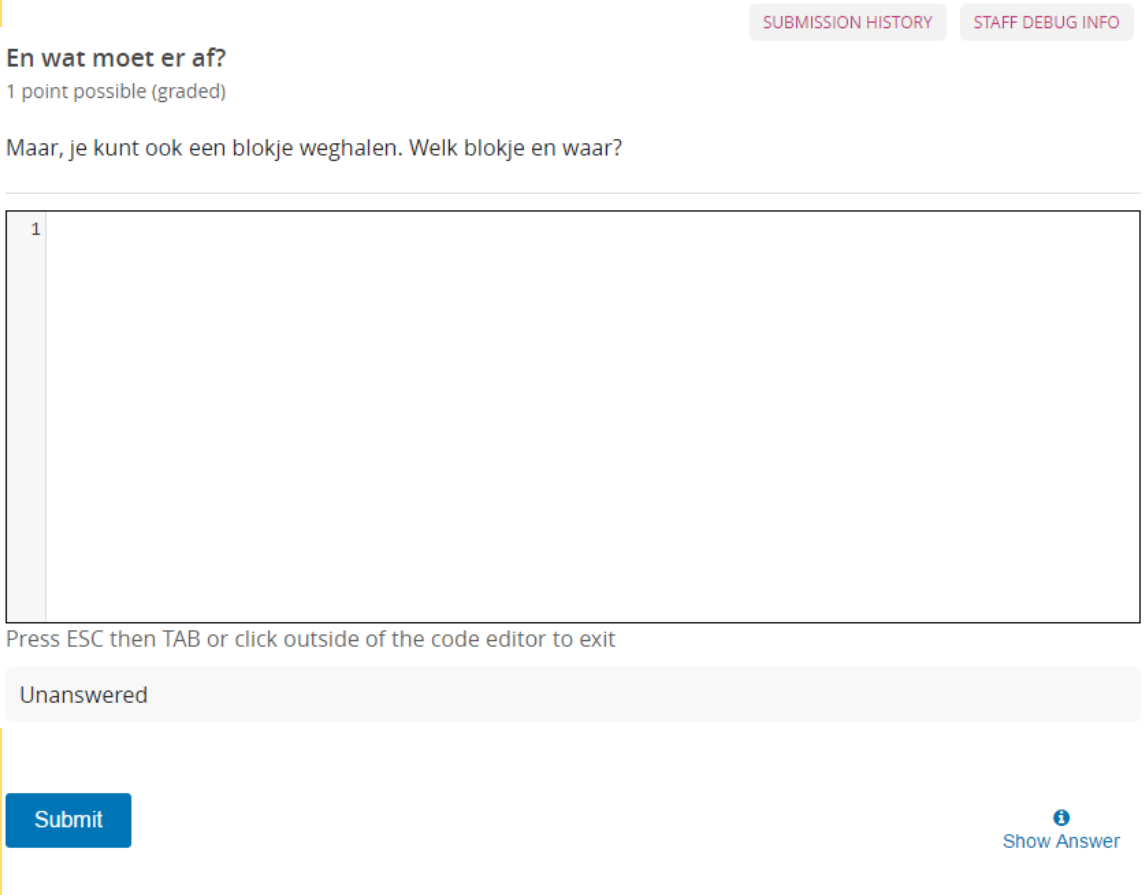
Kijk naar dit programma:



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

- 10
- 100
- 110 ✔

The course includes tests



About programming *and smells!*


Are smells harder
to learn?


Are smells harder to learn?
Nope!

Smells are not harder than Coding!

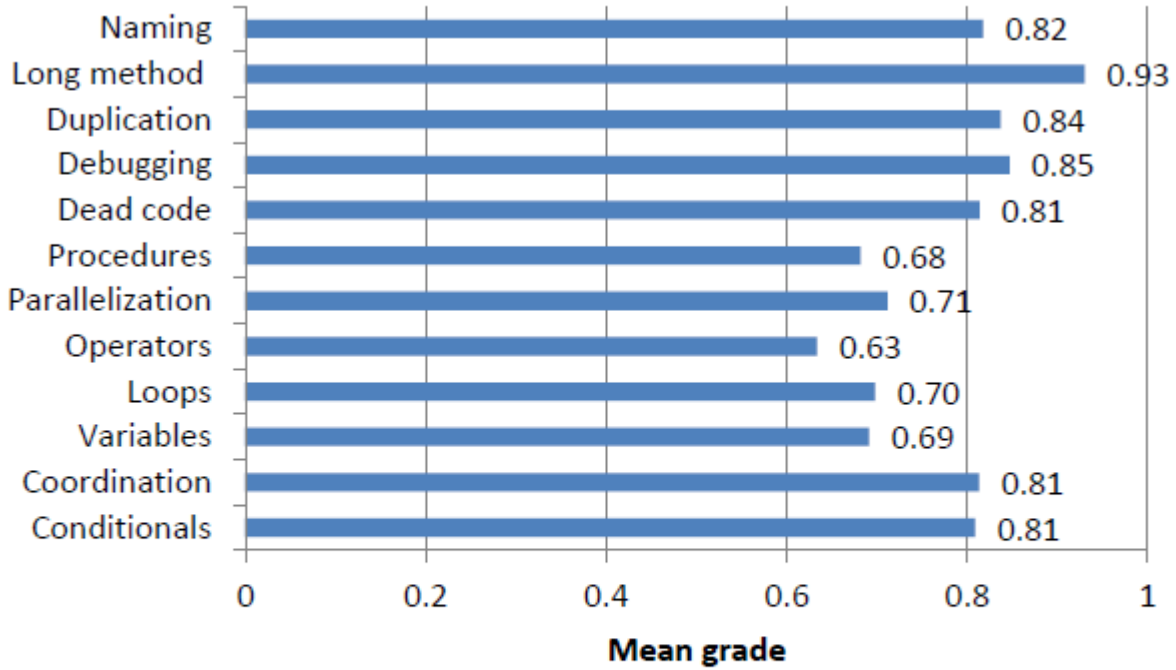


Fig. 4. Mean grade of all student answers (first attempts) to all questions corresponding to different programming and software engineering concepts

*Paper Under Review

Smells are not harder than Coding!

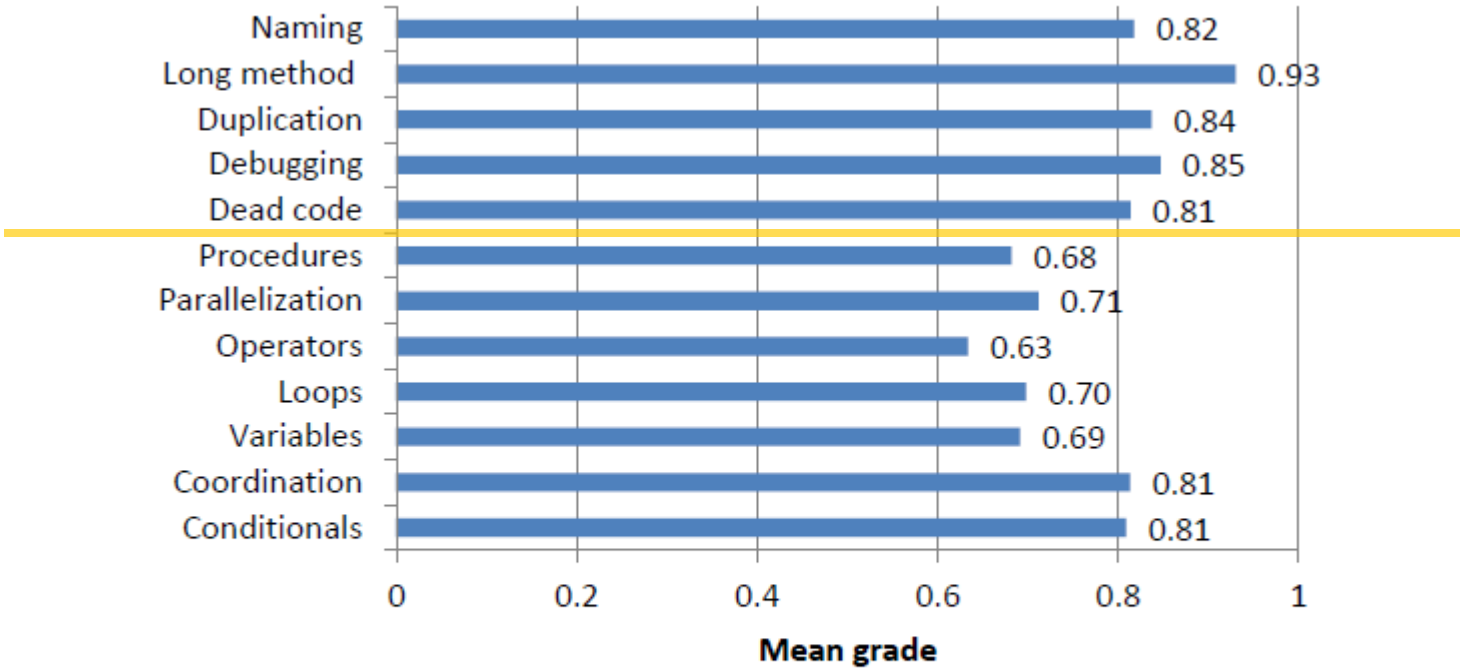


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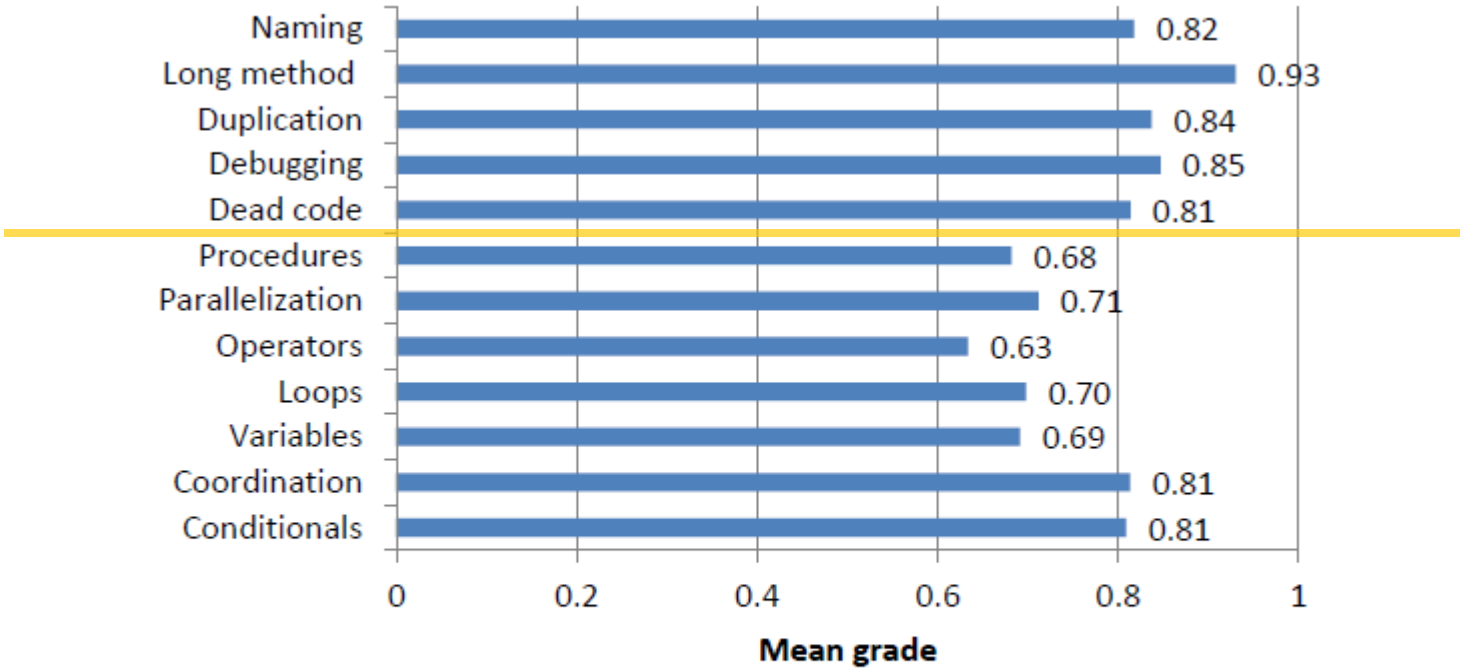
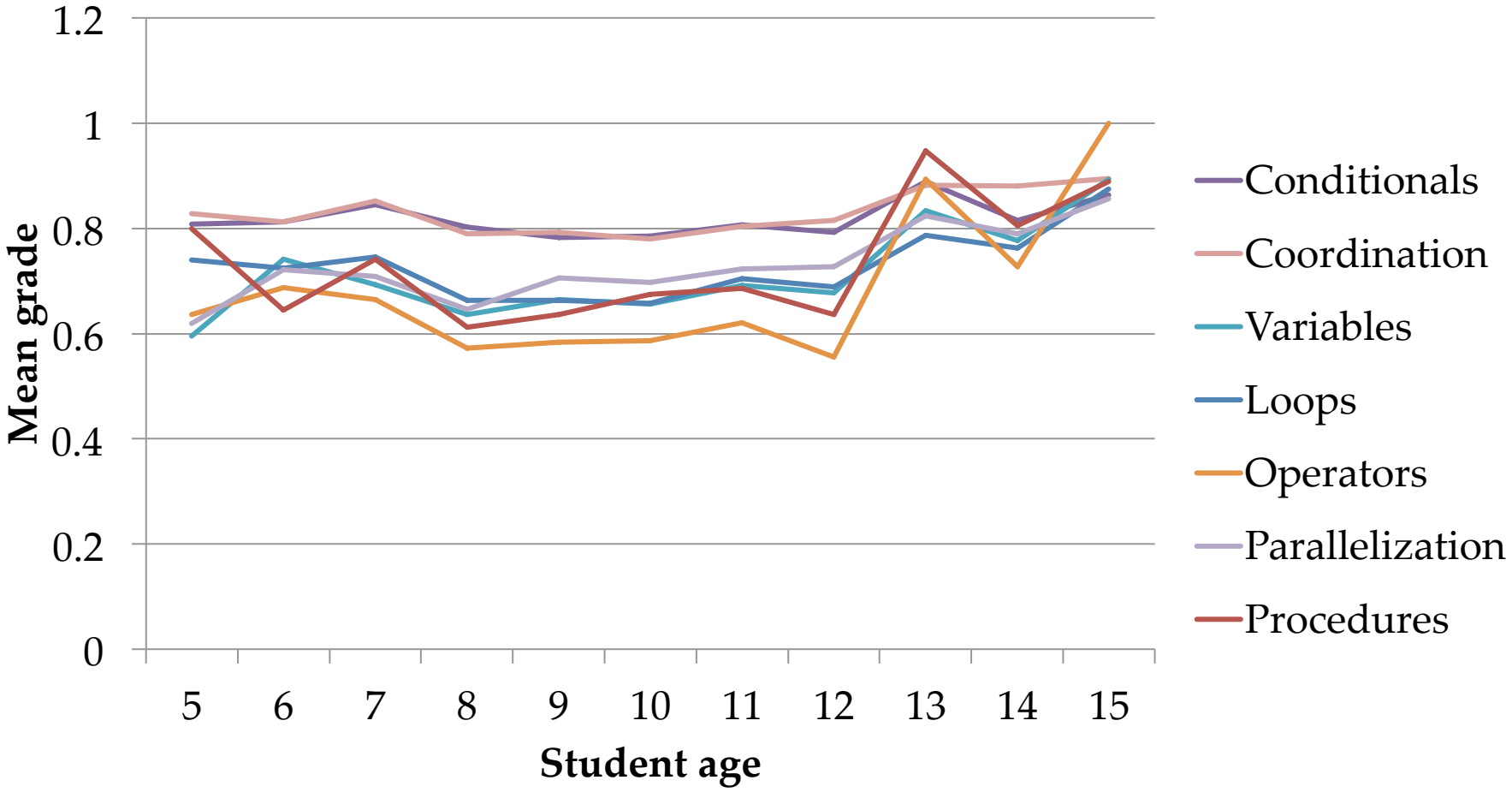


Fig. 4. Mean grade of all student answers (first attempts) to all questions corresponding to different programming and software engineering concepts

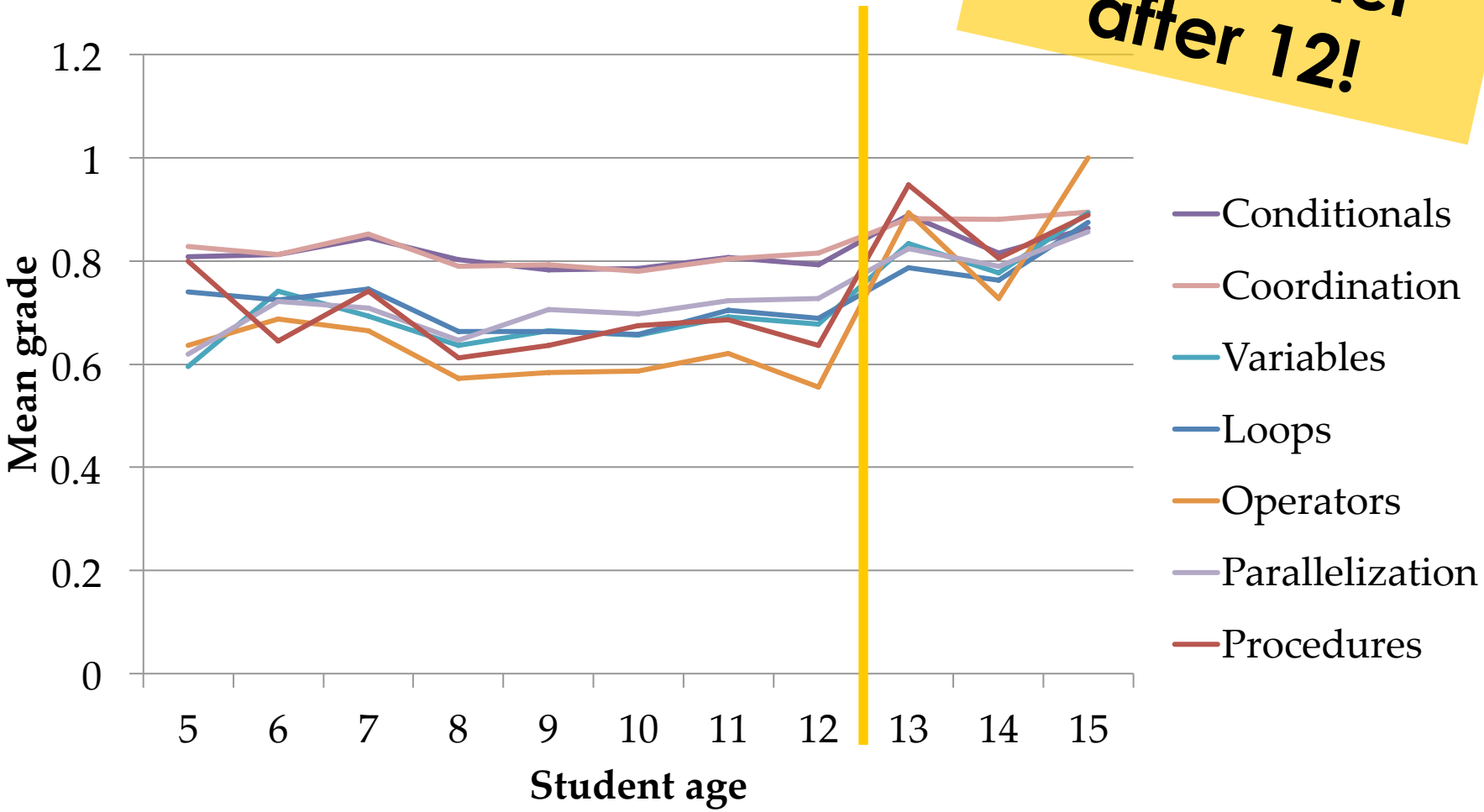
*Paper Under Review

Some coding concepts are harder though



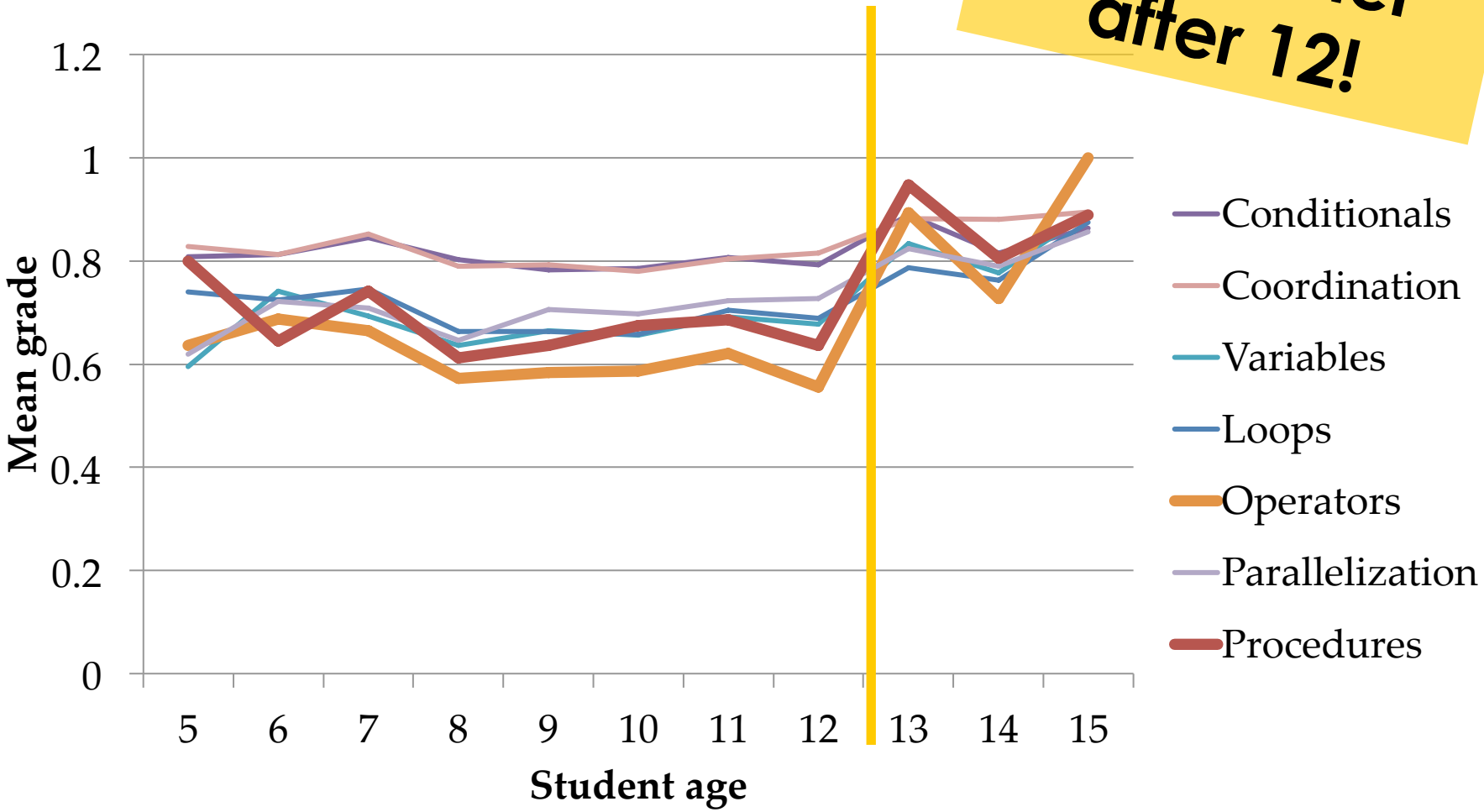
Some coding concepts are harder though

Get easier after 12!



Some coding concepts are harder though

Get easier after 12!




How Do Kids Program in the Wild?
@Felienne


ogram
?
lienne
Create stories, games, and animations
Share with others around the world
17.803.341
Uitgelichte projecten
WebHunt
Uitgelichte studio's
KEEP CALM AND TAKE LYRICS LITERALLY

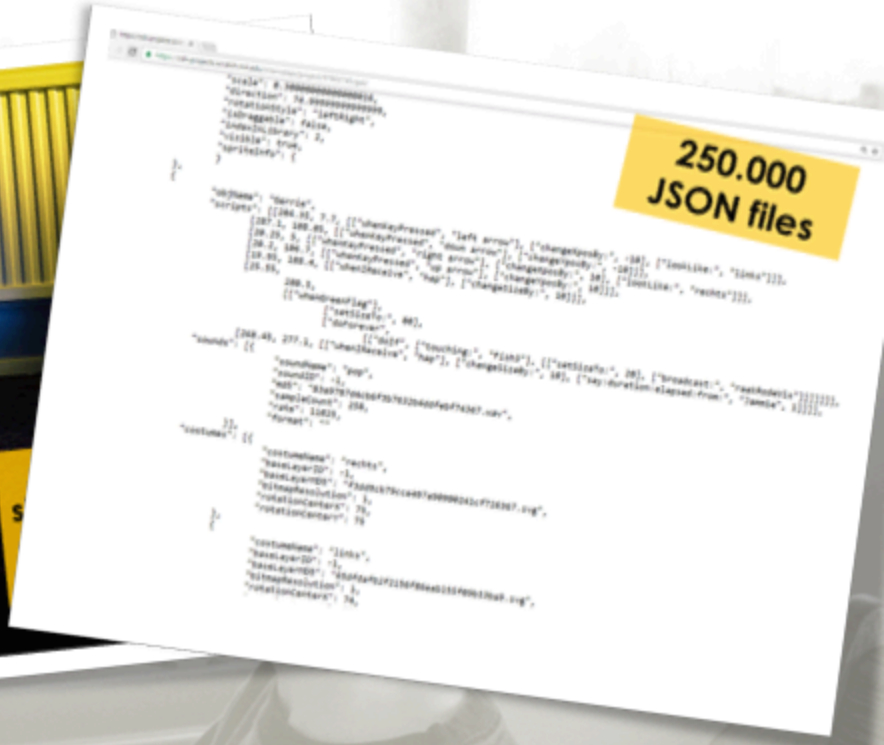

Create stories, games, and animations
Share with others around the world
17.803.341
Uitgelichte projecten
WebHunt
Uitgelichte studio's
KEEP CALM AND TAKE LYRICS LITERALLY
tl;dr
Yes
Kids performed significantly better on the non-smelly program


Create stories, games, and animations
Share with others around the world
17.803.341
Uitgelichte projecten
Uitgelichte studio's
250.000
JSON files


Create stories, games, and animations
Share with others around the world
17.803.341
Uitgelichte projecten
Uitgelichte studio's
250.000
JSON files
Many programs
are small...


Create stories, games, and animations
Share with others around the world
17.803.341

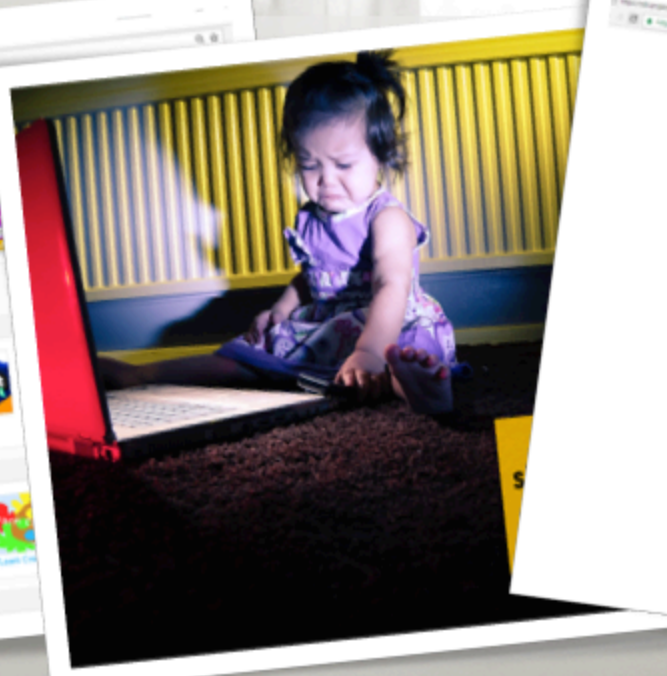


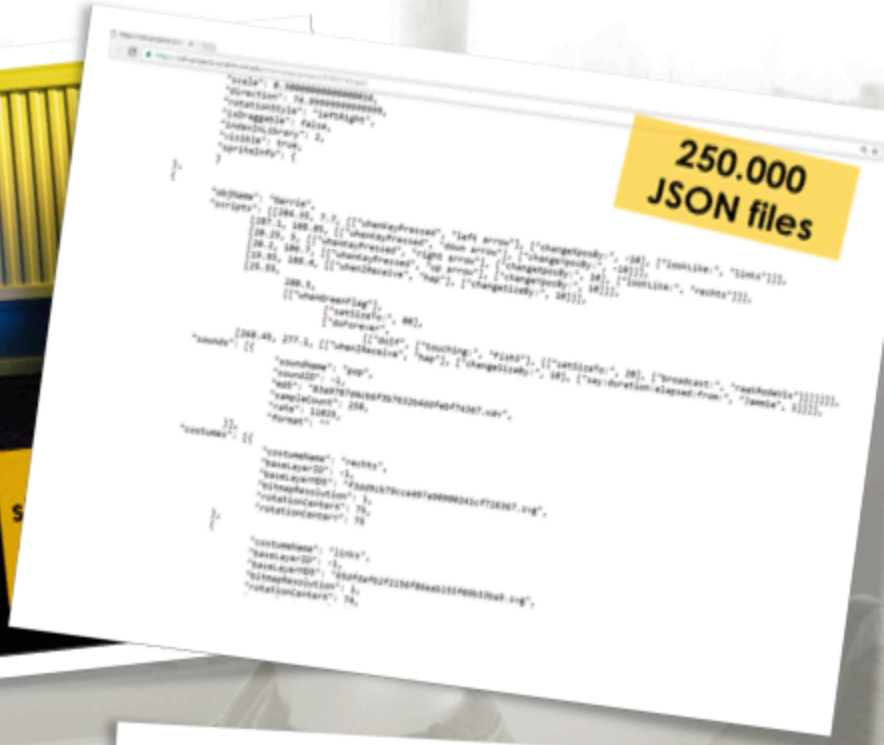

250.000
JSON files


Many programs
are small...


Smells are
common











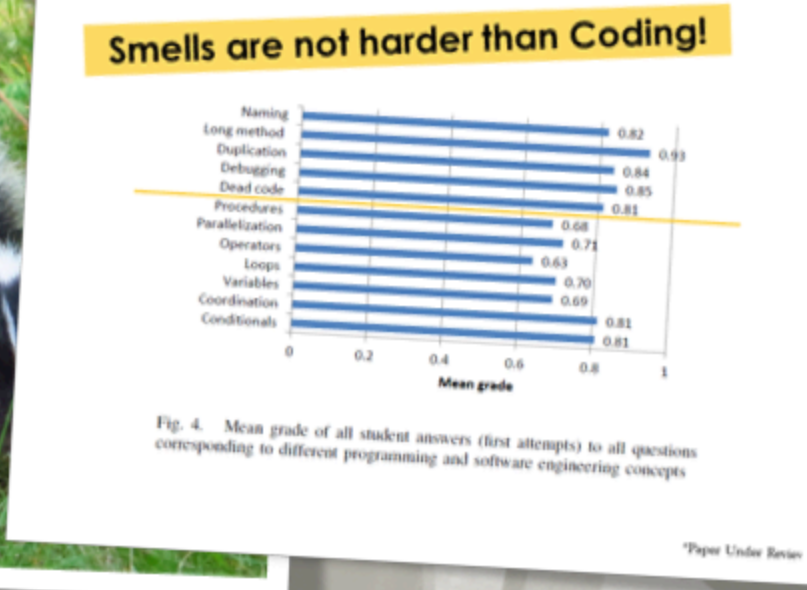


Fig. 4. Mean grade of all student answers (first attempts) to all questions corresponding to different programming and software engineering concepts

*Paper Under Review

How do kids program in the wild?

@Felienne

250.000 JSON files

Many programs are small...

Smells are common

Smells are not harder than Coding!

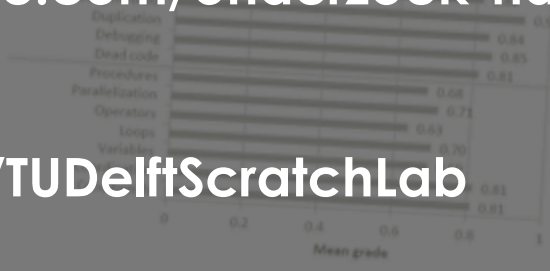


Fig. 4. Mean grade of all student answers (first attempts) to all questions corresponding to different programming and software engineering concepts

More info?

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

Want to connect?

- mail@felienne.com




Useful
objects
can be art!

Can code be art?

```
<html>
 <head>
  <title>PHP Test</title>
 </head>
 <body>
    <?php echo '<p>Hello World</p>'; ?>
 </body>
</html>
```

Can code be art?

```
<html>
 <head>
  <title>PHP Test</title>
 </head>
 <body>
   <?php echo '<p>Hello World</p>'; ?>
 </body>
</html>
```

Also: representation of the world




Fruit
-shape:string
-color:string
juice()
peel()
Like OO!


What's
next??


Let's play!
Tonight at the Social!

Popular sorting algorithms [edit]

While there are a large number of sorting algorithms, in practical implementations a few algorithms predominate. Insertion sort is widely used for small data sets, while for large data sets an asymptotically efficient sort is used, primarily heap sort, merge sort, or quicksort. Efficient implementations generally use a hybrid algorithm, combining an asymptotically efficient algorithm for the overall sort with insertion sort for small lists at the bottom of a recursion. Highly tuned implementations use more sophisticated variants, such as Timsort (merge sort, insertion sort, and additional logic), used in Android, Java, and Python, and introsort (quicksort and heap sort), used (in variant forms) in some C++ sort implementations and in .NET.

For more restricted data, such as numbers in a fixed interval, distribution sorts such as counting sort or radix sort are widely used. Bubble sort and variants are rarely used in practice, but are commonly found in teaching and theoretical discussions.

When physically sorting objects, such as alphabetizing papers (such as tests or books), people intuitively generally use insertion sorts for small sets. For larger sets, people often first bucket, such as by initial letter, and multiple bucketing allows practical sorting of very large sets. Often space is relatively cheap, such as by spreading objects out on the floor or over a large area, but operations are expensive, particularly moving an object a large distance – locality of reference is important. Merge sorts are also practical for physical objects, particularly as two hands can be used, one for each list to merge, while other algorithms, such as heap sort or quick sort, are poorly suited for human use. Other algorithms, such as library sort, a variant of insertion sort that leaves spaces, are also practical for physical use.

Simple sorts [edit]

Two of the simplest sorts are insertion sort and selection sort, both of which are efficient on small data, due to low overhead, but not efficient on large data. Insertion sort is generally faster than selection sort in practice, due to fewer comparisons and good performance on almost-sorted data, and thus is preferred in practice, but selection sort uses fewer writes, and thus is used when write performance is a limiting factor.

Insertion sort [edit]

Main article: Insertion sort

Insertion sort is a simple sorting algorithm that is relatively efficient for small lists and mostly sorted lists, and is often used as part of more sophisticated algorithms. It works by taking elements from the list one by one and inserting them in their correct position into a new sorted list.[17] In arrays, the new list and the remaining elements can share the array's space, but insertion is expensive, requiring shifting all following elements over by one. Shell sort (see below) is a variant of insertion sort that is more efficient for larger lists.

Selection sort [edit]

Main article: Selection sort

Selection sort is an in-place comparison sort. It has $O(n^2)$ complexity, making it inefficient on large lists, and generally performs worse than the similar insertion sort. Selection sort is noted for its simplicity, and also has performance advantages over more complicated algorithms in certain situations.

The algorithm finds the minimum value, swaps it with the value in the first position, and repeats these steps for the remainder of the list.[18] It does no more than n swaps, and thus is useful where swapping is very expensive.

Efficient sorts [edit]

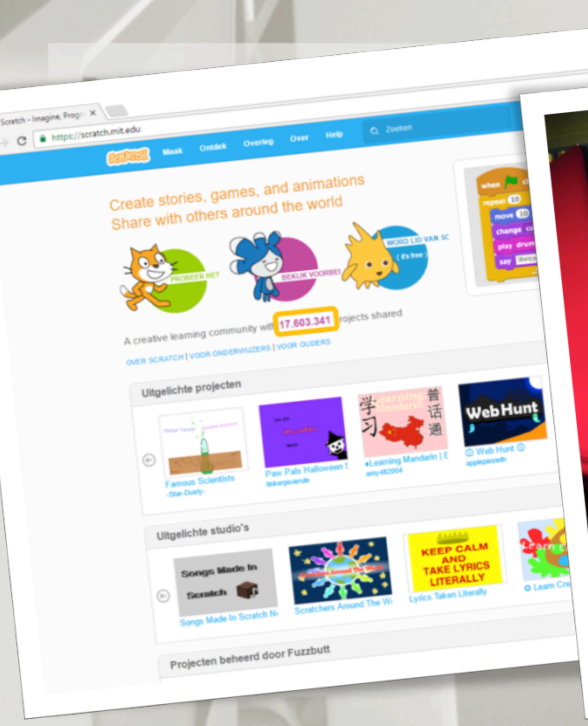
Practical general sorting algorithms are almost always based on an algorithm with average time complexity (and generally worst-case complexity) $O(n \log n)$, of which the most common are heapsort, merge sort, and quicksort. Each has advantages and drawbacks, with the most significant being that simple implementation of merge sort uses $O(n)$ additional space, and simple implementation of quicksort has $O(n^2)$ worst-case complexity. These problems can be solved or ameliorated at the cost of a more complex algorithm.

While these algorithms are asymptotically efficient on random data, for practical efficiency on real-world data various modifications are used. First, the overhead of these algorithms becomes significant on smaller data, so often a hybrid algorithm is used, commonly switching to insertion sort once the data is small enough. Second, the algorithms often perform poorly on already sorted data or almost sorted data – these are common in real-world data, and can be sorted in $O(n)$ time by appropriate algorithms. Finally, they may also be unstable, and stability is often a desirable property in a sort. Thus more sophisticated algorithms are often employed, such as Timsort (based on merge sort) or introsort (based on quicksort, falling back to heap sort).

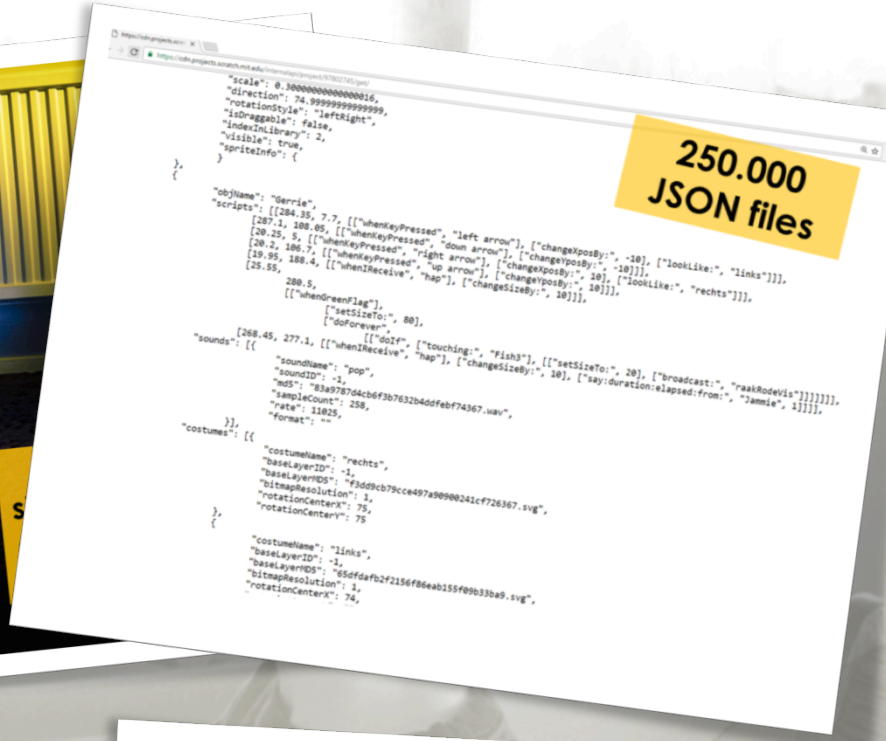
Merge sort [edit]

Create sorting in your style


Expressionism











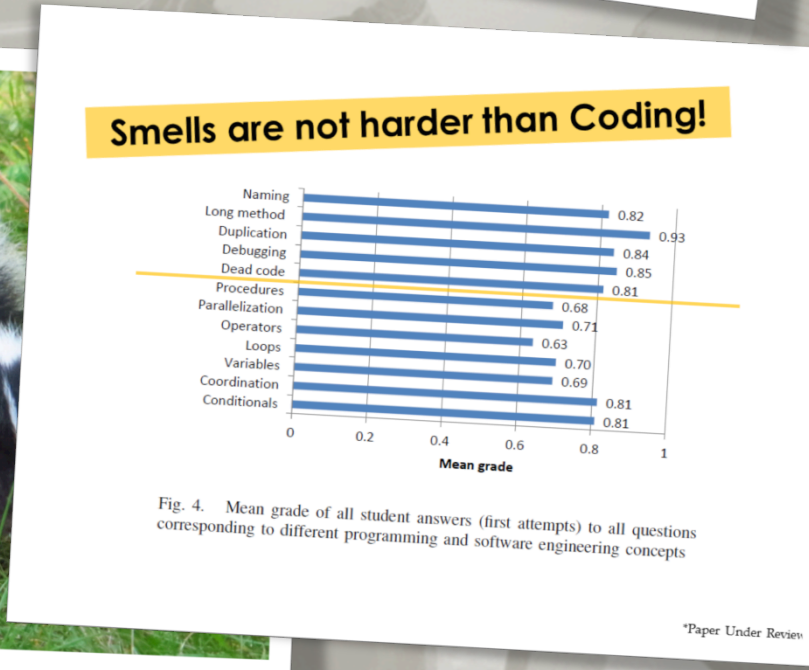


Fig. 4. Mean grade of all student answers (first attempts) to all questions corresponding to different programming and software engineering concepts

*Paper Under Review