

BEN SHAPIRO Presents

THE FUTURE **OF CS EDUCATION**

Starring MICRO:BIT



MONTH

DAY

YEAR

HOUR

MIN

NOV

05

1985

AM

PM

09

00

DESTINATION TIME

MONTH

DAY

YEAR

HOUR

MIN

JUL

13

2016

AM

PM

01

29

PRESENT TIME

MONTH

DAY

YEAR

HOUR

MIN

MAY

31

2009

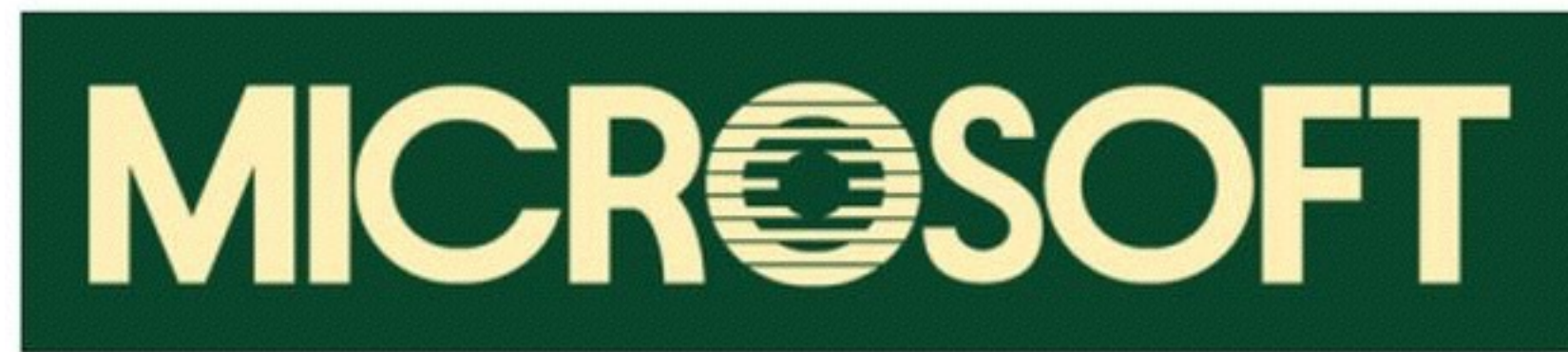
AM

PM

04

20

LAST TIME DEPARTED



10 year anniversary

\$140M in sales

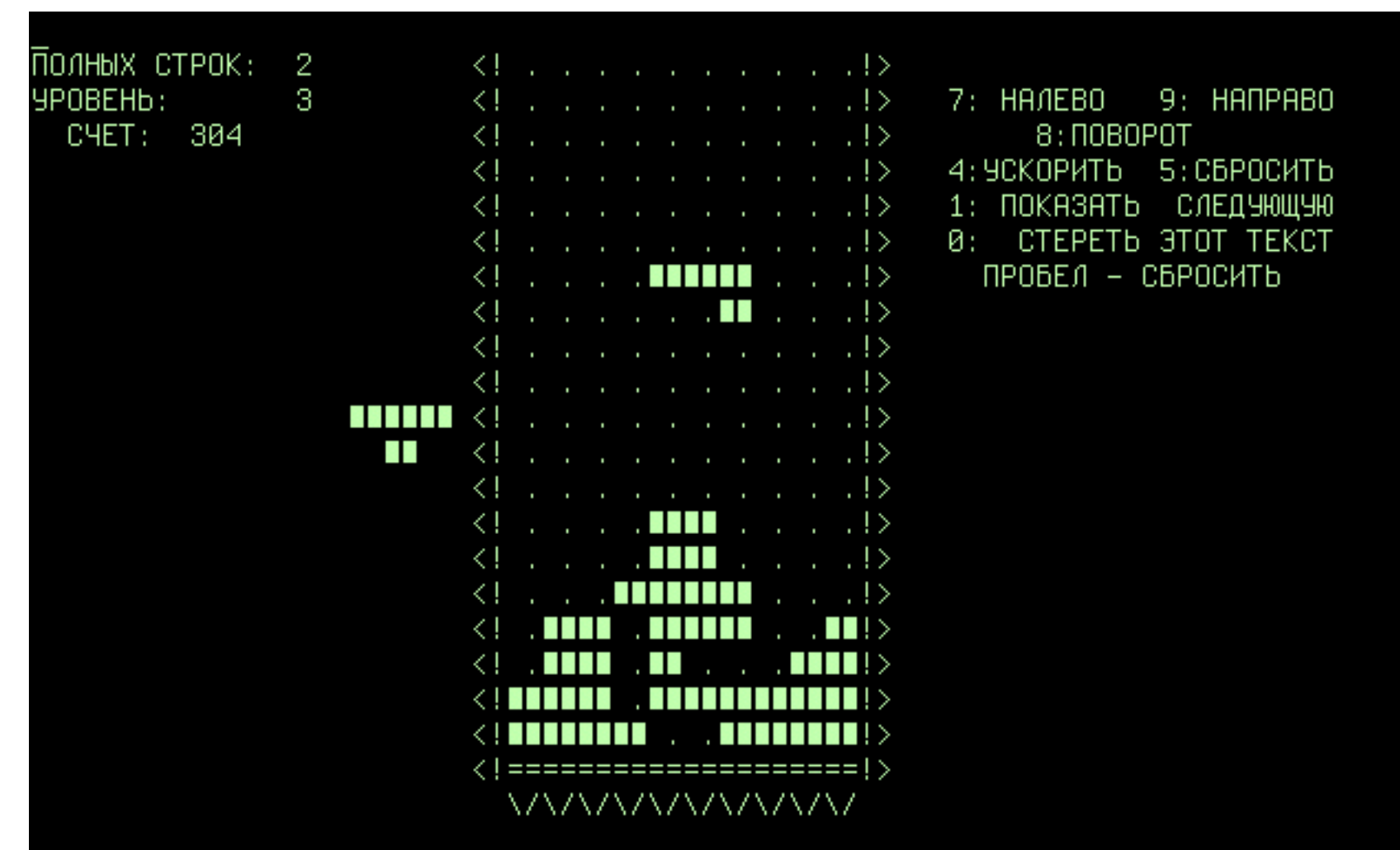
DOS 3.2 & Windows 1.0 released

1985

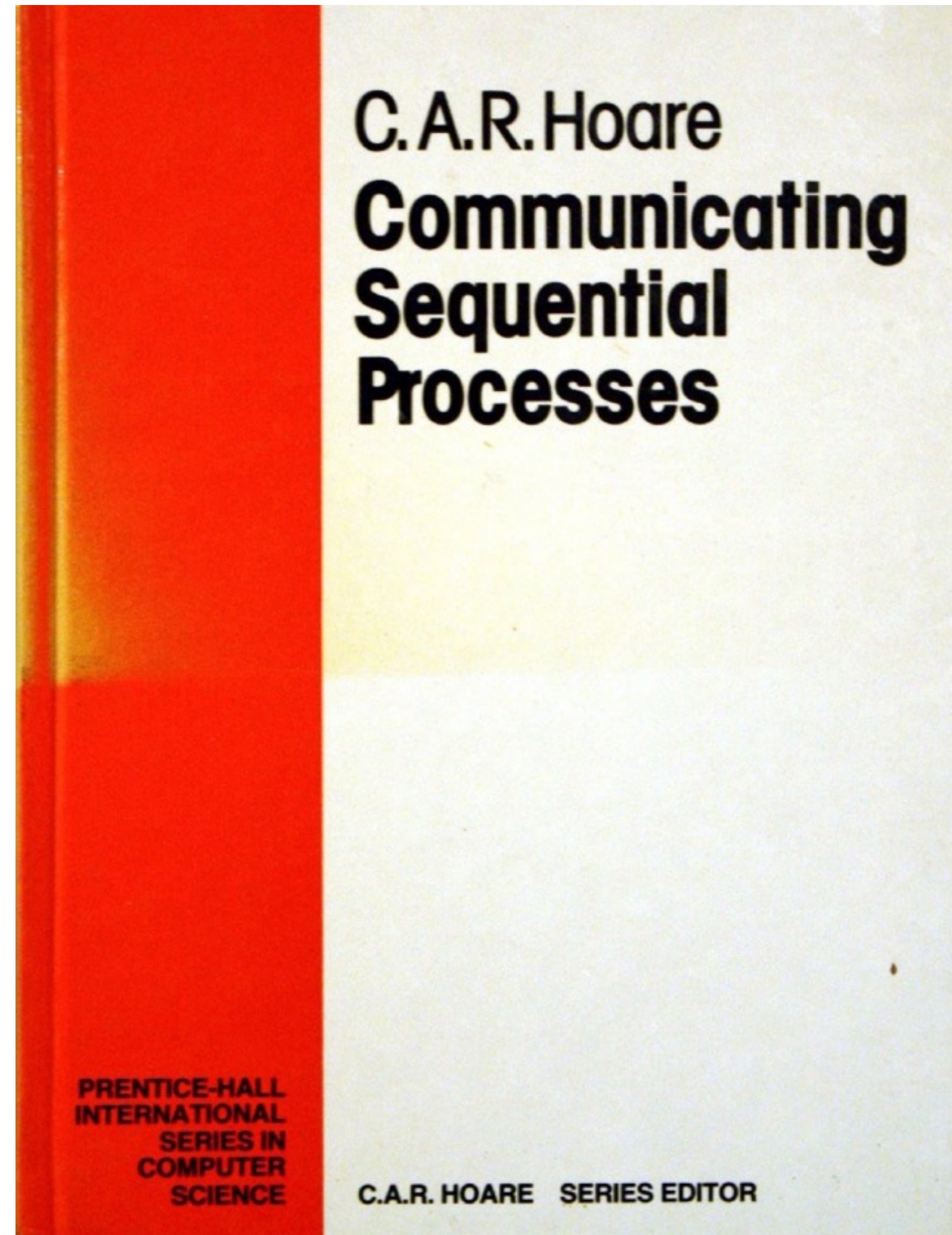
C++

NSFNET and DNS
launched

80386 released

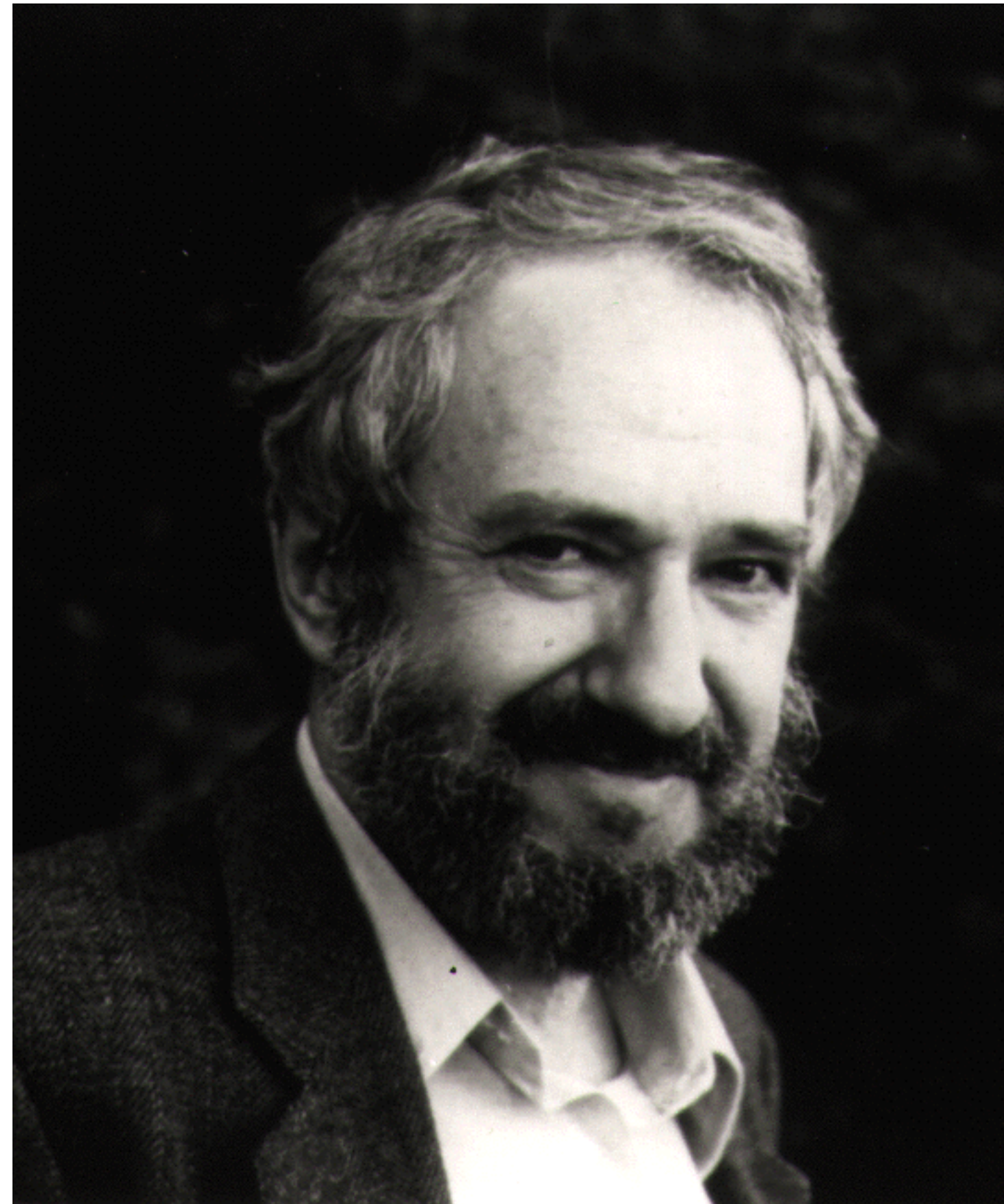


1985

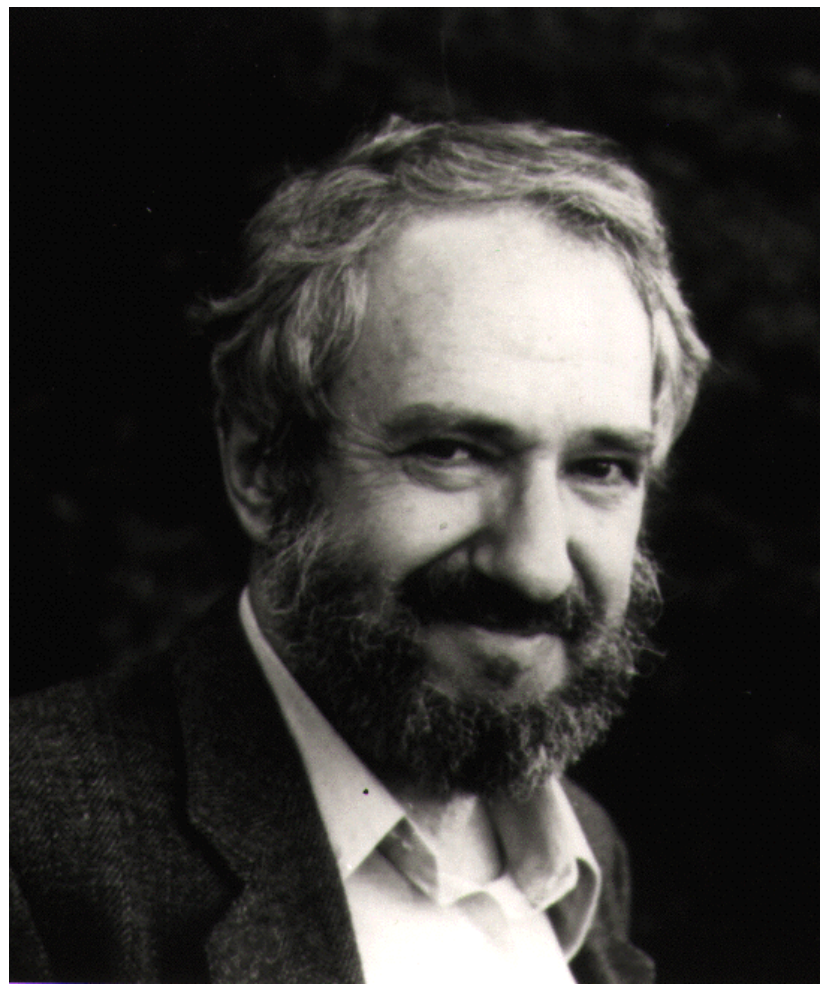


1985

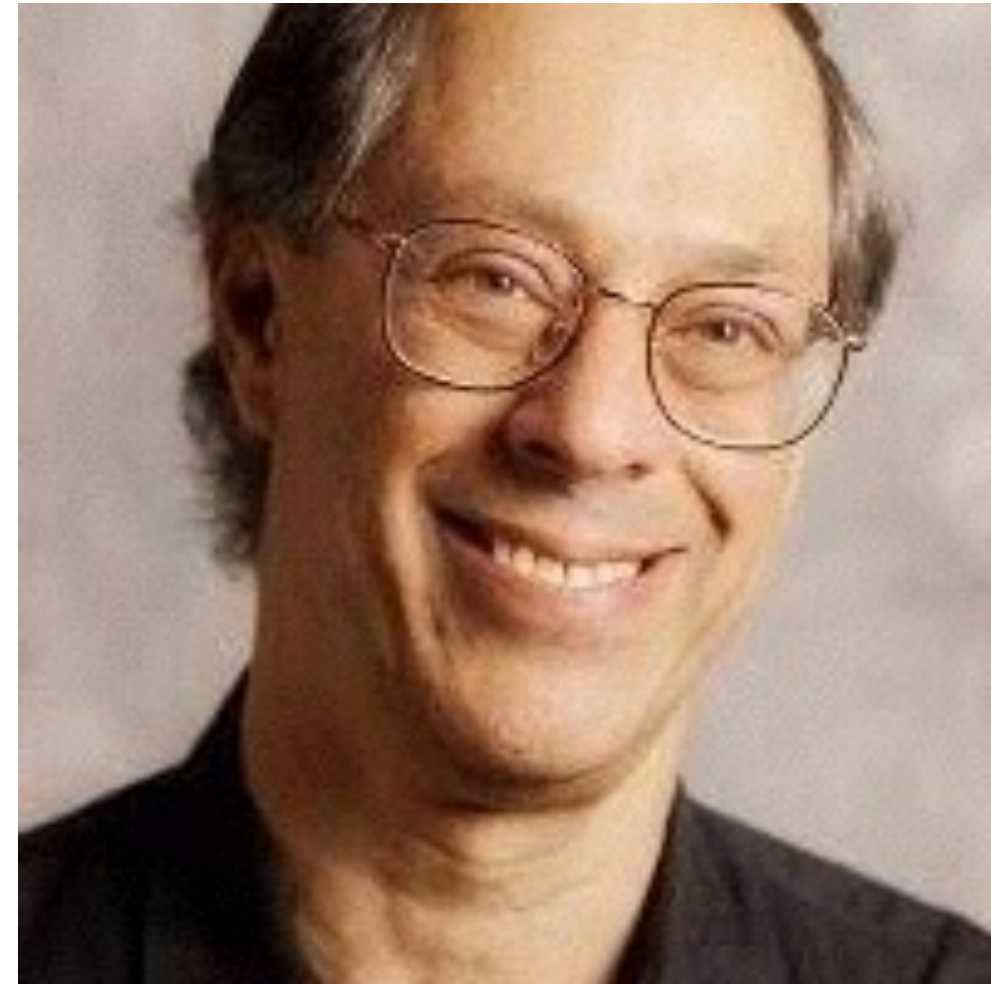
1985



Seymour Papert



Seymour Papert



Daniel Bobrow



Cynthia Solomon



Wally Feurzig

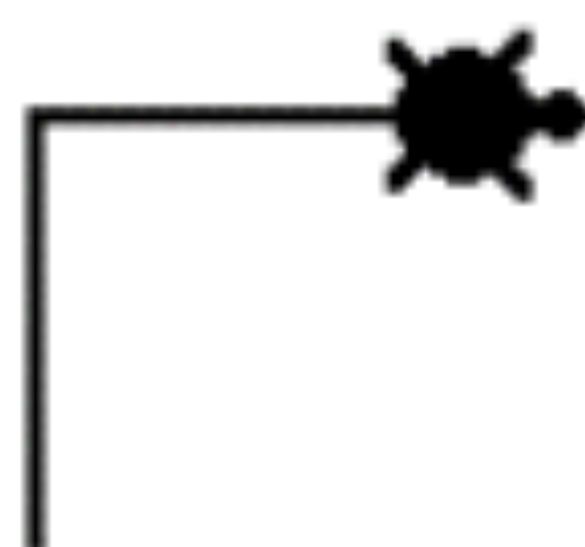
LOGO Language Creators



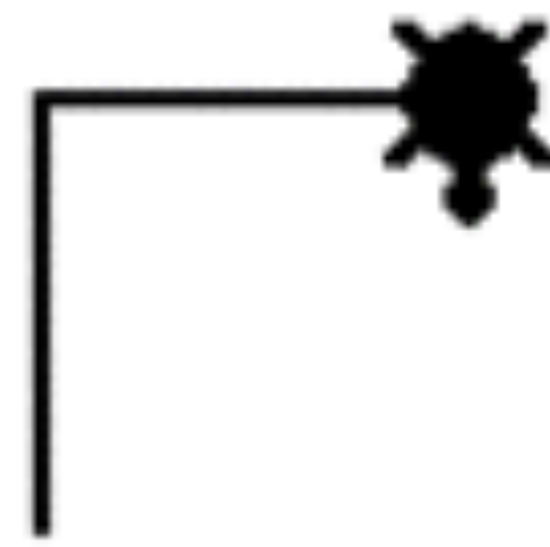
`forward 50`



`right 90`



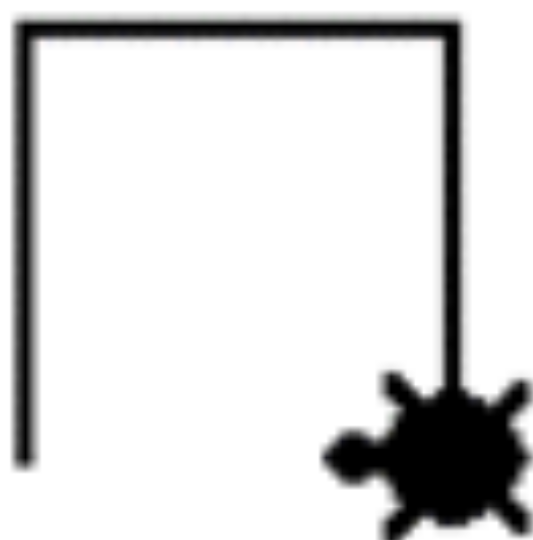
`forward 50`



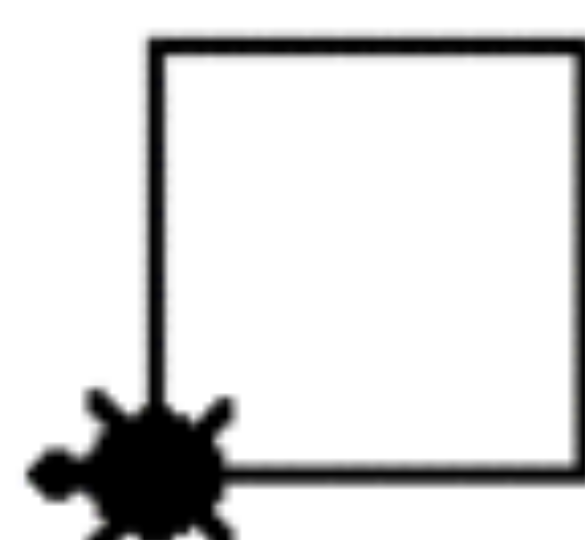
`right 90`



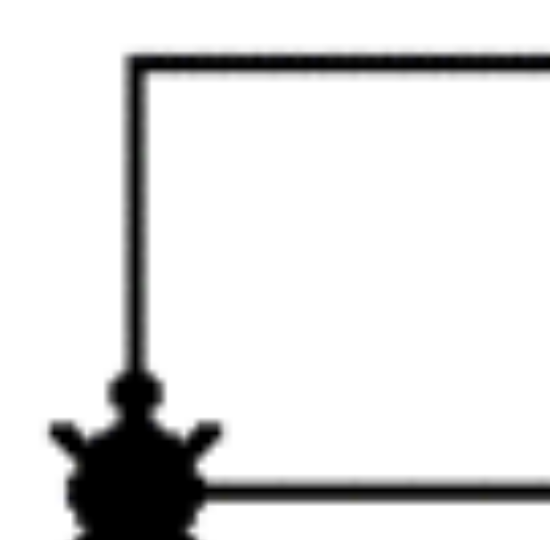
`forward 50`



`right 90`



`forward 50`



`right 90`

TO SQUARE

REPEAT 4 [FORWARD 100 RIGHT 90]

END


```
TO SQUARE :LENGTH  
  REPEAT 4 [ FORWARD :LENGTH RIGHT 90 ]  
END
```


1985

K12 CS Education Content

Loops,
Conditionals,
IO (Graphics, Keyboard, Sound), &
Procedural Abstraction



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05

1985

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PRESENT TIME

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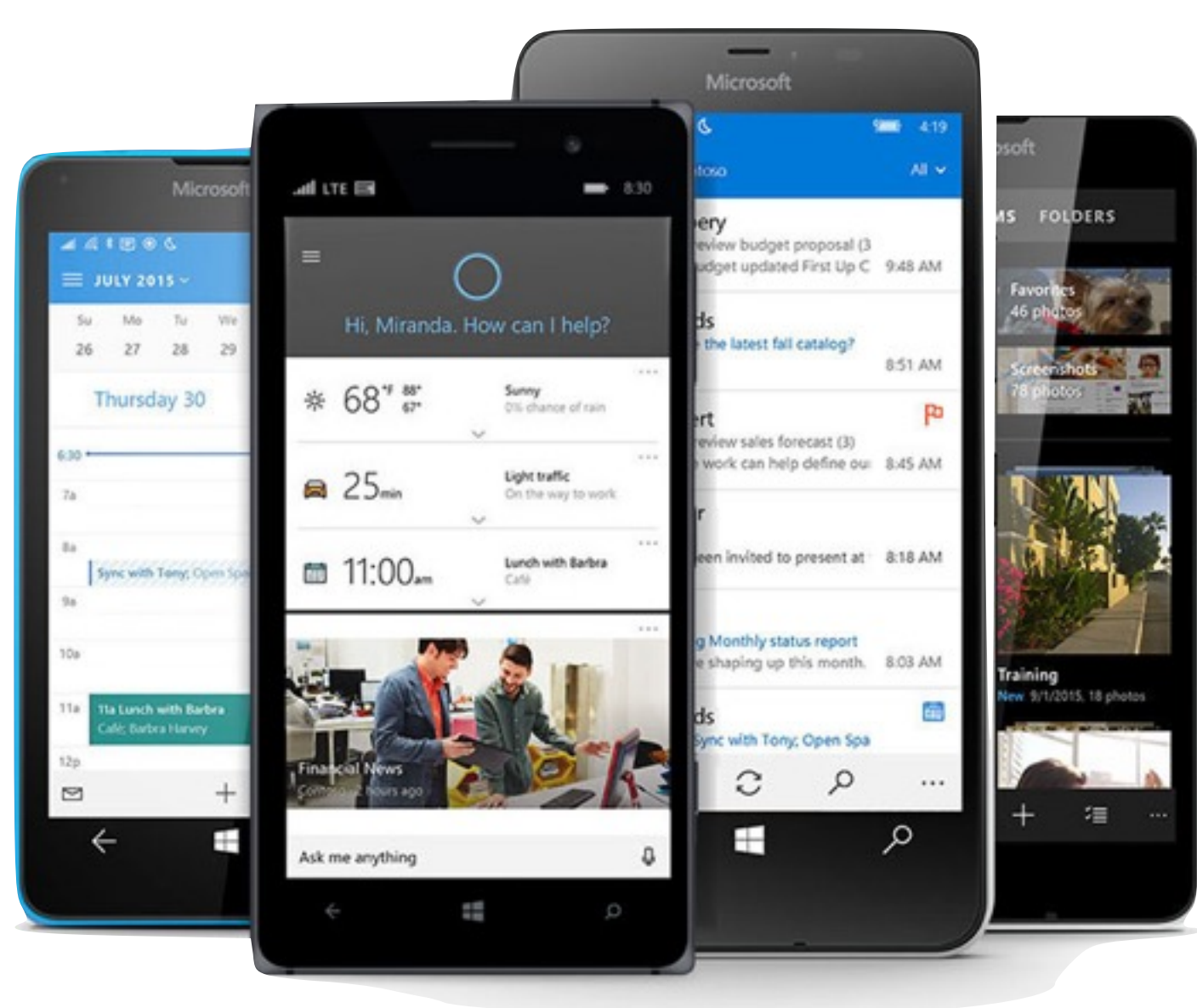
AM

PM

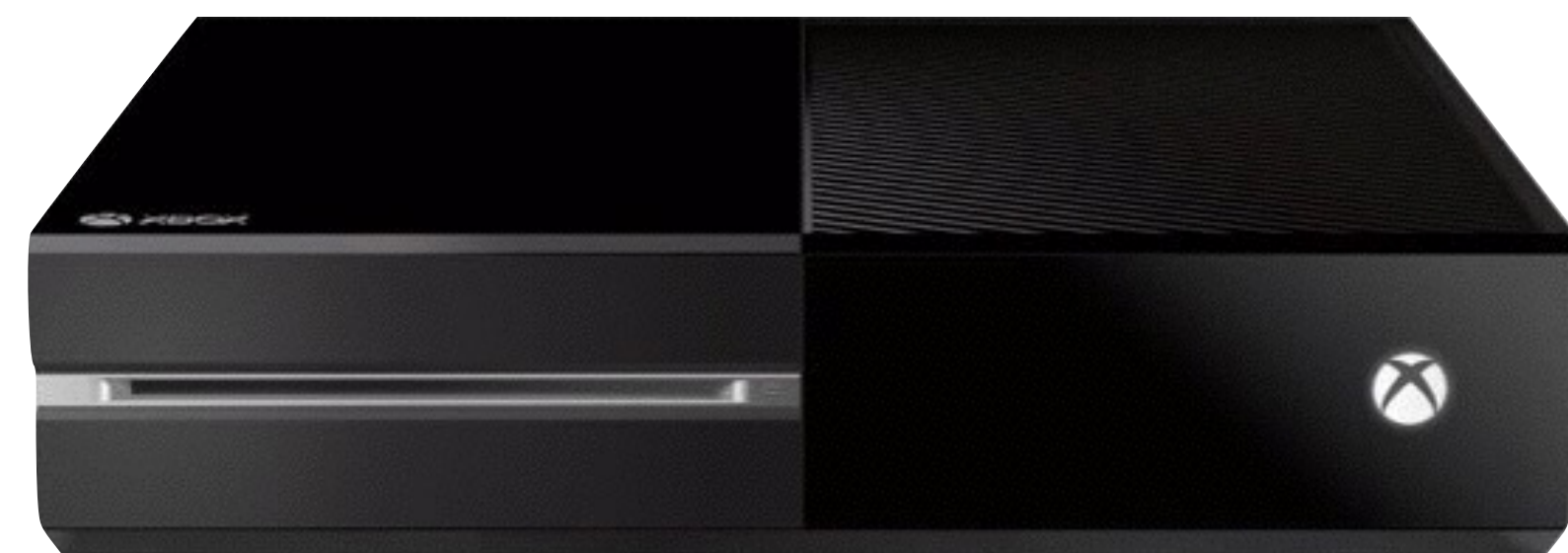
04

20

LAST TIME DEPARTED



2016



bing



2016 Computing Is...

- Highly (inter-)networked
- Dependent upon concurrent and distributed systems
- Architecturally heterogeneous
- Social

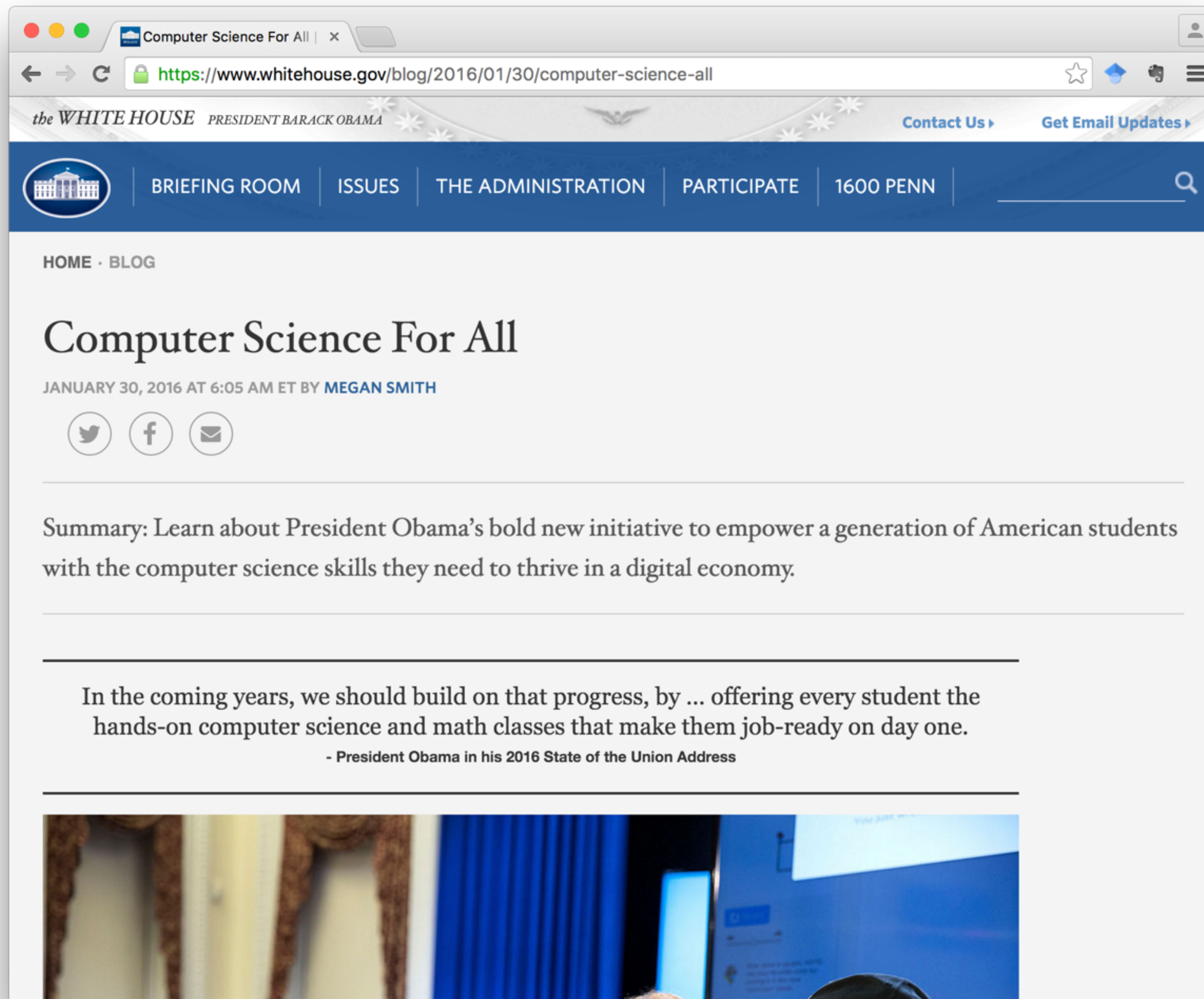
2016

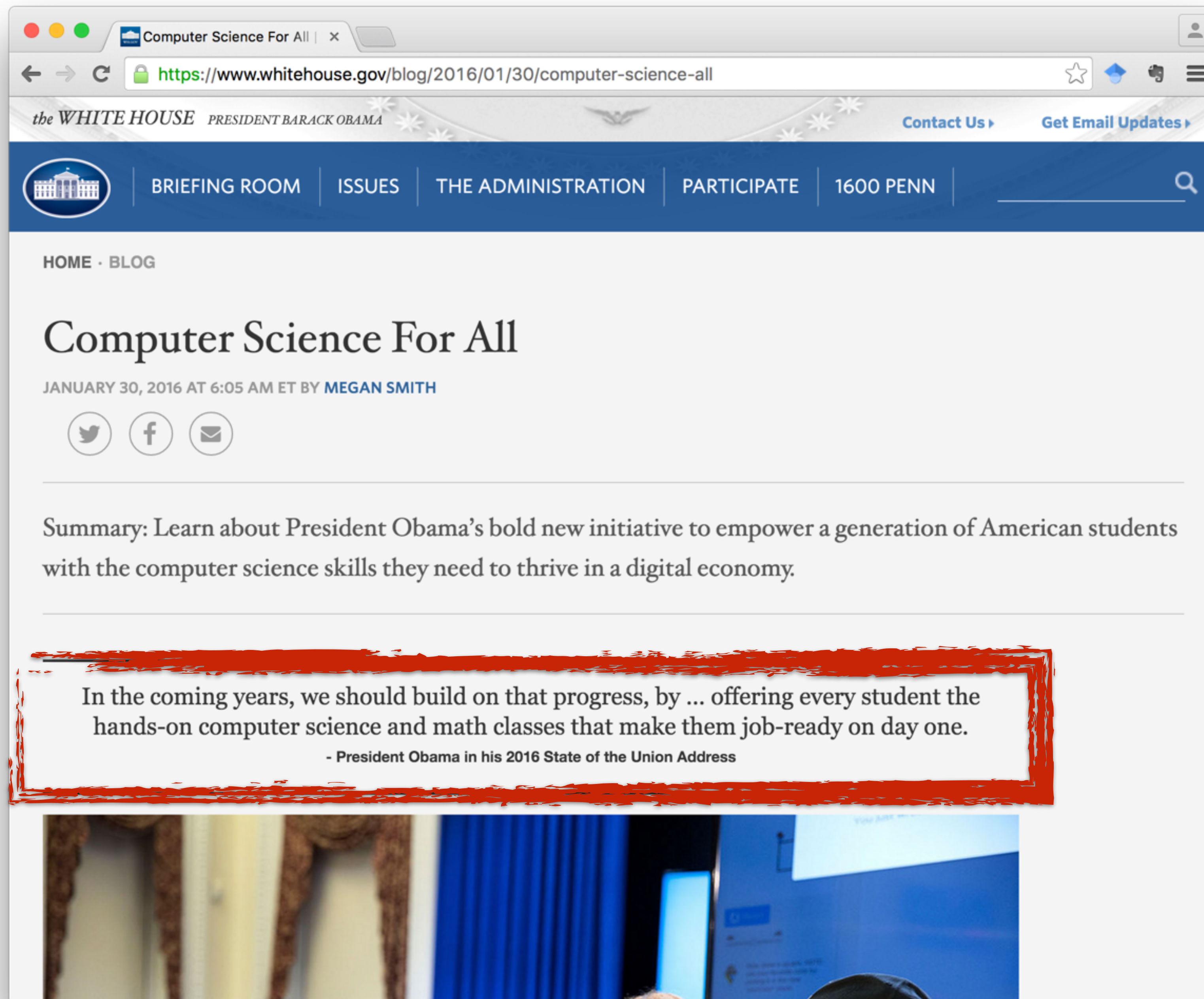
Computer Science Education

CS Education

growing

in popularity

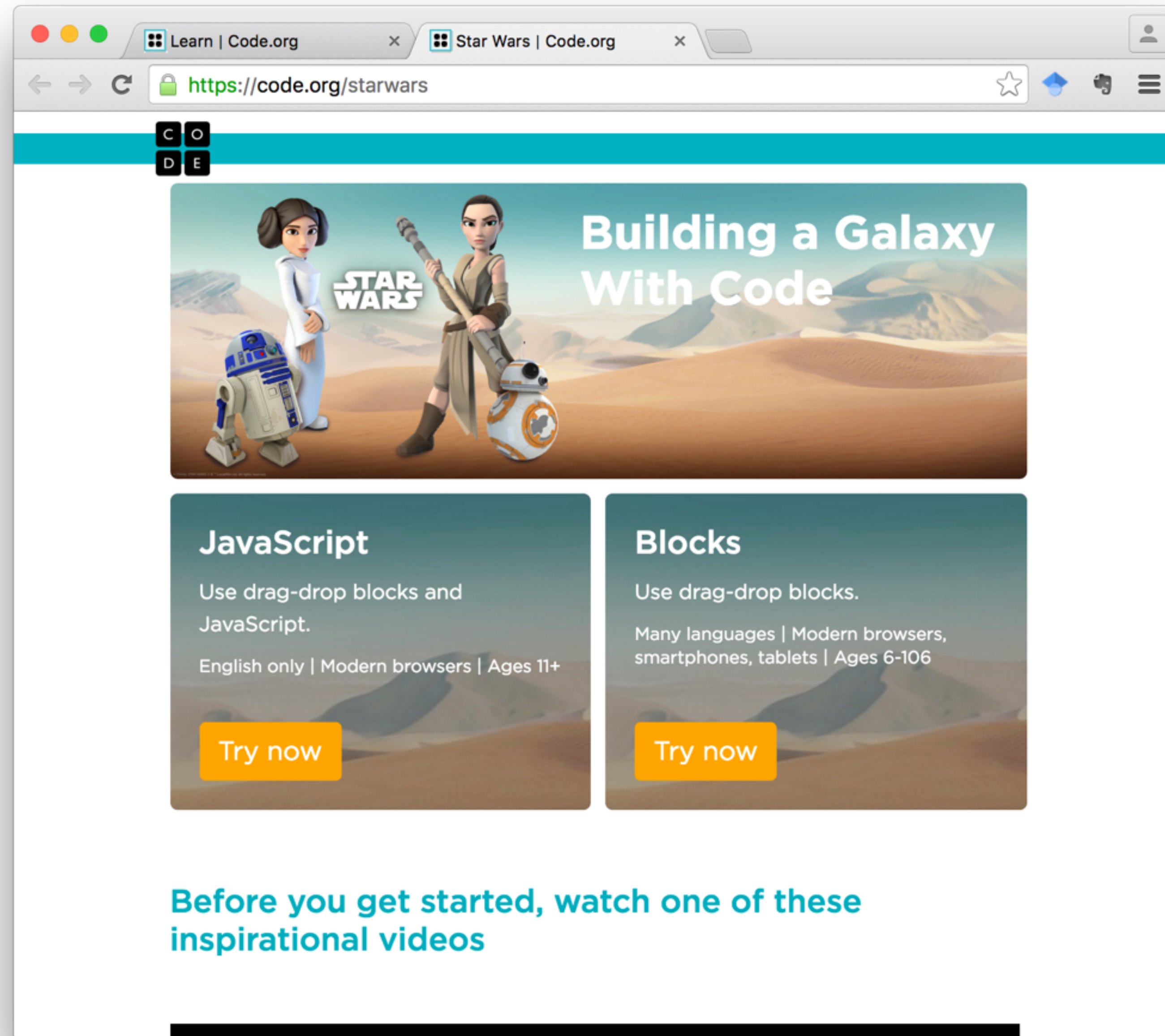




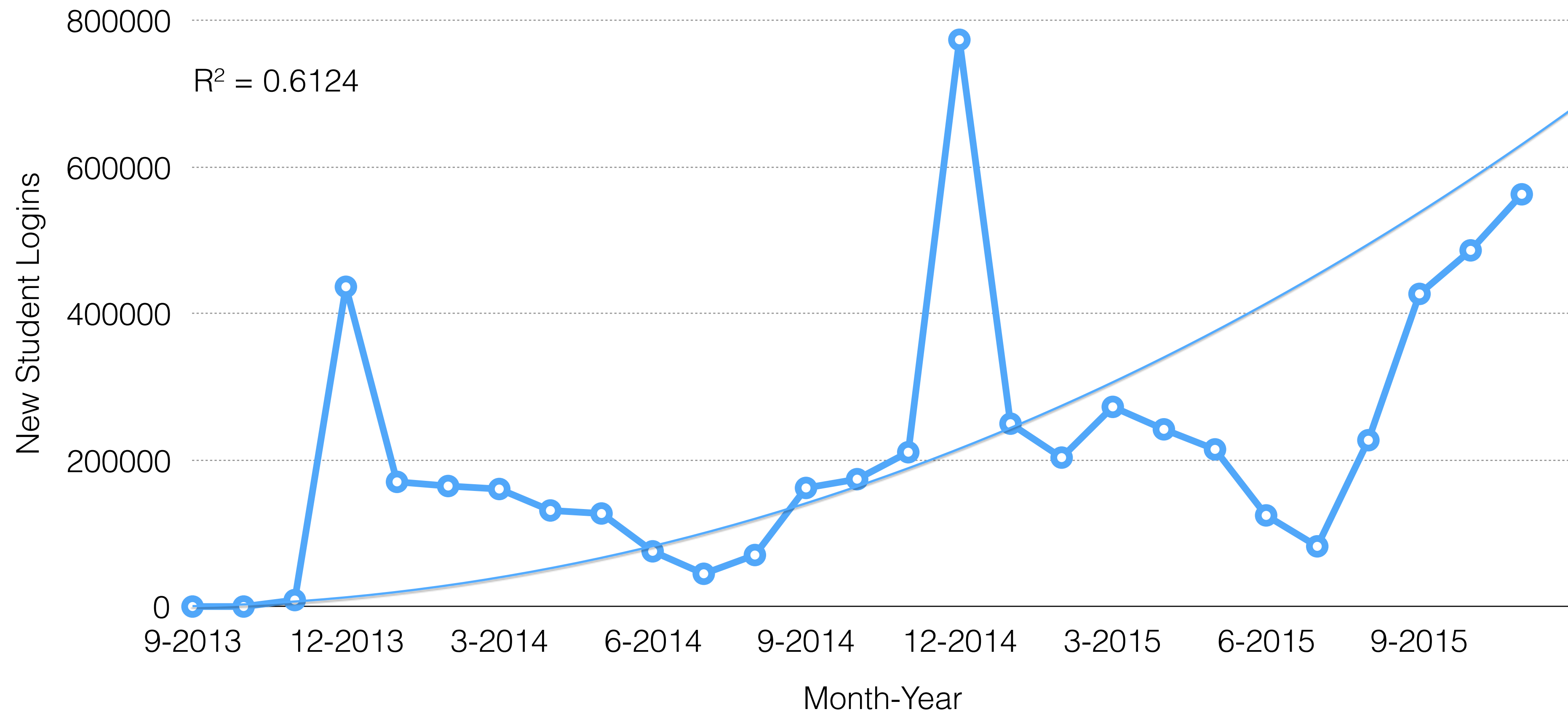
a growing field

LOTS of kids
learning CS

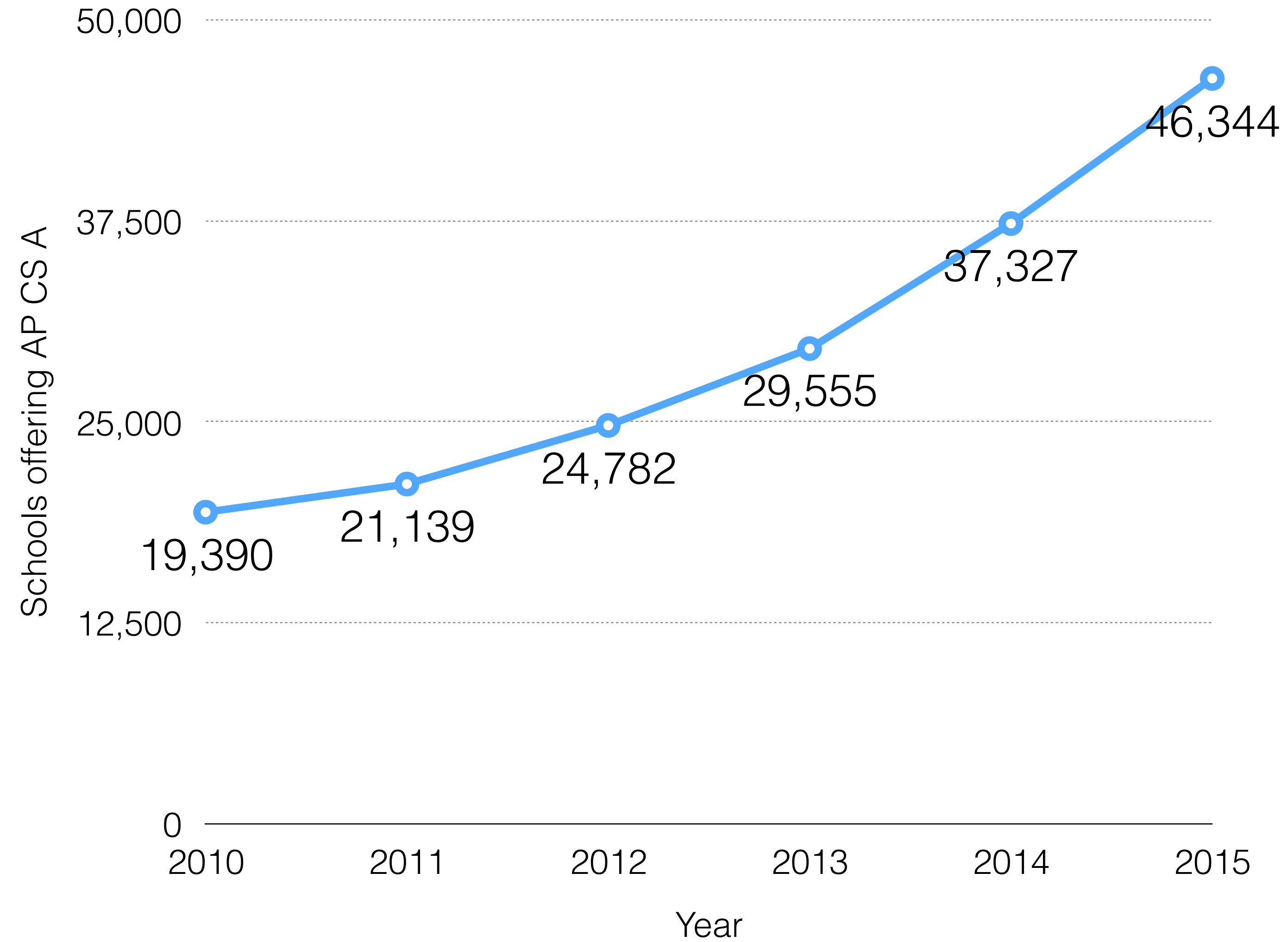
code.org



New code.org Log-Ins



U.S. Schools offering AP CS



Ericson (2015)

K12CS.org



A Framework for K-12 Computer Science Education

a growing field

still **HUGE** inequities

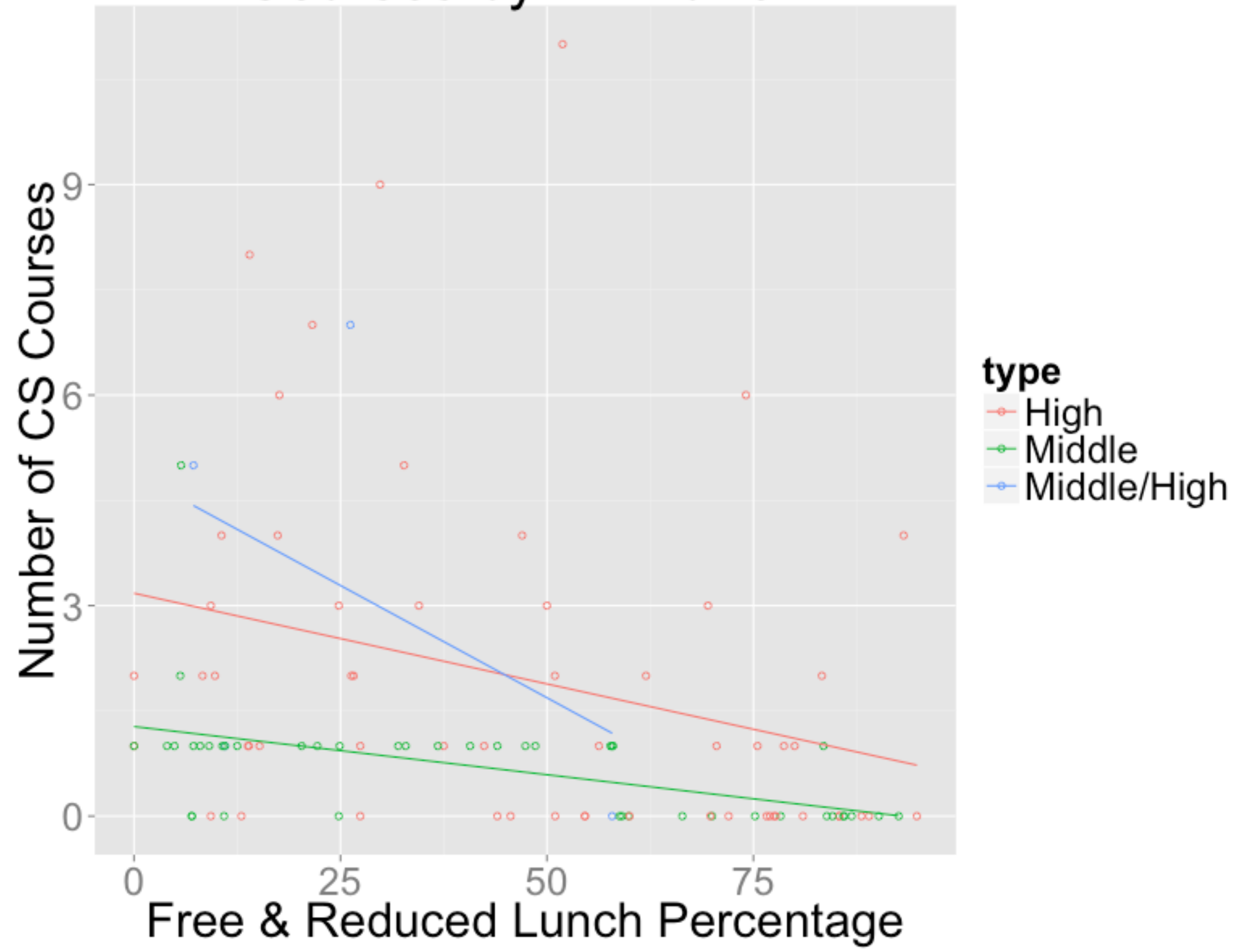
gender

race

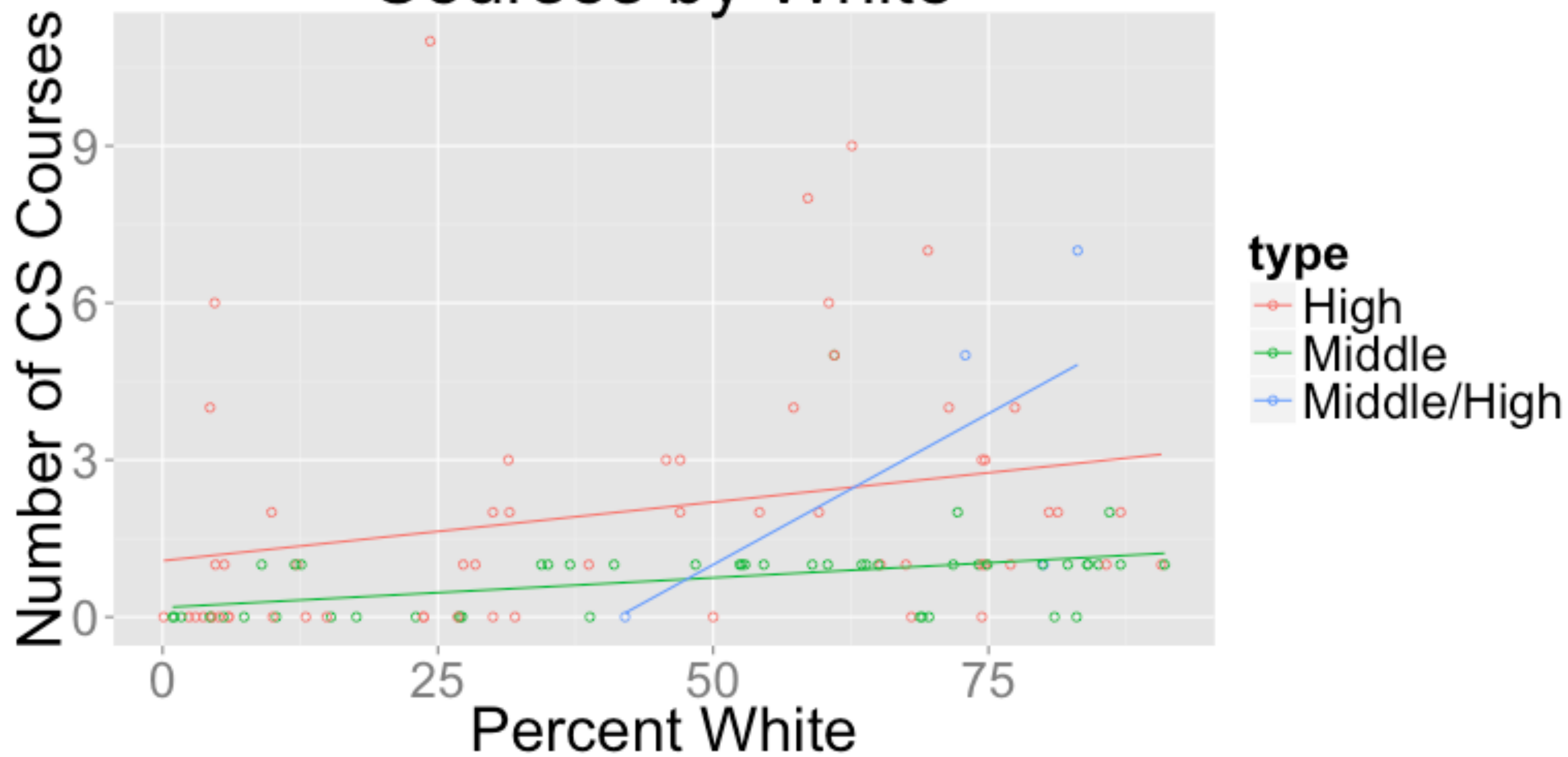
economic status

Data students in my
class collected &
analyzed last semester

School Level Courses by FR Lunch



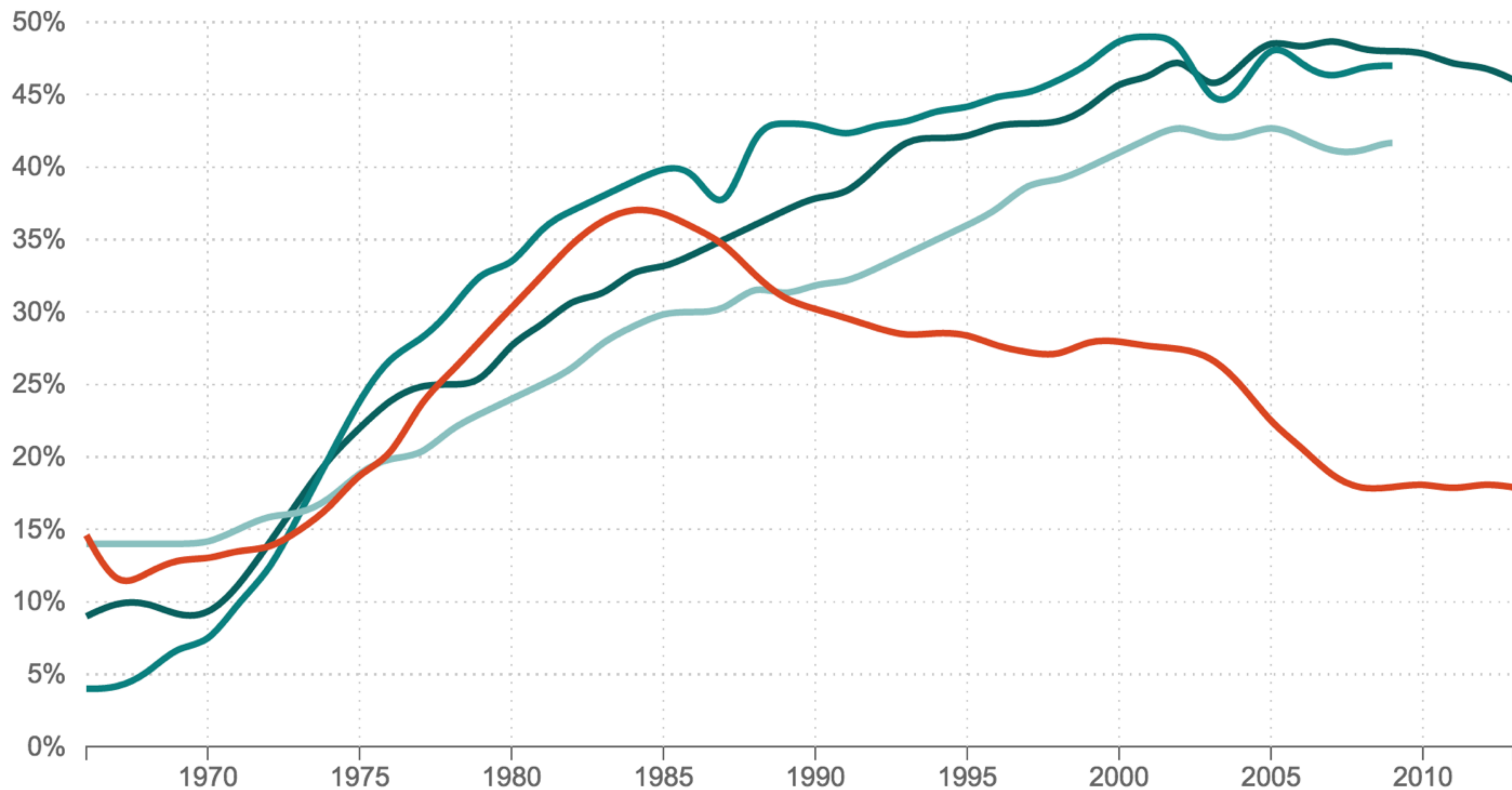
School Level Courses by White



What Happened To Women In Computer Science?

% Of Women Majors, By Field

Medical School Law School Physical Sciences Computer science



Source: National Science Foundation, American Bar Association, American Association of Medical Colleges

Credit: Quoc Trung Bui/NPR

How are kids learning
CS in 2016?

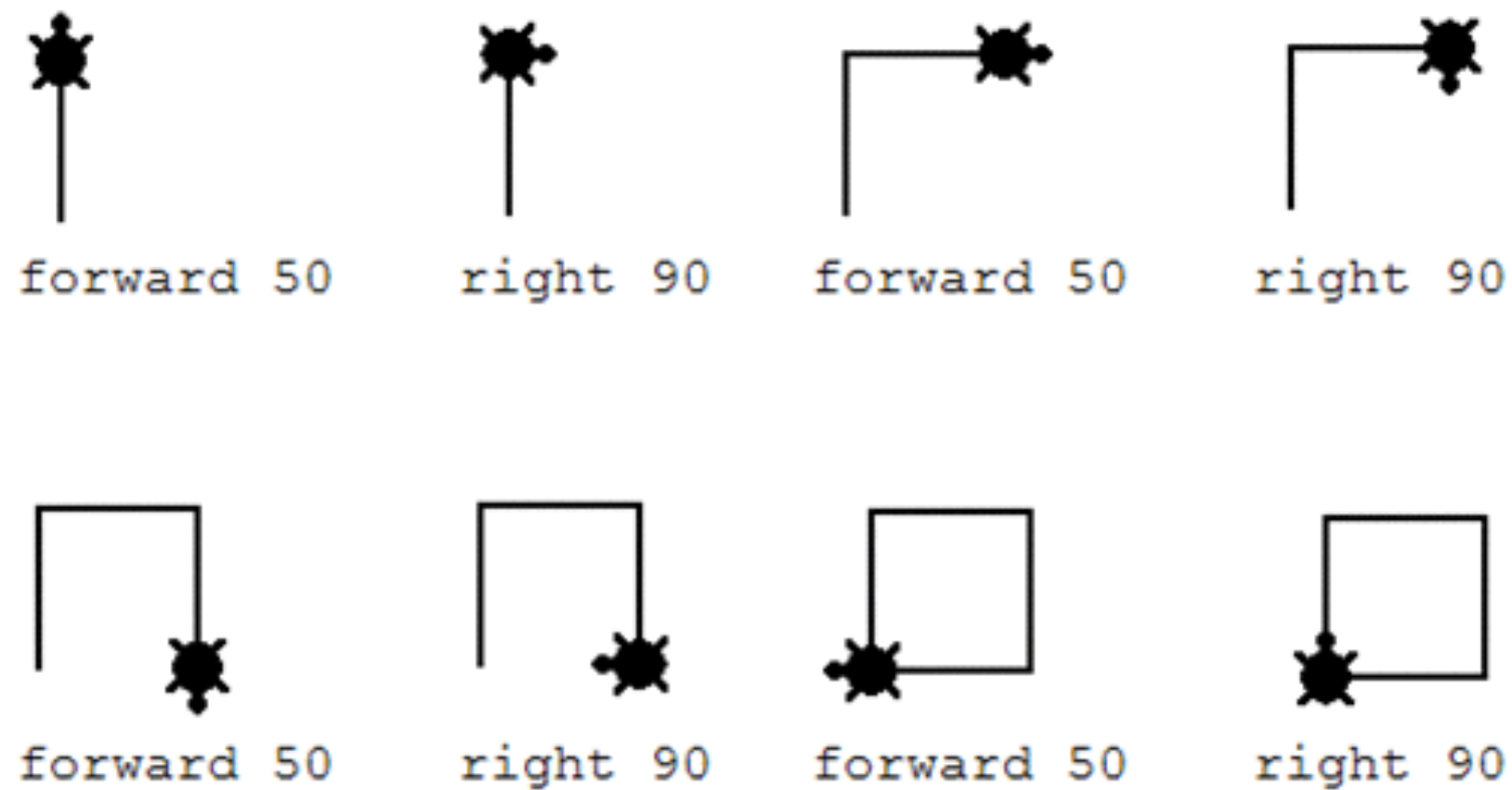
1985

Loops,
Conditionals,
IO (Graphics, Keyboard, Sound), &
Procedural Abstraction

TO SQUARE

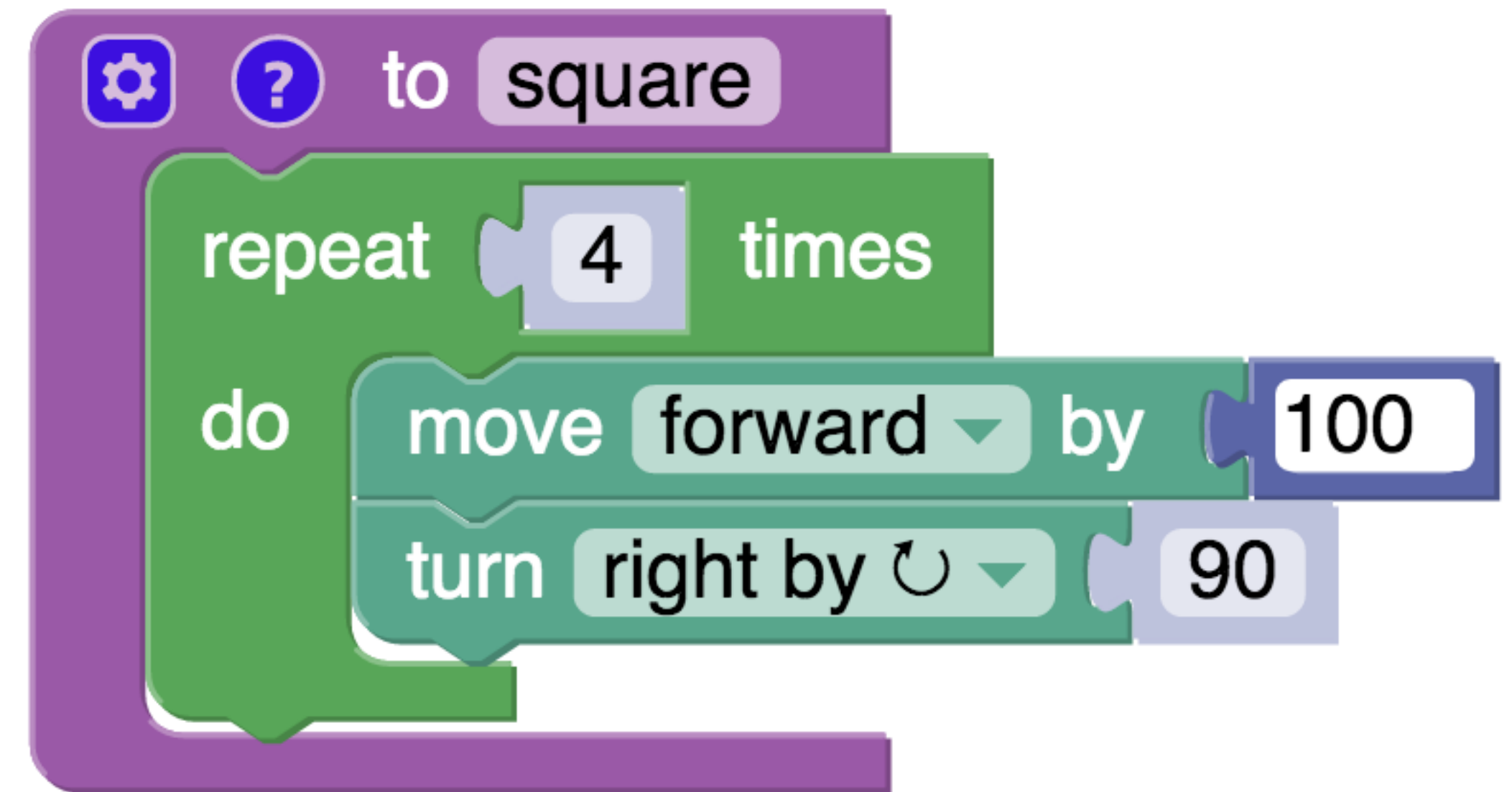
REPEAT 4 [FORWARD 10 RIGHT 90]

END



2016

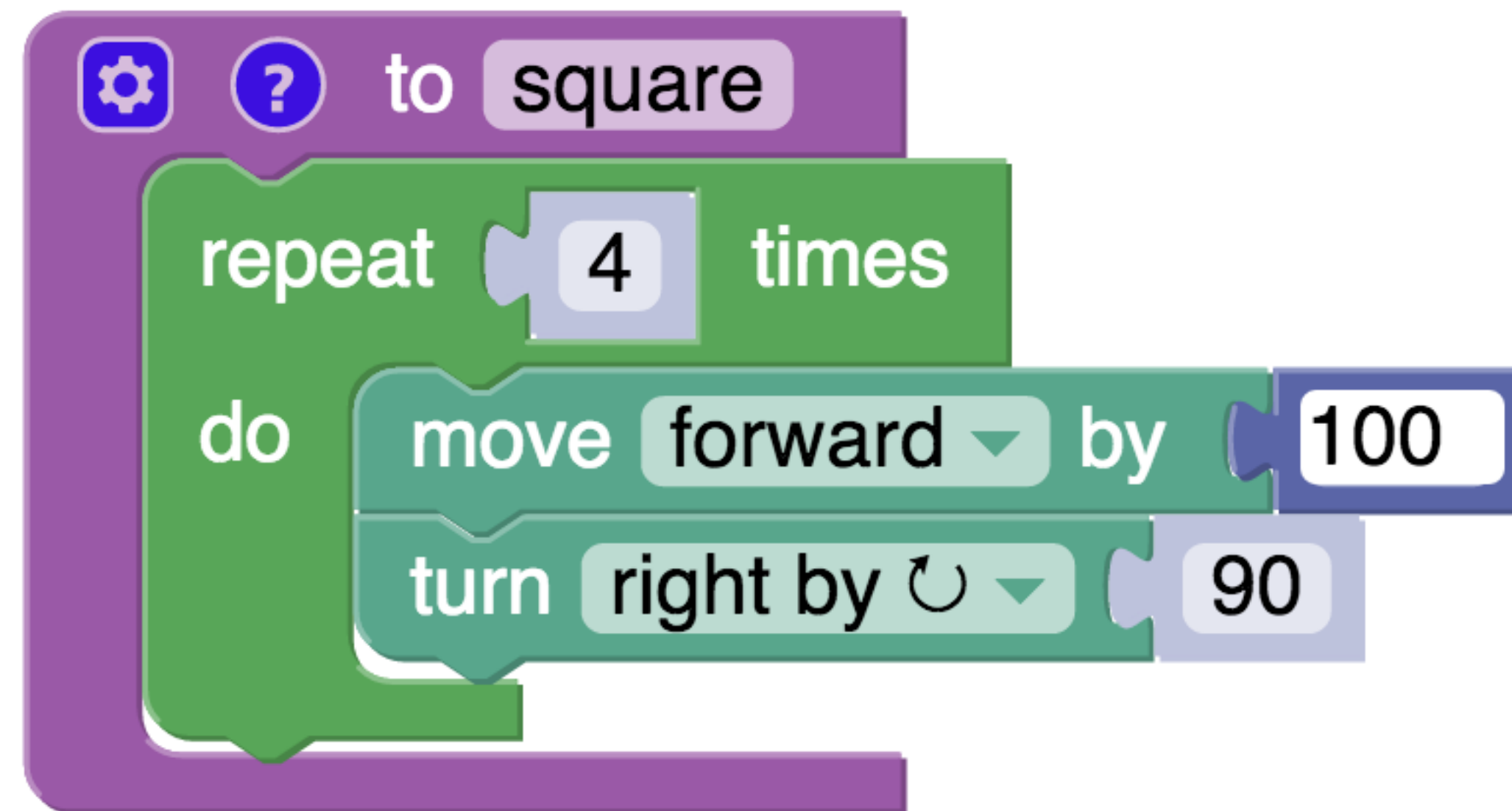
Loops,
Conditionals,
IO (Graphics, Keyboard, Sound), &
Procedural Abstraction



1985

```
TO SQUARE  
  REPEAT 4 [ FORWARD 10 RIGHT 90 ]  
END
```

2016



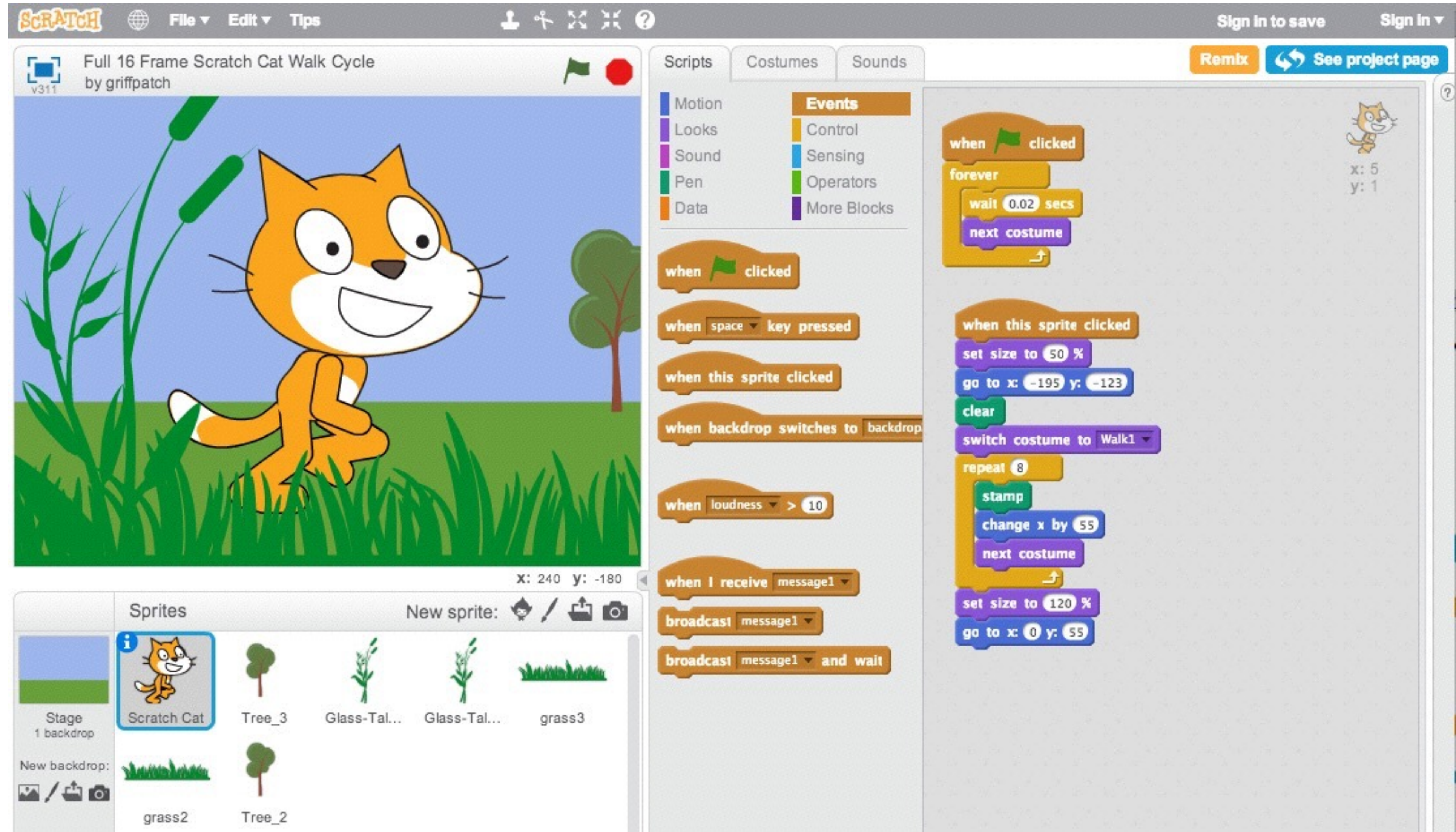
Meet the new code...

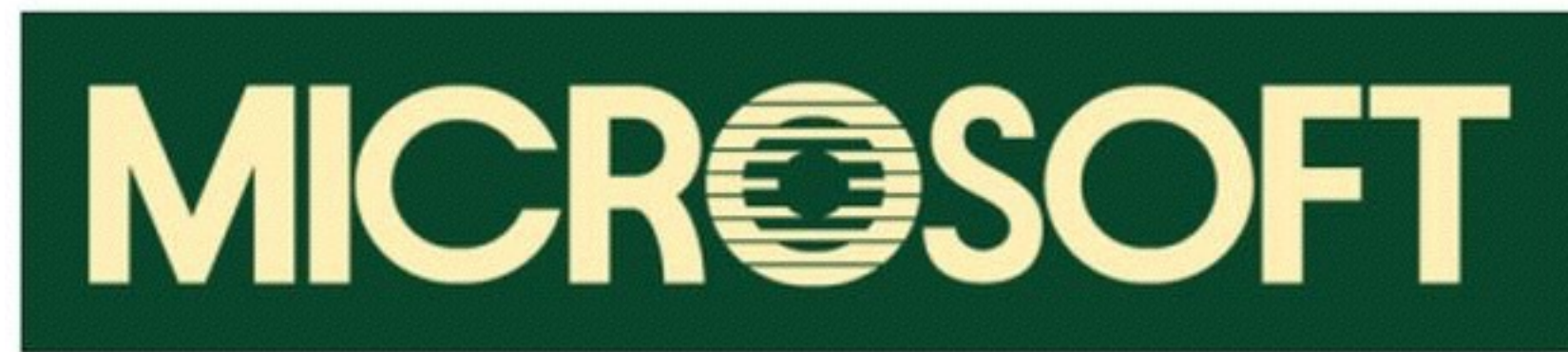
1985 Loops,
 Conditionals,
 IO (Graphics, Keyboard, Sound), &
 Procedural Abstraction

2016 Loops,
 Conditionals,
 IO (Graphics, Keyboard, Sound), &
 Procedural Abstraction

...same as the old code.

Retro-Computing Education





10 year anniversary

\$140M in sales

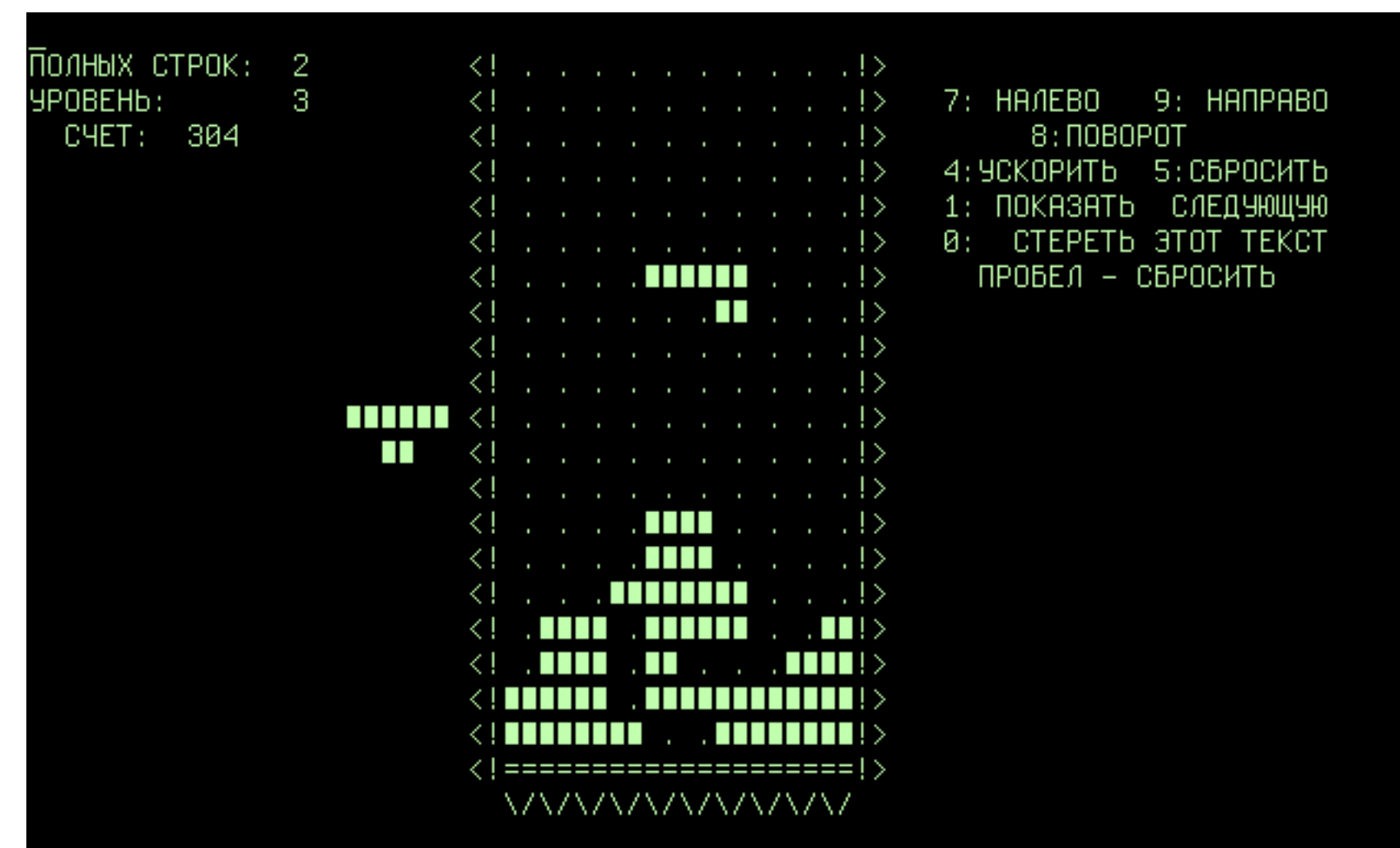
DOS 3.2 & Windows 1.0 released

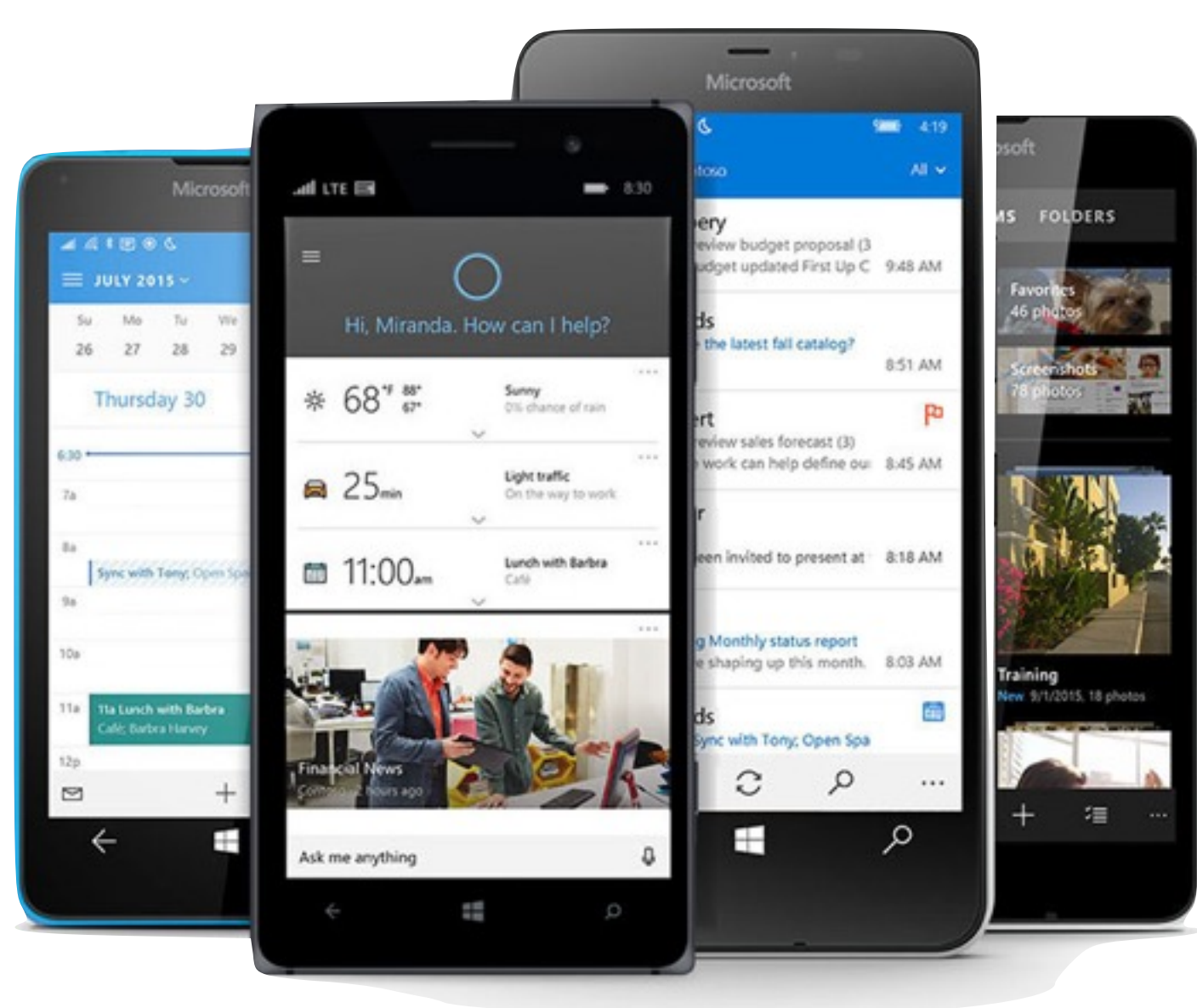
1985

C++

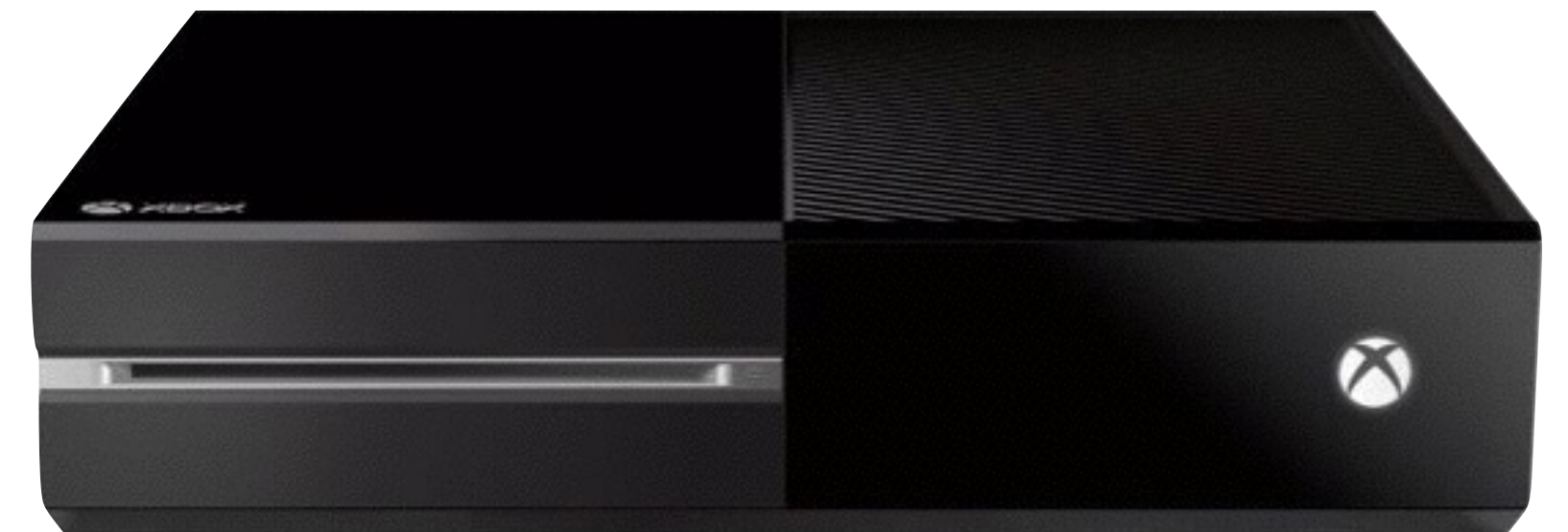
NSFNET and DNS
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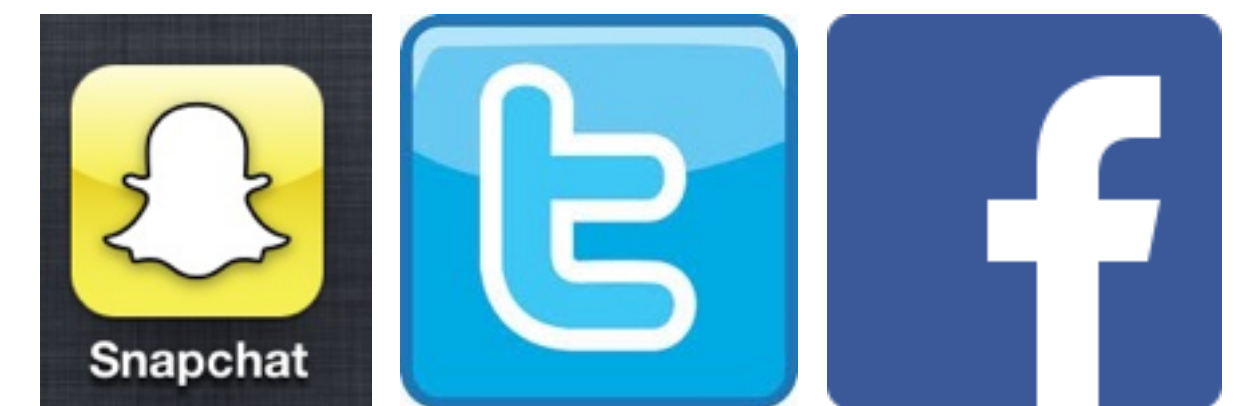




2016



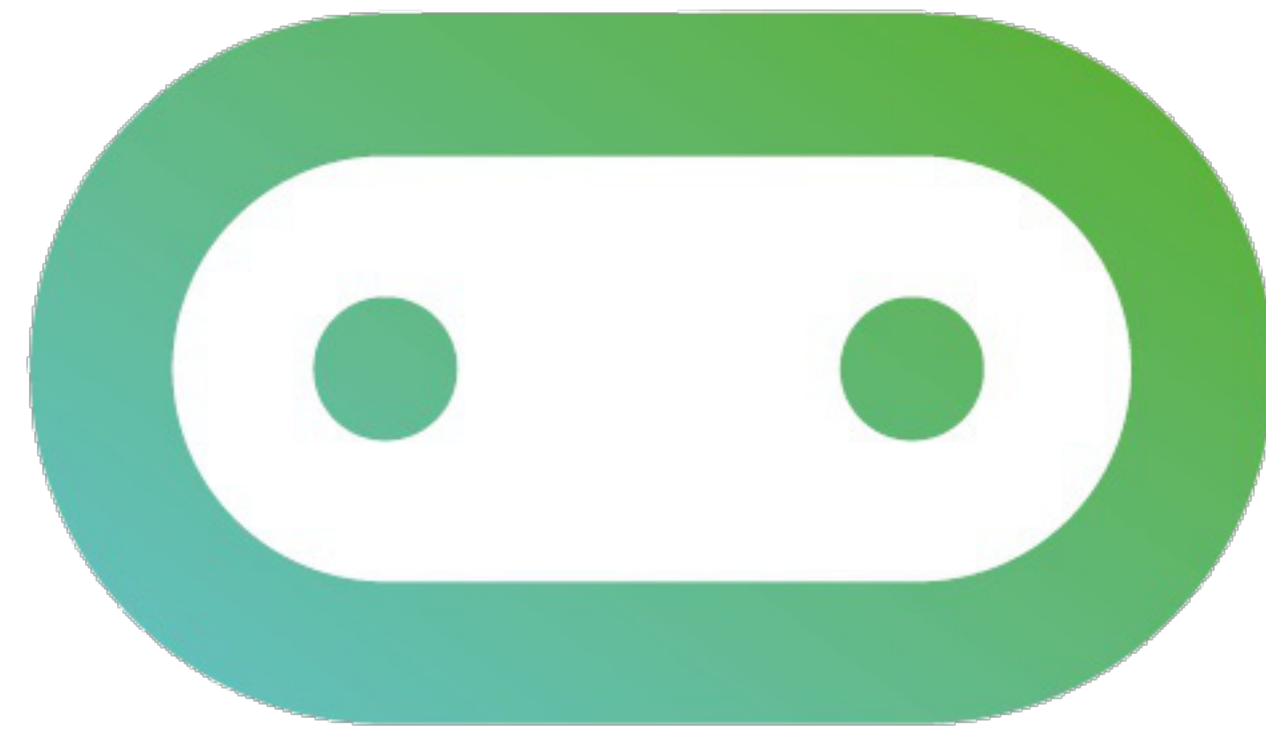
bing



2016 CS Education

should look like

2016 CS



micro:bit

2016 Computing Is...

- Networked
- Built upon concurrent and distributed systems
- Architecturally heterogeneous (from wearables to clouds)
- Social
- Statistical (machine learning)

2016 Computing Is...

- **Networked**
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Wearables



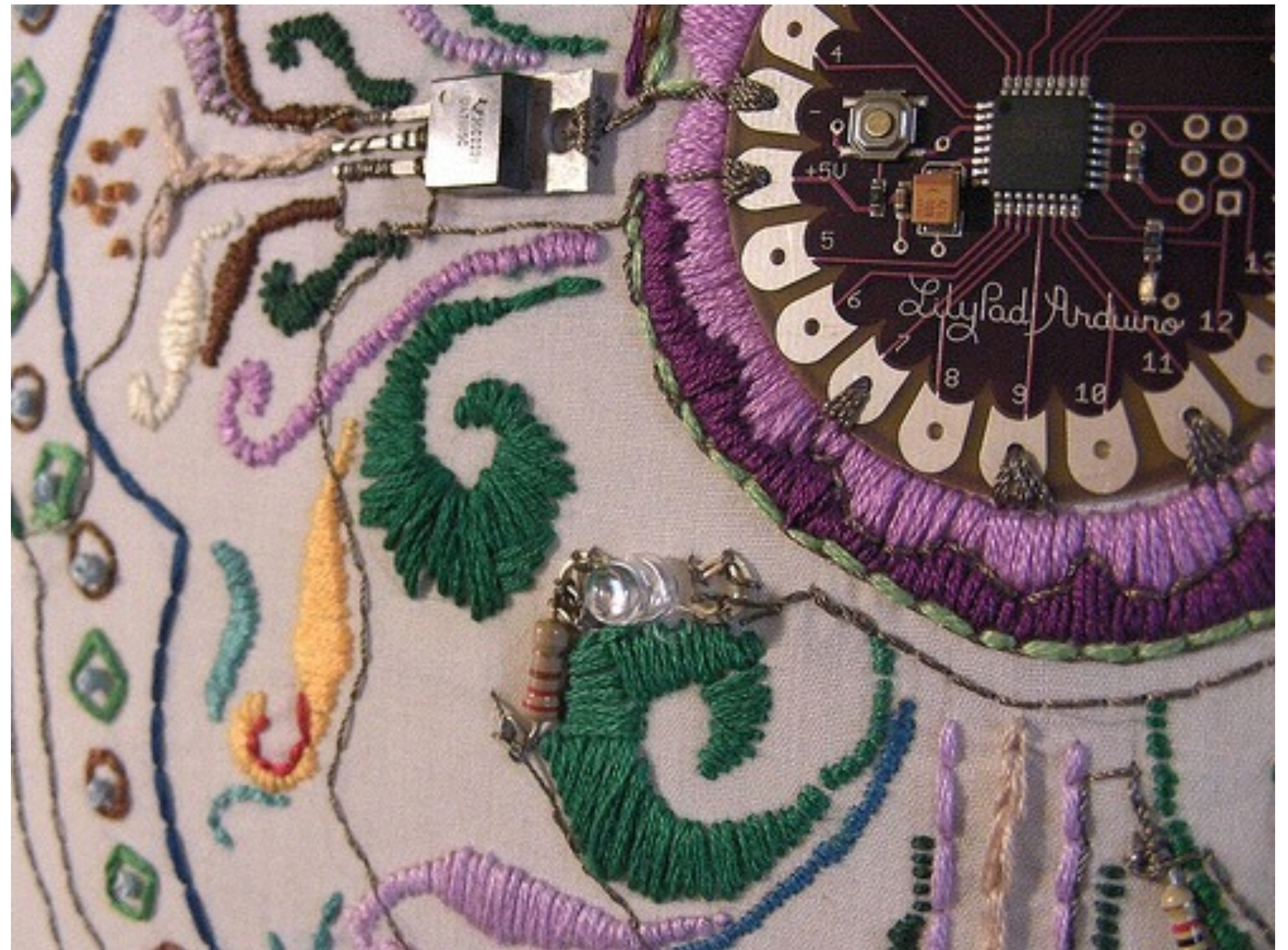
E-Textile Artifacts

images by
Kristin Searle
Utah State University


e-textiles



Leah Buechley



LilyPad Arduino

but
Programming = 

```
int lightState = 0;
bool buttonPressed = false;

void setup() {
  pinMode( 1 , INPUT);
  pinMode( 2 , OUTPUT);
  digitalWrite(2, LOW);
}

void loop() {
  if (digitalRead(1) == HIGH){
    if (buttonPressed == false){
      buttonPressed = true;
      if (lightState == 0) {
        lightState = 1;
        digitalWrite(2, HIGH);
      }else{
        lightState = 0;
        digitalWrite(2, LOW);
      }
    }
  }else{ //thus digitalRead(1) == LOW
    if (buttonPressed = true){
      buttonPressed = false;
    }
  }
}
```

Minimal Arduino
code to toggle a light
with a button.


```
int lightState = 0;
bool buttonPressed = false;

void setup() {
  pinMode(1, OUTPUT);
}
```

Welcome back!

...to try again.

n.

```
if (lightState == 0) {
```



```
}
} else
if
```

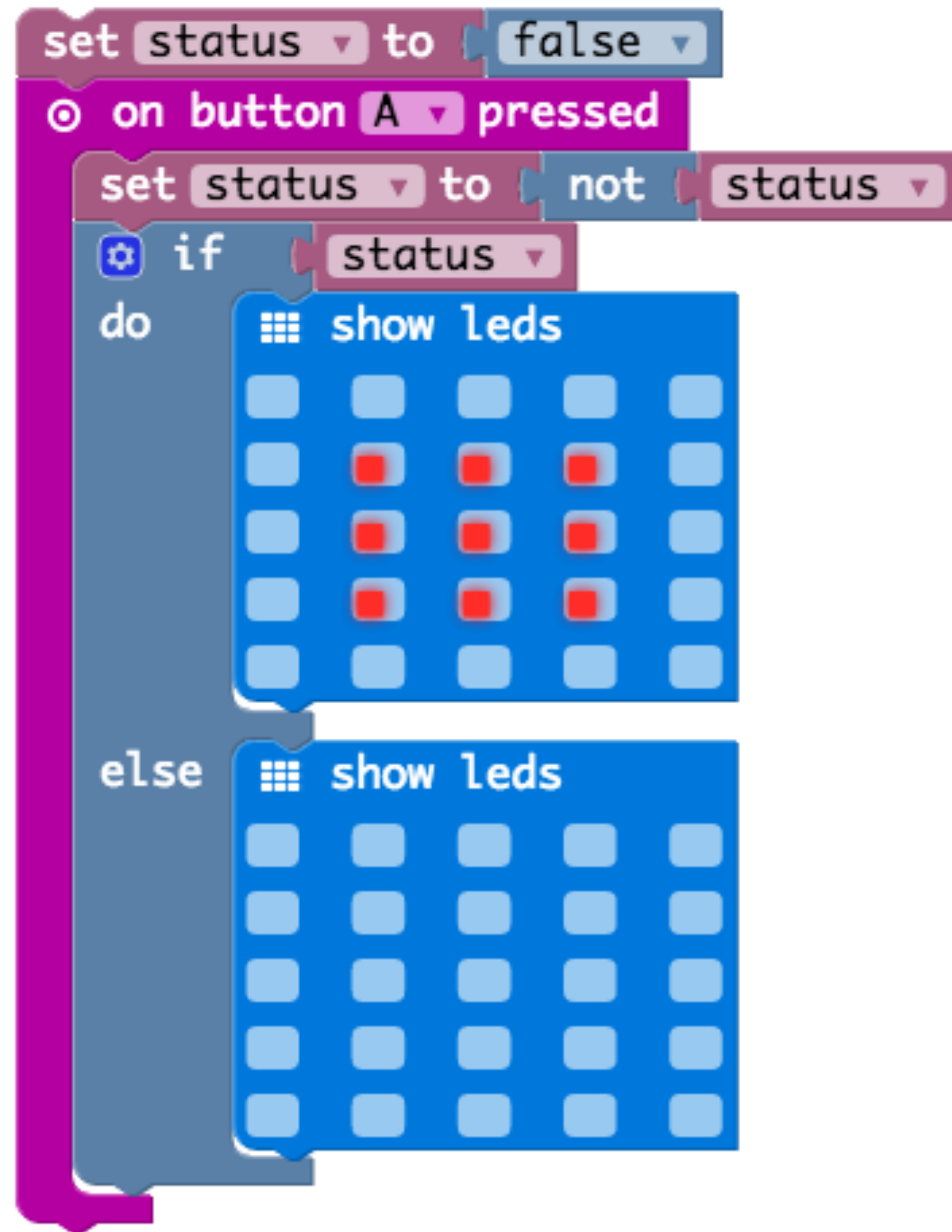
```
buttonPressed = false;
```

```
}
```

```
}
```

```
}
```

Micro:bit makes this easy



```

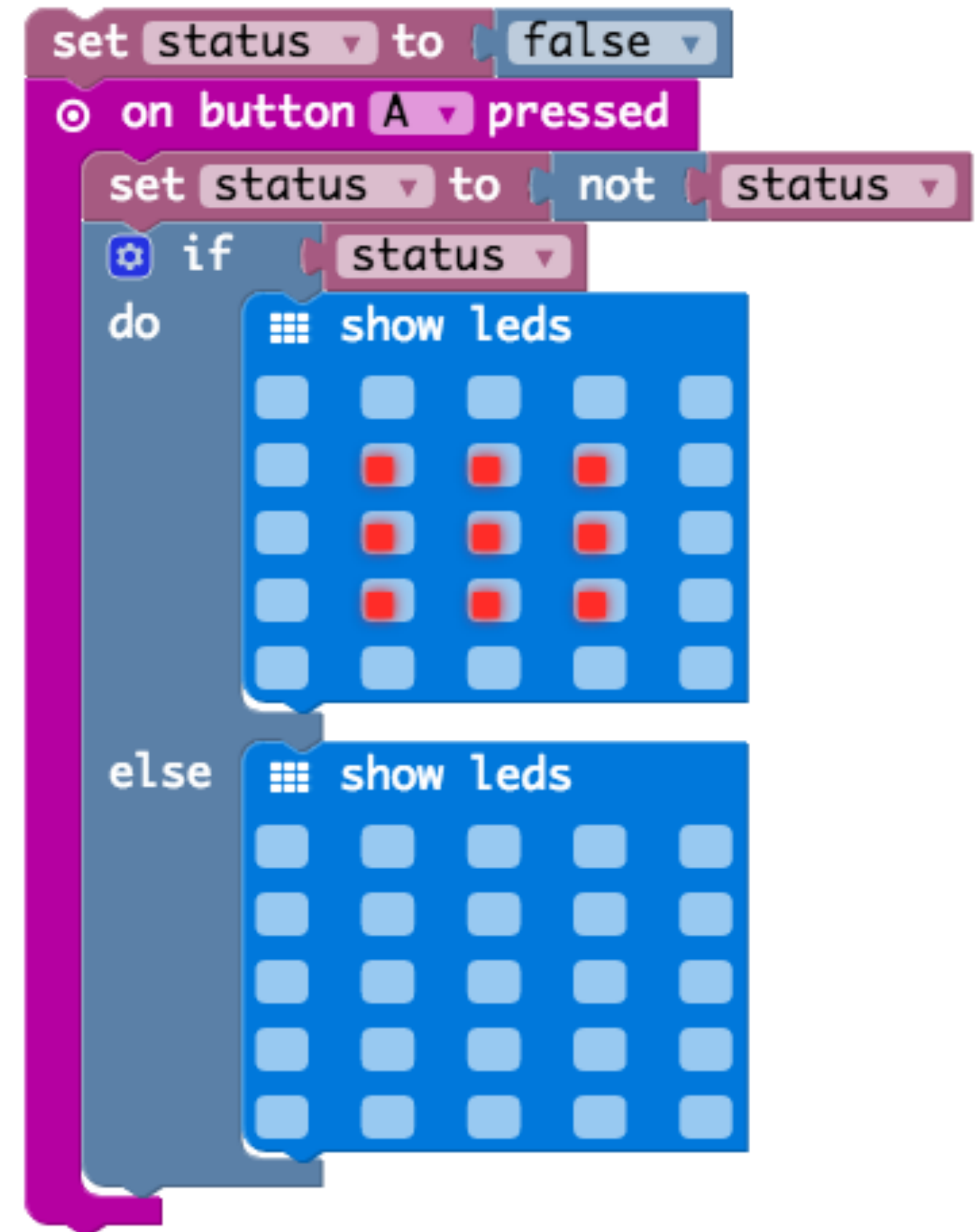
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void setup() {
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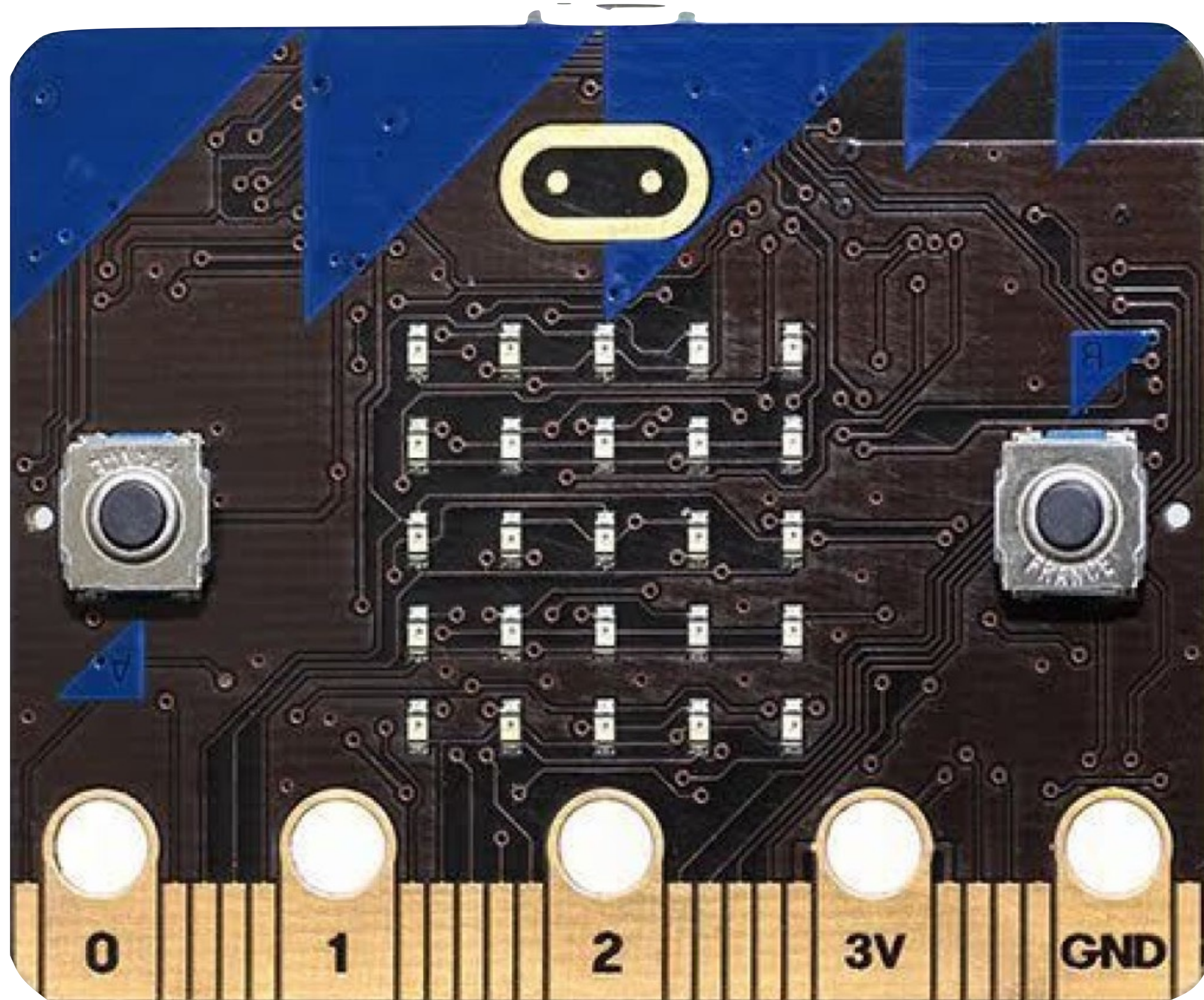
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        lightState = 0;
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      }
    }
  }else{ //thus digitalRead(1) == LOW
    if (buttonPressed == true){
      buttonPressed = false;
    }
  }
}

```

VS.



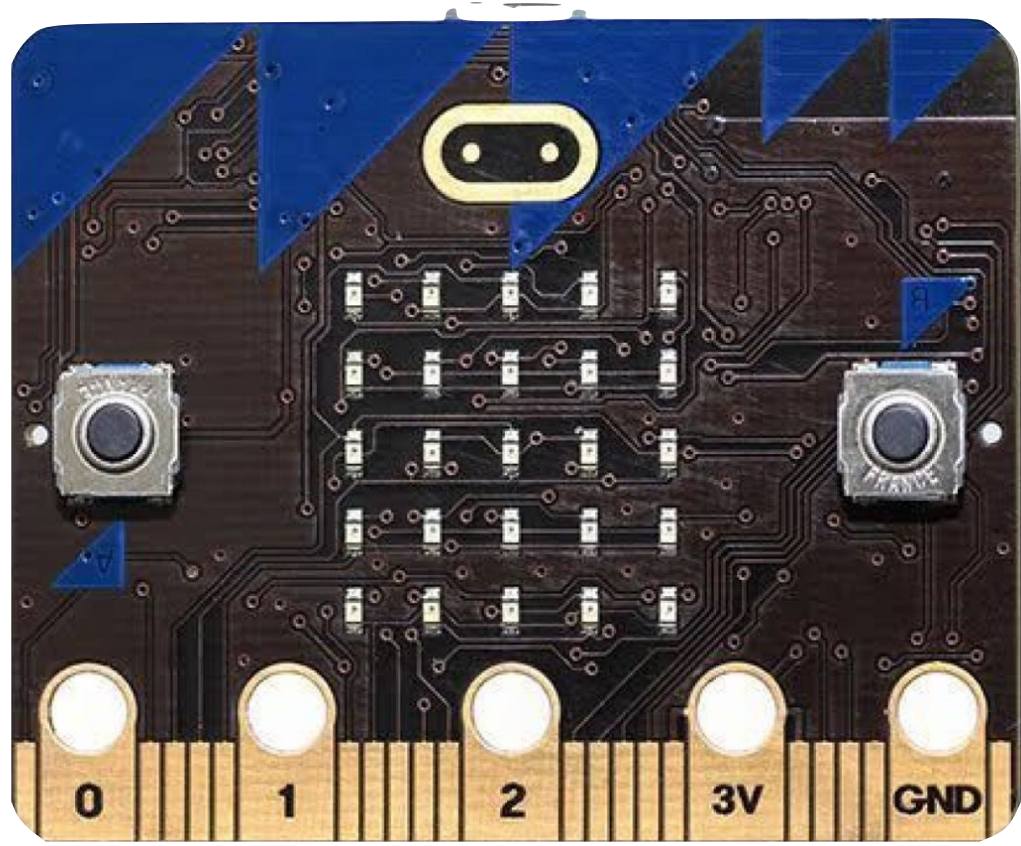
One hitch...



Distance from eyelets to edge leads to shorts with adjacent pins.

← Distance too large.

Easy Fix



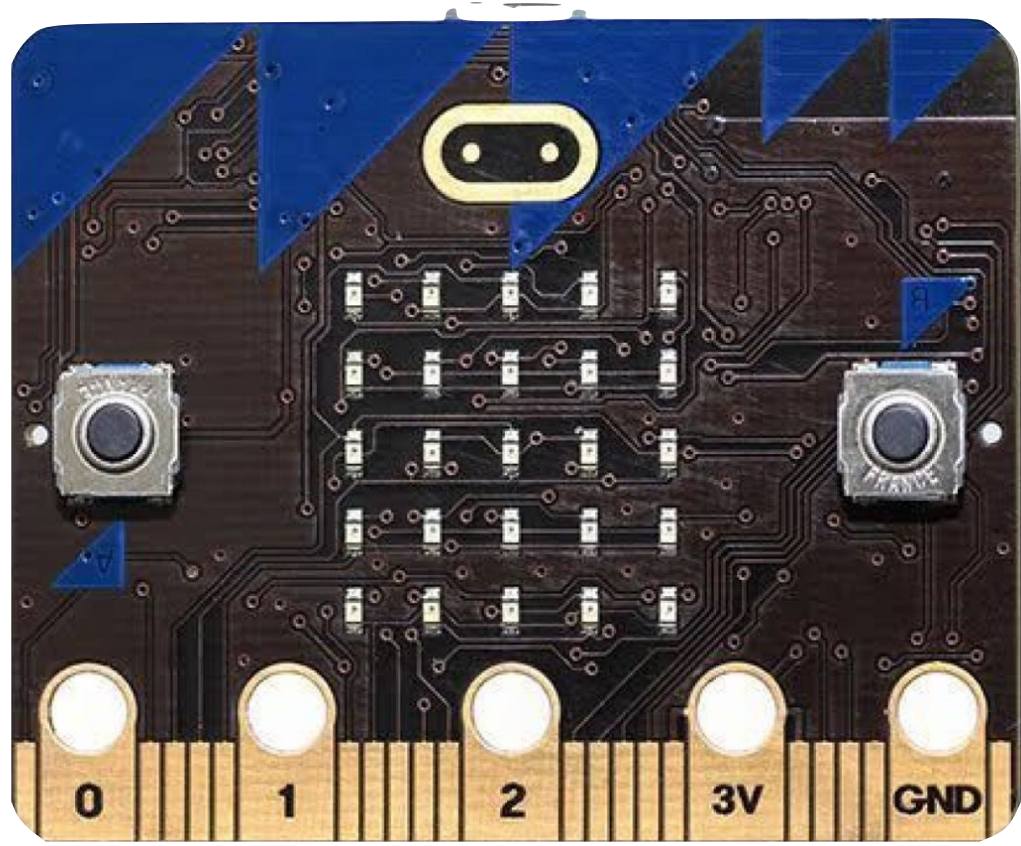
+



+



Easy Fix



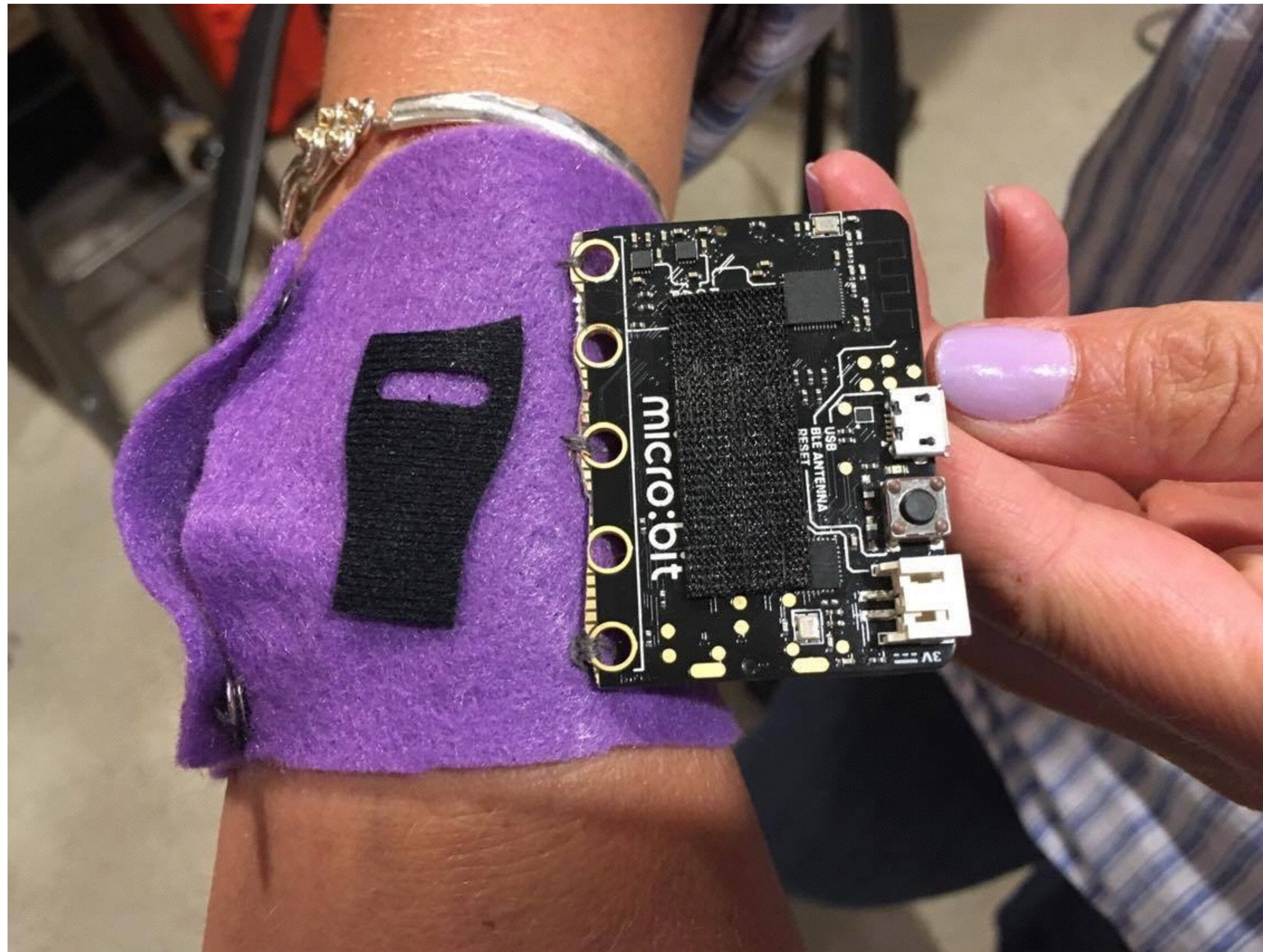
+



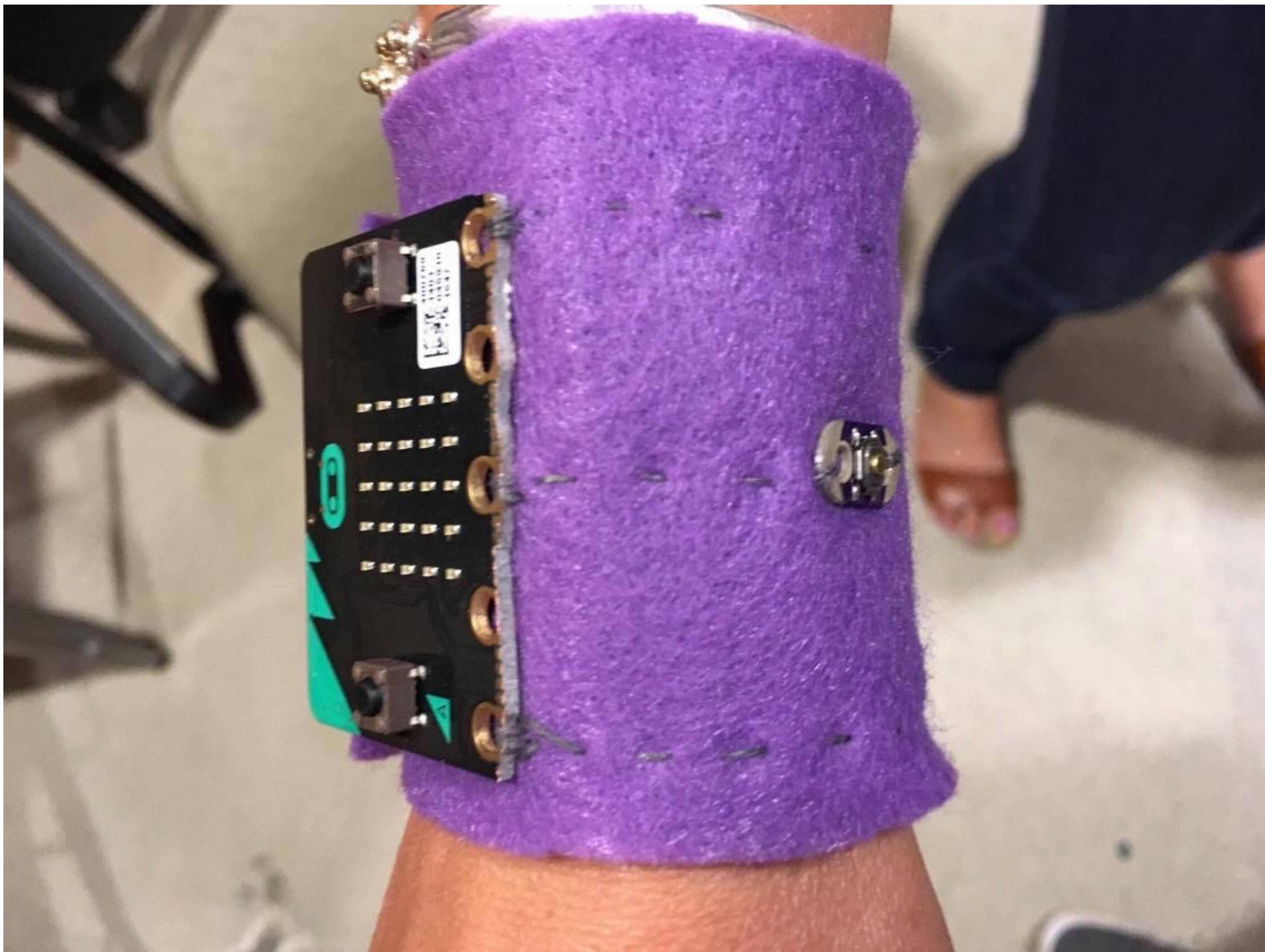
+







Made with Kristin Searle (Utah State)





Summer
camp
sponsored by
NCWIT



I like poetry, long
walks on the beach
and poking dead
things with a stick.

Networking

Micro:bit
does
wireless
networking

Antenna



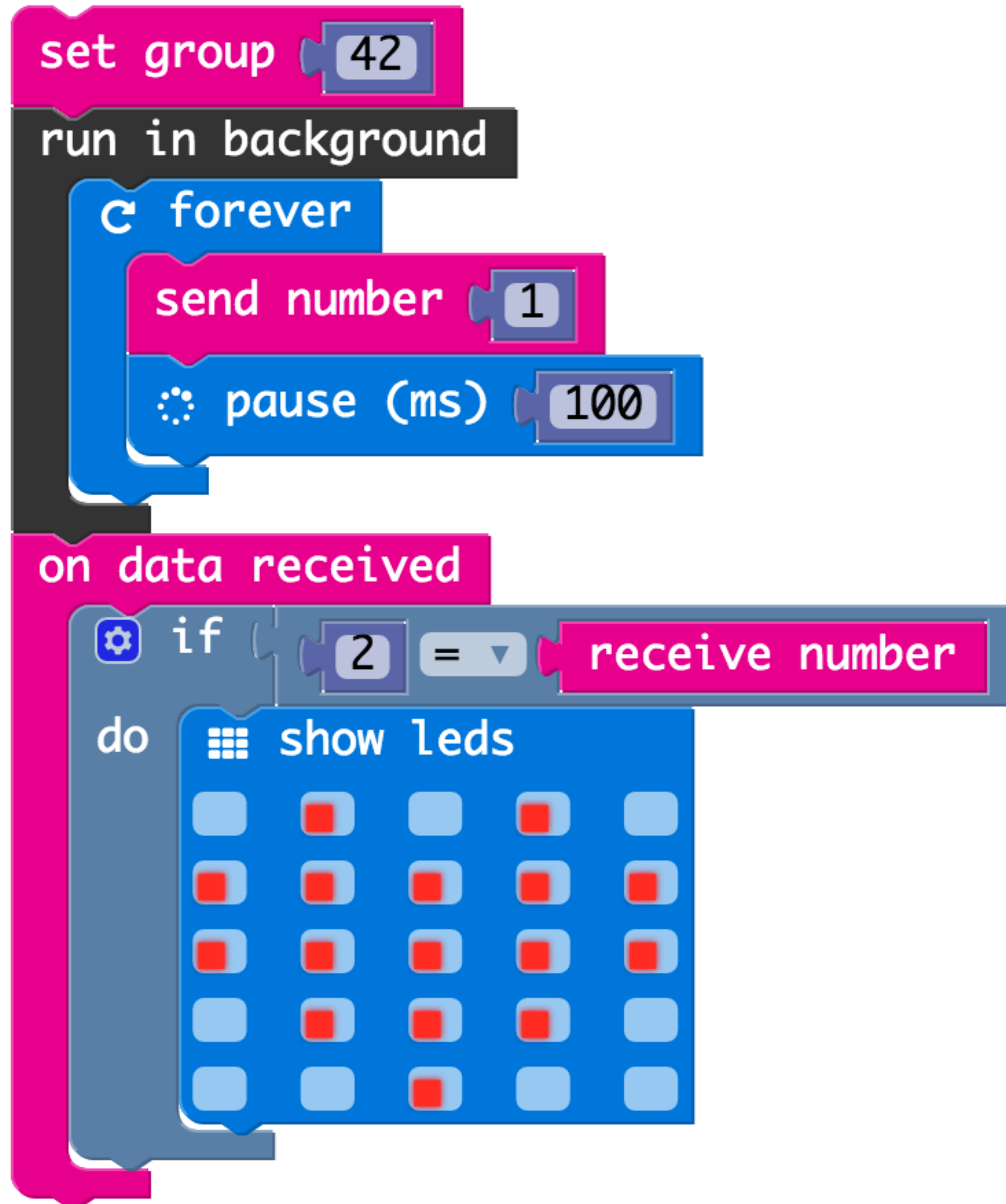
A Simple Abstraction



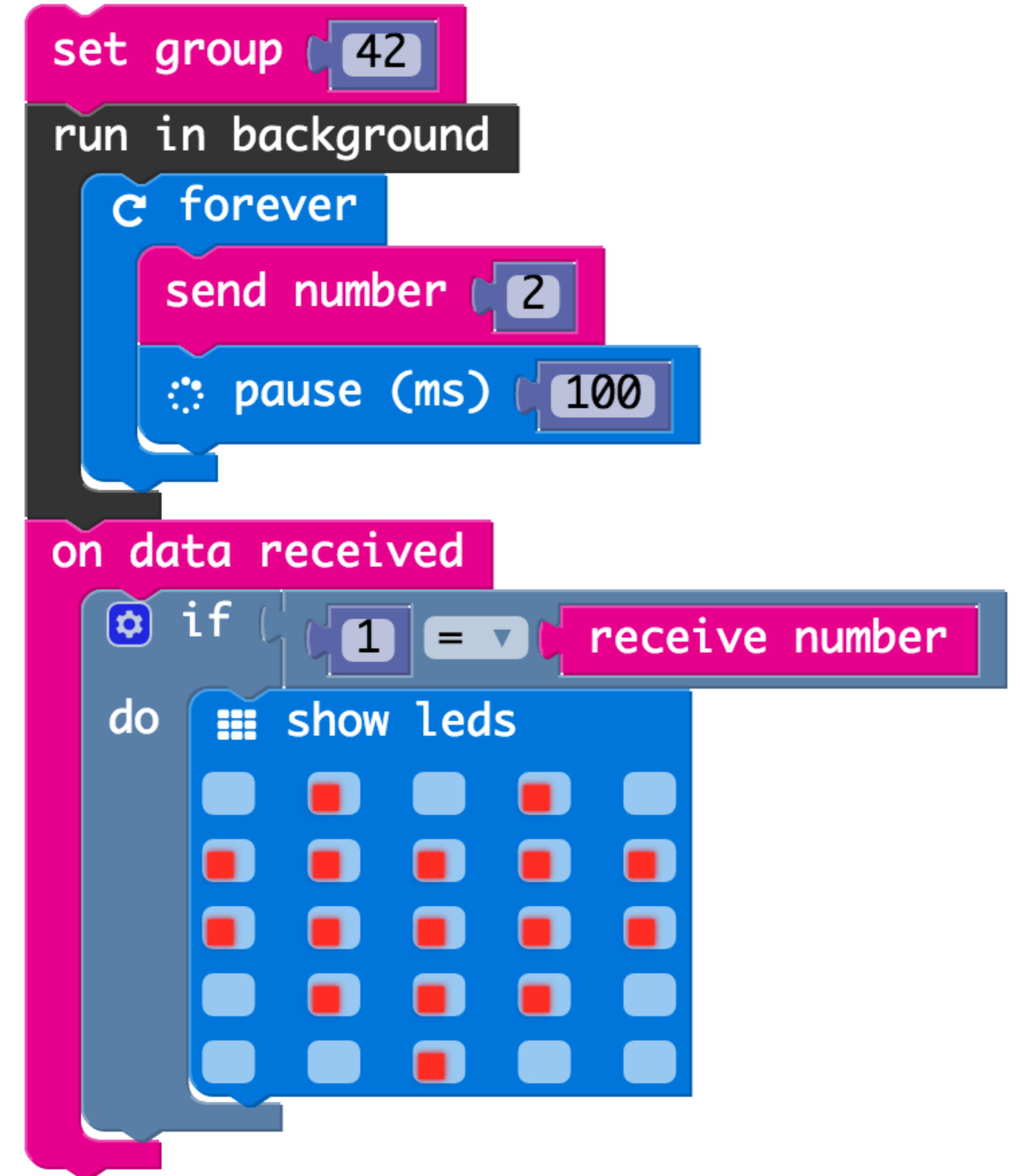
What can kids do with this?



Device 1



Device 2



This Fall Networked Friendship Jewelry Workshops

together with

BOULDER
PUBLIC LIBRARY

Toward heterogeneity



ATLAS
INSTITUTE

INV
DES

2007

I like poetry, long
walks on the beach
and poking dead
things with a stick.



ATLAS
INSTITUTE

INVESTIGATING
DESIGN



I like poetry, long
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and poking dead
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ATLAS
INSTITUTE

INVESTIGATING
DESIGN

Investigating
2007

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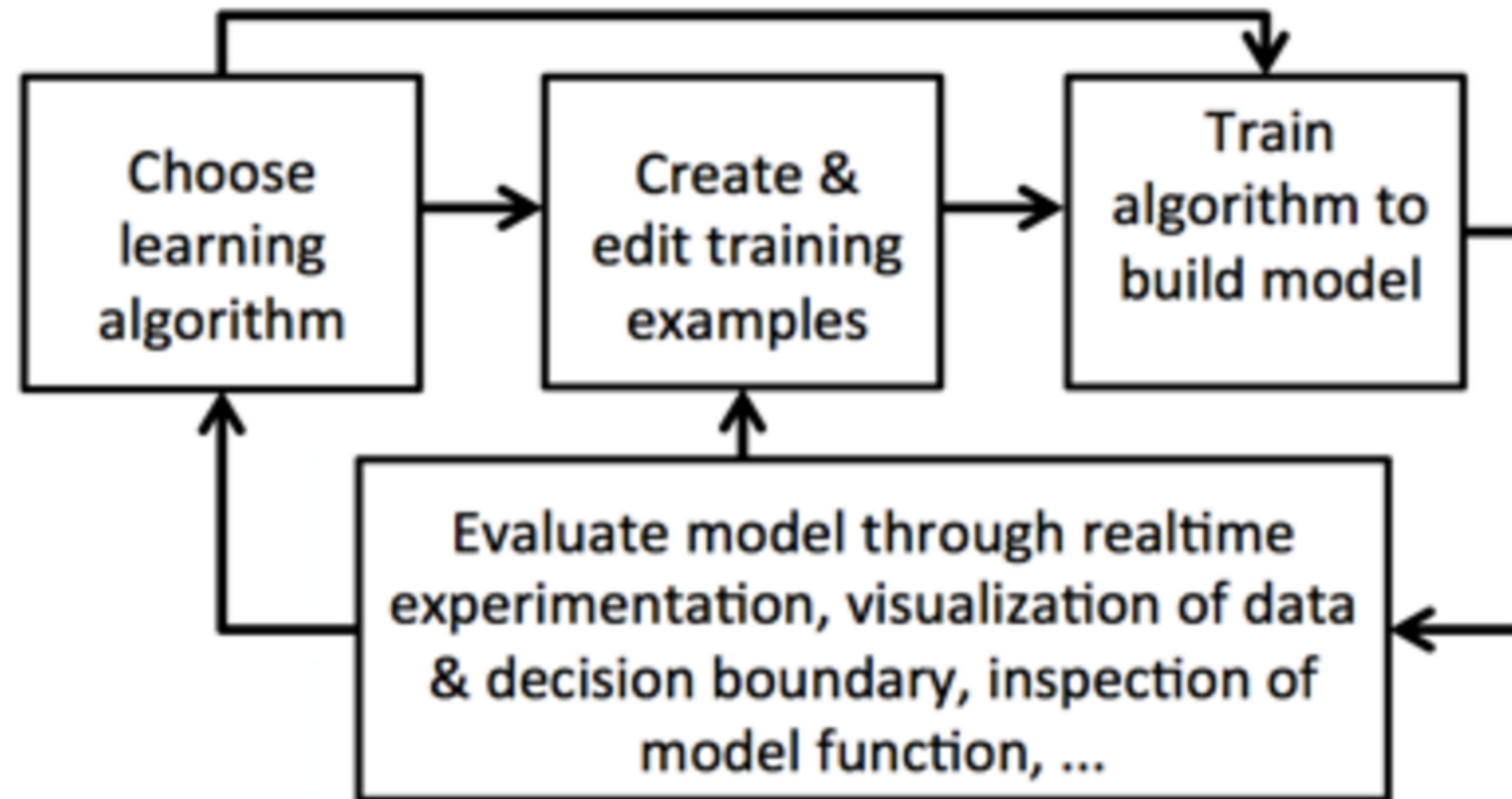
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- **Statistical** (machine learning)

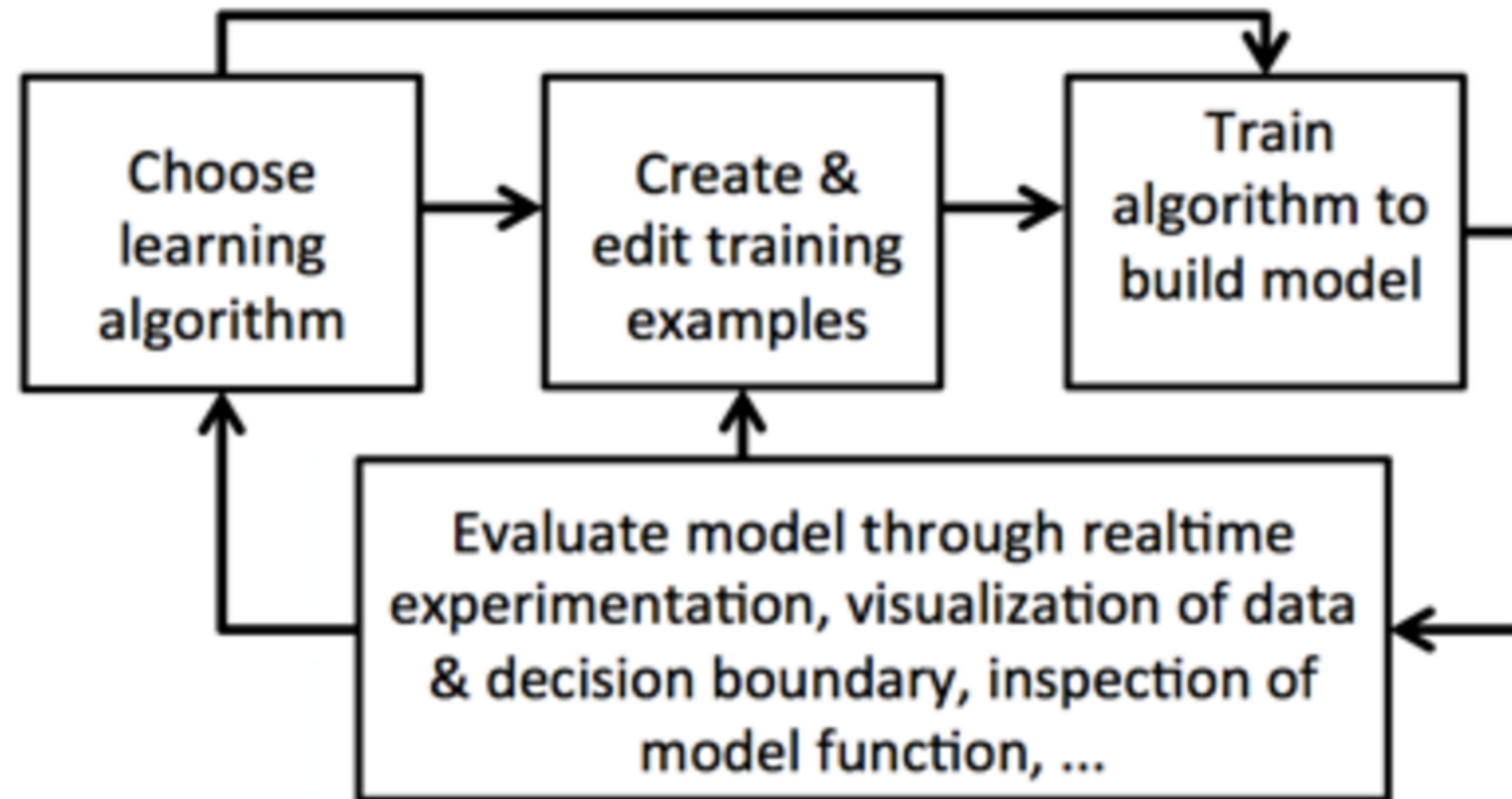
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Interactive Machine Learning

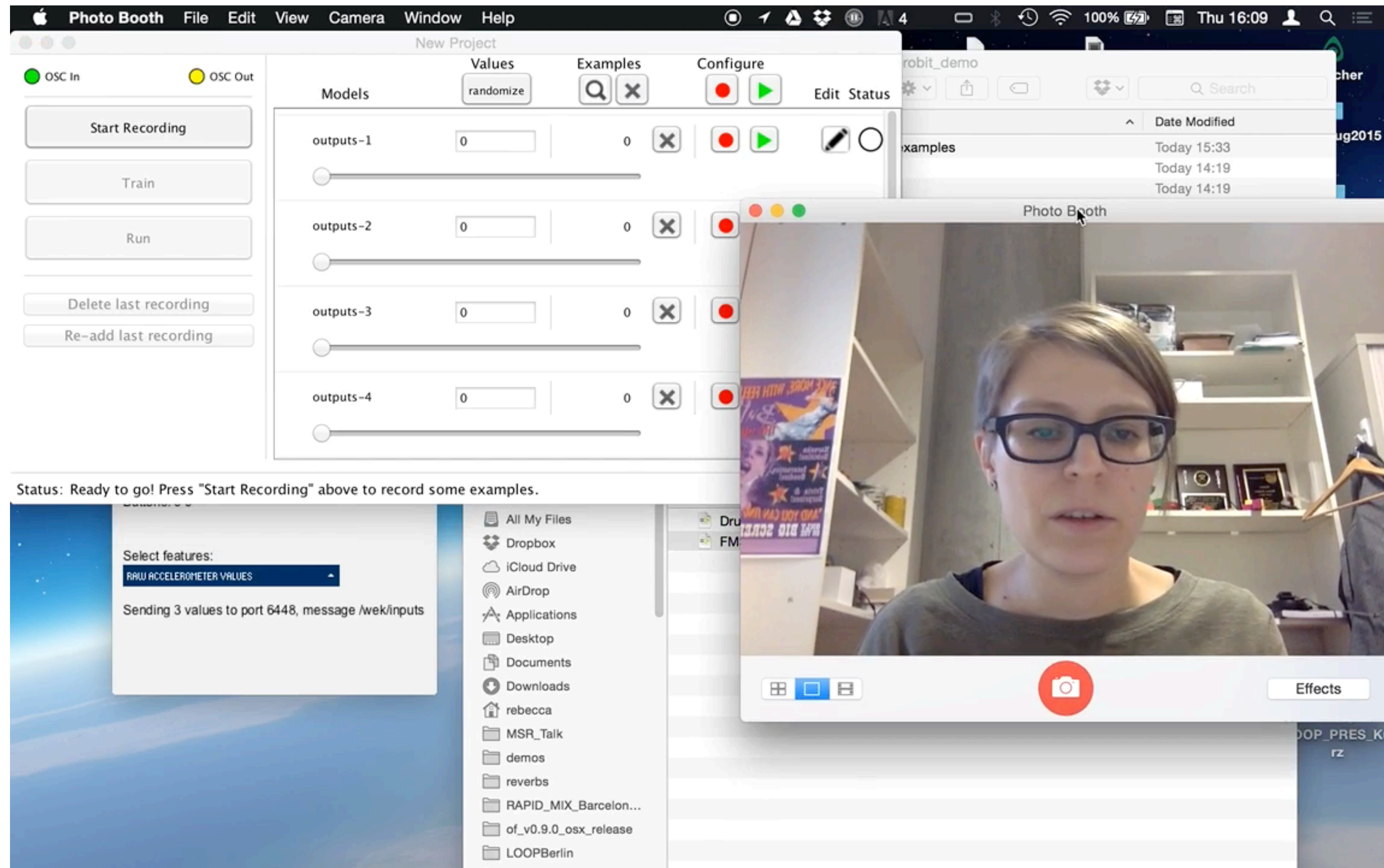


Interactive Machine Learning



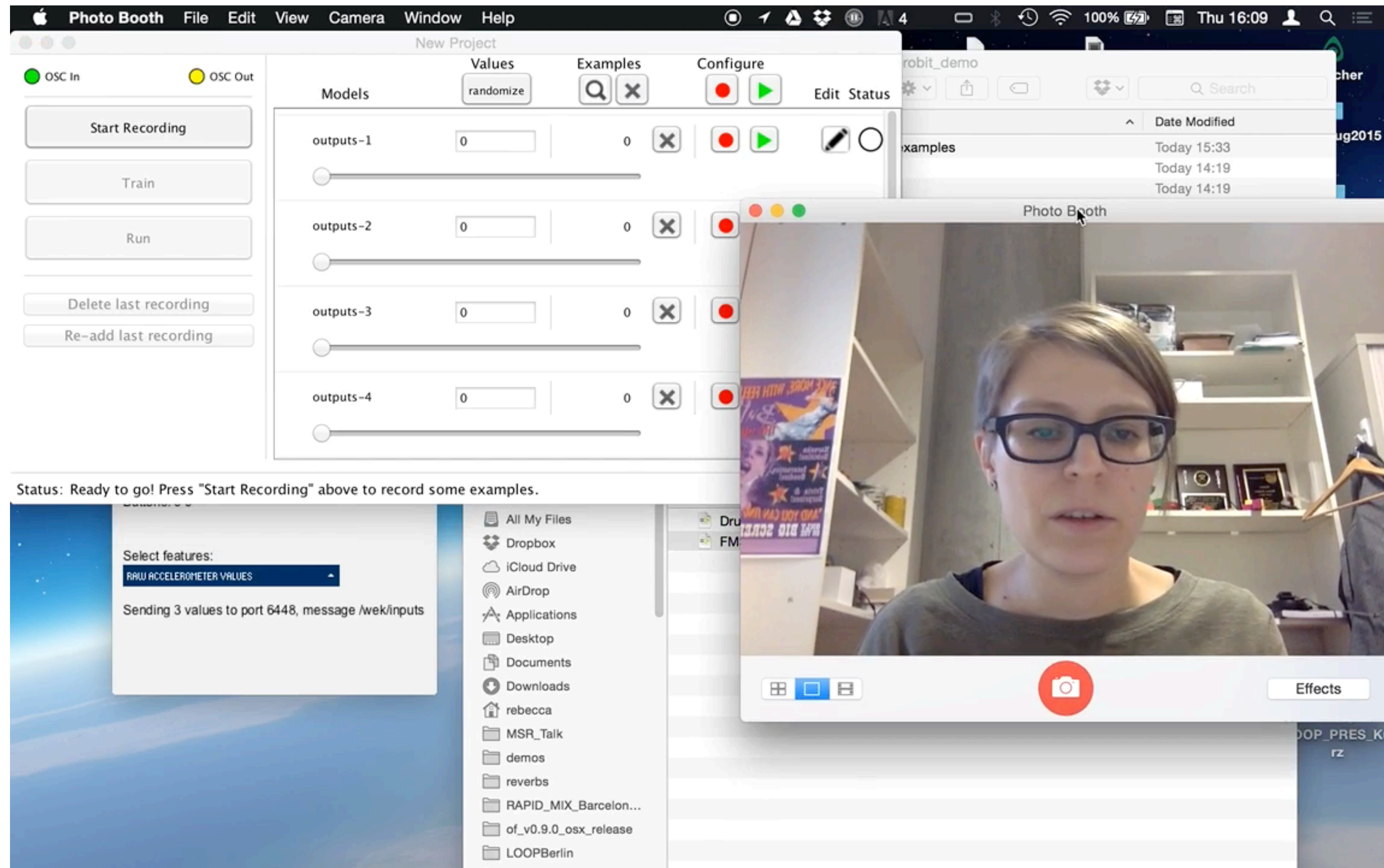
Rebecca Fiebrink

Interactive Machine Learning



Rebecca Fiebrink, *Goldsmiths University of London*

Interactive Machine Learning



Rebecca Fiebrink, *Goldsmiths University of London*

Custom fitness wearables for safe physical training

Leah Petrucelli



Custom fitness wearables for safe physical training

Leah Petrucelli



Micro:bit enables

THE FUTURE
OF CS EDUCATION

Thank you.

ben.shapiro@colorado.edu



College of Engineering & Applied Science
UNIVERSITY OF COLORADO **BOULDER**

ATLAS
INSTITUTE

