Love Letter to the Computer

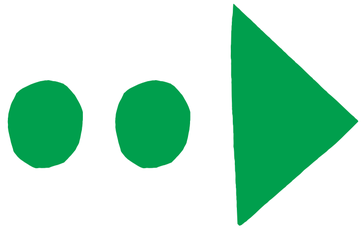
- on Storytelling and Software

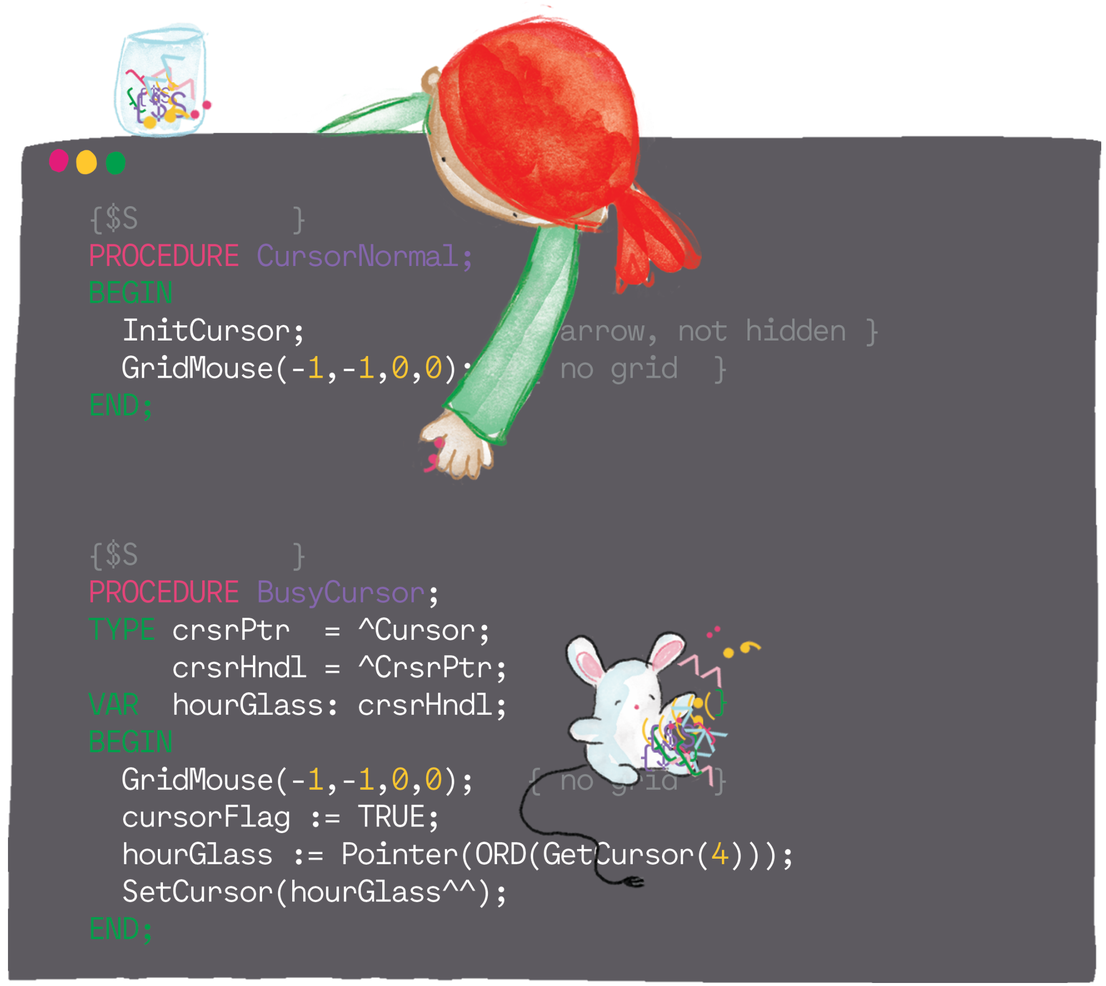
Linda Liukas
@lindaliukas

www.helloruby.com


Author
Illustrator
Programming educator

If code is the new lingua franca, instead of grammar classes, we need poetry lessons.





Stories..

..help us make sense of the world.

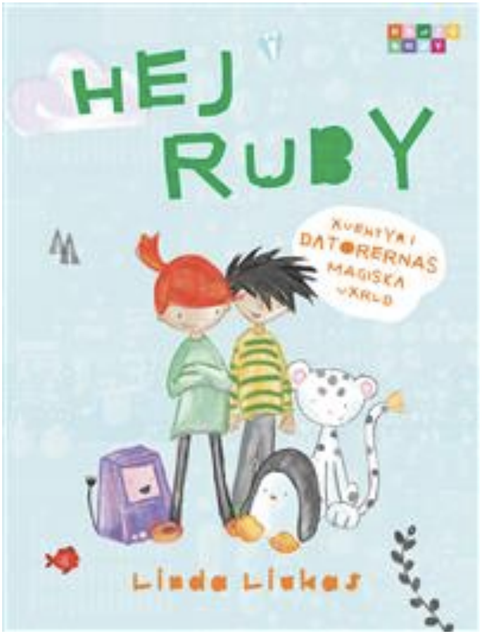
..connect us to ourselves and to each other.


헬로 루비: 코딩이랑 놀자!


ルビィの ぼうけん
こんにちは! プログラミング
リンダ・リウカス 作
島井雪 訳
親子で楽しむ!
世界中で大反響!
プログラマー的思考法を育む知育絵本
プログラマーである作者が、初めてプログラミングに触れる子どもたちのために作り上げた10のストーリー&アクティビティ
リンダ・リウカス

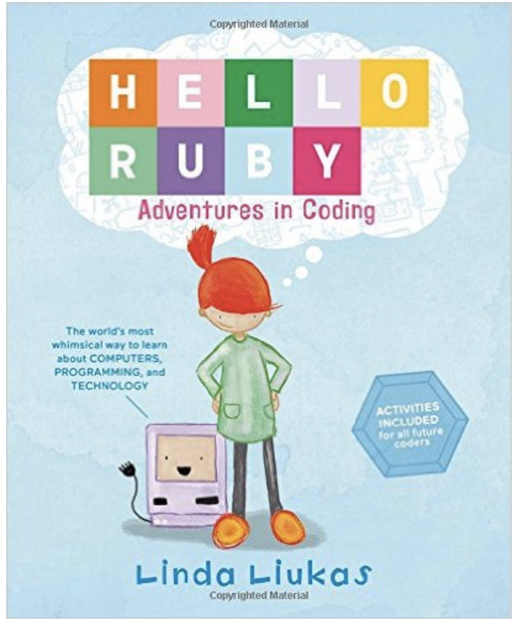

Linda Liukas
À la découverte du codage !
1re approche dès 5 ans
Glénat jeunesse


SVEIKA, RŪBIJ!
AIZRAUJOŠI UZDEVUMI VISIEM TOPOŠAJIEM PROGRAMMĒTĀJIEM
Linda Liukasa


HEJ RUBY
Äventyr i datorernas magiska värld
Linda Liukas


Een avontuurlijk sprookje over programmeren
Linda Liukas


MAAILMAN PARAS KOODI-SATUKIRJA!
Otava
Linda Liukas


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HELLO RUBY
Adventures in Coding
The world's most whimsical way to learn about COMPUTERS, PROGRAMMING, and TECHNOLOGY
ACTIVITIES INCLUDED for all future coders
Linda Liukas
Copyrighted Material


MATKA TIETO-KONEESEEN
Mukana askarreltava tietokone!
Otava
Linda Liukas


HELLO RUBY
TERE, RUBY!
Programmeerimis-seiklused
Sisaldab ülesandeid!
Linda Liukas



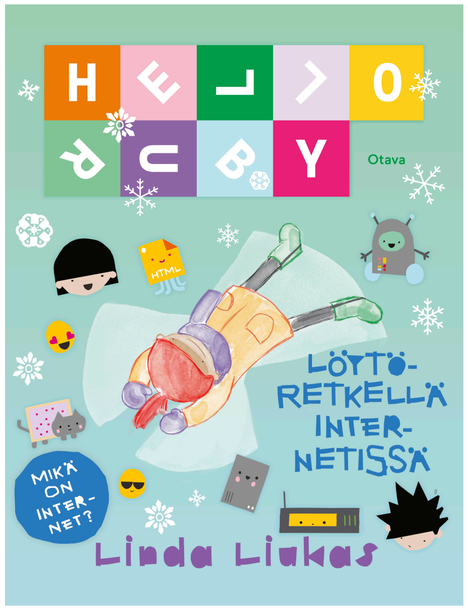
A story of a small girl and a big adventure in thinking like a computer.

- Computational Thinking
- Decomposition
- Algorithms
- Sequences



A twist on Alice in Wonderland: Ruby falls inside a computer!

- Hardware of computers
- Software of computers
- Input/output
- Sensors
- What are computers?



What if you could build the Internet out of snow?

- Networks and infrastructure
- Hardware of Internet
- Software of Internet
- Applications
- Staying safe online



A modern Pinocchio: Ruby wants to take the robot to school to learn

- AI and Machine Learning
- Computers vs. Humans
- Bias in AI
- What AI can do?

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HELLO RUBY

Meet Ruby About Books Play Teach



HELLO RUBY

PROGRAMMIER DIR DEINE WELT

Mit Hello Ruby kann man auf die wohl wundersamste Weise der Welt etwas über Computer, Technik und Codes lernen.

Hallo!

Intro
Wenn Roboter zur Schule gehen
Expedition ins Internet
Die Reise ins Innere des Computers
Programmier dir deine Welt
Spiele
Freunde
Presse
FAQ

Die Geschichte begann mit einem Buch, und nun setzt Ruby ihre Abenteuer in Form von Übungen, Spielen und Apps fort. Hello Ruby eignet sich für Kinder ab fünf Jahren – doch können selbst Erwachsene vielleicht noch etwas dazulernen.

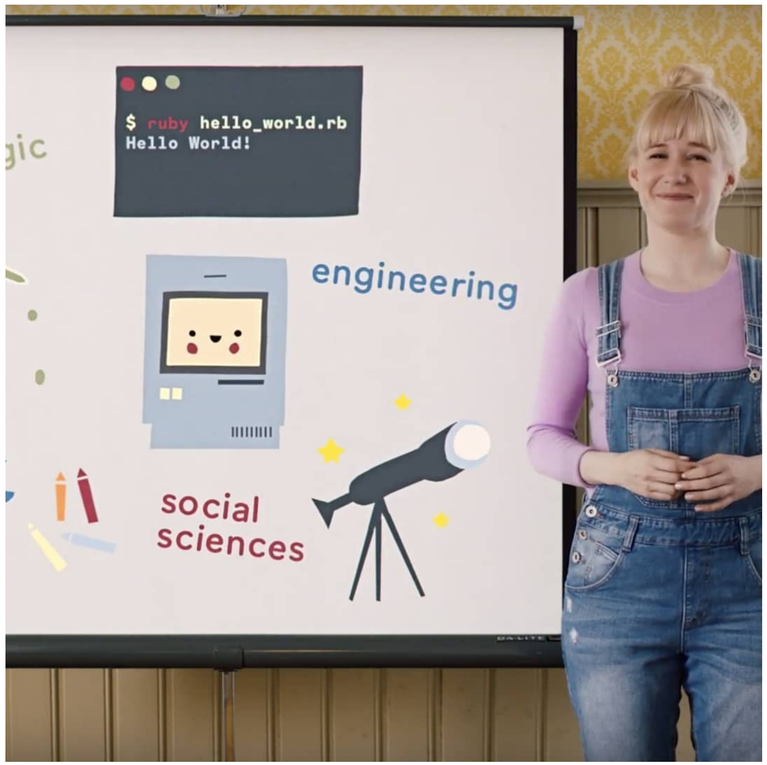
Wenn Roboter zur Schule gehen



Was ist künstliche Intelligenz?

Julia hat das beste Spielzeug der Welt: einen intelligenten und niedlichen kleinen Roboter. Ruby und Julia meinen, dass der Roboter mehr lernen sollte. Aber gehen Roboter zur Schule?

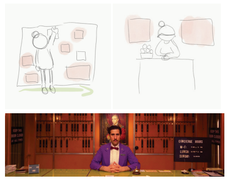






helloruby.com/
loveletters

PICTURE TYPES



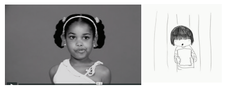
DESK AND WALL
Linda by the desk and hanging stuff on the wall. Mid-shot, mediun closeup, closeup.



ANIMATION
Linda in front of an old-school screen. Animations appear here in text or vector images. Mid-shot or medium closeup.



CLASSROOM
Kids crafting, building, answering, playing. There are a few shots that require long shots.



KIDS TO CAMERA
Medium close-up, kids either asking question for next episode, pronouncing computer science concepts or explaining what they've built.



BIRDS EYE / SURFACE
Used for illustrating concepts through everyday objects. Background/surface changes.



INTRO
The theme of the episode appears in the envelope, shot on a surface.

COLOR SCHEMES & STYLE

All colors are muted, also in animation.



The pictures should be symmetric, with pops of color and playfulness.



MEET THE CAST



Luna, 10 years Lamin, 9 years Pierce, 8 years Eila, 7 years Pratyush, 8 years Sarah, 8 years

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HELLO RUBY - TEACHER TRAINING VIDEOS - VERSION 1

Hello Ruby

EPISODE 1: WHAT IS COMPUTER SCIENCE

0.00-0.30- 1. INTRO
A stop motion animation of paper envelopes stacking up, with hand written episode names on them. Finally, episode 1 envole appears, with title COMPUTER SCIENCE.

0.30-1.00- 2. INT - DESK
LINDA LIUKAS, in her chair, drawing/building/doing something. We get to know who she is and why she is on a mission. The space is colorful, full of odd details mixing up computers and classroom.

LINDA

Hi! I'm Linda Liukas, a children's book author, illustrator and programmer.

This series is a love letter to the computer and it's intended for you, the curious and creative teacher.

0.30-0.40 - 3. INT - DESK

LINDA, turning around and pointing at the globe: New York, Tokyo, setting credibility.

LINDA

For the past five years I've worked with primary school teachers around the world, helping them see computer science the way I see it:

0.40-1:00 - 4. INT - DESK
LINDA, showing pictures of ADA LOVELACE, JOSEPH MARIA JACQUARD, CHARLES BABBAGE AND CLAUDE SHANNON.

LINDA

Computers are of the crowning intellectual achievement of the twentieth century. Bringing them to the world required so many different talents: from a daughter of a poet and mathematician, to a jacquard loom maker with his punch cards, an inventor obsessed with cogs and steam, an electrical engineer who combined laws of electrical circuits with eccentric English mathematical logic and countless other philosophers, material scientists, artists, dreamers and tinkerers.

Computers are about humans, and their big ideas.

1.40-2.00 - 5. INT - DESK
Partly voice over, Linda drawing on margins of books little doodles

LINDA

But that's not the way computer science is for most us. For most of us, computer science is boring, mechanical, inaccessible and complex.

That's why Hello Ruby was born, literally in the margins of my computer science books, explaining computing in a playful and gentle way. And that's the world I want to show you.

2.00 - 3:00 - 6. INT - ANIMATION

Linda at the screen.

LINDA

Computer science is not coding. Programming is for computer science the same as pipettes in chemistry, brushes for an artist or telescope to an astronomer.

Another thing computer science isn't is learning to use spreadsheets, sending emails or searching the Internet. It's not e-skills, ICT skills or digital literacy. And it definitely isn't something digital natives know how to do by playing with their mobile phones.

We often think that computer science is about studying the computer, like physics is about understanding the physical world, but this is not true either.

LINDA

So what is computer science? It's the science of using computers to solve problems. Information is the thing that computer science is fascinated with: how we represent, store, manipulate and present it.

And, turns out, more and more of the big problems in science, biology, economy, engineering and healthcare can be solved effectively by working together with a computer.

3:00 - 3:10 - 7. INT. - STUDIO KIDS

are probably hundreds of computers in our homes and we interact with hundreds of others in our daily lives.

3.00-4.00 - 10. INT. -ANIMATION
Pictures of a car, a grocery store, a dog and a toilet.

Linda

Which one of these do you think is a computer? None you might think.

But you know a car is a computer, it has a navigation system inside of it. And a dog -- a dog might not be a computer, but it has a collar and the collar might have a computer inside of it. And grocery stores, they have so many different kinds of computers, like the cashier system and the burglar alarms. And kids, you know what? In Japan, toilets are computers and there's even hackers who hack them.

4.00-5:00 - 11. INT. - BIRDS EYE
Surface where Linda organises everyday items.

LINDA

And we go further and I give the children these little stickers with an on/off button on them. And I tell the kids, "Today you have this magic ability to make anything in this room into a computer."

LINDA

And then I had this little girl who came to me and took a bicycle lamp and she said, "If this bicycle lamp were a computer, we could go on a biking trip with my father and we would sleep in a tent and this biking lamp could also be a movie projector." And that's the moment I'm looking for, the moment when the kid realizes that the world is definitely not ready yet, that a really awesome way of making the world more ready is by building technology and that each one of us can be a part of that change.

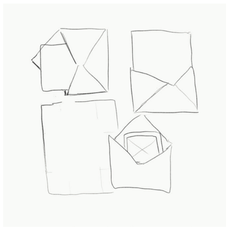
5.00-5.30 - 12. INT. - ANIMATION
Definition of technology animated at the screen.

Linda

This is the last generation of kids that will remember a computer by the keyboard and the screen. The next generation is already chatting away with computers.

Linda

EPISODE 1: COMPUTER SCIENCE



SHOT 1: INTRO

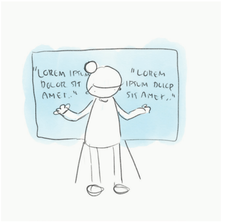


SHOT 2-3: DESK
Introduction to Linda and the series. Possibly bring Ruby books.

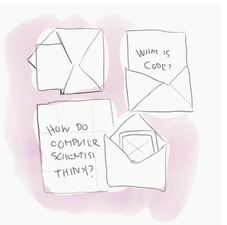




SHOT 10: DESK



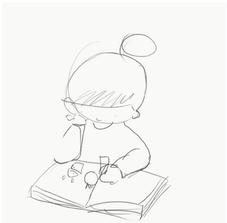
SHOT 11: ANIMATION



SHOT 13: BIRDSEYE



SHOT 4: DESK/WALL



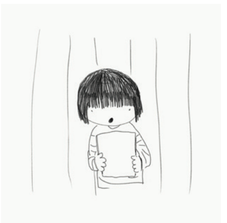
SHOT 5: DESK
Partly voice-over.



SHOT 6: ANIMATION
First time with the animation!



SHOT 14: DESK



SHOT 12: OUTRO



Databases

big-● Data structures

Binary trees P=NP?

Memory allocation

Distributed programming

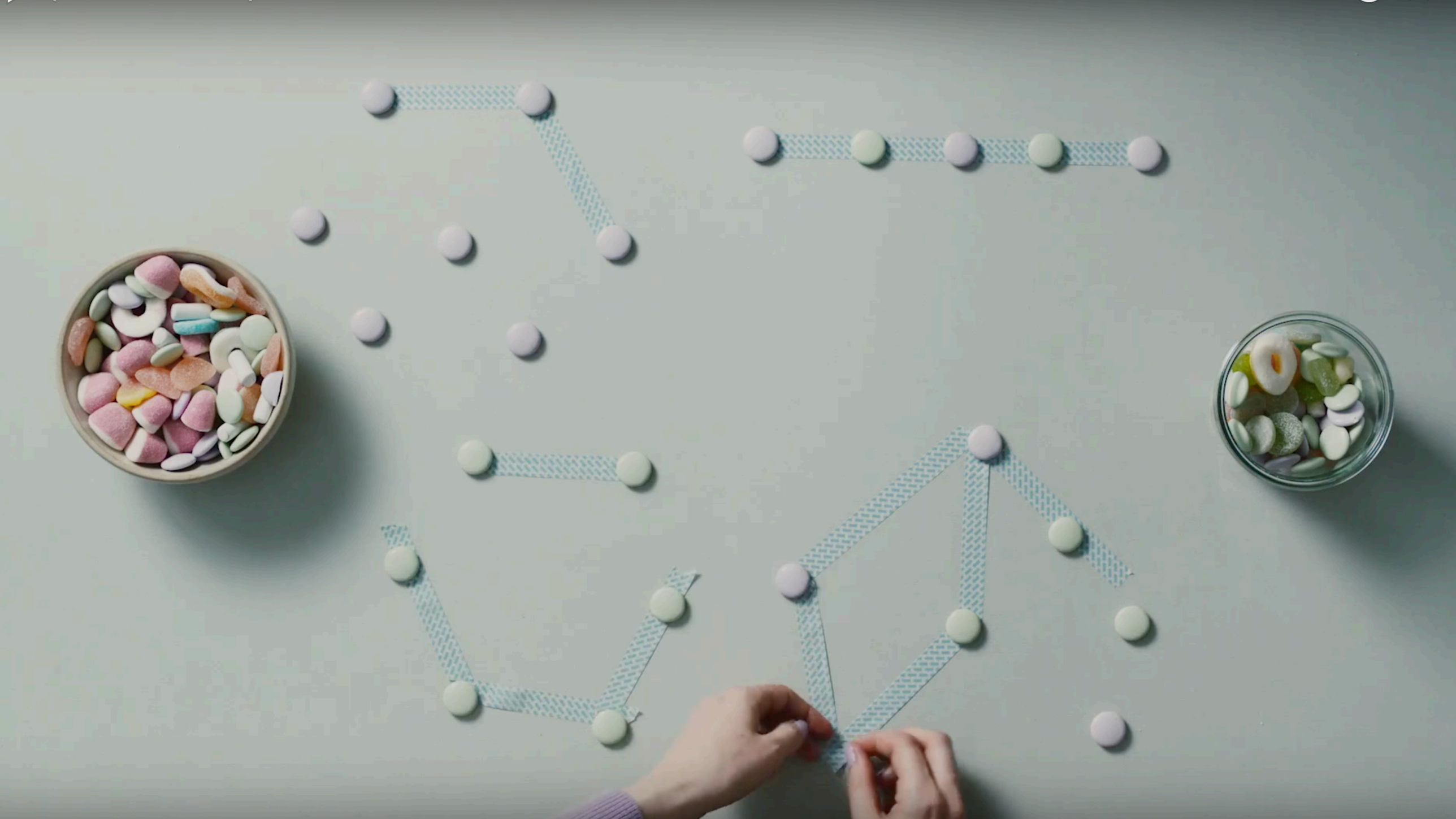










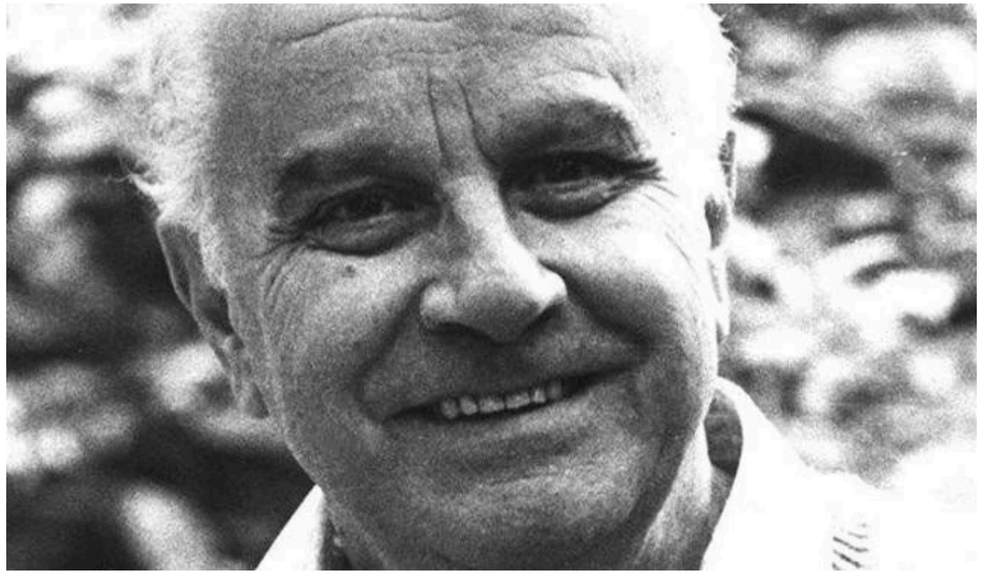


“Computer Science is no more about computers than astronomy is about telescopes.”
– Dijkstra



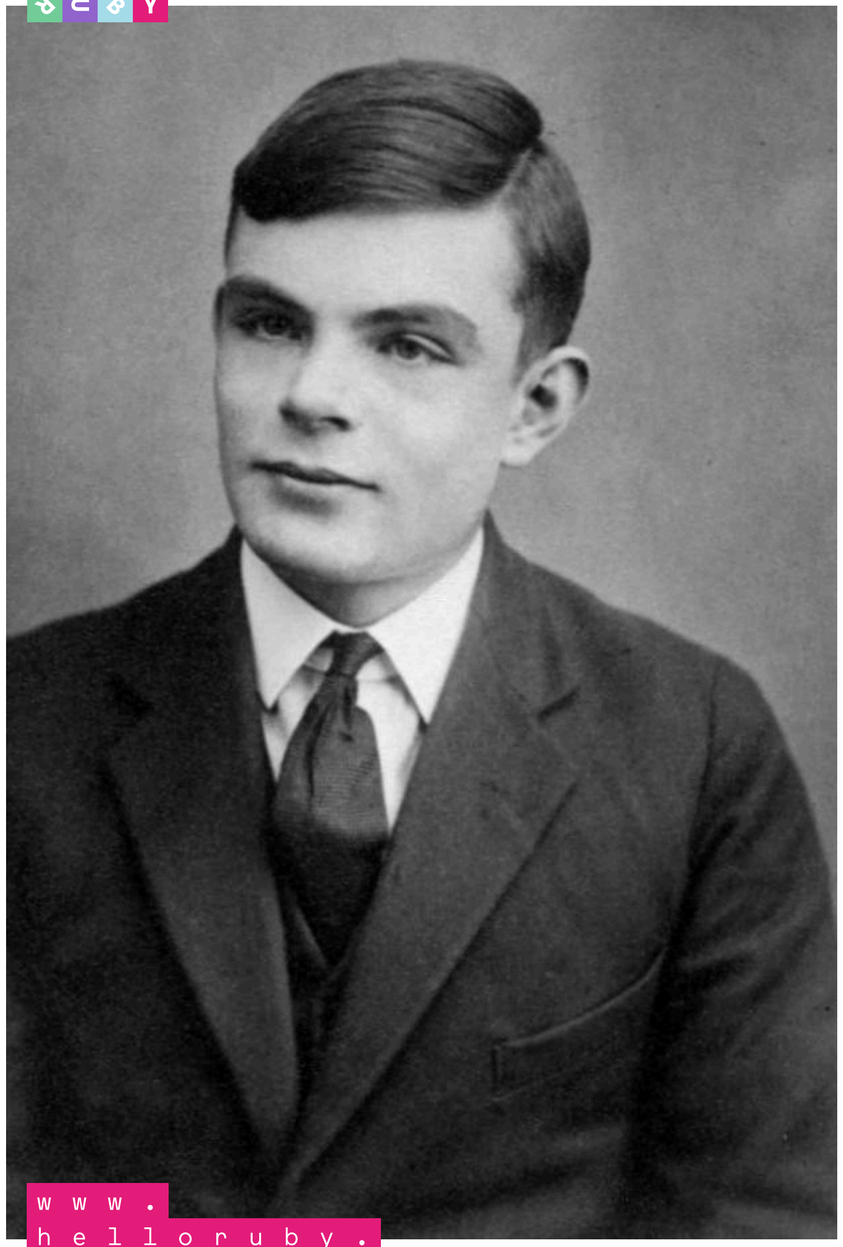






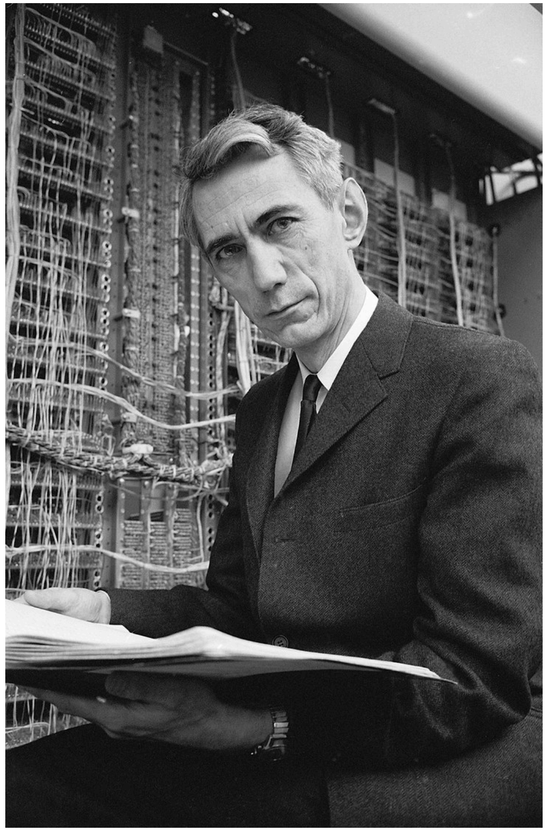


Montessori, Piaget, Papert, Malaguzzi, Tove Jansson











Turing, von Neumann,
Boole, Lovelace, Shannon,
Bush, Kay

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"In most mathematical lessons the whole difference lies in the fact that the student is asked to accept from outside an already **entirely organised intellectual discipline** which he may or may not understand"
- Jean Piaget

"Don't present students with **pre-organised vocabulary and concepts,** but rather provide students with a **learning environment grounded in action.**"
- Jean Piaget


Curiosity

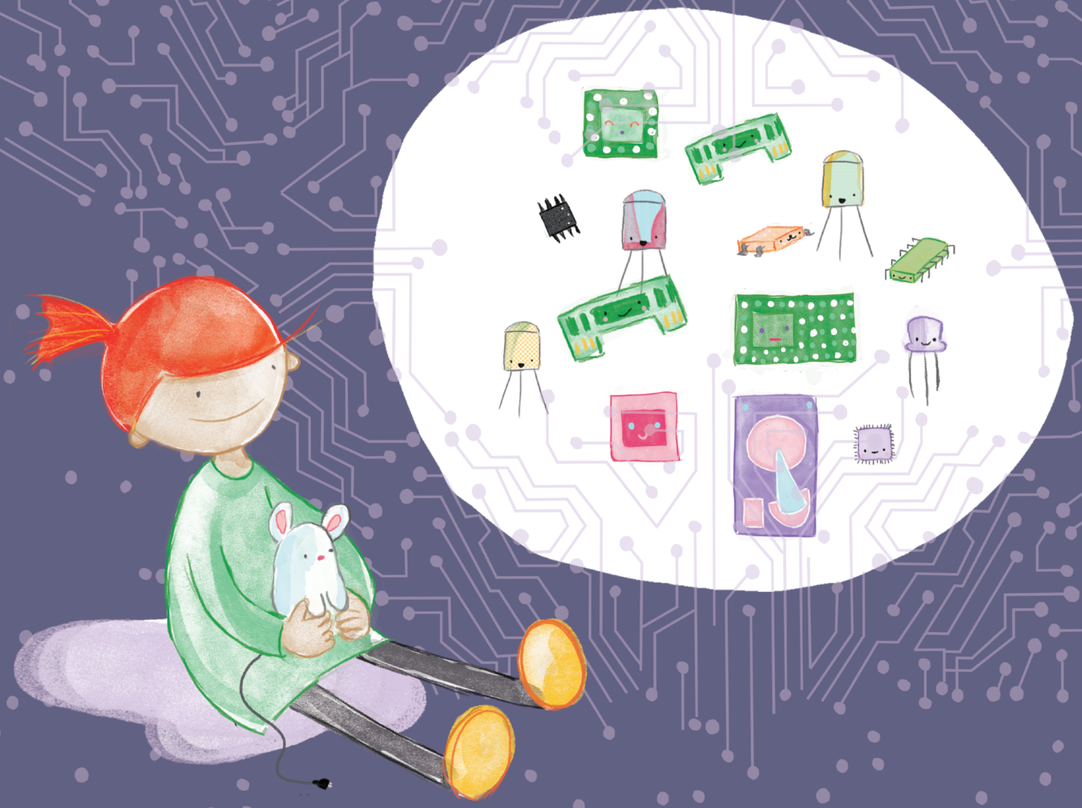
Fearlessness



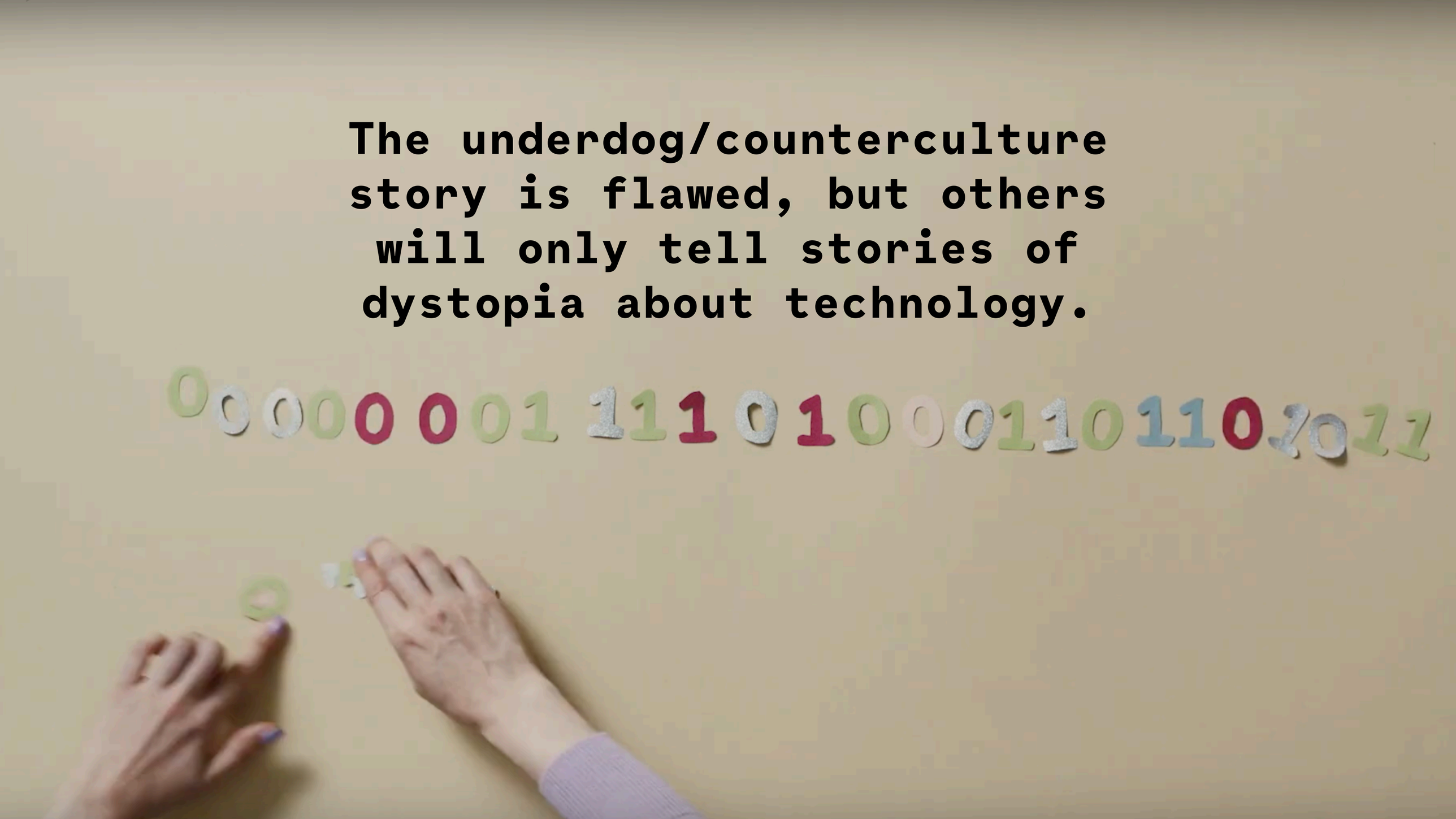
Wonder



Preparing kids for a world where so many problems are computer problems.



The underdog/counterculture story is flawed, but others will only tell stories of dystopia about technology.



THE UNDERDOG STORY

Cinderella, Rocky,
The Tech Industry

ACTUALLY, YEP!

NOPE!

Change
Circumstance

STARTS and STOPS

Inner resolve

Coach

Enemy

Given a chance







Character want's what they can't get

NEW LIFE

ABC



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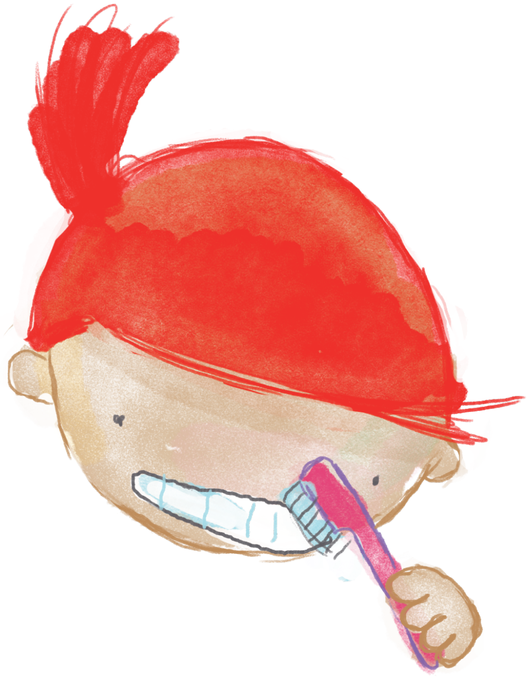
A is for algorithm

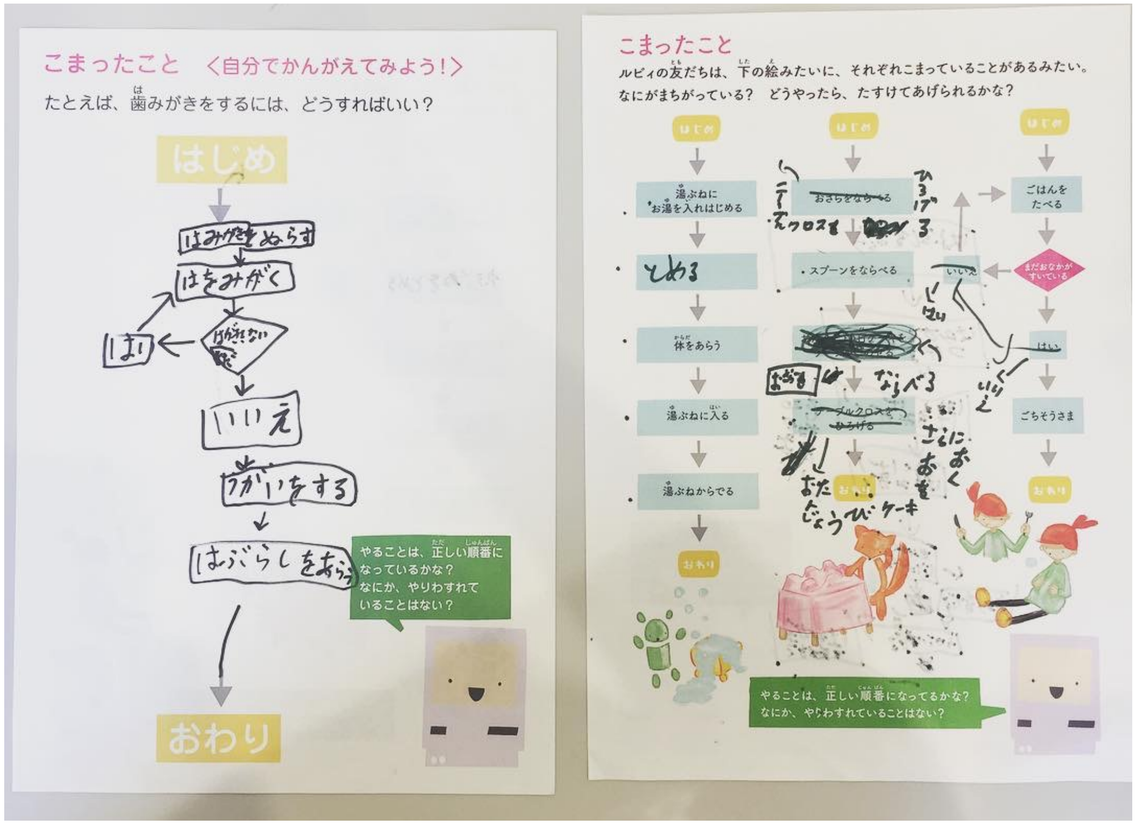


START

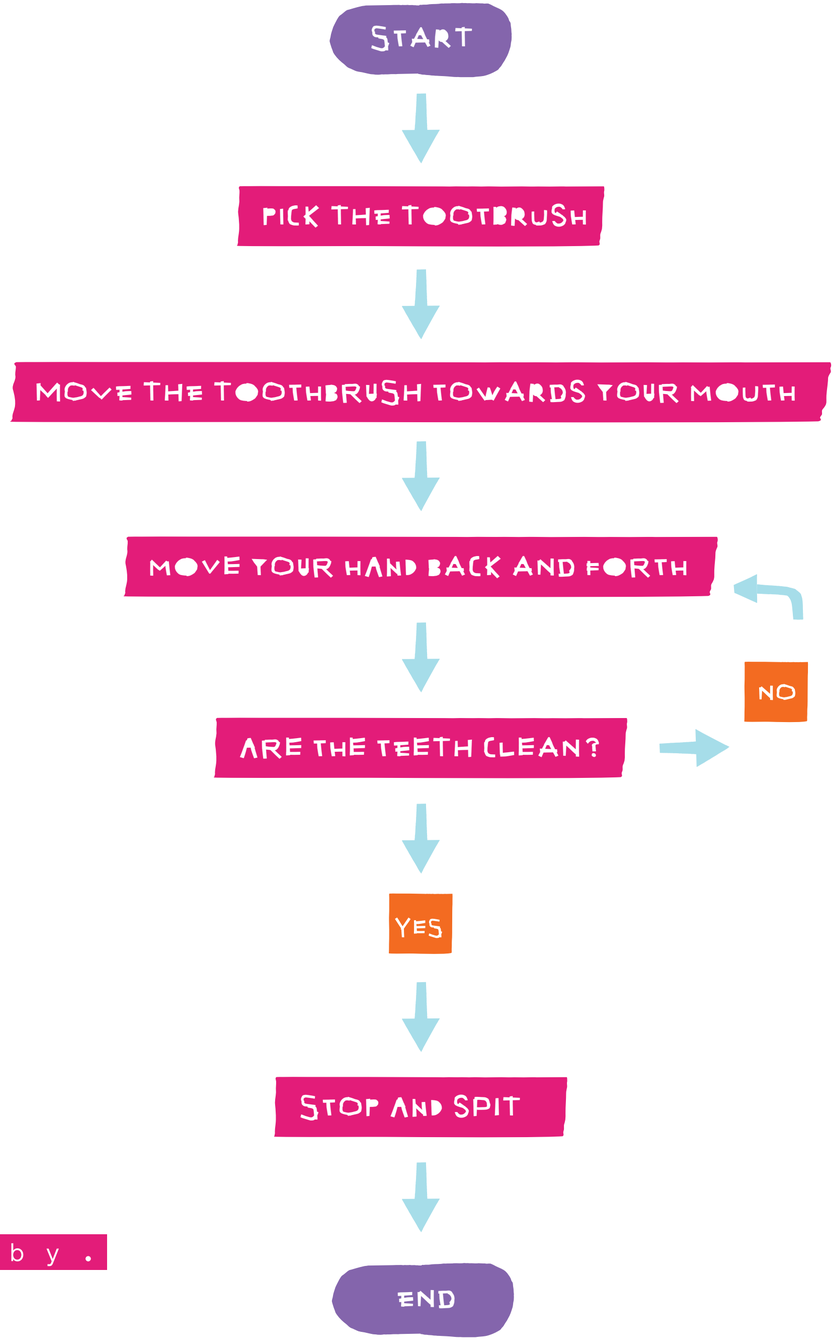
END

BRUSH YOUR TEETH




こまったこと　〈自分でかんがえてみよう!〉
たとえば、歯みがきをするには、どうすればいい？
はじめ
はみがきをぬらす
はをみがく
はい
いいえ
うがいをする
はぶらしをあらう
おわり
やることは、正しい順番になっているかな？
なにか、やりわすれていることはない？
こまったこと
ルビィの友だちは、下の絵みたいに、それぞれこまっていることがあるみたい。
なにがまちがっている？　どうやったら、たすけてあげられるかな？
はじめ
湯ぶねにお湯を入れはじめる
ためる
体をあらう
湯ぶねに入る
湯ぶねからでる
おわり
おさらをならべる
スプーンをならべる
ごはんをたべる
まだおなかがすいている
いいえ
はい
ごちそうさま
おわり
やることは、正しい順番になってるかな？
なにか、やりわすれていることはない？

HOW DID IT GO?



... do we know what a toothbrush is?

.. what about the toothpaste?

.. remember to open the toothpaste?

.. remember to stop moving your hand towards the mouth!

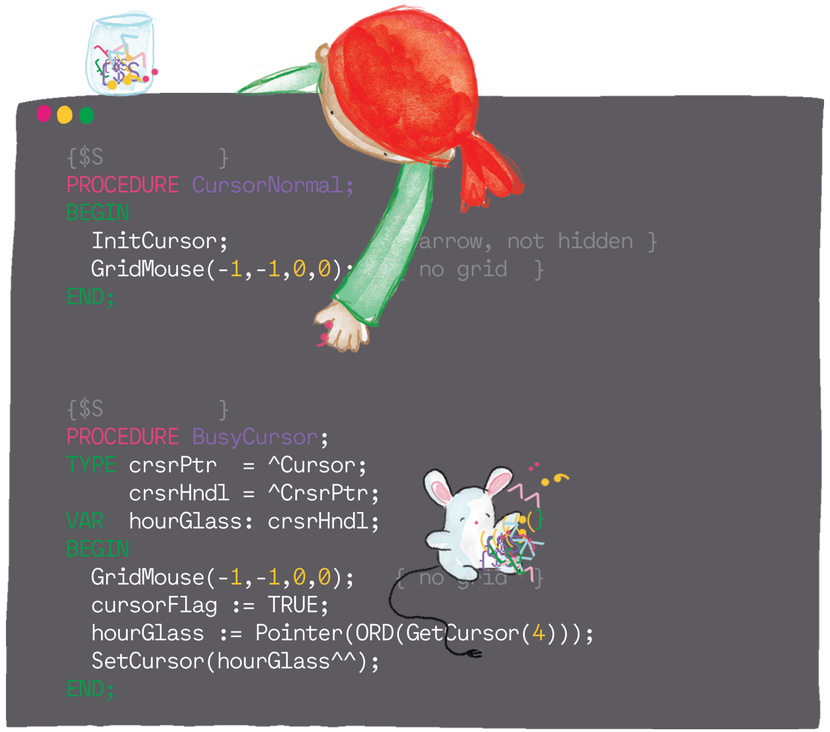
.. defining clean

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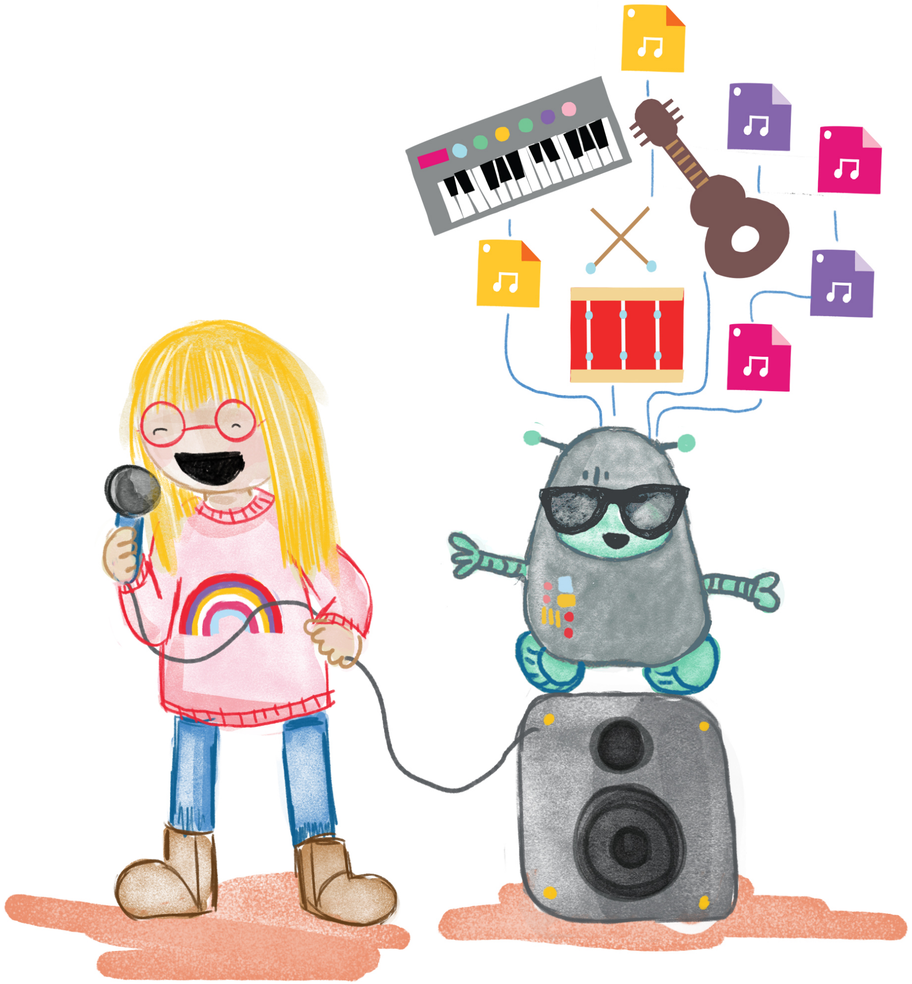
Pair programming

The other one drives, the other one gives instructions.

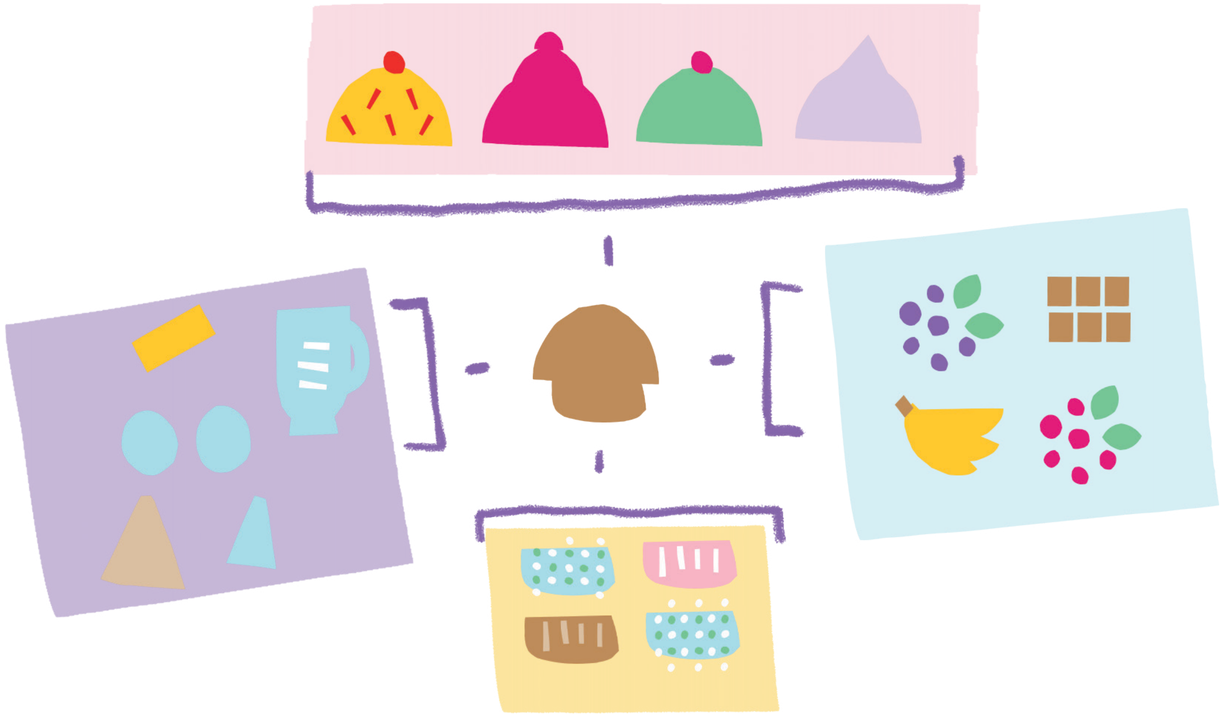


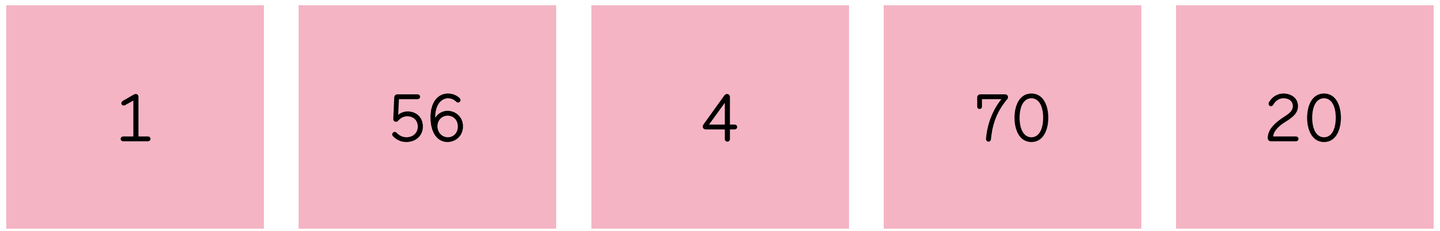
Debugging

1. Explain to three friends what you tried to do before asking teacher.
2. Explain in English. Draw. Act. Talk to a rubber duck.



Creativity



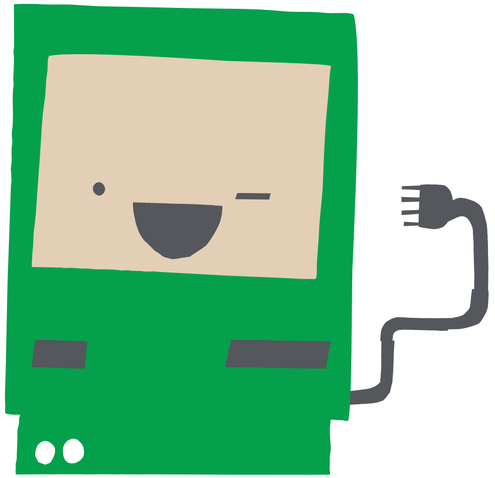

1
56
4
70
20

1	56	8	67	71
78	24	4	33	20
45	81	2	70	10
1	66	98	89	82

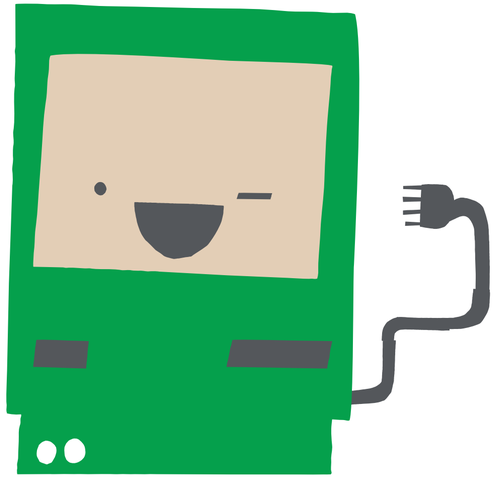


	715	1	56	8	67	71	820	71
71	71	455	56	8	67	71	677	712
20	20	78	24	343	433	20	201	20
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322	821	1	66	98	89	82	82	82
		71	1	56	435	67	171	71

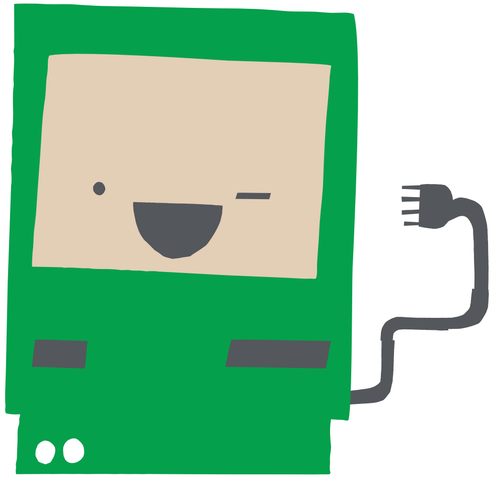
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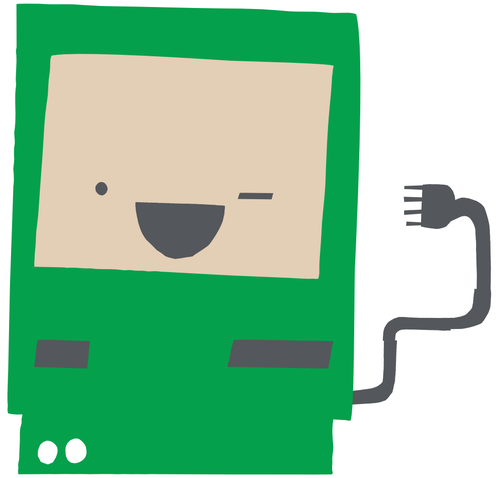
1	56	4	70	20



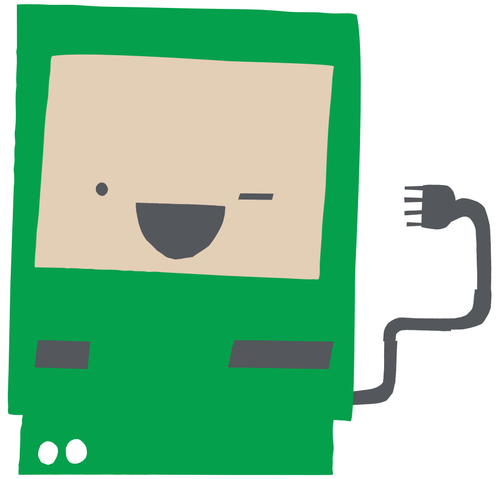
1	56	4	70	20



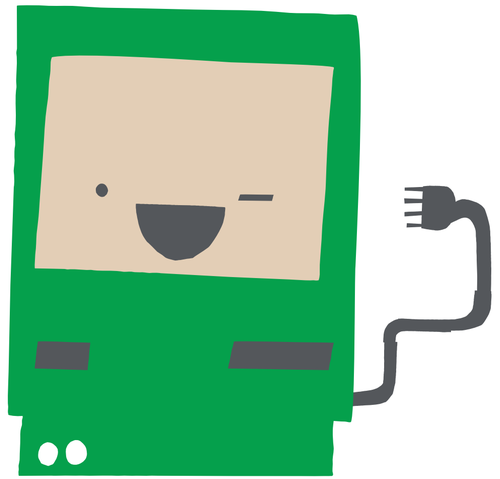
1	4	56	70	20



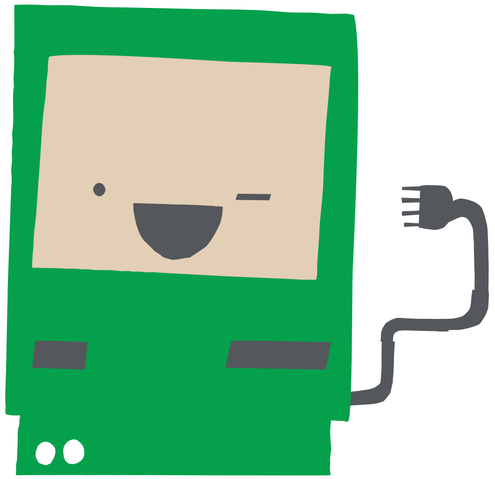
1	4	56	70	20



1	4	56	70	20



1	4	56	20	70



1	4	56	20	70

This is called bubble sort algorithm.

```
do
  swapped = false
  for i = 1 to indexOfLastUnsortedElement-1
    if leftElement > rightElement
      swap(leftElement, rightElement)
      swapped = true
while swapped
```



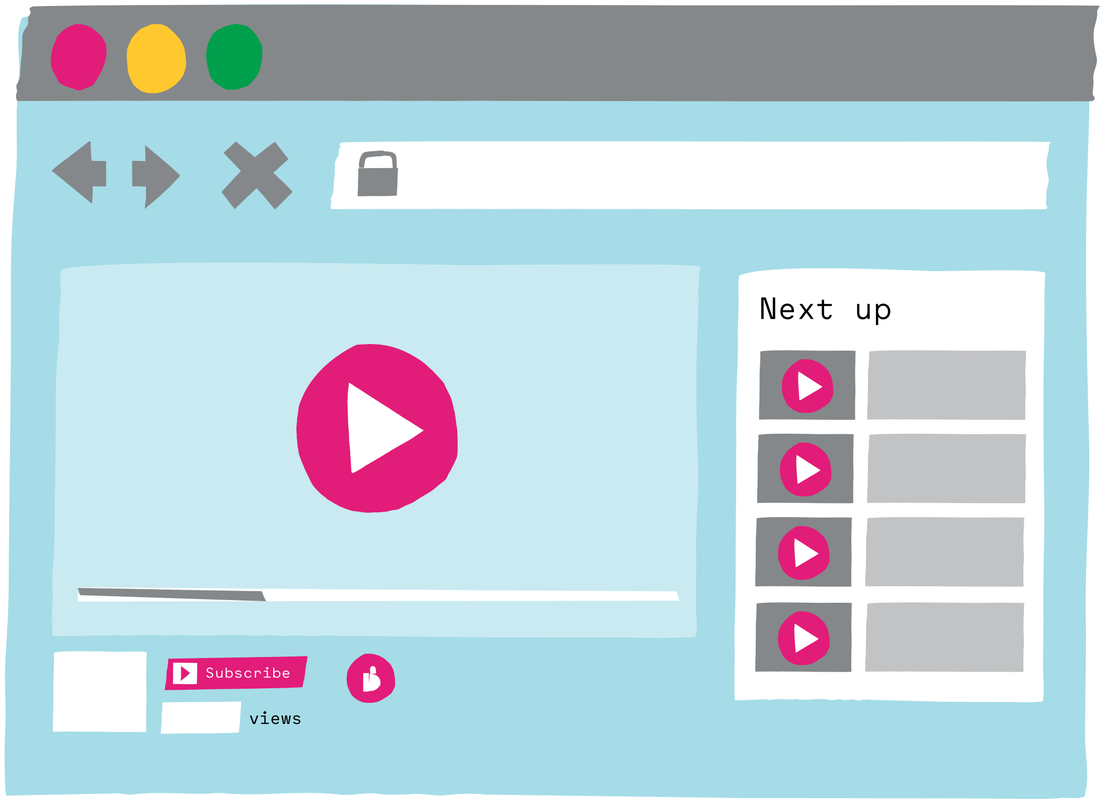
Where is the algorithm?



Where is the algorithm?



Where is the algorithm?



‘Surprise Play Doh Eggs Peppa Pig Stamper Cars Pocoyo Minecraft Smurfs Kinder Play Doh Sparkle Brilho’;



Computational thinking

CONCEPTS

Data

Pattern recognition

Logical & critical thinking

Algorithms

Decomposition

Abstraction

PRACTICES

Automation

Persistency

Systems thinking

Tinkering

Collaboration

Debugging

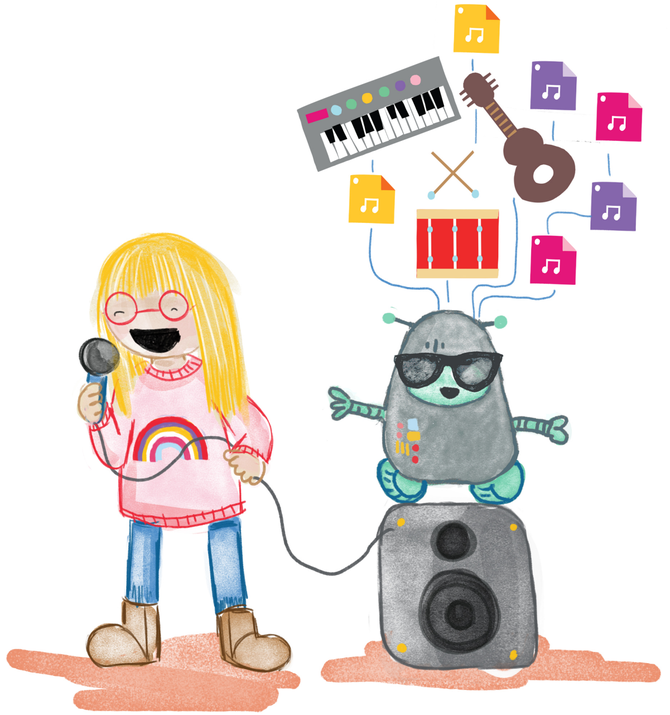
Creativity

Computational thinking

Thinking about problems in a way that allows computers to solve them. Computational thinking is something people do, not computers. It includes logical thinking and the ability to recognise patterns, think with algorithms, decompose a problem, and abstract a problem.

B is for

(boolean) logic



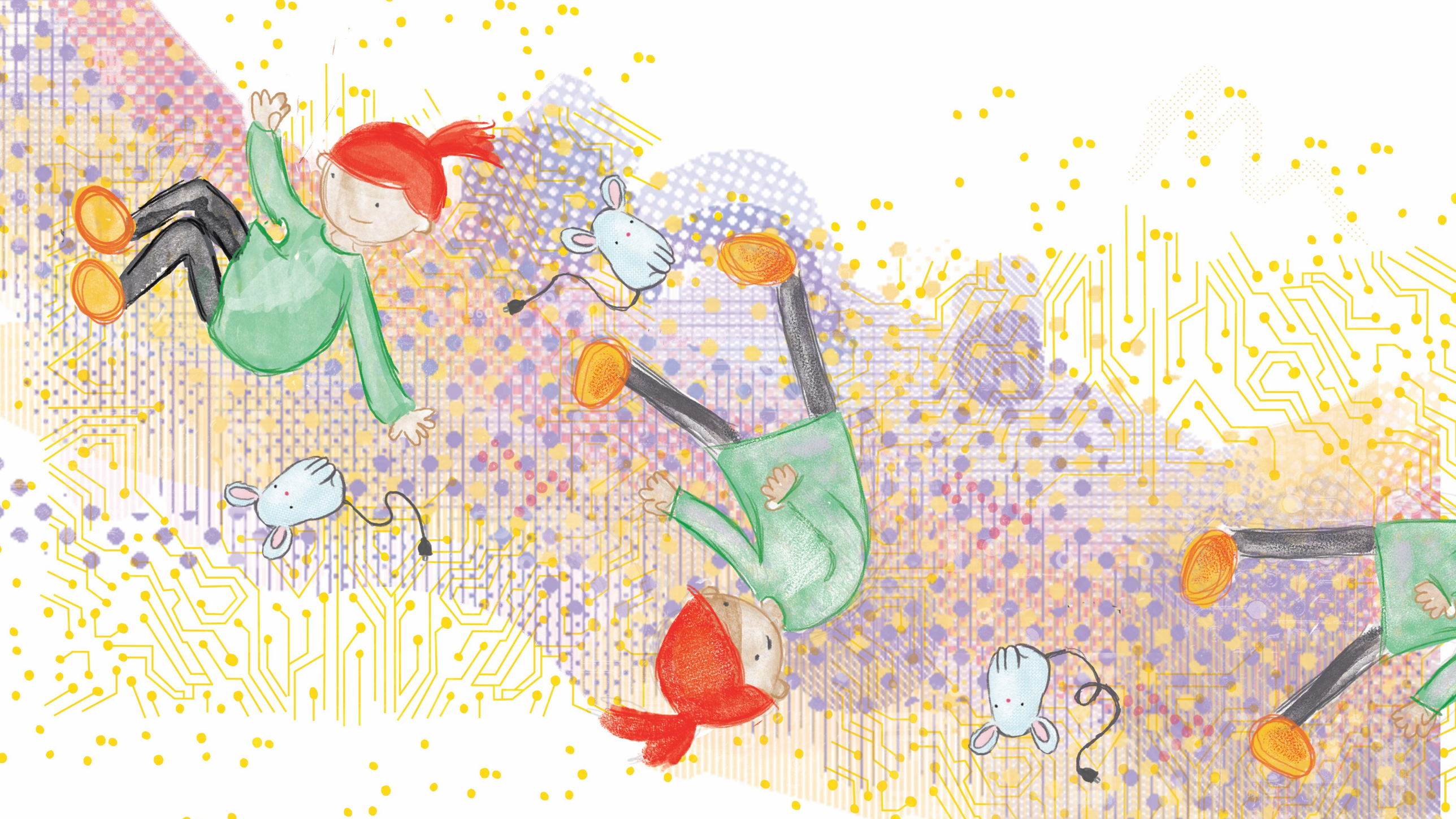


Computers
are
abstraction
machines.



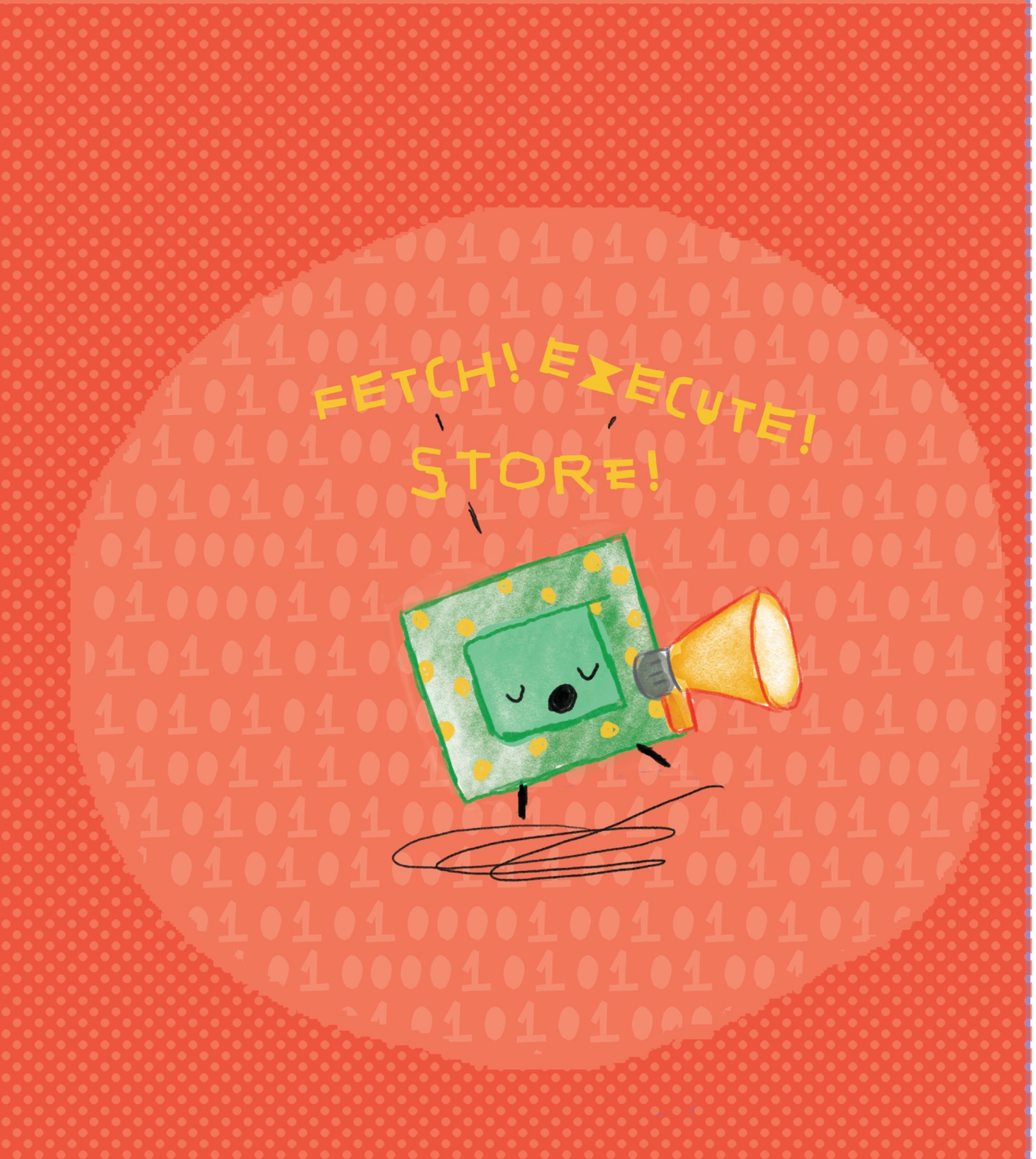


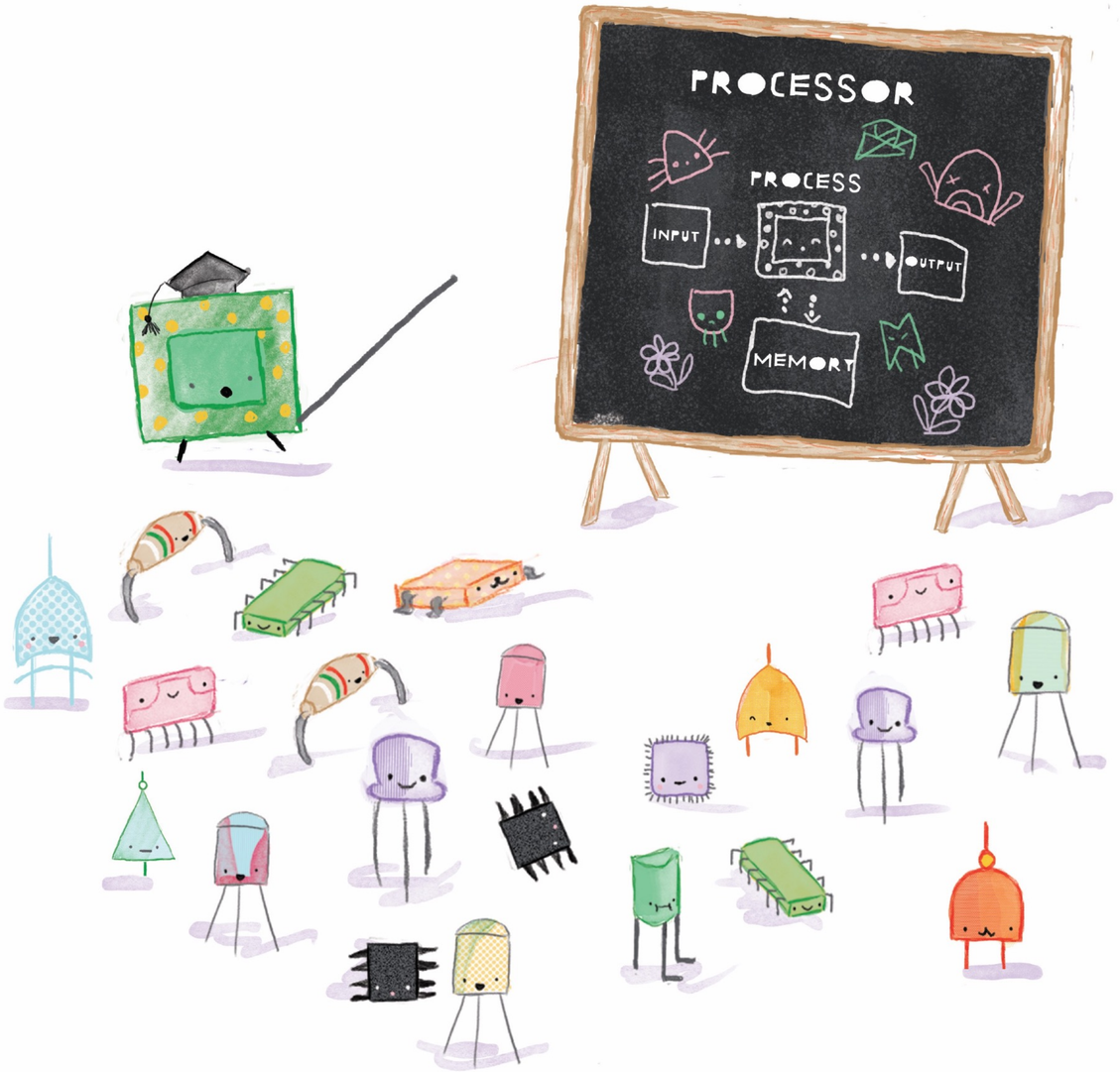


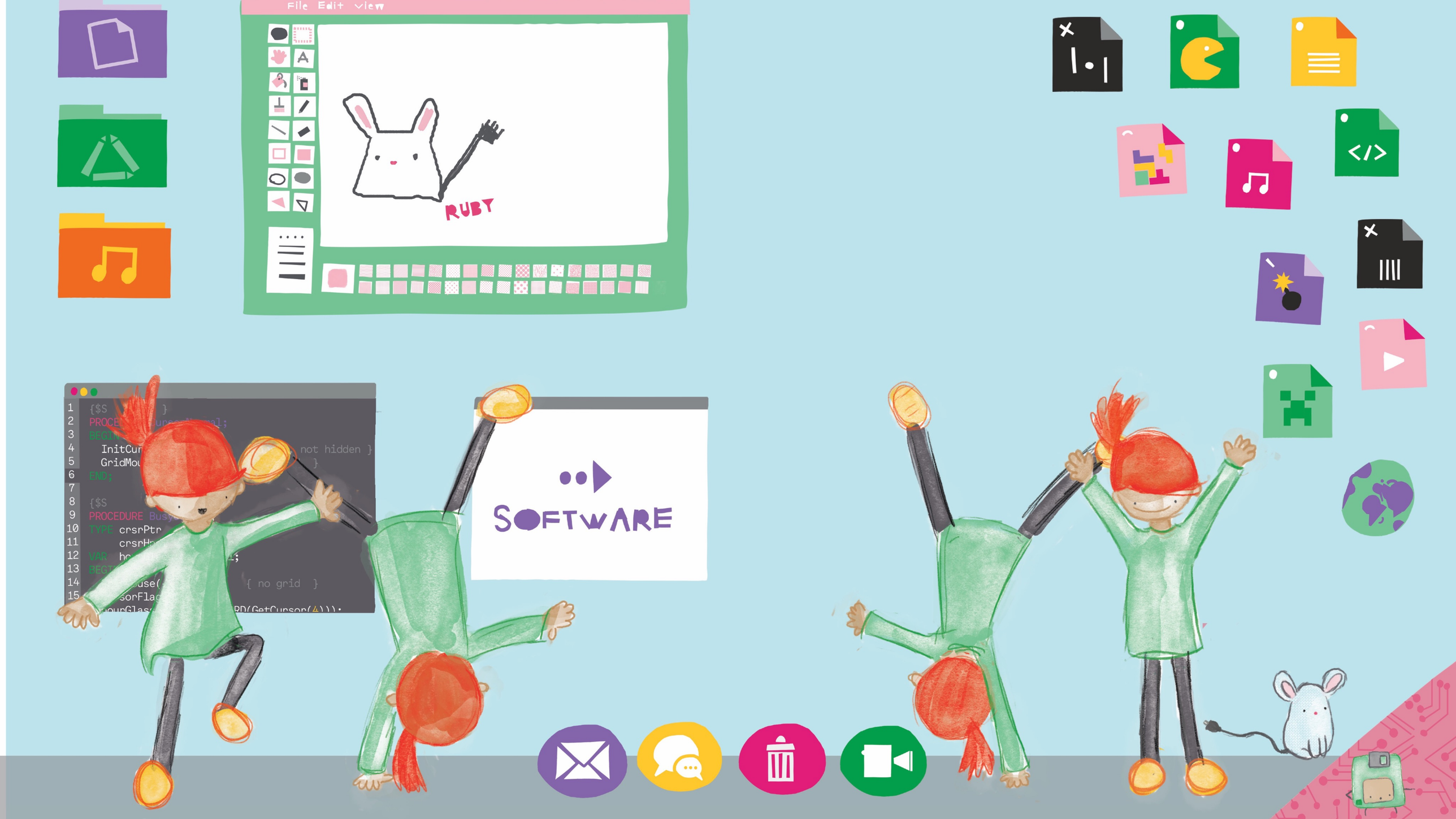




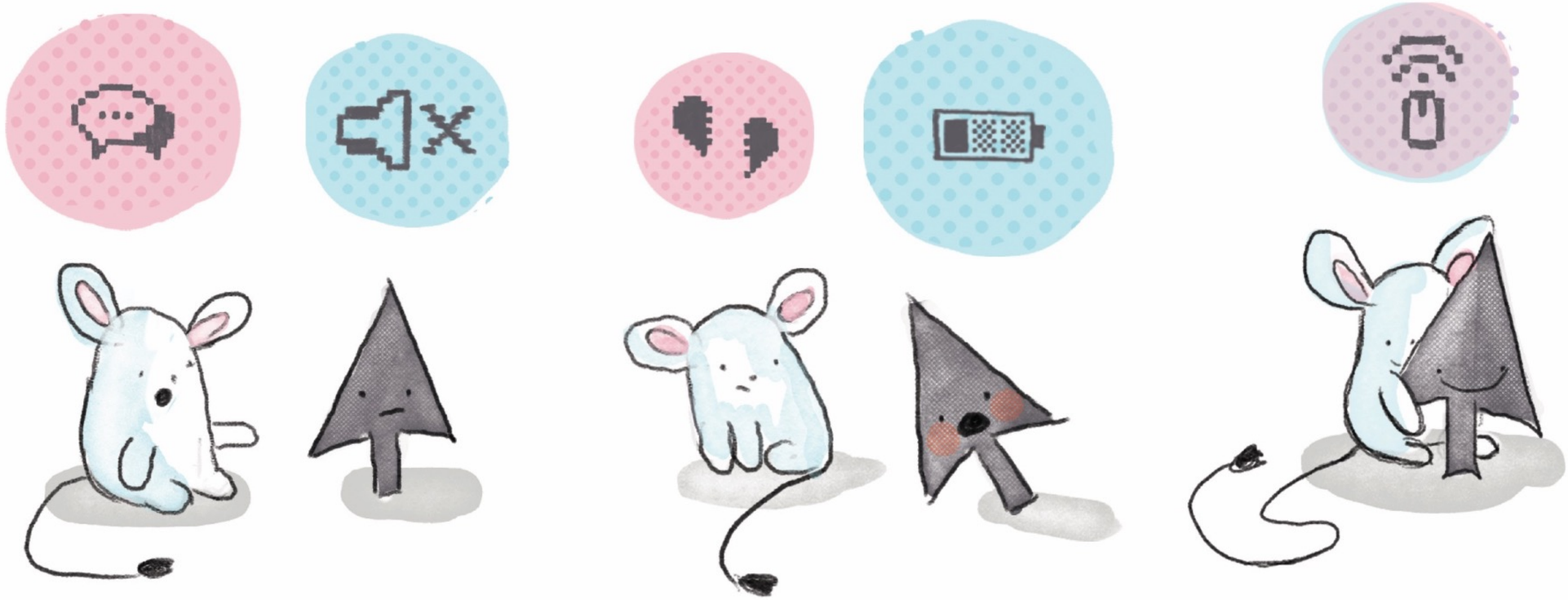

AND
TAI
EI


FETCH! EXECUTE!
STORE!


PROCESSOR
PROCESS
INPUT
OUTPUT
MEMORY


File Edit View
RUBY
SOFTWARE

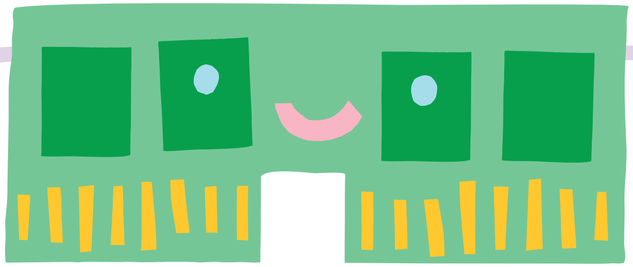

MISSING
SUDO
PROCESSOR
DEVICES
SECURITY
MEMORY
FILES
UTILITIES
HARDWARE
SOFTWARE





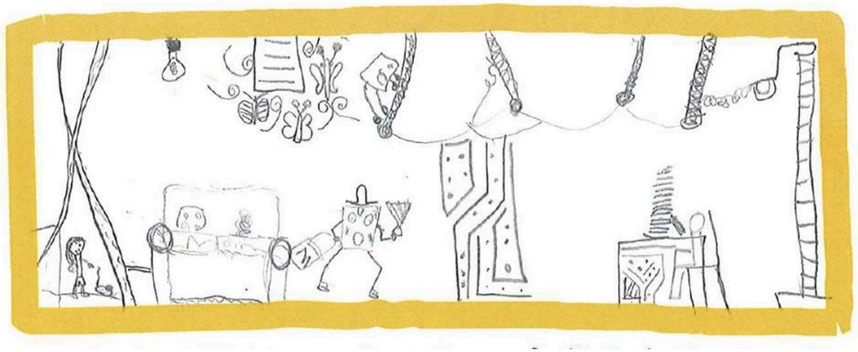
Computers
are
abstraction
machines.

WHAT IS INSIDE A COMPUTER?



Draw!

Draw how you imagine a computer works :)
What does the inside look like? How does it function? Is there magic?



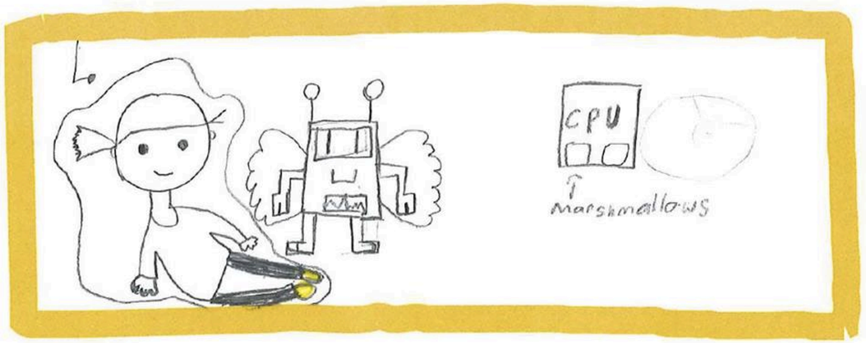
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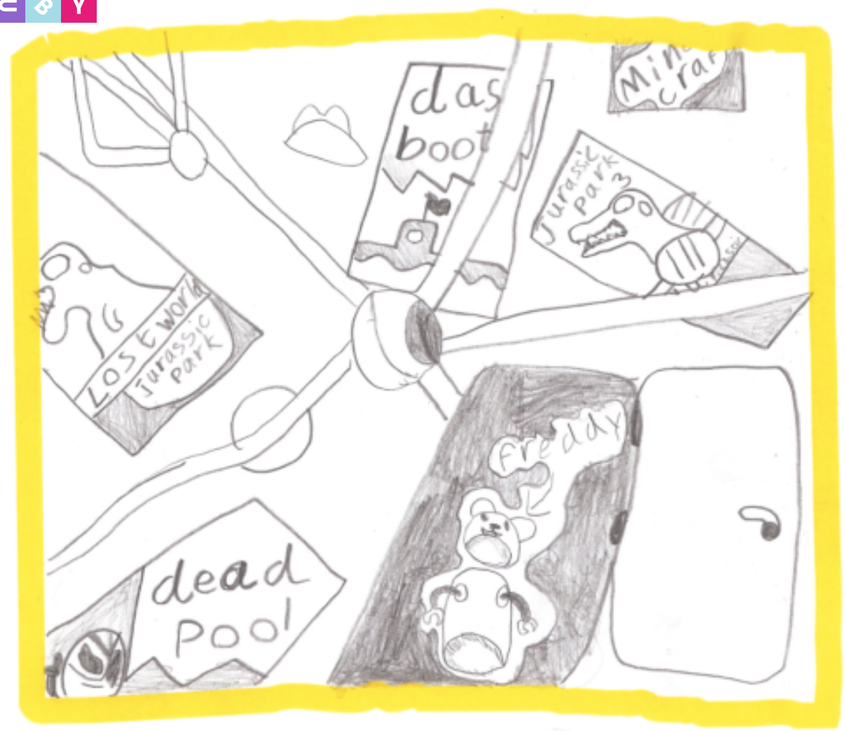


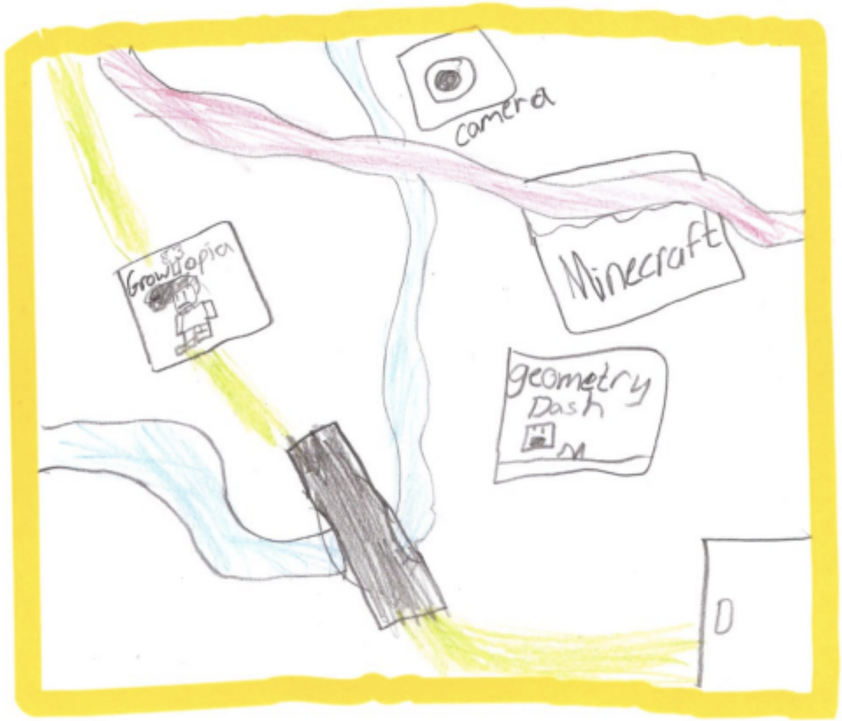
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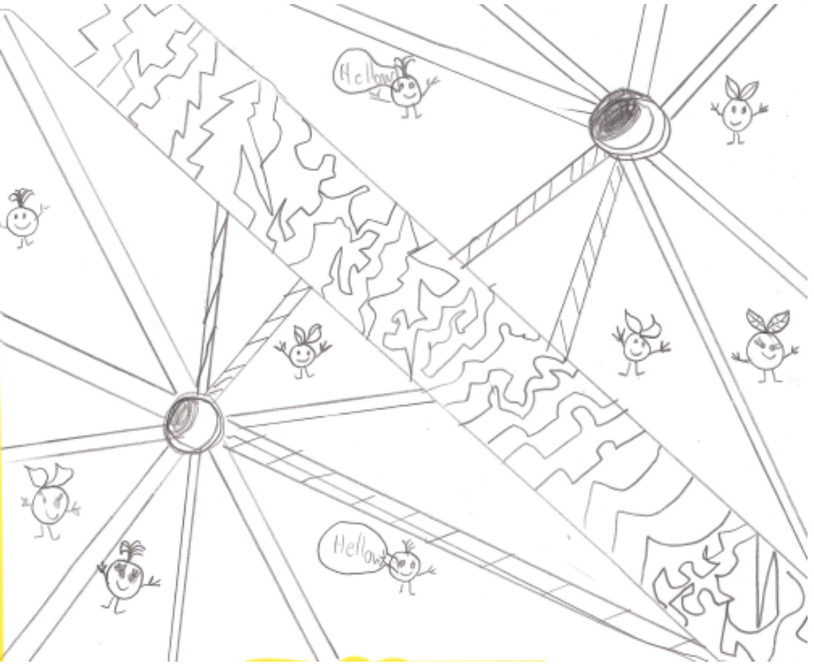
Matthew Scadding's students imaginations are always delightful. What's inside a computer by the Ravenswood year 2 students from Sydney, Australia!

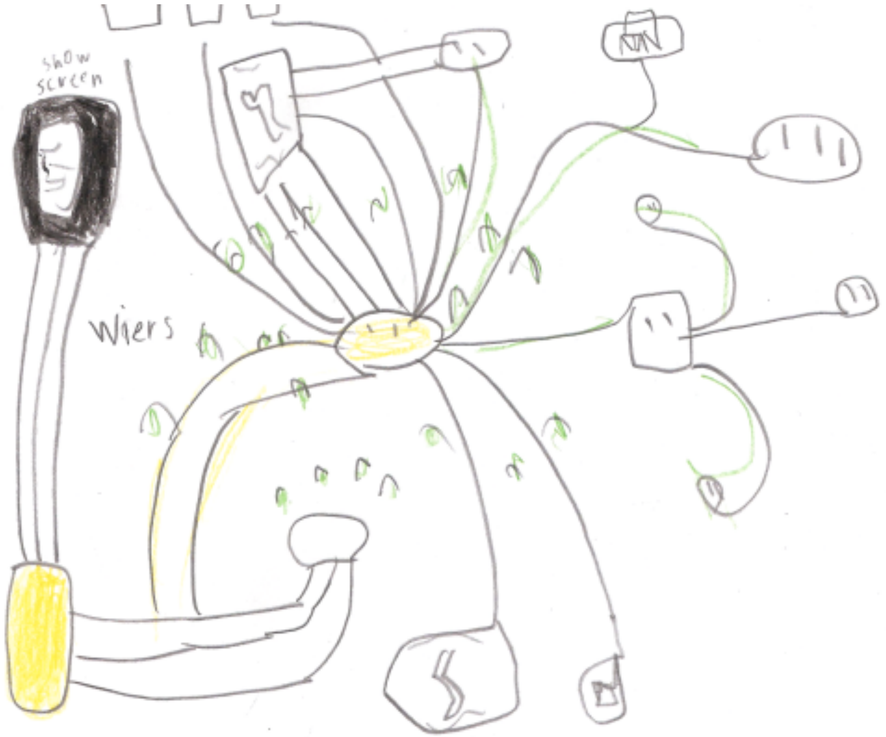


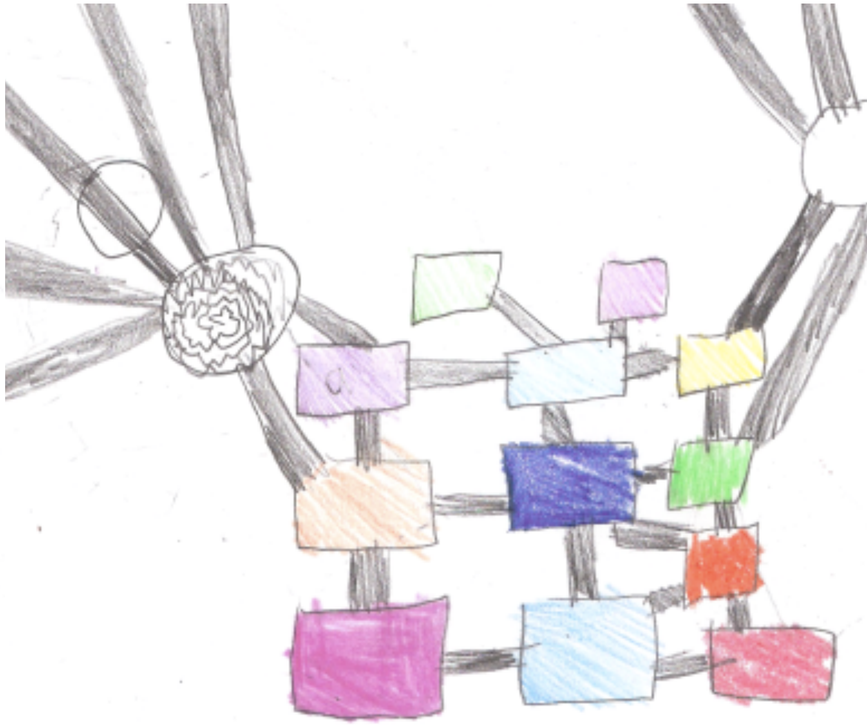


The Content Creators

Kids drawing their apps, games, camera, and files within.
A computer is a concrete place to hold your things inside of.

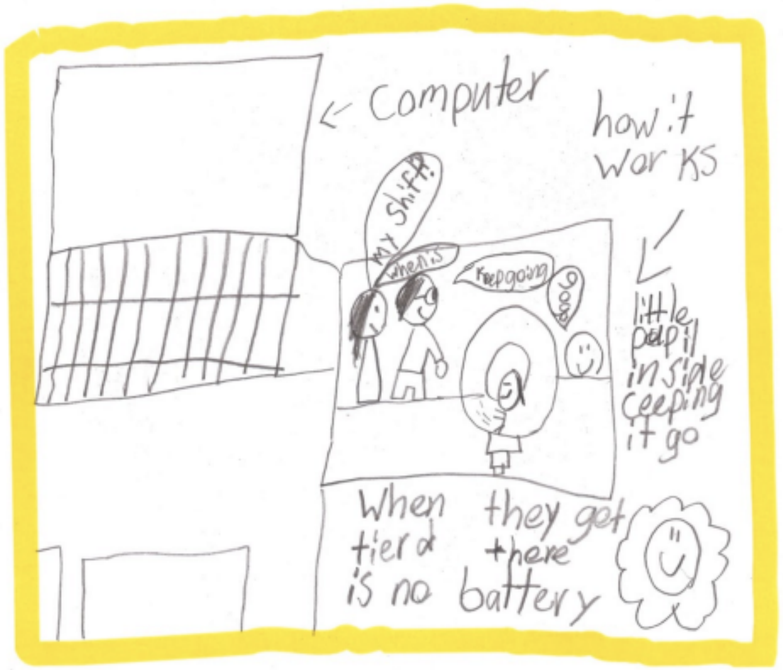






The Linkers

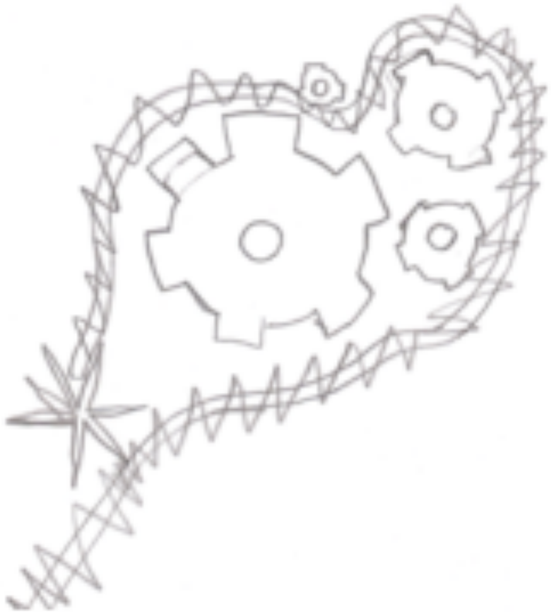
Drawings that expressed connected parts, components, networks and elements by abstract drawings of wire connections and boxes linked with lines.



The Scenographers

The scenographer -kids took the computer to the theatre stage. Carrying out functions was also a popular drawing theme, with some of the kids noting that people or bugs physically carry out functions from one part of the computer to the other.

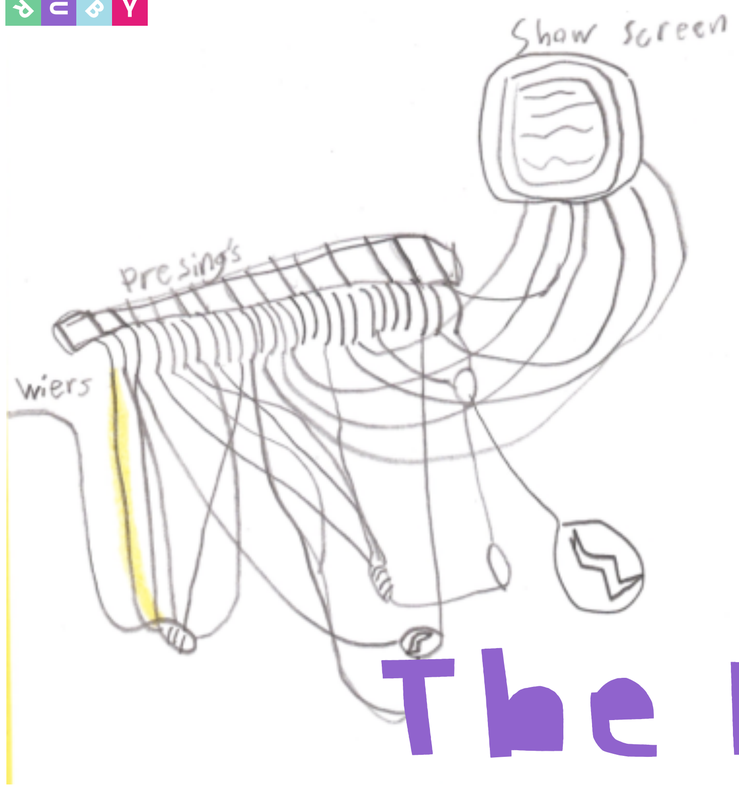






The Gear Gurus

Represented computers as gears interlocking for a mechanical action to be carried out.





The Drafters

Super technical drawings included resistors, wires, motherboards, and everything electronic to show that there exists nothing but elements which a current runs through. **To our interpretation of their drawing, a computer is based on logic not magic, on connections not abstract things.**

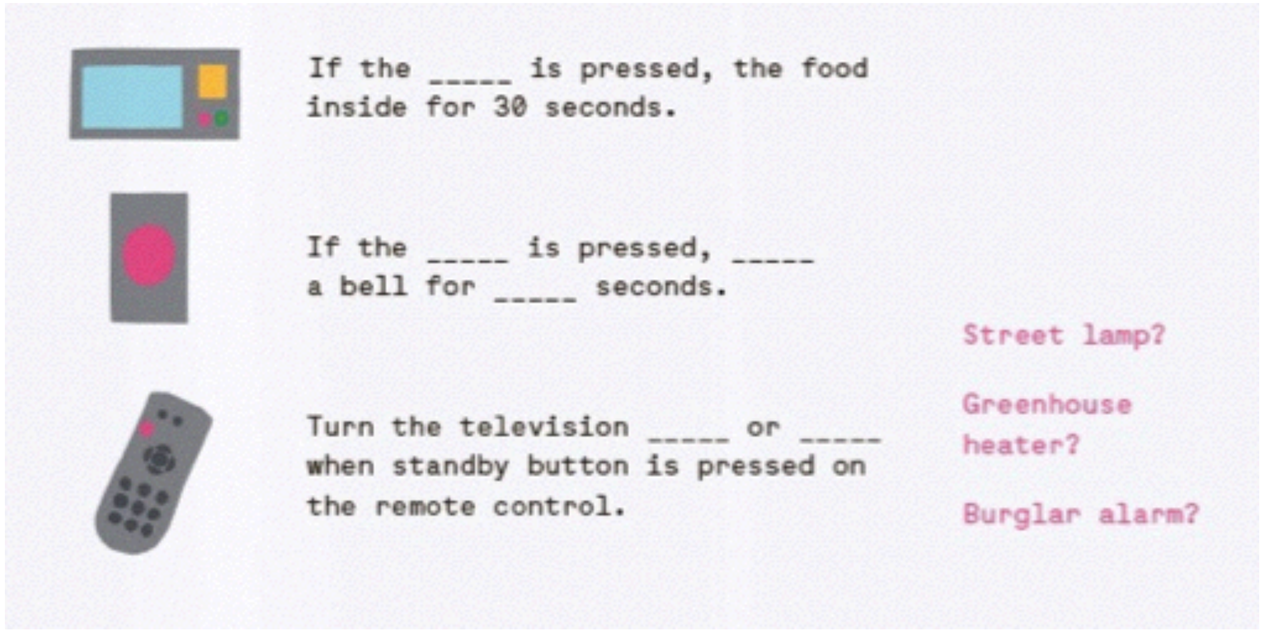


Computers
are
abstraction
machines.



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There’s hundreds of computers in every home.







My MagiCal ComPUTer

1 This is what I made into a computer:

2 The name of my computer:

3 When I press the on/off button my computer will:

Draw a picture of yourself using your new computer.

Computers have sensors that can recognize changes in the environment. Color the sensors your computer has and describe what they do.

- **Orientation.**
- **Temperature.**
- **Vibration.**
- **Moisture.**
- **Internet.**

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YOU ARe GREAT!

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I/O

Charles Babbage, Alan Turing, John von Neumann

CPU

Input

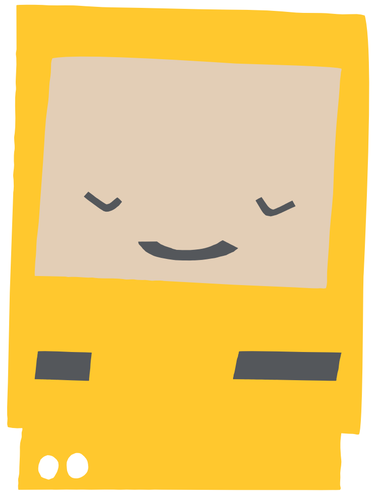
Control Unit

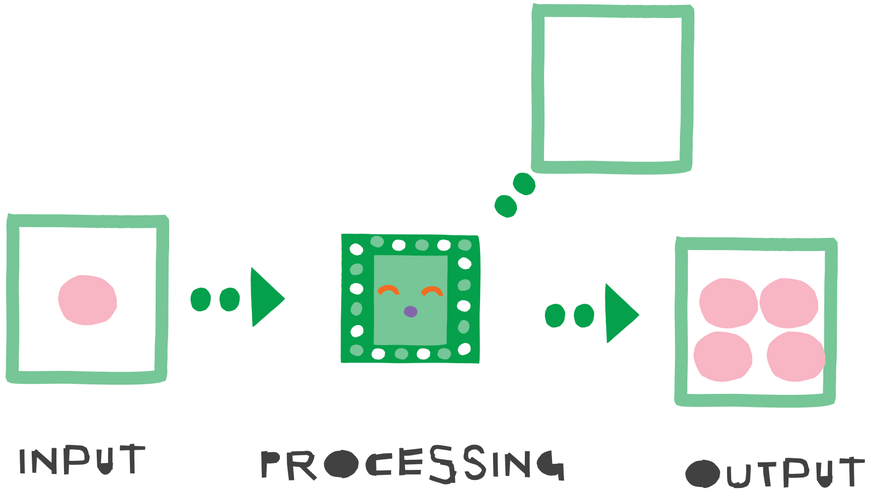
Arithmetic Logic Unit

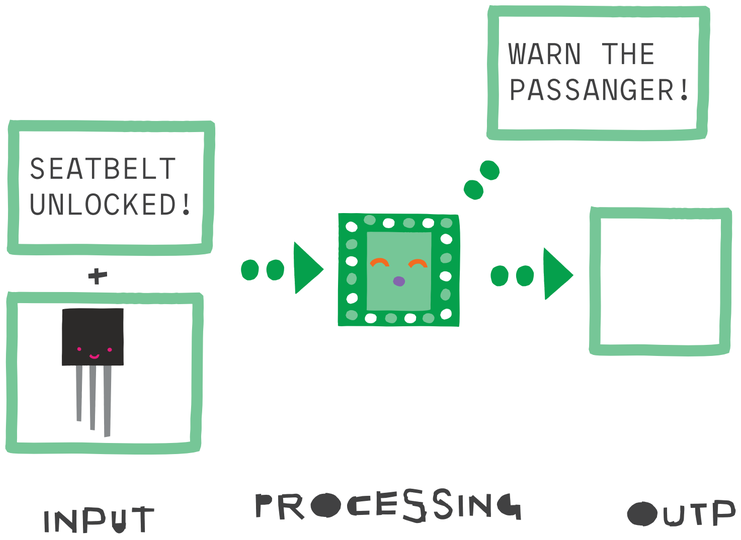
Immediate access store

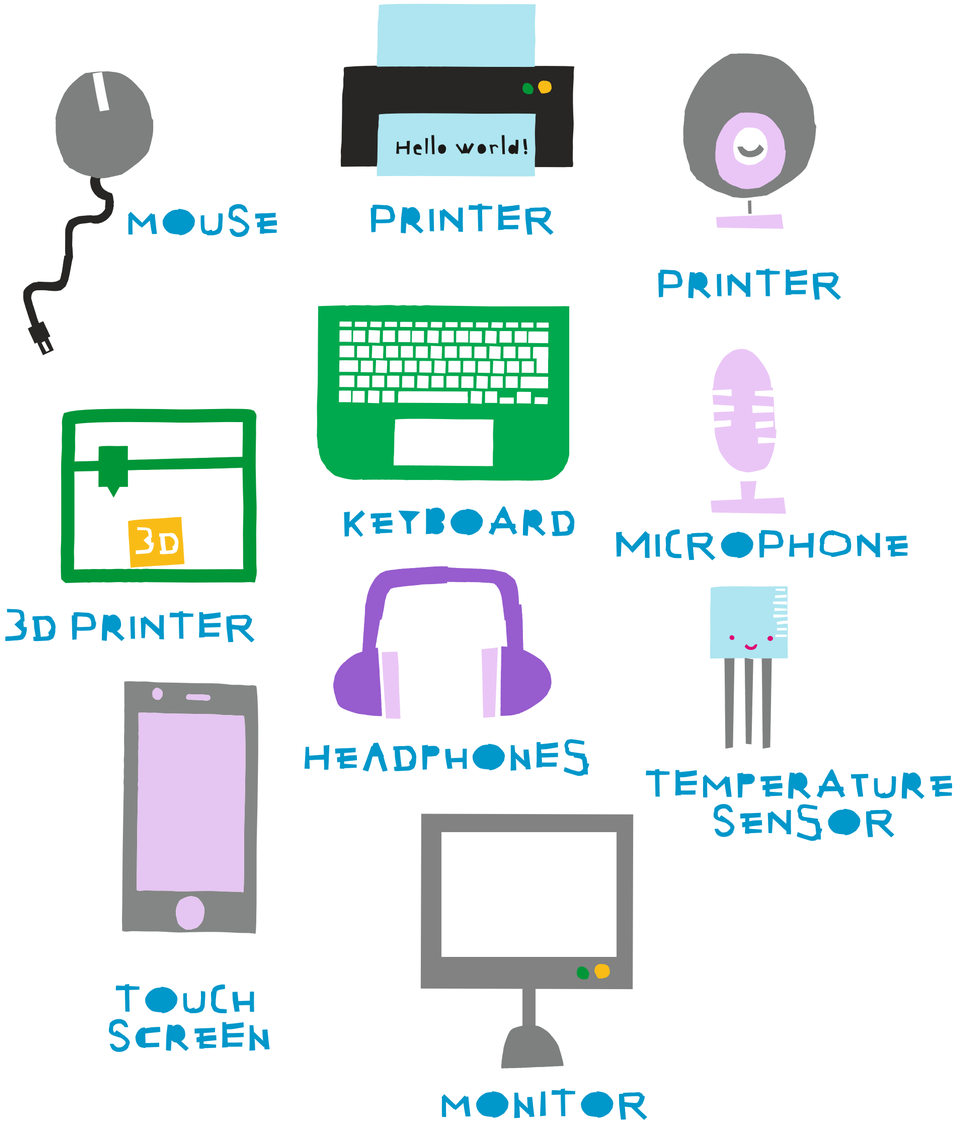
Program, Data and modified data

Output




INPUT
PROCESSING
OUTPUT


SEATBELT UNLOCKED!
+
WARN THE PASSANGER!
INPUT
PROCESSING
OUTPUT


MOUSE
Hello world!
PRINTER
PRINTER
3D
3D PRINTER
KEYBOARD
MICROPHONE
HEADPHONES
TEMPERATURE SENSOR
TOUCH SCREEN
MONITOR

Input

CRAWL OUT
BACKSIDE
FIRST!

Output

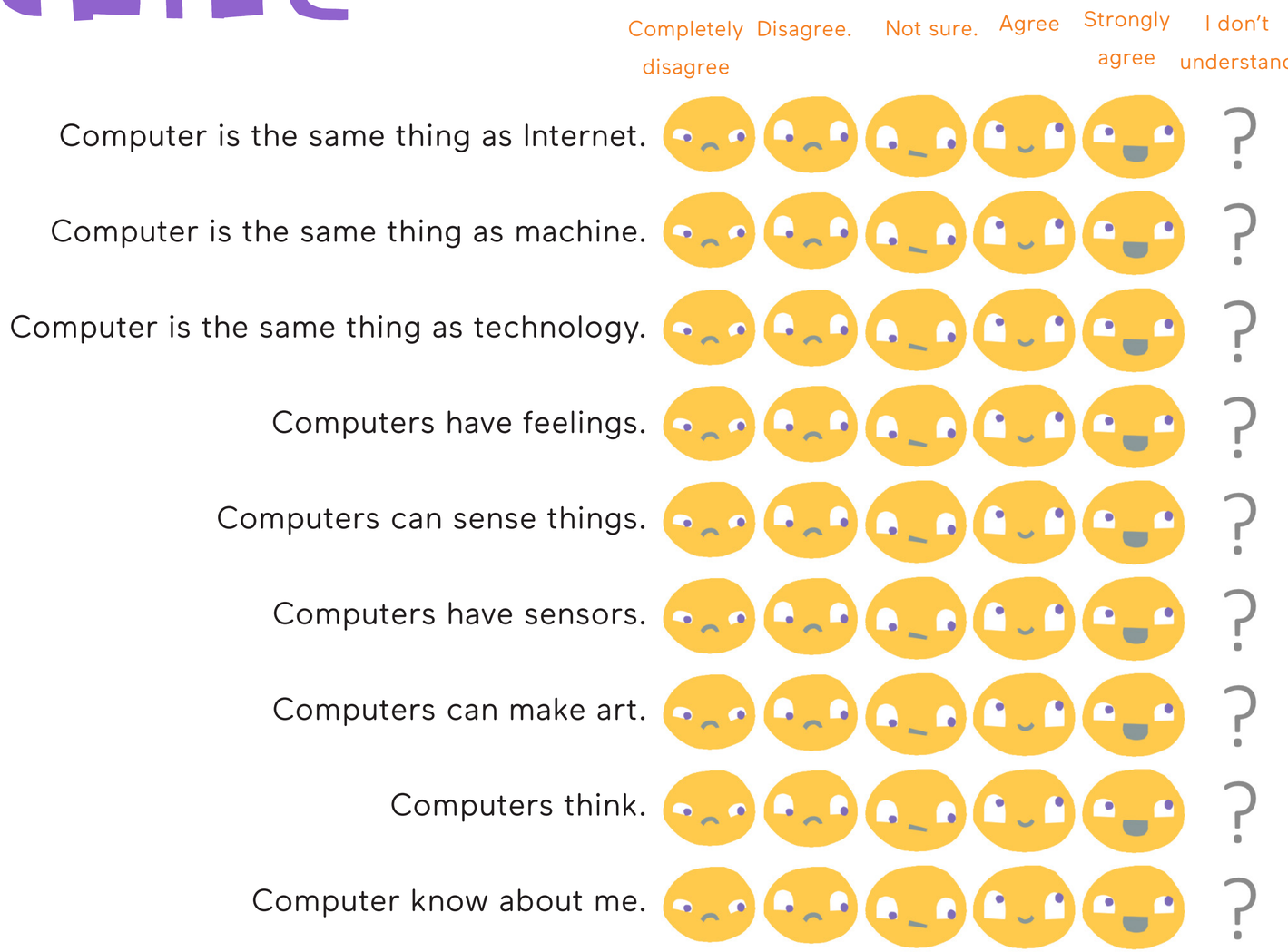
Process



Notional machine

“An abstraction of the computer that one can use for thinking about what a computer can and will do.”
- Benedict DuBoulay

“We want students to understand what a computer can do, what a human can do, and why that’s different. To understand computing is to have a robust mental model of a notional machine.”
- Mark Guzdial

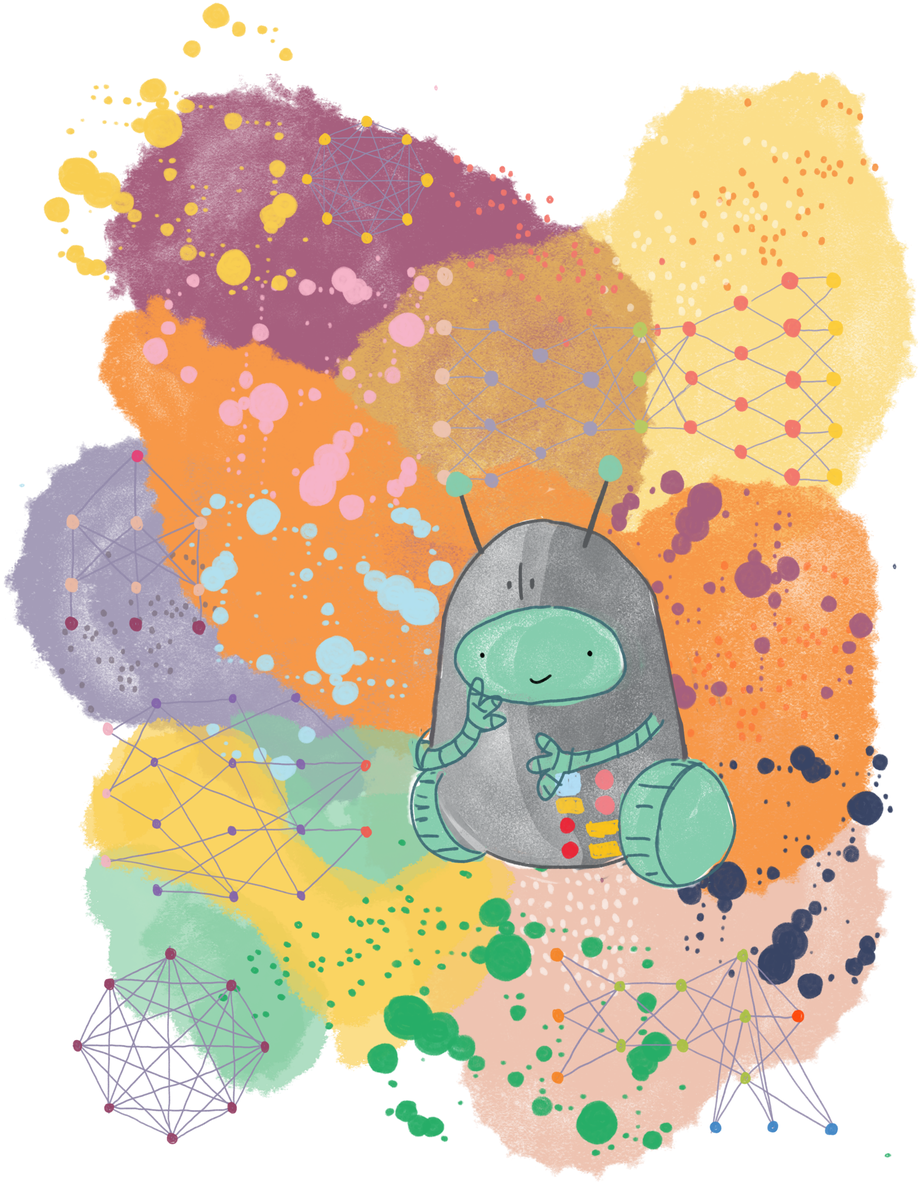


C

is for

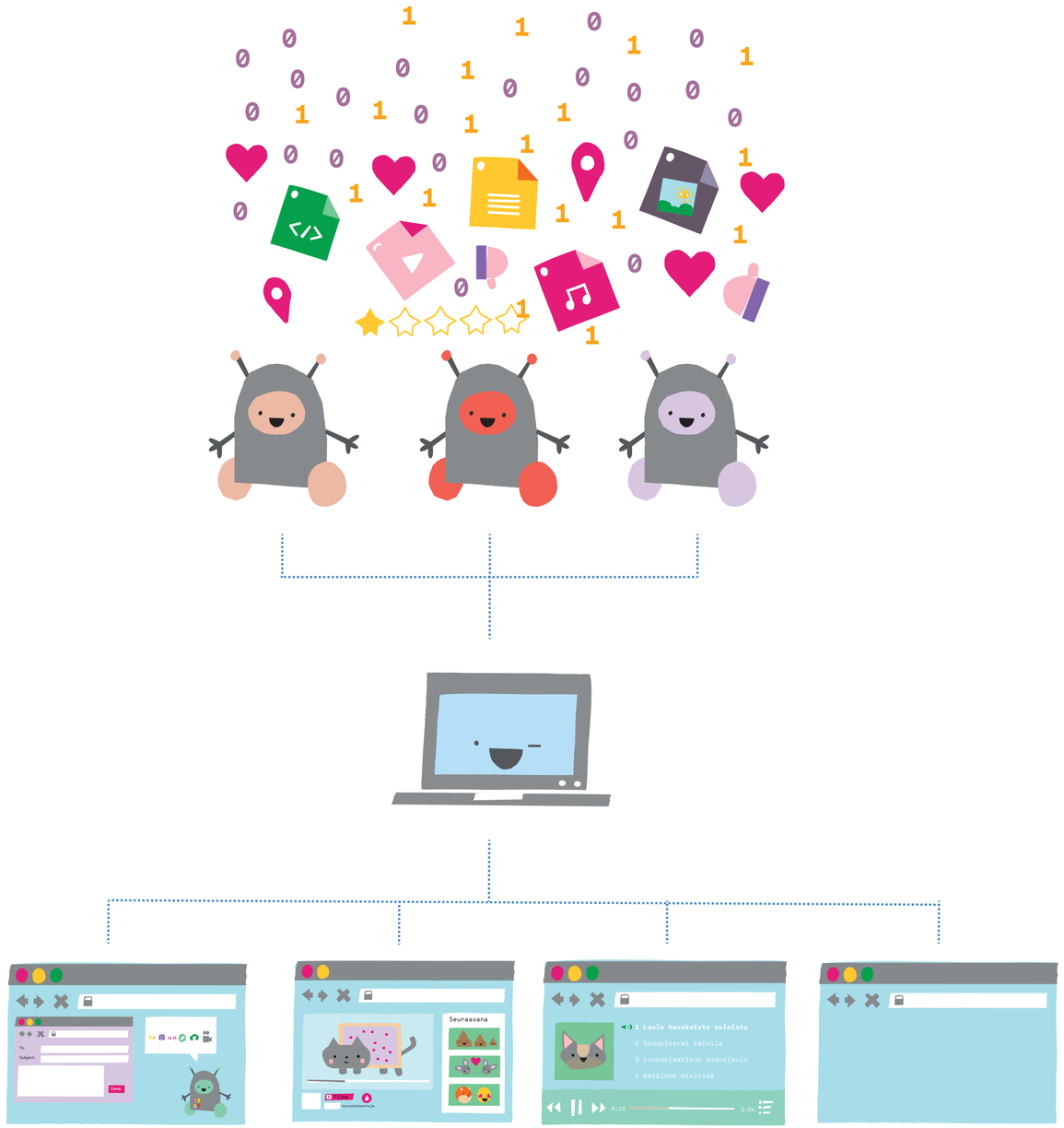
creativity anc
computers



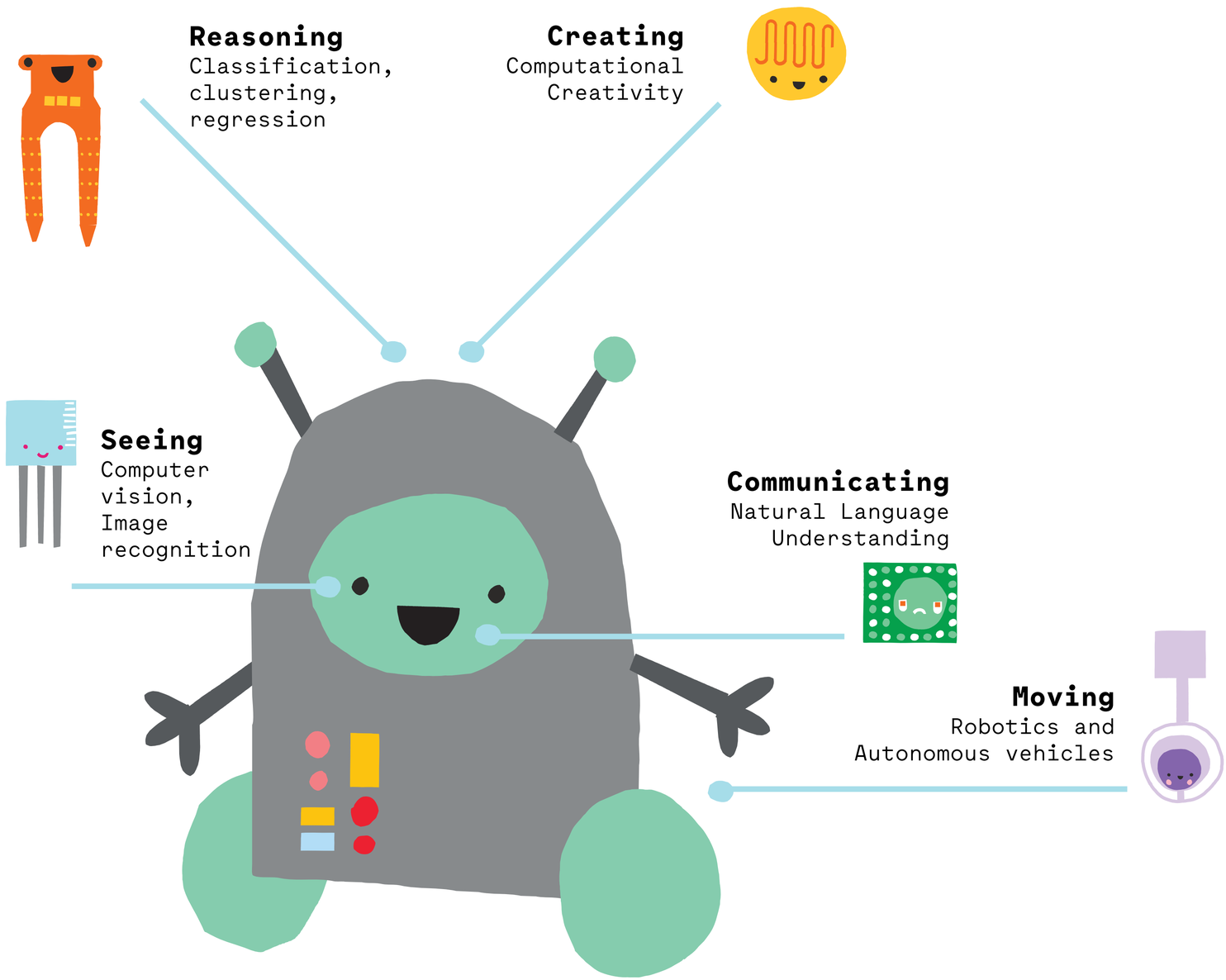


Here be the dragons

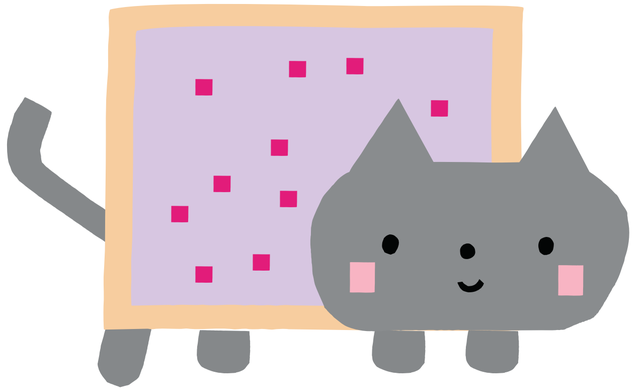
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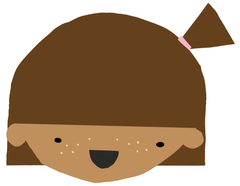

Seuraavana
1 Laulu hauskoista asioista
2 Sadepisarat katolla
3 Lounaslaatikon avauslaulu
4 Kesäloma mielessä

Machine Learning



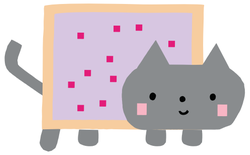
Is this a cat?





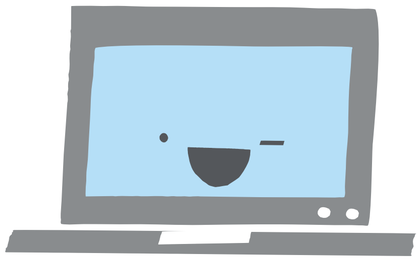
PROBLEM TO SOLVE

Is this a cat?





ANSWER THE QUESTION



GATHER DATA

Examples of cats

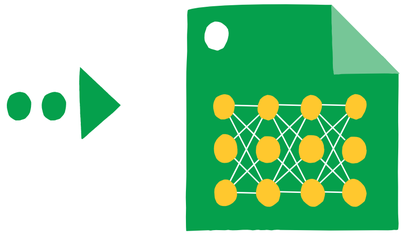


GATHER DATA

Examples of cats



BUILD A MODEL

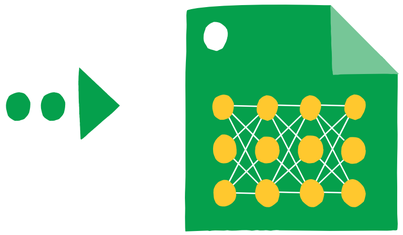


GATHER DATA

Examples of cats



BUILD A MODEL



ANSWER THE QUESTION

Yes!

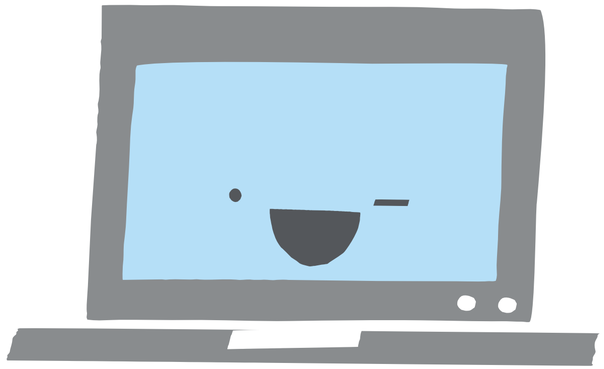


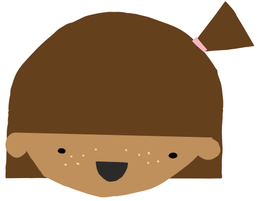
in



out

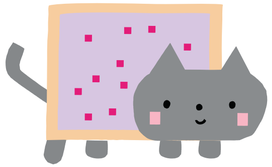
```
snowleopard  CERTAIN, 0.6
cat          LIKELY, 0.39
monkey       UNLIKELY, 0.01
```





PROBLEM TO SOLVE

Is this a cat?



ANSWER THE QUESTION

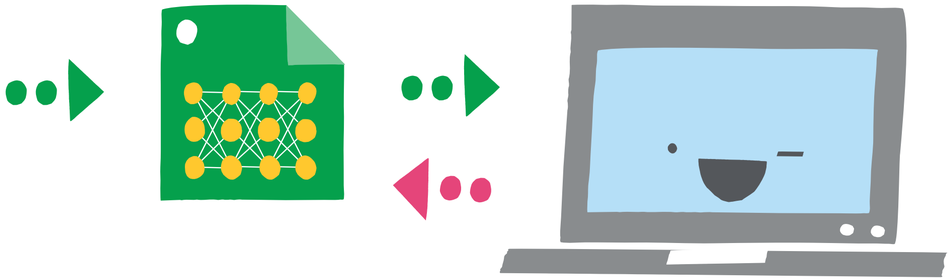
Yes!

GATHER DATA

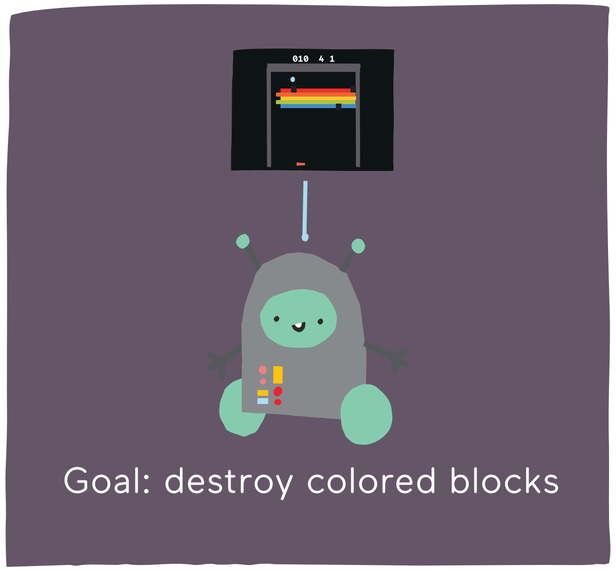
Examples of cats



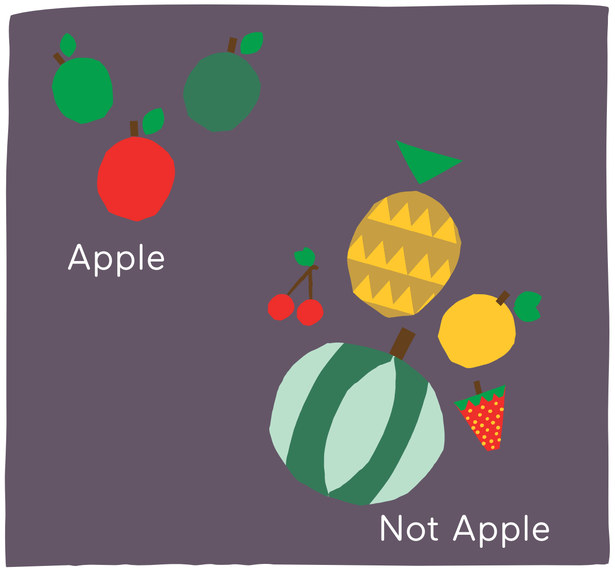
BUILD A MODEL



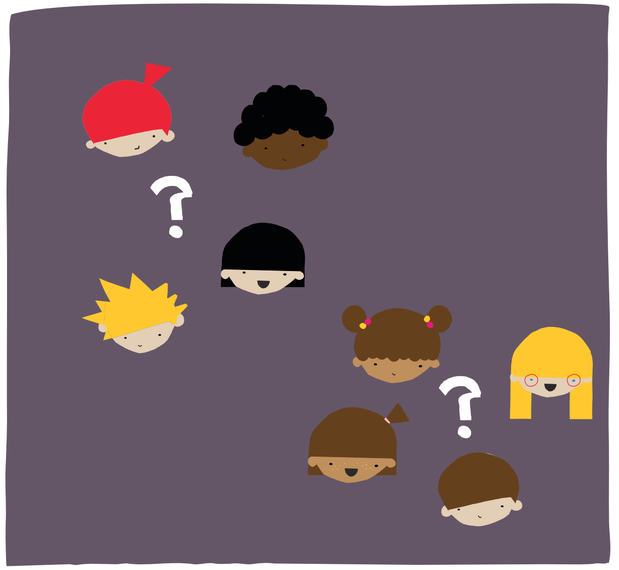
UPDATE MODEL



Reinforcement learning

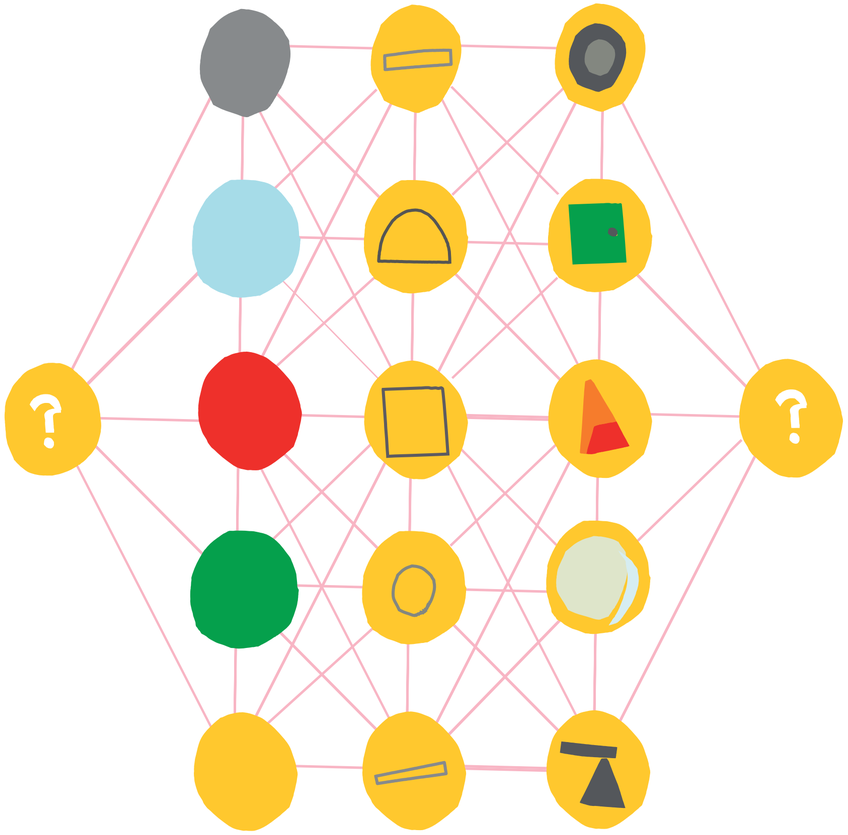


Supervised Learning Algorithms

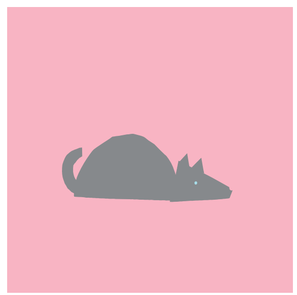


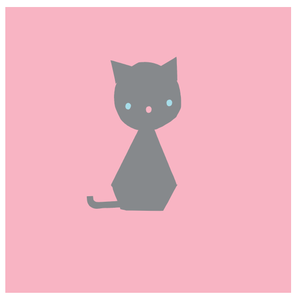
Unsupervised Learning Algorithms



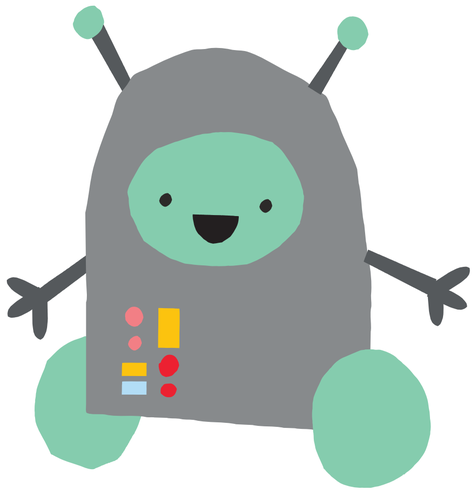

Colors
Edges
Parts
?
?



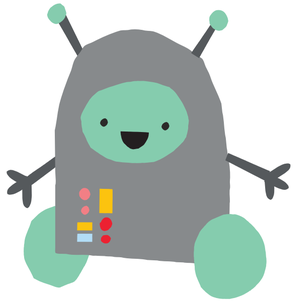


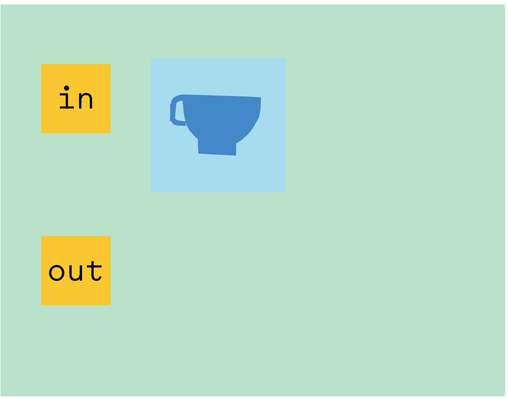


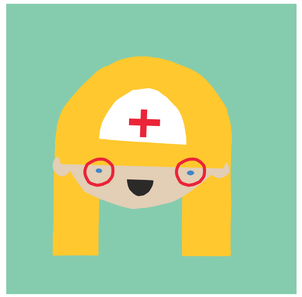
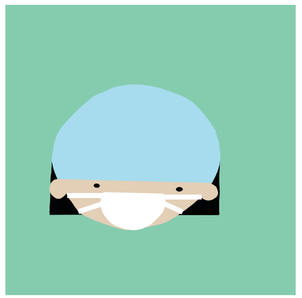


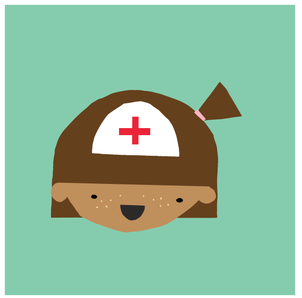
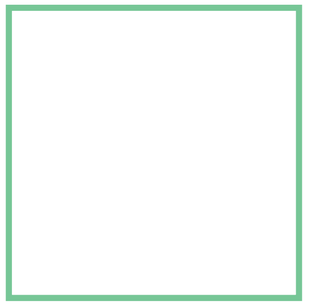
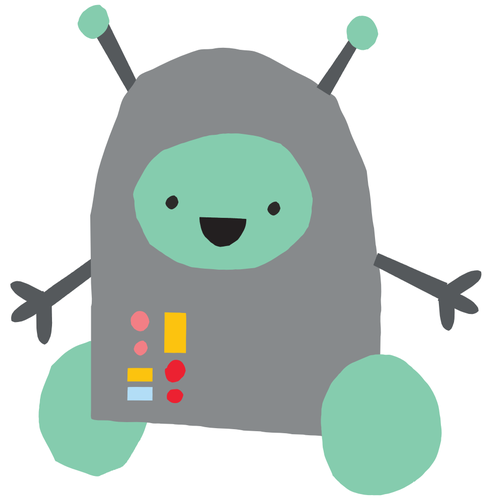







in
out

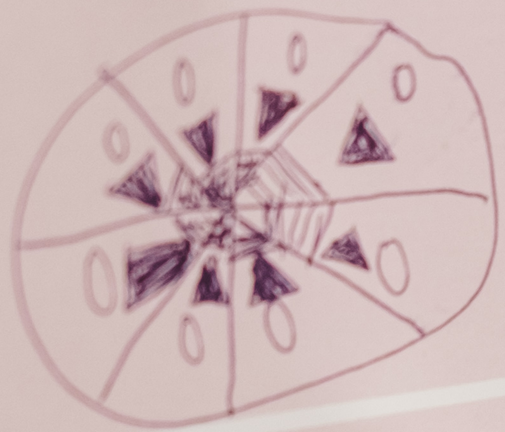



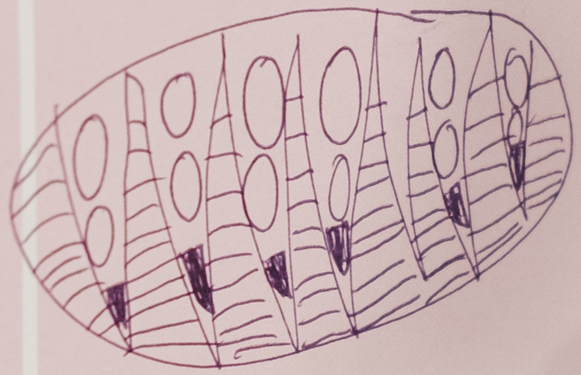




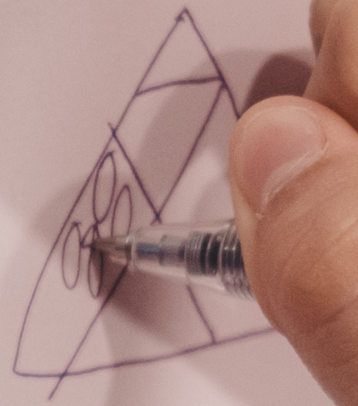
THIS IS WHAT I WANT TO TEACH:

I want to teach how to make pizza.

This is my training data.







You can teach your machine to recognise a cat or a dog!


N HALUAISIN OPETTAA:
Tässä on opetusaineistoni:
Voit opettaa koneen tunnistamaan kissan tai koiran!
Voit opettaa koneen tunnistaamaan tervehdyksen tai laittamaan musiikin päälle.
VINOUMA
Pyydä kaveria lisäämään yksi esimerkki opetusaineistoosi.
in
out
Kaikki kissat ovat harmaita.

ykyisin koneet
Täytä ensin
nerkki ham-

PIMINEN





THIS IS WHAT I WAN

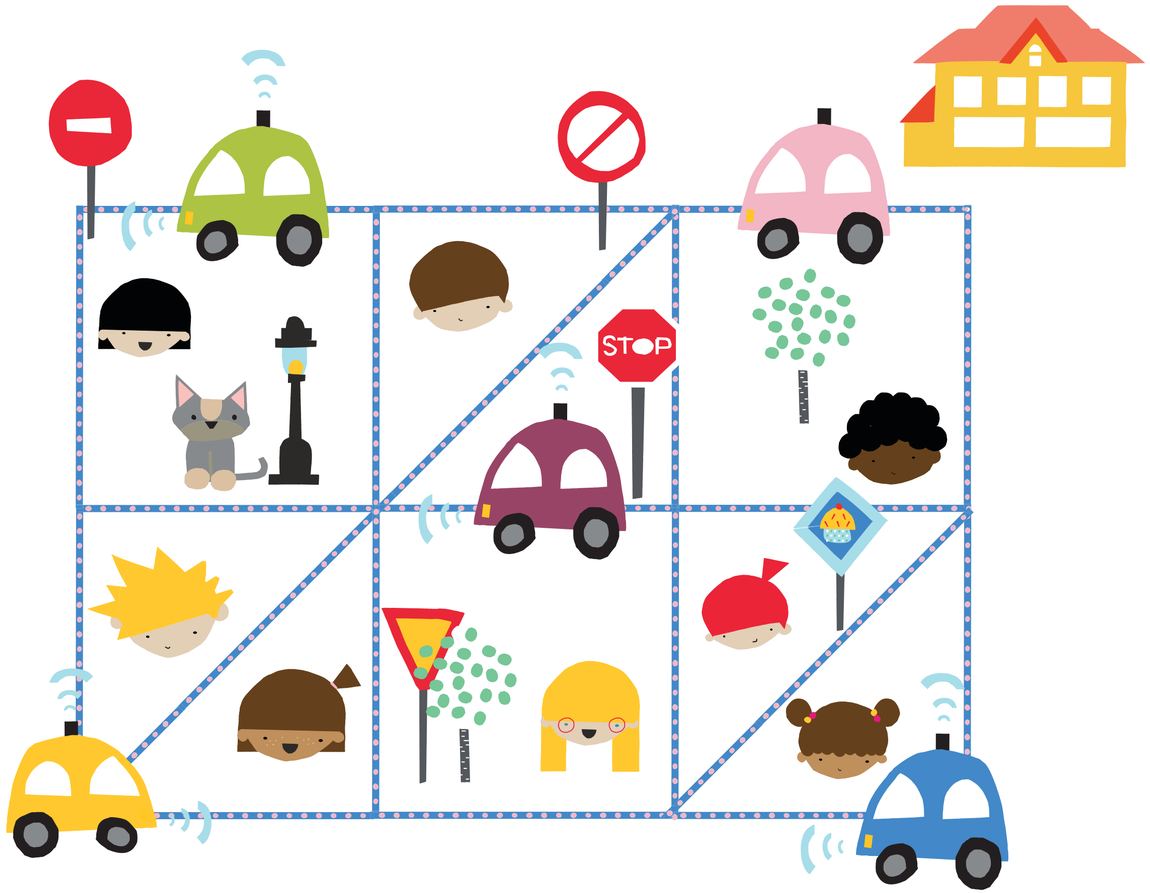
How to recognise

This is my training data.

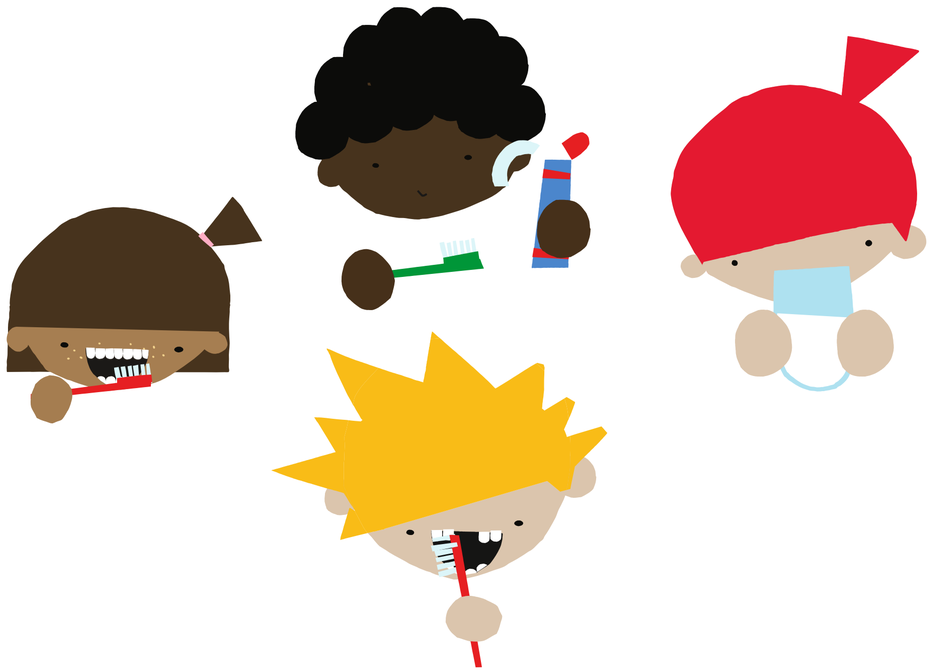
You can teach your machine to recognise a cat or a dog!

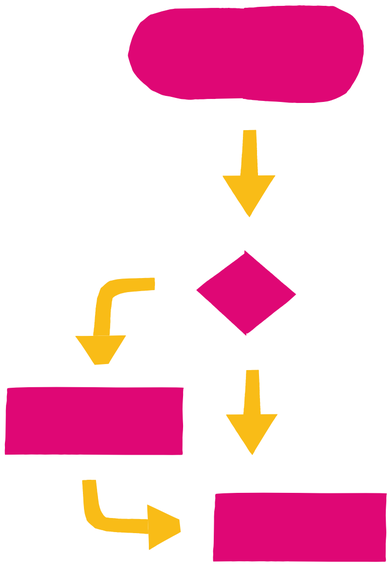
You can teach AI to recognise commands like Hello or Play

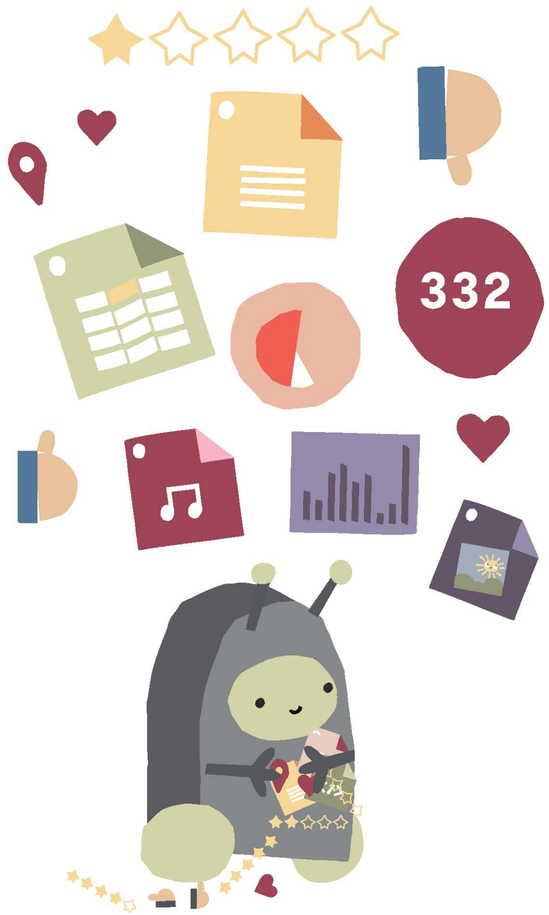
INPUT	OUTPUT	APPLICATION
Picture	Are there human faces (0 or 1)	Photo tagging
English sentence	French sentence	Translation
Car cameras	Position of other cars	Self-driving cars
Audioclip	Transcript of audio clip	Speech recognition



INPUT	PROCESS	OUTPUT
Car cameras	Map of position of other cars	Driving

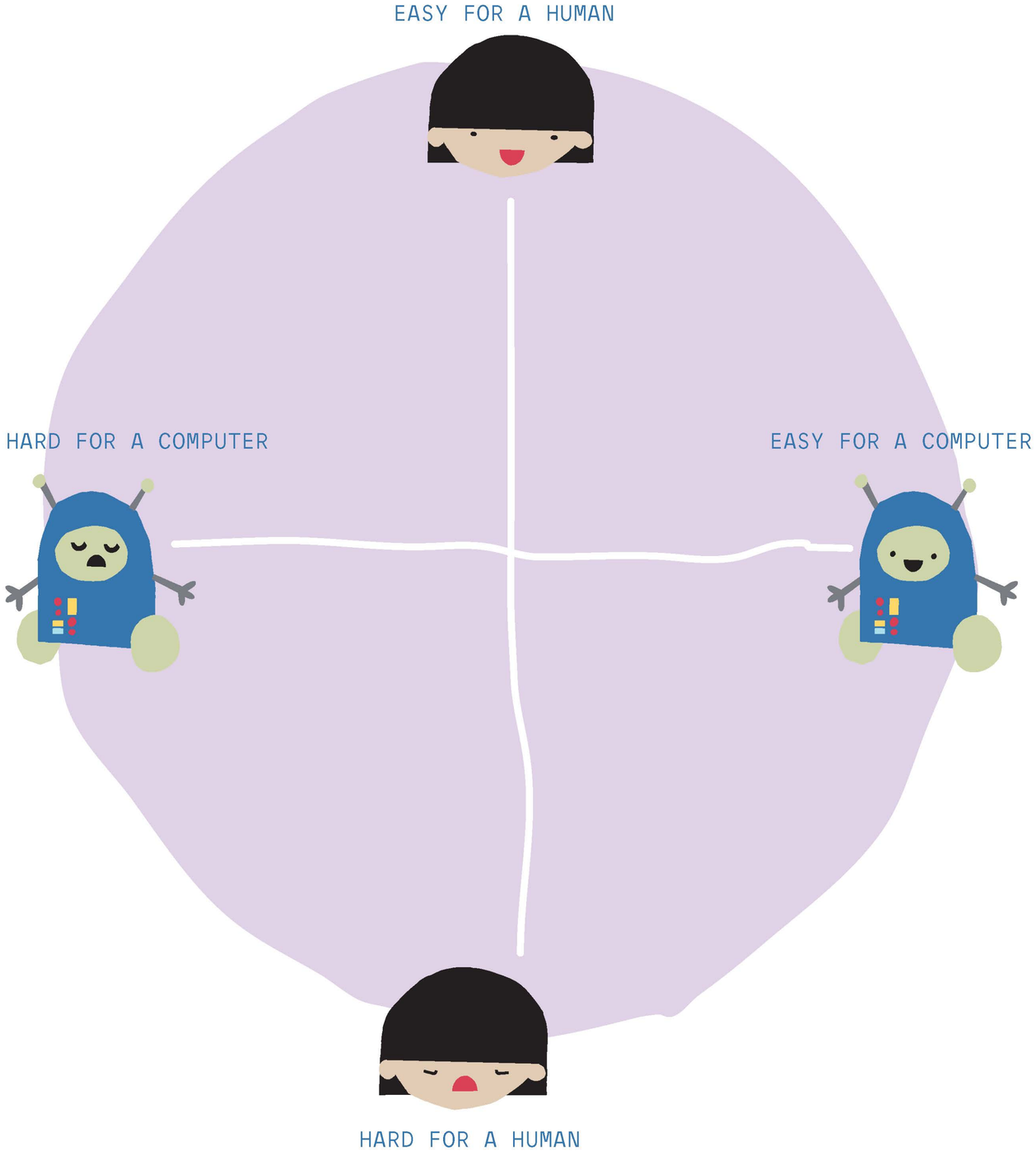






	I Can Do it!	I Did it but didn't fully Get it	I DidN't gEt it at ALL
Identify authors of literary works			
Save the bees			
Hunt for subatomic particles			
Categorise ramen by shop			
Fly an F-16 fighter jet			
Block or remove Facebook accounts			
Predict hard drive failures			
Identify you from your walk			
Detect liars at border control			
Diagnose skin cancers			
Optimise retail inventory			
Write sports bulletins			
Predict box office performance			
Detect bogus expenses claims			
Help you use more inclusive language			
Assist the crew of the ISS			
Predict maintenance tasks			
Forecast demand for tractors			

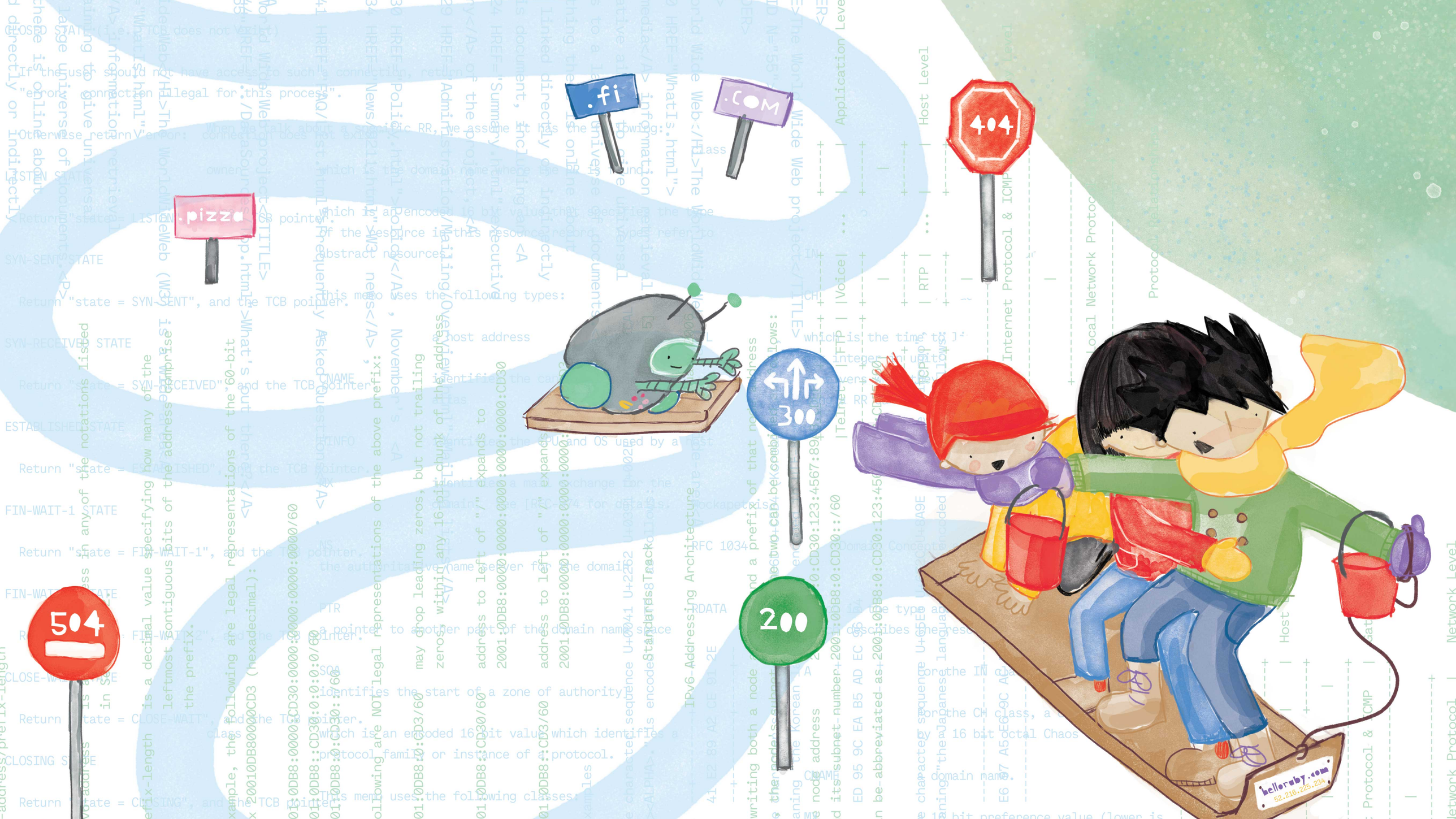
https://deepindex.org/


EASY FOR A HUMAN
HARD FOR A COMPUTER
EASY FOR A COMPUTER
HARD FOR A HUMAN

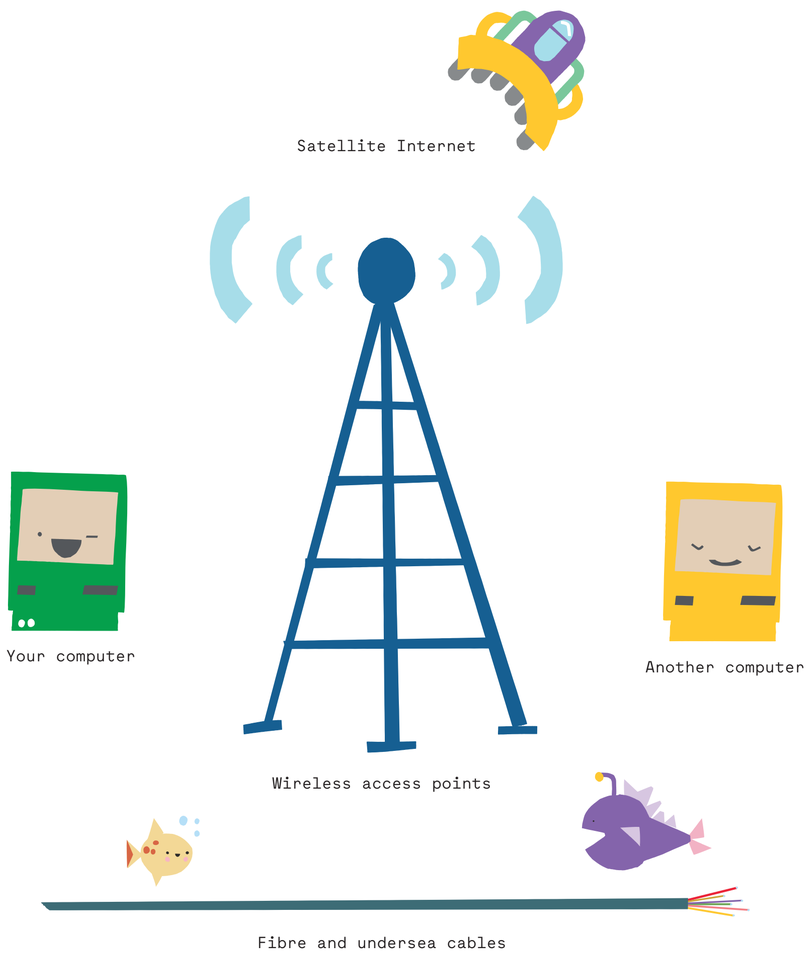


What happens in a world where we don’t have the vocabulary to express what is around us?

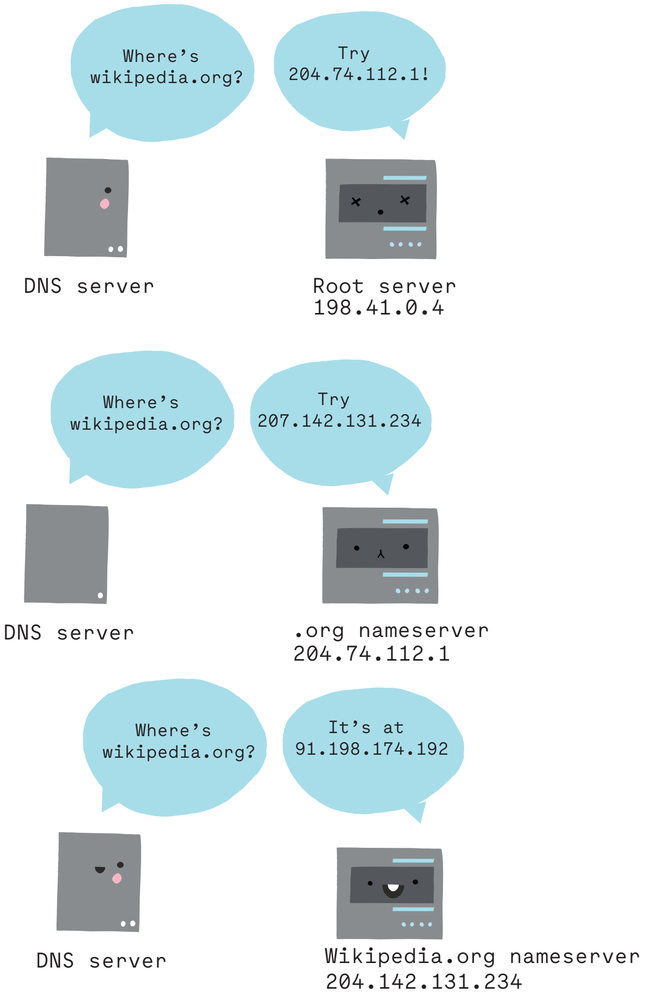



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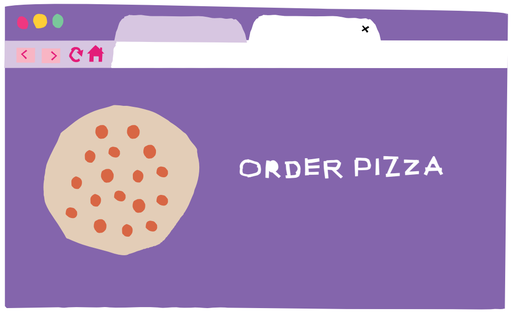




Hardware



Software



Impact




Charles Babbage
Grace Hopper
Vannevar Bush
Alan Turing
Katherine Johnson

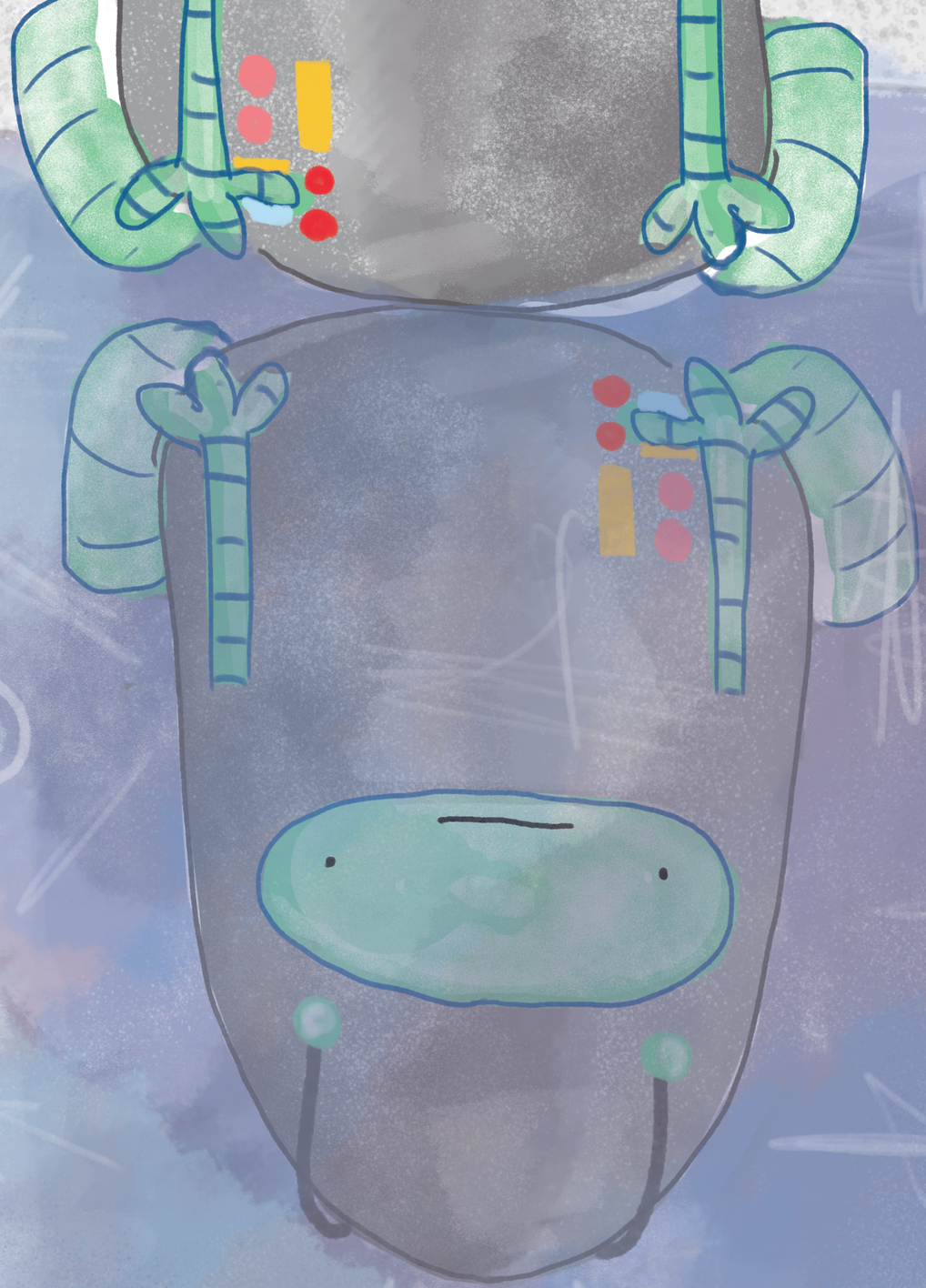

It’s not a
computer.



The next big thing?

www.helloruby.com

Our failure to imagine
plausible futures.

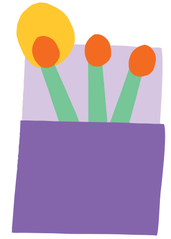




Computer Science needs (utopian) fiction



Stories about humans, stories about things, stories about ideas and human imagination.





Technology is built on humanity.

Computer *(km-pytr)*
n.
person who makes calculations or computations; a calculator, a reckoner; spec. a person employed to make calculations in an observatory, in surveying.

Technology (from Greek τέχνη)
Techne, "art, skill, cunning of hand"; and -λογία, -logia[1]. Techniques, skills and competencies alongside the tools needed to do the job. Agriculture is a technology; democracy is a technology.

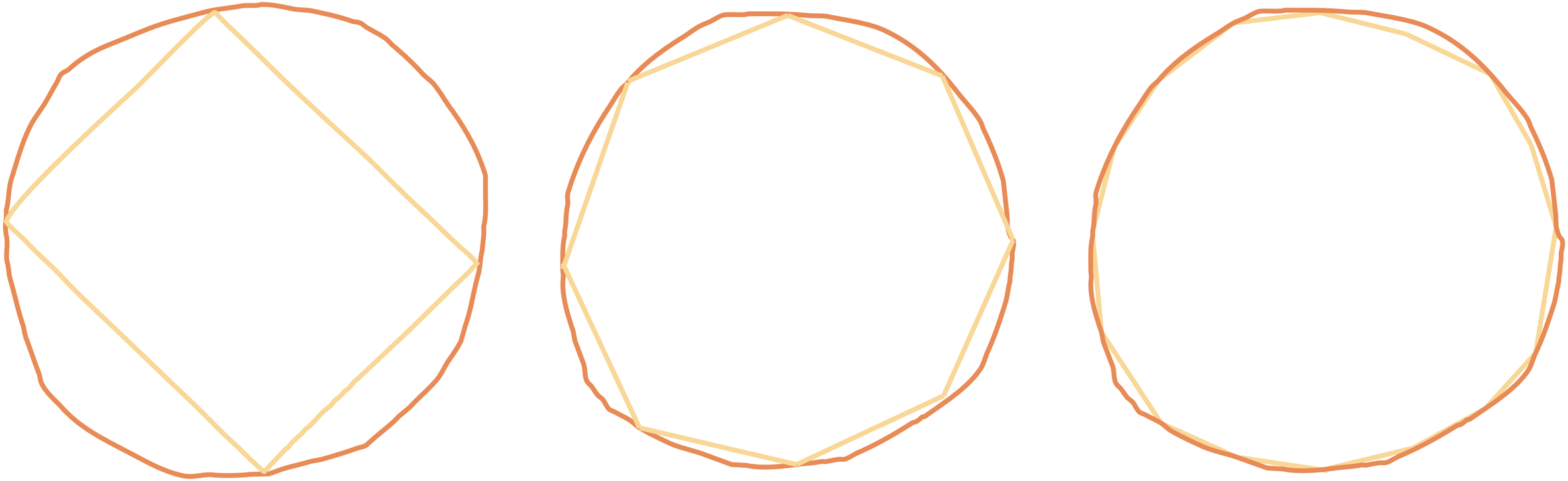


Technology (from Greek τέχνη)
Techne, "art, skill, cunning of hand"; and -λογία, -logia[1]. Techniques, skills and competencies alongside the tools needed to do the job. Agriculture is a technology; democracy is a technology.



"Technology is the production of superfluities—today as in the Paleolithic age. That is why animals are atechnical; they are content with the simple act of living."

- Jose Ortega y Gasset



..but stories, they happen to those who can tell them.

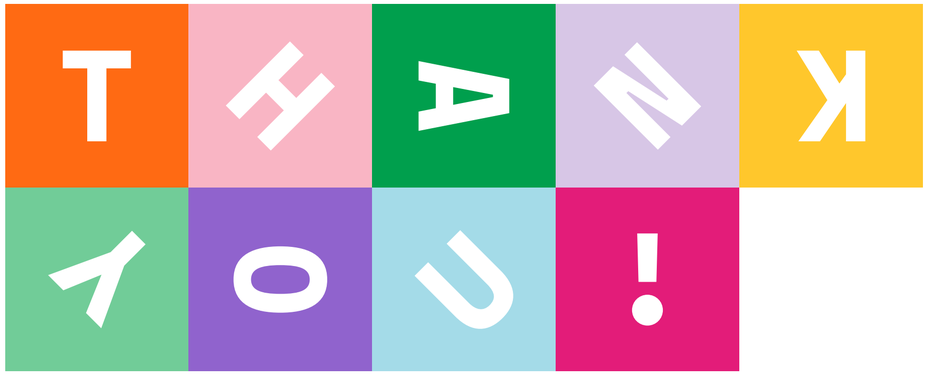
Exercise 3

Explain!

What is technology? What is it used for?
And who uses it?

Technology is electricity that moves. It is used to play. I use it to have a conversation with my mom, we use a WhatsApp application. People uses technology.


else
if
else
else
else



Linda
Liukas
Author
&
Illustrator
Hello
Ruby
+358415143405
linda@helloruby.com
twitter:@lindaliukas
www.helloruby.com