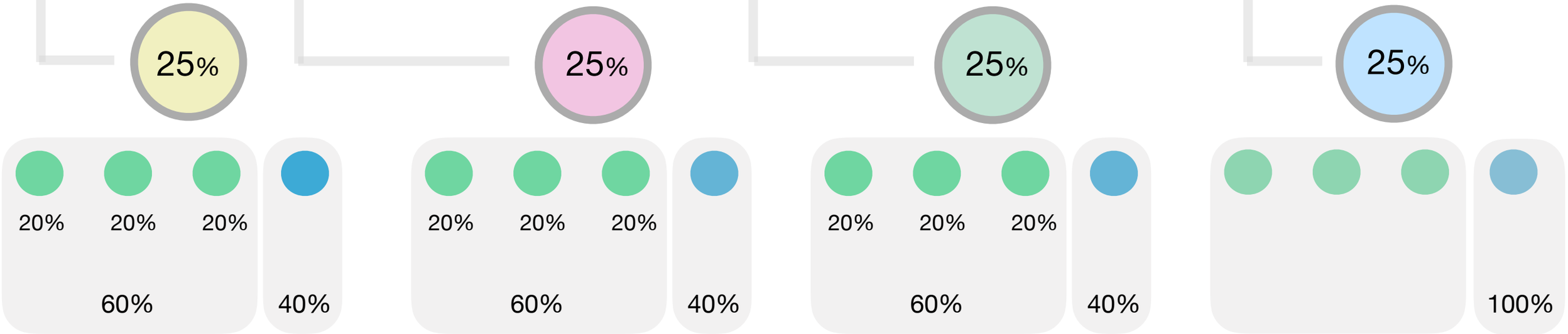
¿Que?, ¿Como?

Juegos bióticos y la biología de microorganismos

Ecología espacial y del paisaje

OSH y HomeScope:
microscopio hazlo-tu-mismo robótico, digital, e inteligente

Plataforma de programación Godot:
desarrollando juntos un juego biótico



10月 11月 12月 01月 03月

Juegos bióticos y la biología de microorganismos

10月

1周

De maquinas y seres vivos:

auto-poiesis & allo-poiesis

Hibridizando organismos y maquinas

a través de video juegos

25%

20%　20%　20%

60%

40%

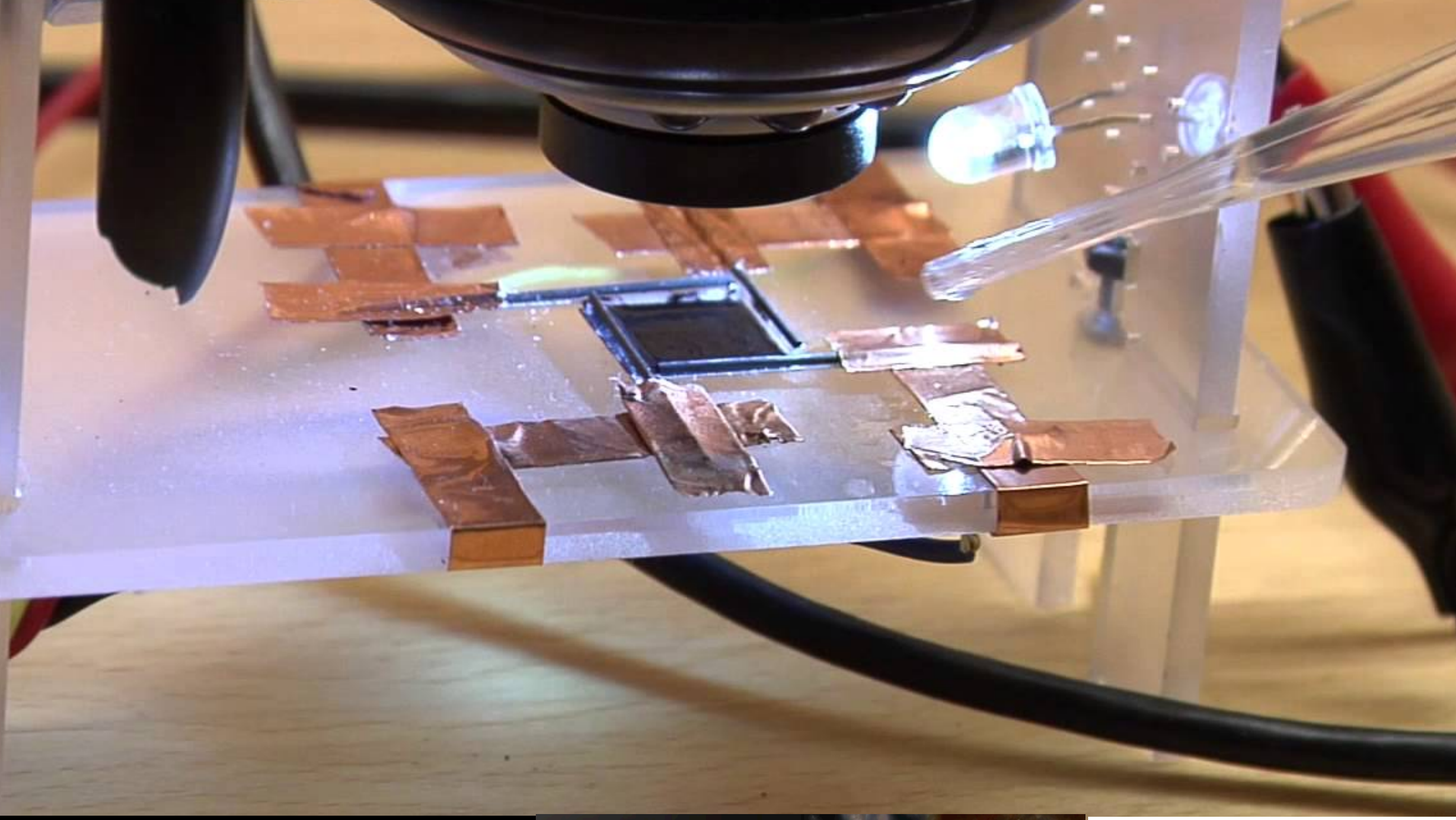
1周

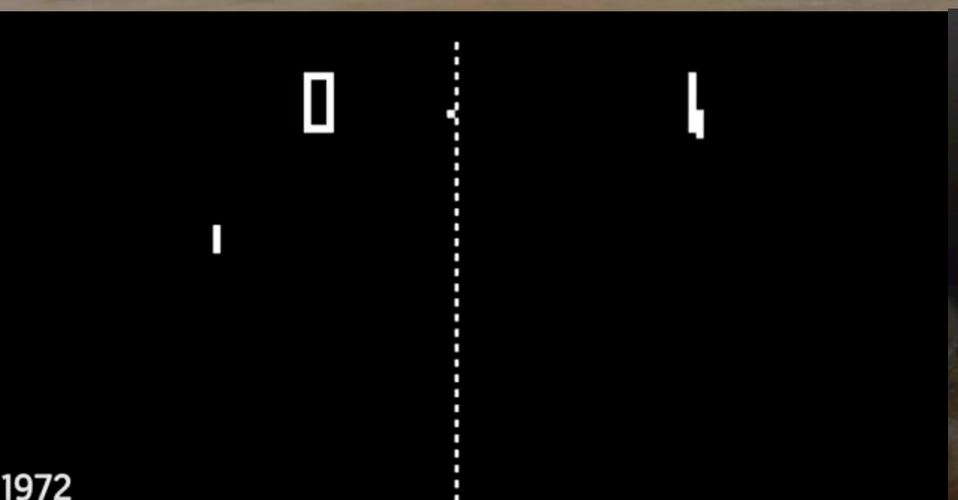
20%

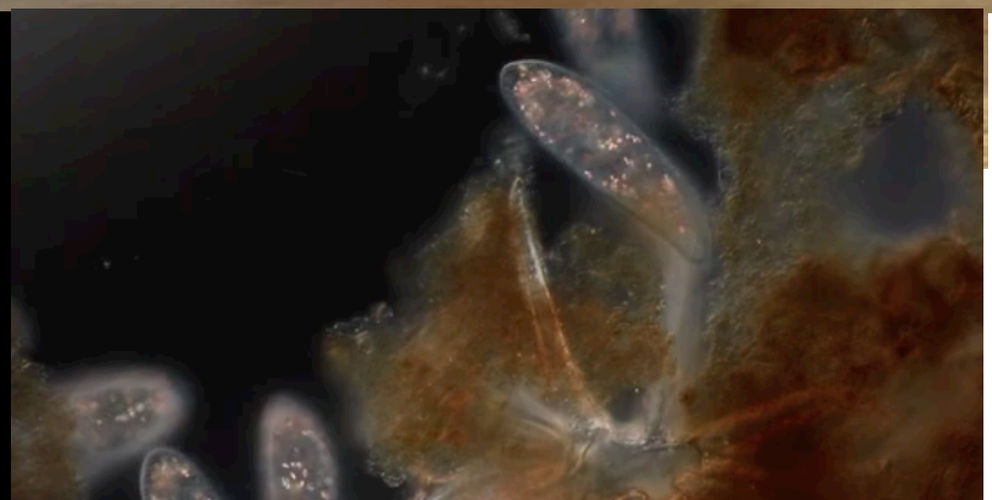
Formular 5 preguntas y/o observaciones

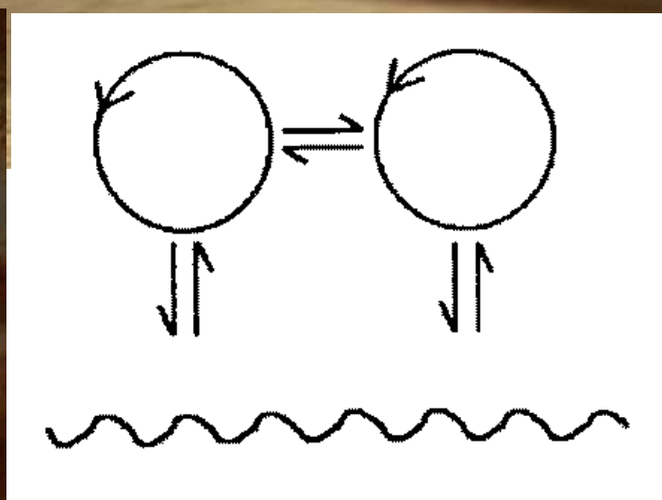
basado en：3 lecturas =　（ 1 + 2 ）

profundizar en los temas　a través de una **discusión**




0
1
1972





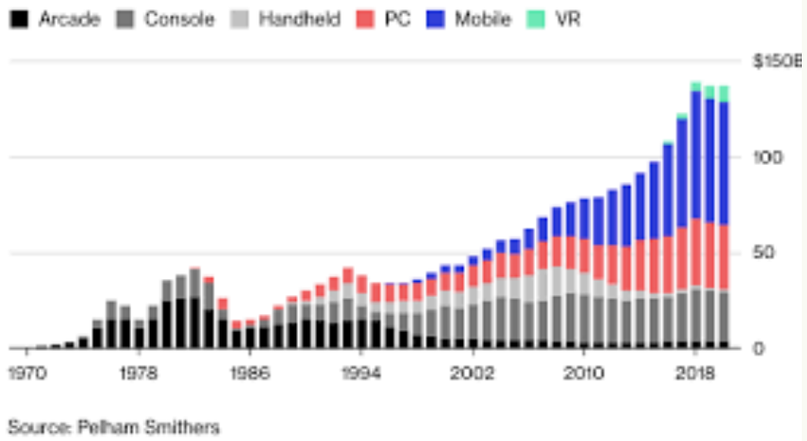
VR

mobile phone

PC (computer)

Consoles

Arcade

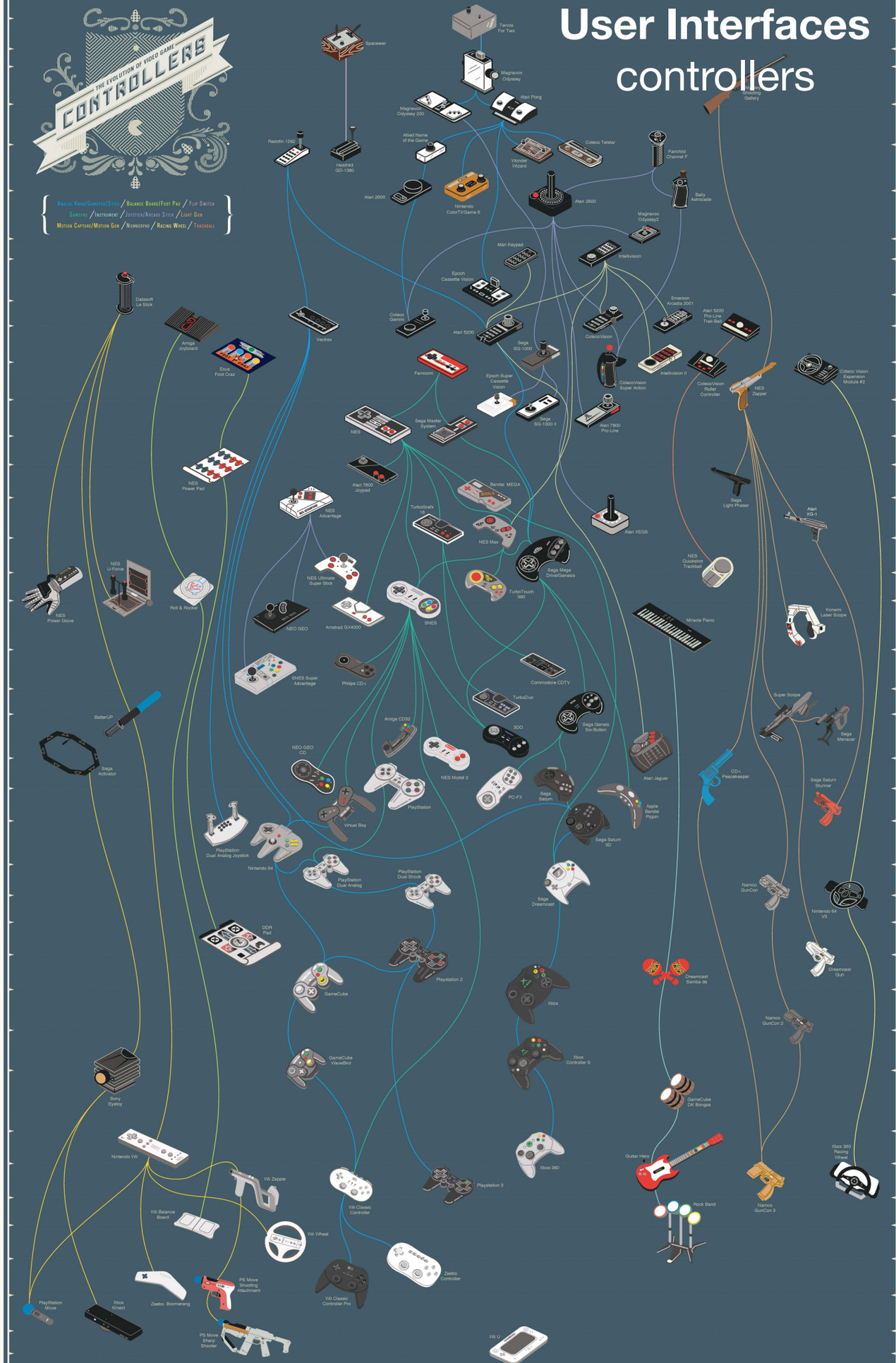


Video Juegos

https://retronuke.com/games-are-changing-evolution-of-video-games/

Computer graphics

User Interfaces
controllers



Juegos bióticos y la biología de microorganismos

10月

2周

Computadoras y video juegos:
maquinas de Turing, computación & video juegos

Evolución de maquinas y video juegos

25%

20%

20%

20%

20%

60%

40%

1周 2周

20%

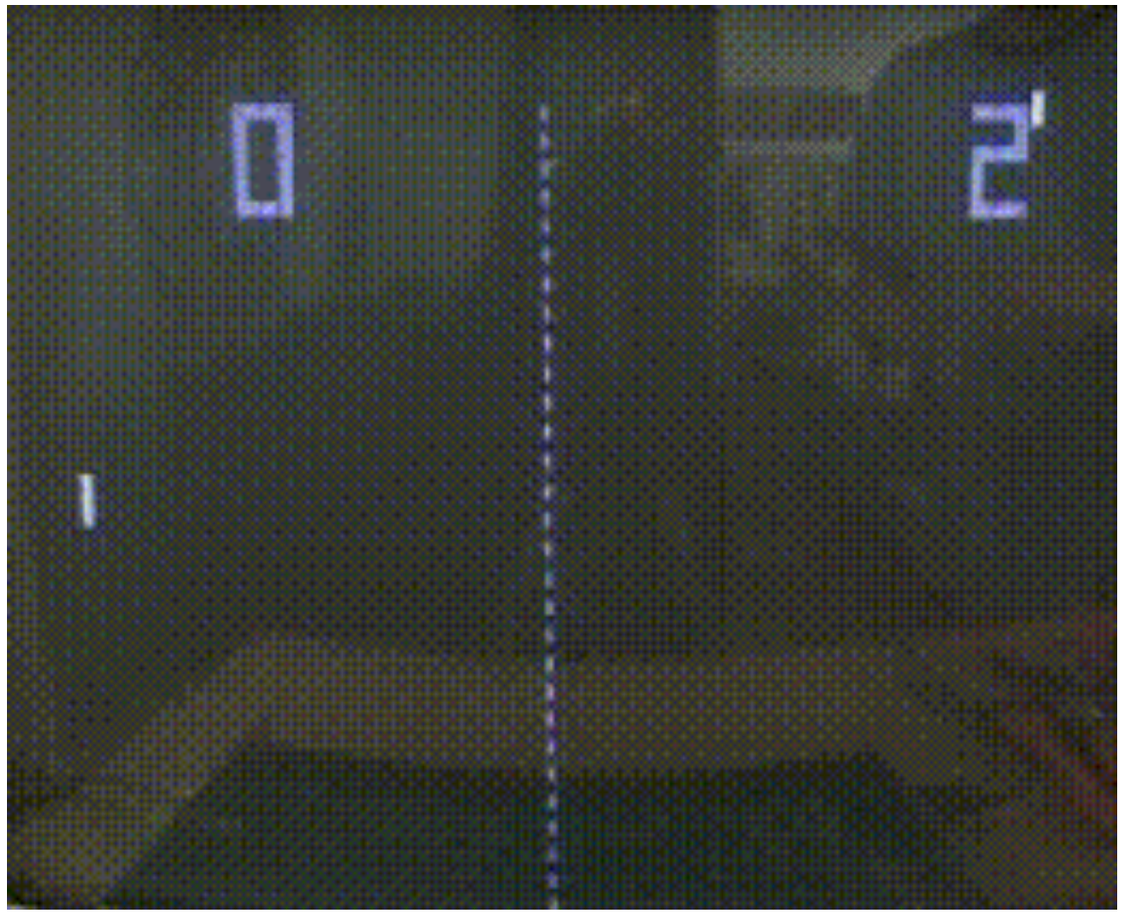
formular un par de párrafos **(media pagina)**

basado en： 1 articulo + 3 videos y
Jugar con Little Man Computer (CPU/RAM)

¿Qué es para mi **computar** y **programar**?

video juegos

$$\vec{F} = m \cdot \vec{a}$$

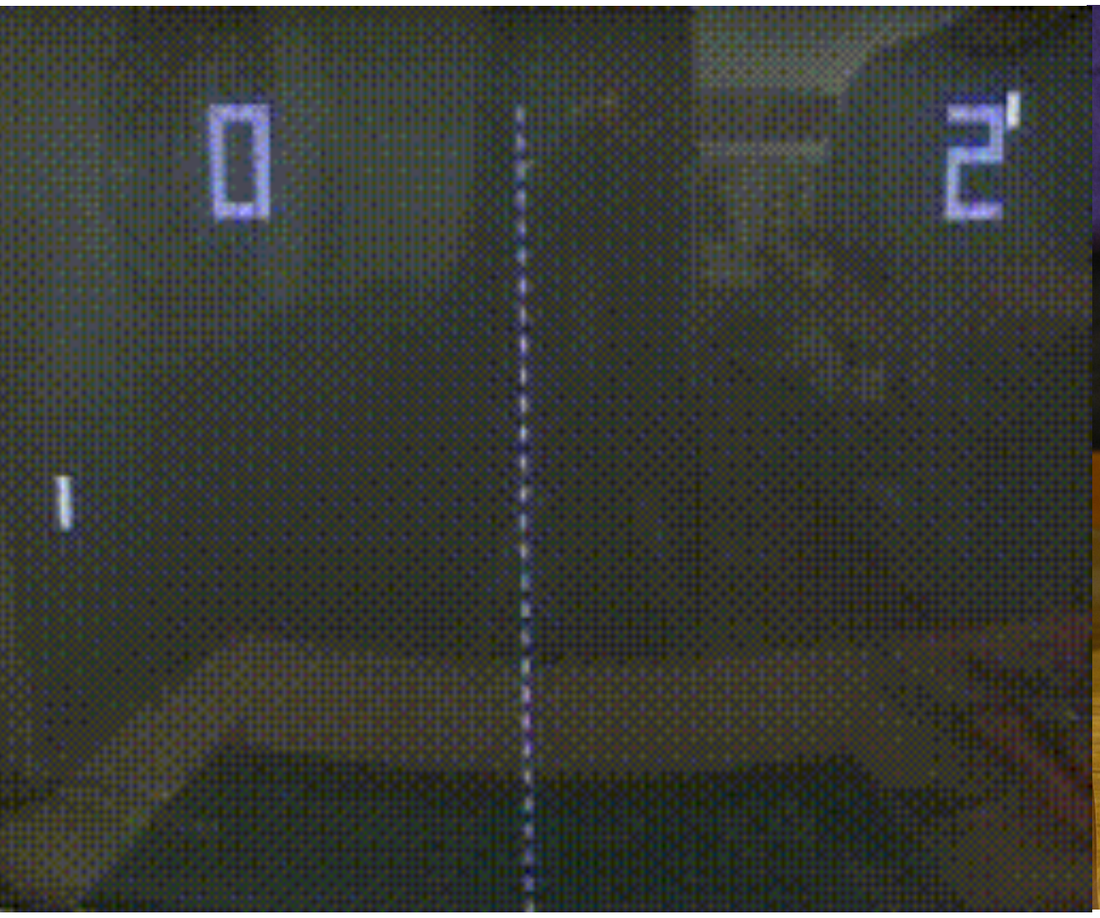


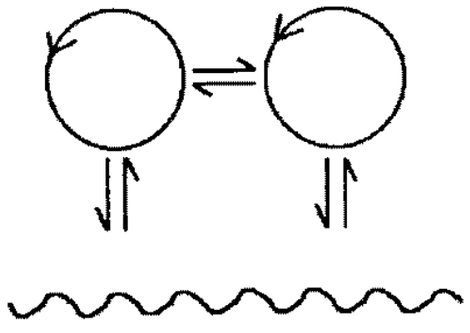
where you hit the ball on the paddle
determines the angle at which it comes off

1972

Model

$$\vec{F} = m \cdot \vec{a}$$





Algoritmo

Programa

Computar

Simulation

(maquina) **computadora**

Apple 1, 1975

1972

tty, 1855

Reading : Scientific American April 1999 (4 text pages)

Alan Turing's Forgotten Ideas in Computer Science

Well known for the machine, test and thesis that bear his name, the British genius also anticipated neural-network computers and "hypercomputation"

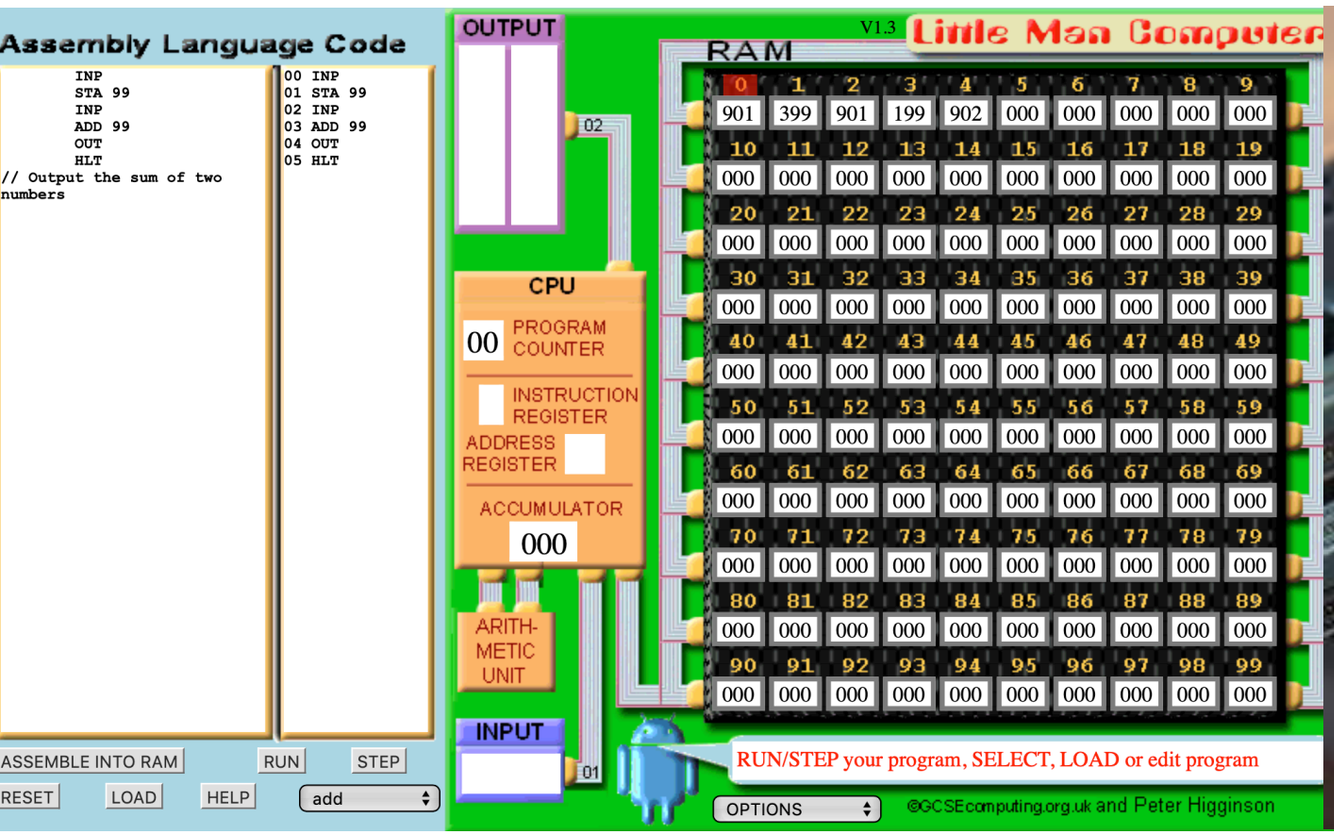
by B. Jack Copeland and Diane Proudfoot

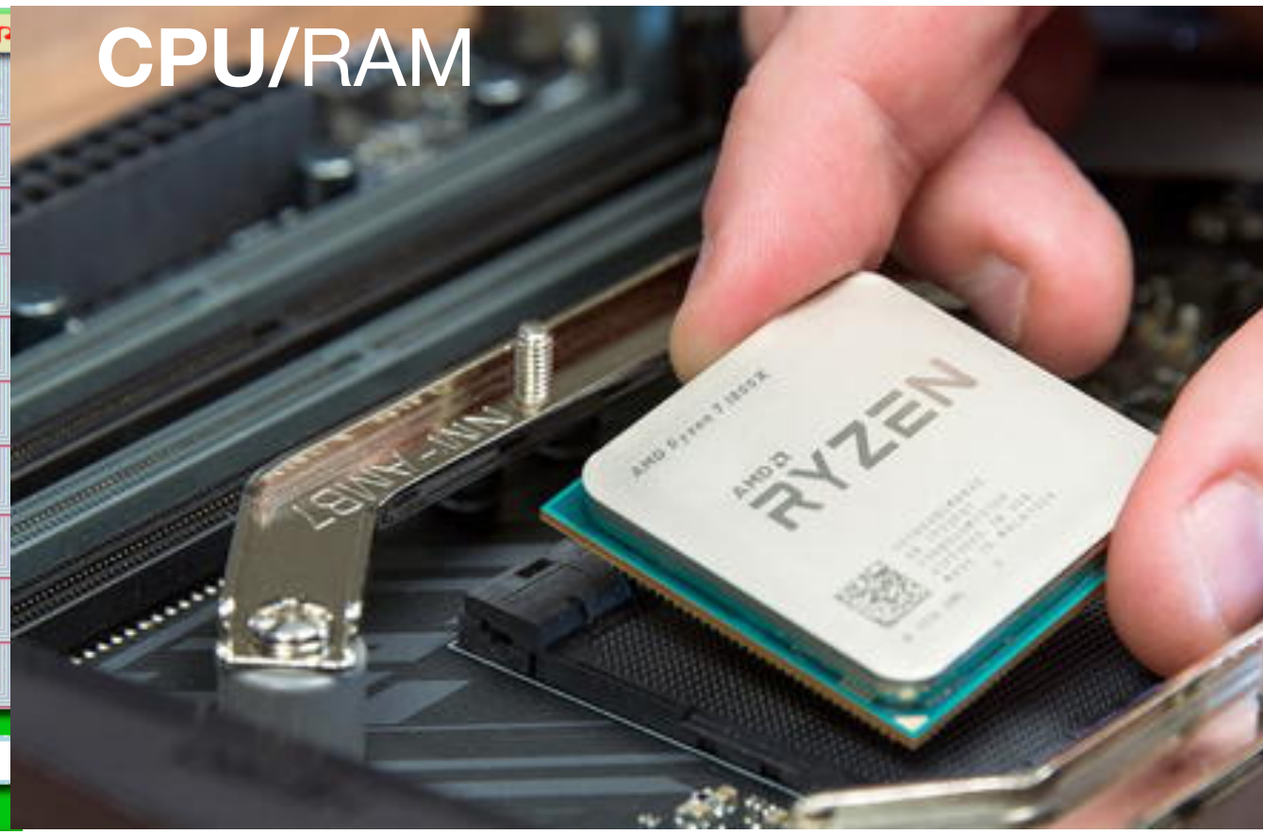
Alan Turing, 22 years old replied to Hilbert on **decidability**

Video 1: Turing Machines explained visually (8'45") Art of the Problem

Video 2: Turing Machines - The Accidental Birth of Computer Science (17') Up and Atom

LMC - Little Man Computer





After reading & watching videos., **Play online**: LMC simulator + help (e.i. sum 3 + 5)

ENIAC PROGRAMMERS PROJECT

http://eniacprogrammers.org

Electronic Numeric Integrator and Computer

1944 –1946 ->

tty, 1855

tty, 1944

tty, 1933

Pascalina, 1652

UPDATED: AUG 22, 2018 · ORIGINAL: DEC 13, 2016

Human Computers: The Women of NASA

BRYNN HOLLAND

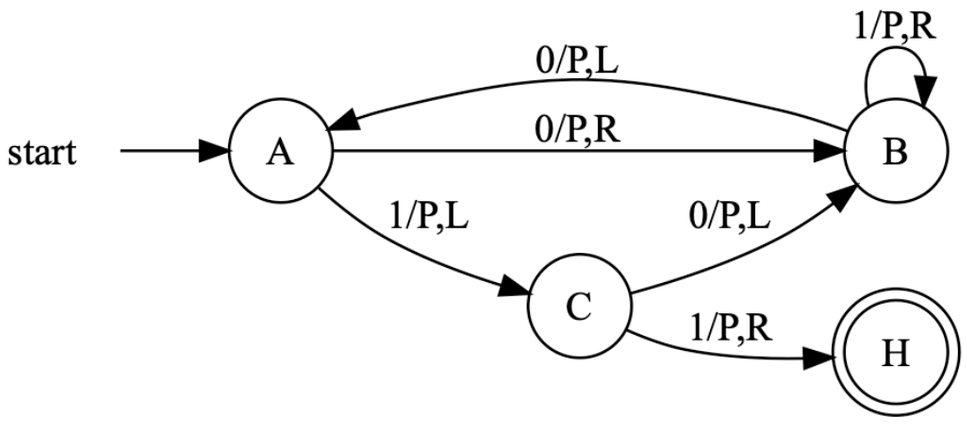
Mechanization of mental work
(decision machine)

ON COMPUTABLE NUMBERS, WITH AN APPLICATION TO THE ENTSCHEIDUNGSPROBLEM

By A. M. Turing.

[Received 28 May, 1936.—Read 12 November, 1936.]

The "computable" numbers may be described briefly as the real numbers whose expressions as a decimal are calculable by finite means.



Mental states, instructions set, & tape

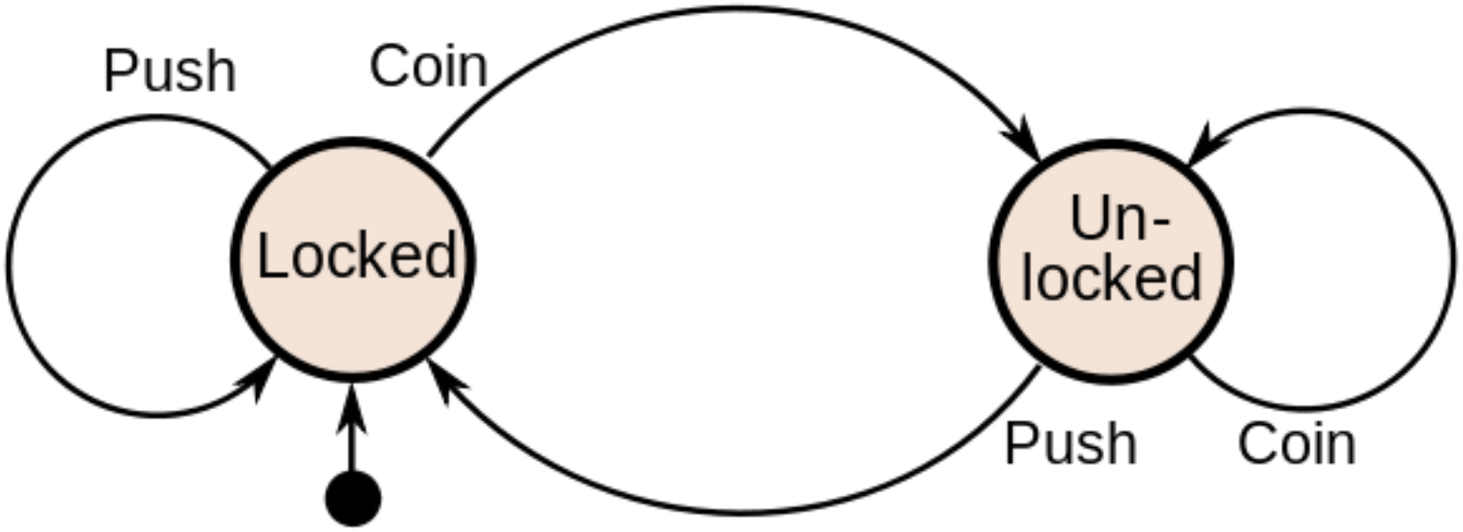
@ m-state

IF (aware of) symbols → **DO** (move, write/erase) → **NEXT** (next m-state)

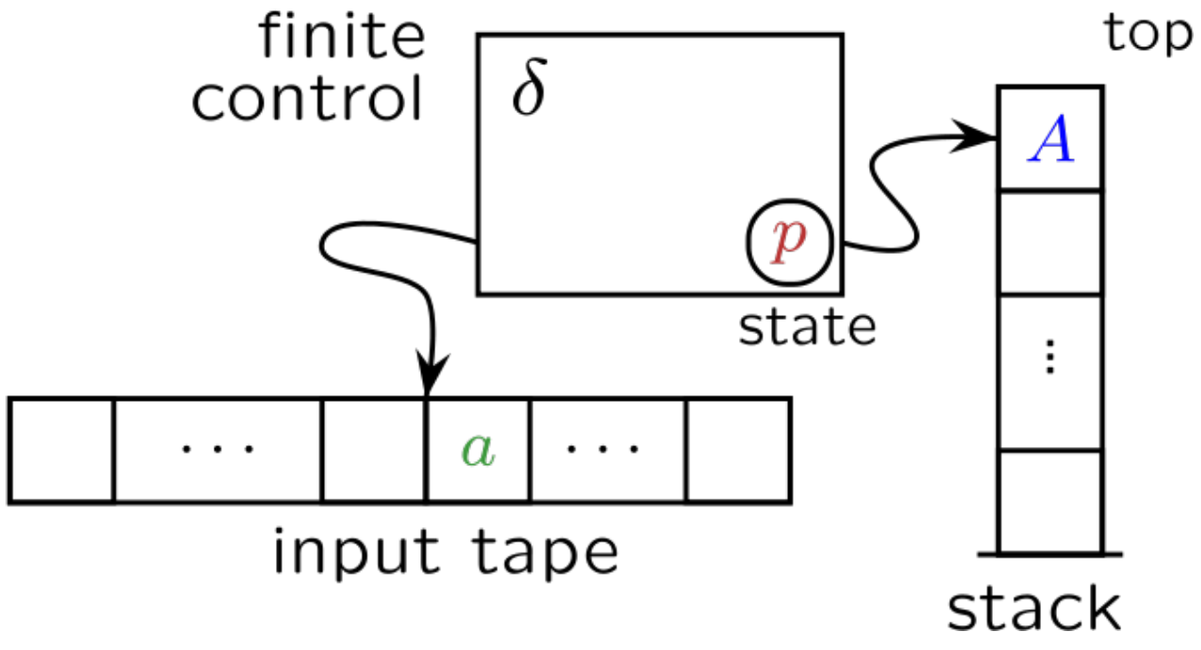
Program

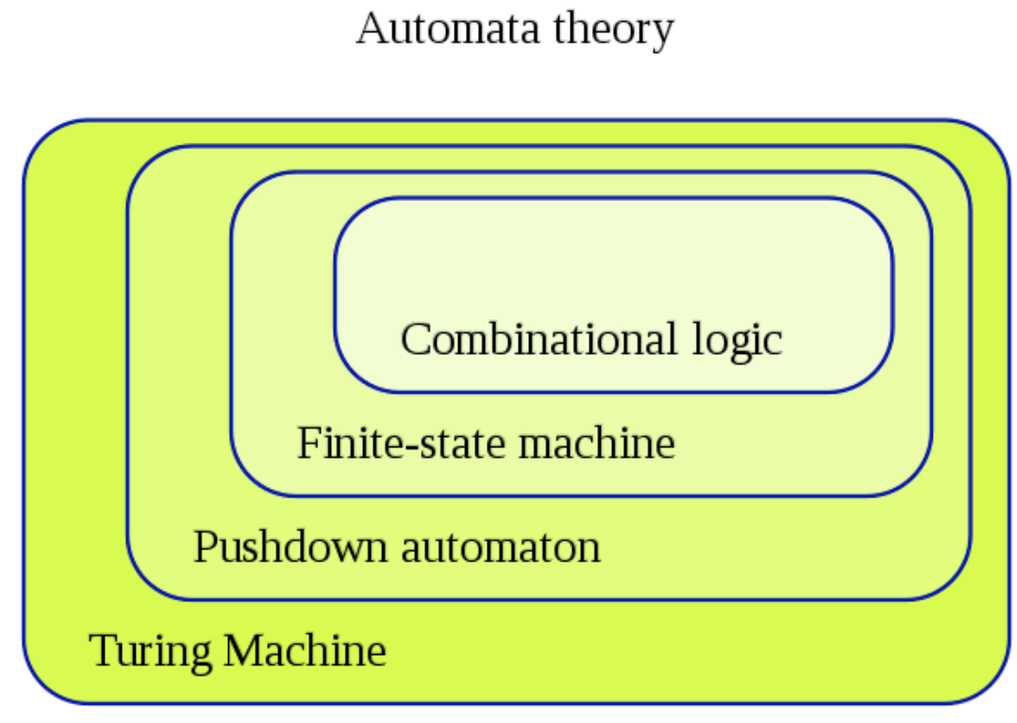
Algorithm

Finite state machine (automata)

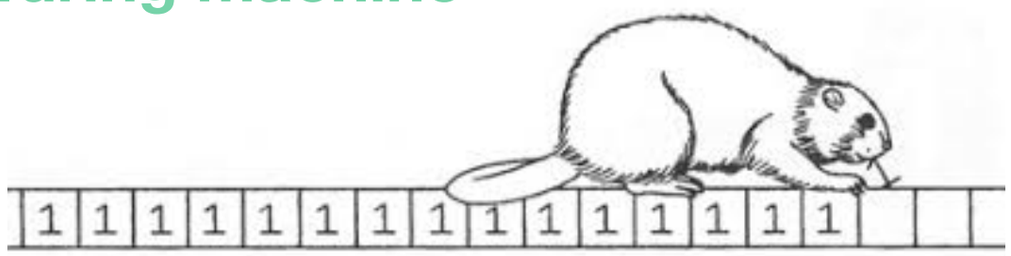


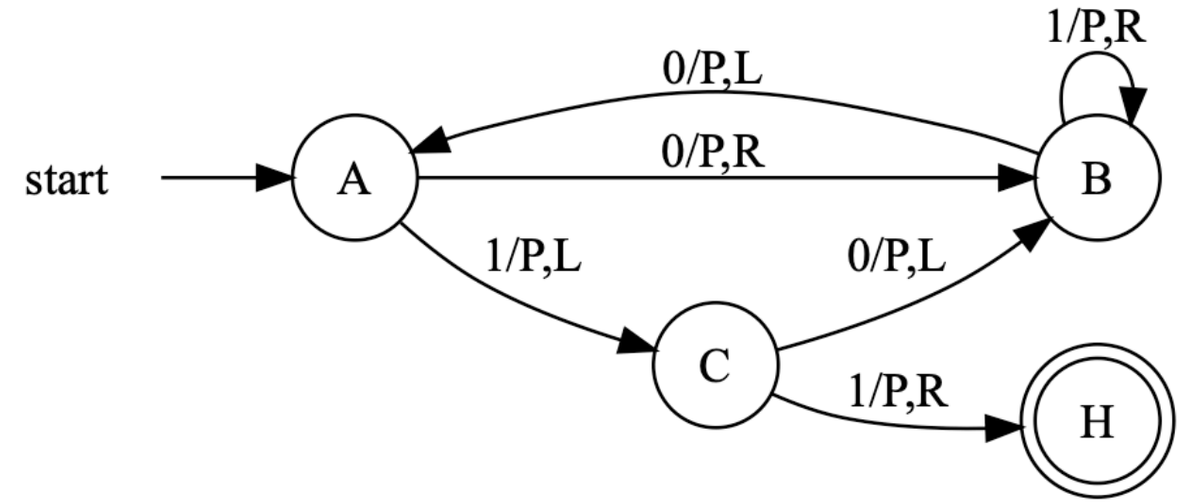
Push down automata





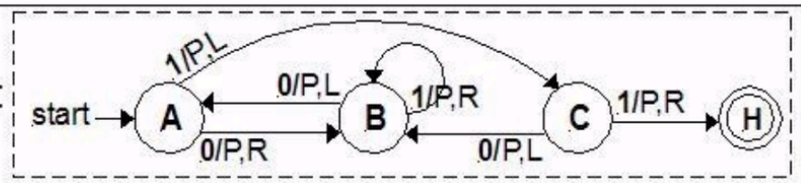
Turing machine





3-state busy beaver

3-state busy beaver:



Total system state -- complete configuration (aka "instantaneous description") TAPE & TABLE & HEAD

Sequence	Instruction	Head	Instruction: A B C H	TAPE & TABLE & HEAD
		0 0 0 0 0 0 0 **0** 0 0 0 0 0 0 0		
1	A	0 0 0 0 0 0 0 **0** 0 0 0 0 0 0 0	A	A **0**
2	B	0 0 0 0 0 0 0 **0** **1** 0 0 0 0 0 0	B	B **0** 1
3	A	0 0 0 0 0 0 **1** **1** 0 0 0 0 0 0 0	A	1 A **1**
4	C	0 0 0 0 0 **1** **1** **0** 0 0 0 0 0 0 0	C	1 1 C **0**
5	B	0 0 0 0 **1** **1** **1** **0** 0 0 0 0 0 0 0	B	1 1 1 B **0**
6	A	0 0 0 **1** **1** **1** **1** **0** 0 0 0 0 0 0 0	A	1 1 1 1 A **0**
7	B	0 0 0 0 **1** **1** **1** **1** 1 0 0 0 0 0 0	B	1 1 1 B **1** 1
8	B	0 0 0 0 0 **1** **1** **1** 1 1 0 0 0 0 0	B	1 1 B **1** 1 1
9	B	0 0 0 0 0 0 **1** **1** 1 1 1 0 0 0 0	B	1 B **1** 1 1 1
10	B	0 0 0 0 0 0 0 **1** 1 1 1 1 0 0 0	B	B **1** 1 1 1 1
11	B	0 0 0 0 0 0 0 **0** 1 1 1 1 1 0 0	B	B **0** 1 1 1 1 1
12	A	0 0 0 0 0 0 **1** **1** 1 1 1 1 1 0 0	A	1 A **1** 1 1 1 1
13	C	0 0 0 0 0 **1** **1** **1** 1 1 1 1 0 0 0	C	1 1 C **1** 1 1 1
14	H	0 0 0 0 0 0 **1** **1** 1 1 1 1 1 0 0 0	H	1 H **1** 1 1 1 1

time -->

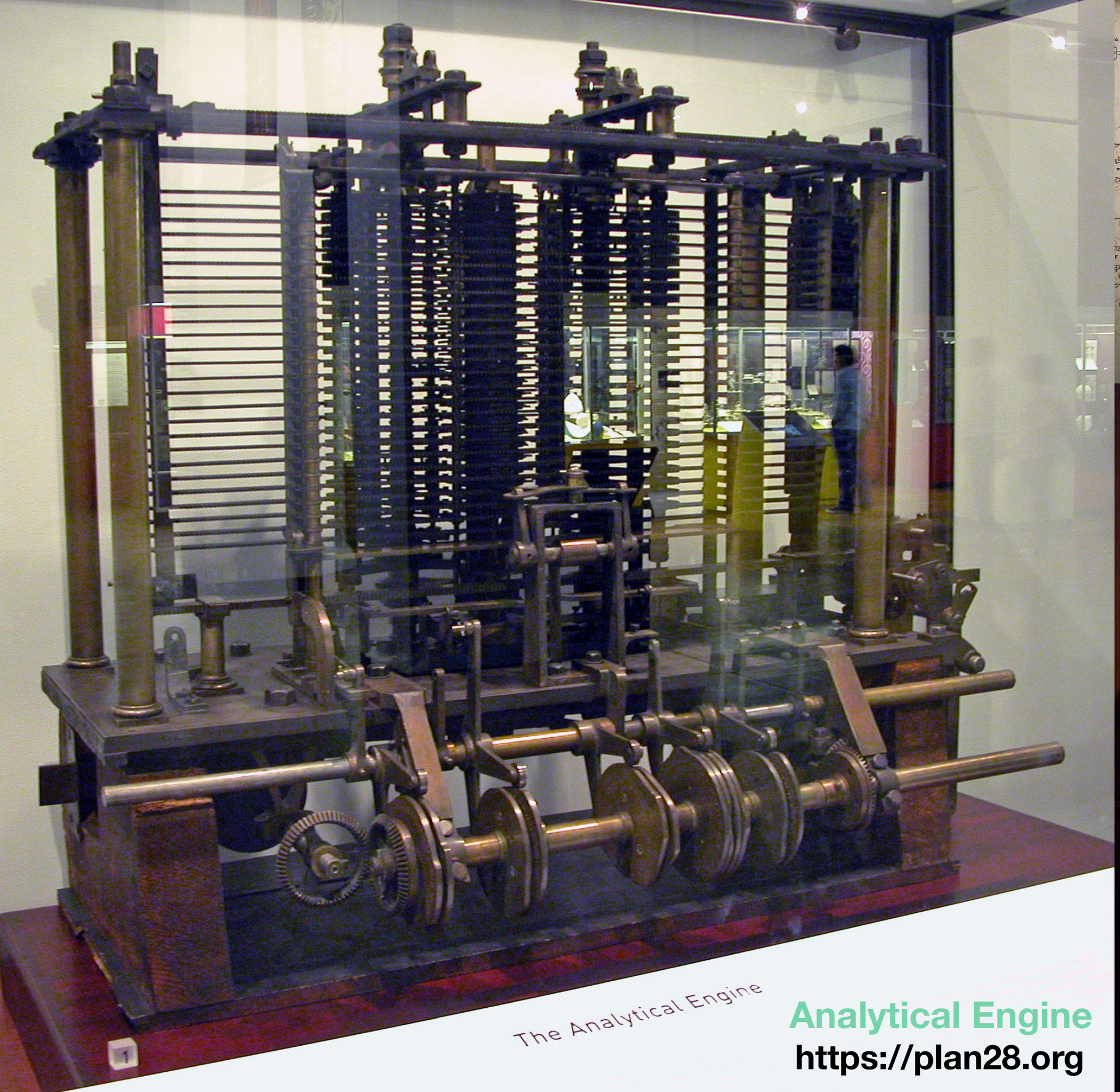
Progress of the computation (state-trajectory) of a 3-state busy beaver

The first program Diagram for the computation by the Engine of the Numbers of Bernoulli. See Note G. (page 722 *et seq.*)

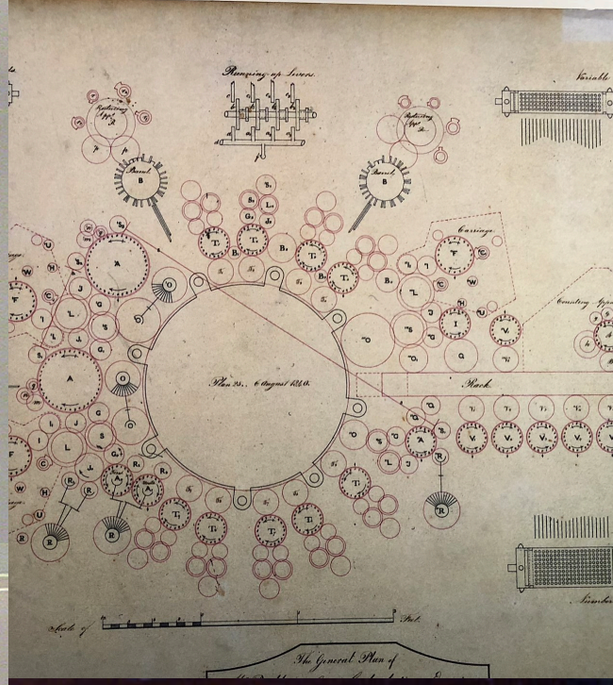
Nature of Operation.	Variables acted upon.	Variables receiving results.	Indication of change in the value on any Variable.	Statement of Results.	Data.			Working Variables.									Result Variable
					${}^{1}V_1$ ○ 0 0 1 [1]	${}^{1}V_2$ ○ 0 0 2 [2]	${}^{1}V_3$ ○ 0 0 4 [n]	${}^{0}V_4$ ○ 0 0 0 [ ]	${}^{0}V_5$ ○ 0 0 0 [ ]	${}^{0}V_6$ ○ 0 0 0 [ ]	${}^{0}V_7$ ○ 0 0 0 [ ]	${}^{0}V_8$ ○ 0 0 0 [ ]	${}^{0}V_9$ ○ 0 0 0 [ ]	${}^{0}V_{10}$ ○ 0 0 0 [ ]	${}^{0}V_{11}$ ○ 0 0 0 [ ]	${}^{0}V_{12}$ ○ 0 0 0 [ ]	${}^{0}V_{13}$ ..... ○ 0 0 0 [ ]	${}^{1}V_{21}$ B_1 in a decimal fraction. [B_1]	${}^{1}V_{22}$ B_3 in a decimal fraction. [B_3]	${}^{1}V_{23}$ B_5 in a decimal [B_5]
×	${}^{1}V_2 \times {}^{1}V_3$	${}^{1}V_4, {}^{1}V_5, {}^{1}V_6$	${}^{1}V_2 = {}^{1}V_2$, ${}^{1}V_3 = {}^{1}V_3$	$= 2n$	...	2	n	$2n$	$2n$	$2n$										
−	${}^{1}V_4 - {}^{1}V_1$	${}^{2}V_4$	${}^{1}V_4 = {}^{2}V_4$, ${}^{1}V_1 = {}^{1}V_1$	$= 2n-1$	1	...	...	$2n-1$												
+	${}^{1}V_5 + {}^{1}V_1$	${}^{2}V_5$	${}^{1}V_5 = {}^{2}V_5$, ${}^{1}V_1 = {}^{1}V_1$	$= 2n+1$	1	...	...	...	$2n+1$											
÷	${}^{2}V_5 \div {}^{2}V_4$	${}^{1}V_{11}$	${}^{2}V_5 = {}^{0}V_5$, ${}^{2}V_4 = {}^{0}V_4$	$= \frac{2n-1}{2n+1}$	...	...	...	0	0	...	...	...	...	...	$\frac{2n-1}{2n+1}$					
÷	${}^{1}V_{11} \div {}^{1}V_2$	${}^{2}V_{11}$	${}^{1}V_{11} = {}^{2}V_{11}$, ${}^{1}V_2 = {}^{1}V_2$	$= \frac{1}{2} \cdot \frac{2n-1}{2n+1}$	...	2	...	...	...	...	...	...	...	...	$\frac{1}{2} \cdot \frac{2n-1}{2n+1}$					
−	${}^{0}V_{13} - {}^{2}V_{11}$	${}^{1}V_{13}$	${}^{2}V_{11} = {}^{0}V_{11}$, ${}^{0}V_{13} = {}^{1}V_{13}$	$= -\frac{1}{2} \cdot \frac{2n-1}{2n+1} = A_0$	...	...	...	...	...	...	...	...	...	...	0	.....	$-\frac{1}{2} \cdot \frac{2n-1}{2n+1} = A_0$			
−	${}^{1}V_3 - {}^{1}V_1$	${}^{1}V_{10}$	${}^{1}V_3 = {}^{1}V_3$, ${}^{1}V_1 = {}^{1}V_1$	$= n-1\ (=3)$	1	...	n	...	...	...	...	...	...	$n-1$						
+	${}^{1}V_2 + {}^{0}V_7$	${}^{1}V_7$	${}^{1}V_2 = {}^{1}V_2$, ${}^{0}V_7 = {}^{1}V_7$	$= 2 + 0 = 2$	...	2	...	...	...	...	2									
÷	${}^{1}V_6 \div {}^{1}V_7$	${}^{3}V_{11}$	${}^{1}V_6 = {}^{1}V_6$, ${}^{0}V_{11} = {}^{3}V_{11}$	$= \frac{2n}{2} = A_1$	...	...	...	...	...	$2n$	2	...	...	...						
×	${}^{1}V_{21} \times {}^{3}V_{11}$	${}^{1}V_{12}$	${}^{1}V_{21} = {}^{1}V_{21}$, ${}^{3}V_{11} = {}^{3}V_{11}$	$= B_1 \cdot \frac{2n}{2} = B_1 A_1$	...	...	...	...	...	...	...	...	...	...						
+	${}^{1}V_{12} + {}^{1}V_{13}$	${}^{2}V_{13}$	${}^{1}V_{12} = {}^{0}V_{12}$, ${}^{1}V_{13} = {}^{2}V_{13}$	$= -\frac{1}{2} \cdot \frac{2n-1}{2n+1} + B_1 \cdot \frac{2n}{2}$ ...	...	...	...	...	...	...	...	...	...	...						
−	${}^{1}V_{10} - {}^{1}V_1$	${}^{2}V_{10}$	${}^{1}V_{10} = {}^{2}V_{10}$, ${}^{1}V_1 = {}^{1}V_1$	$= n-2\ (=2)$	1	...	...	...	...	...	...	...	...	$n-2$						
−	${}^{1}V_6 - {}^{1}V_1$	${}^{2}V_6$	${}^{1}V_6 = {}^{2}V_6$, ${}^{1}V_1 = {}^{1}V_1$	$= 2n-1$	1	...	...	...	...	...	$2n-1$									
+	${}^{1}V_1 + {}^{1}V_7$	${}^{2}V_7$	${}^{1}V_1 = {}^{1}V_1$, ${}^{1}V_7 = {}^{2}V_7$	$= 2 + 1 = 3$	1	...	...	...	...	...	3									
÷	${}^{2}V_6 \div {}^{2}V_7$	${}^{1}V_8$	${}^{2}V_6 = {}^{2}V_6$, ${}^{2}V_7 = {}^{2}V_7$	$= \frac{2n-1}{3}$	...	...	...	...	...	...	$2n-1$	3	$\frac{2n-1}{3}$						
×	${}^{1}V_8 \times {}^{3}V_{11}$	${}^{4}V_{11}$	${}^{1}V_8 = {}^{0}V_8$, ${}^{3}V_{11} = {}^{4}V_{11}$	$= \frac{2n}{2} \cdot \frac{2n-1}{3}$	...	...	...	...	...	...	...	...	0	...	...					
−	${}^{2}V_6 - {}^{1}V_1$	${}^{3}V_6$	${}^{2}V_6 = {}^{3}V_6$, ${}^{1}V_1 = {}^{1}V_1$	$= 2n-2$	1	...	...	...	...	...	$2n-2$									
+	${}^{1}V_1 + {}^{2}V_7$	${}^{3}V_7$	${}^{2}V_7 = {}^{3}V_7$, ${}^{1}V_1 = {}^{1}V_1$	$= 3 + 1 = 4$	1	...	...	...	...	...	4									
÷	${}^{3}V_6 \div {}^{3}V_7$	${}^{1}V_9$	${}^{3}V_6 = {}^{3}V_6$, ${}^{3}V_7 = {}^{3}V_7$	$= \frac{2n-2}{4}$	...	...	...	...	...	...	$2n-2$	4	...	$\frac{2n-2}{4}$	...				
×	${}^{1}V_9 \times {}^{4}V_{11}$	${}^{5}V_{11}$	${}^{1}V_9 = {}^{0}V_9$, ${}^{4}V_{11} = {}^{5}V_{11}$	$= \frac{2n}{2} \cdot \frac{2n-1}{3} \cdot \frac{2n-2}{4} = A_3$	...	...	...	...	...	...	...	...	...	0						
×	${}^{1}V_{22} \times {}^{5}V_{11}$	${}^{0}V_{12}$	${}^{1}V_{22} = {}^{1}V_{22}$, ${}^{0}V_{12} = {}^{2}V_{12}$	$= B_3 \cdot \frac{2n}{2} \cdot \frac{2n-1}{3} \cdot \frac{2n-2}{3} = B_3 A_3$	...	...	...	...	...	...	...	...	...	...	...	...				
+	${}^{2}V_{12} + {}^{2}V_{13}$	${}^{3}V_{13}$	${}^{2}V_{12} = {}^{0}V_{12}$, ${}^{2}V_{13} = {}^{3}V_{13}$	$= A_0 + B_1 A_1 + B_3 A_3$	...	...	...	...	...	...	...	...	...	...	...	...				
−	${}^{2}V_{10} - {}^{1}V_1$	${}^{3}V_{10}$	${}^{2}V_{10} = {}^{3}V_{10}$, ${}^{1}V_1 = {}^{1}V_1$	$= n-3\ (=1)$	1	...	...	...	...	...	...	...	...	...	...	...				

Here follows a repetition of Operations thirteen to twenty

+	${}^{4}V_{13} + {}^{0}V_{24}$	${}^{1}V_{24}$	${}^{4}V_{13} = {}^{0}V_{13}$, ${}^{0}V_{24} = {}^{1}V_{24}$	$= B_7$	...	...	...	...	...	...	...	...	...	...	...	...				
+	${}^{1}V_1 + {}^{1}V_3$	${}^{1}V_3$	${}^{1}V_1 = {}^{1}V_1$, ${}^{1}V_3 = {}^{1}V_3$, ${}^{5}V_6 = {}^{0}V_6$, ${}^{5}V_7 = {}^{0}V_7$	$= n+1 = 4+1 = 5$ ..... by a Variable-card. by a Variable card.	1	...	$n+1$	...	...	0	0									



The Analytical Engine



Charles Babbage, 1834

Analytical Engine

https://plan28.org

Diagram for the computation by the Engine of the Numbers of Bernoulli. See Note G. (page 722 *et seq.*)

Nature of Operation.	Variables acted upon.	Variables receiving results.	Indication of change in the value on any Variable.	Statement of Results.	Data.			Working Variables.											
					$^{1}V_1$	$^{1}V_2$	$^{1}V_3$	$^{0}V_4$	$^{0}V_5$	$^{0}V_6$	$^{0}V_7$	$^{0}V_8$	$^{0}V_9$	$^{0}V_{10}$	$^{0}V_{11}$	$^{0}V_{12}$	$^{0}V_{13}$	$^{1}V_{14}$ .....
					1	2	n											
×	$^{1}V_2 \times {}^{1}V_3$	$^{1}V_4, {}^{1}V_5, {}^{1}V_6$	$\left\{\begin{matrix} {}^{1}V_7 = {}^{1}V_2 \\ {}^{1}V_8 = {}^{1}V_3 \end{matrix}\right\}$	$= 2n$	...	2	n	$2n$	$2n$	$2n$								
−	$^{1}V_4 - {}^{1}V_1$	$^{2}V_4$	$\left\{\begin{matrix} {}^{1}V_3 = {}^{2}V_4 \\ {}^{1}V_1 = {}^{2}V_1 \end{matrix}\right\}$	$= 2n-1$	1	...	...	$2n-1$										
+	$^{1}V_5 + {}^{1}V_1$	$^{2}V_5$	$\left\{\begin{matrix} {}^{1}V_3 = {}^{2}V_5 \\ {}^{1}V_1 = {}^{1}V_3 \end{matrix}\right\}$	$= 2n+1$	1	...	...	...	$2n+1$									
+	$^{2}V_5 + {}^{2}V_4$	$^{1}V_{11}$	$\left\{\begin{matrix} {}^{2}V_5 = {}^{0}V_9 \\ {}^{2}V_4 = {}^{0}V_8 \end{matrix}\right\}$	$= \frac{2n-1}{2n+1}$	...	...	...	0	0	...	...	...	...	...	$\frac{2n-1}{2n+1}$			
+	$^{1}V_{11} + {}^{2}V_2$	$^{2}V_{11}$	$\left\{\begin{matrix} {}^{1}V_{11} = {}^{2}V_{11} \\ {}^{1}V_2 = {}^{1}V_2 \end{matrix}\right\}$	$= \frac{1}{2} \cdot \frac{2n-1}{2n+1}$	...	2	...	...	...	...	...	...	...	...	$\frac{1}{2} \cdot \frac{2n-1}{2n+1}$		
−	$^{2}V_{13} - {}^{2}V_{11}$	$^{1}V_{13}$	$\left\{\begin{matrix} {}^{2}V_{11} = {}^{0}V_{11} \\ {}^{2}V_{13} = {}^{1}V_{13} \end{matrix}\right\}$	$= -\frac{1}{2} \cdot \frac{2n-1}{2n+1} = A_0$	...	...	...	...	...	...	...	...	...	...	0	.....	$-\frac{1}{2} \cdot \frac{2n-1}{2n+1} = A_0$	
−	$^{1}V_3 - {}^{1}V_1$	$^{1}V_{10}$	$\left\{\begin{matrix} {}^{1}V_3 = {}^{1}V_3 \\ {}^{1}V_1 = {}^{1}V_1 \end{matrix}\right\}$	$= n-1\ (=3)$	1	...	n	...	...	...	...	...	...	$n-1$				
+	$^{1}V_2 + {}^{0}V_7$	$^{1}V_7$	$\left\{\begin{matrix} {}^{1}V_2 = {}^{1}V_2 \\ {}^{0}V_7 = {}^{0}V_7 \end{matrix}\right\}$	$= 2 + 0 = 2$	...	2	...	...	...	...	2							
+	$^{1}V_6 + {}^{1}V_7$	$^{2}V_{11}$	$\left\{\begin{matrix} {}^{1}V_6 = {}^{1}V_6 \\ {}^{0}V_{11} = {}^{2}V_{11} \end{matrix}\right\}$	$= \frac{2n}{2} = A_1$	...	...	...	...	...	$2n$	2	...	...	...	$\frac{2n}{2} = A_1$			
×	$^{1}V_{21} \times {}^{2}V_{11}$	$^{1}V_{12}$	$\left\{\begin{matrix} {}^{1}V_{21} = {}^{1}V_{21} \\ {}^{2}V_{11} = {}^{2}V_{11} \end{matrix}\right\}$	$= B_1 \cdot \frac{2n}{2} = B_1 A_1$	...	...	...	...	...	...	...	...	...	...	$\frac{2n}{2} = A_1$	$B_1 \cdot \frac{2n}{2} = B_1 A_1$	.....	
+	$^{1}V_{12} + {}^{1}V_{13}$	$^{2}V_{13}$	$\left\{\begin{matrix} {}^{1}V_{12} = {}^{2}V_{12} \\ {}^{1}V_{13} = {}^{2}V_{13} \end{matrix}\right\}$	$= -\frac{1}{2} \cdot \frac{2n-1}{2n+1} + B_1 \cdot \frac{2n}{2}$ ...	...	...	...	...	...	...	...	...	...	...	.....	0	$\left\{-\frac{1}{2} \cdot \frac{2n-1}{2n+1} + B_1 \cdot \frac{2n}{2}\right\}$	
−	$^{1}V_{10} - {}^{1}V_1$	$^{2}V_{10}$	$\left\{\begin{matrix} {}^{1}V_{10} = {}^{2}V_{10} \\ {}^{1}V_1 = {}^{1}V_1 \end{matrix}\right\}$	$= n-2\ (=2)$	1	...	...	...	...	...	...	...	...	$n-2$				
−	$^{1}V_6 - {}^{1}V_1$	$^{2}V_6$	$\left\{\begin{matrix} {}^{1}V_6 = {}^{1}V_6 \\ {}^{1}V_1 = {}^{1}V_1 \end{matrix}\right\}$	$= 2n-1$	1	...	...	...	...	$2n-1$								
+	$^{1}V_1 + {}^{2}V_2$	$^{2}V_7$	$\left\{\begin{matrix} {}^{1}V_1 = {}^{1}V_1 \\ {}^{2}V_2 = {}^{2}V_2 \end{matrix}\right\}$	$= 2 + 1 = 3$	1	...	...	...	...	...	3							
+	$^{2}V_6 + {}^{2}V_2$	$^{1}V_8$	$\left\{\begin{matrix} {}^{2}V_6 = {}^{0}V_6 \\ {}^{2}V_2 = {}^{2}V_2 \end{matrix}\right\}$	$= \frac{2n-1}{3}$	...	...	...	...	...	$2n-1$	3	$\frac{2n-1}{3}$			$\frac{2n}{2} \cdot \frac{2n-1}{3}$			
×	$^{1}V_8 \times {}^{2}V_{11}$	$^{4}V_{11}$	$\left\{\begin{matrix} {}^{1}V_8 = {}^{0}V_8 \\ {}^{2}V_{11} = {}^{4}V_{11} \end{matrix}\right\}$	$= \frac{2n}{2} \cdot \frac{2n-1}{3}$	...	...	...	...	...	...	...	0	...	...				
−	$^{2}V_6 - {}^{1}V_1$	$^{2}V_6$	$\left\{\begin{matrix} {}^{2}V_6 = {}^{2}V_6 \\ {}^{1}V_1 = {}^{1}V_1 \end{matrix}\right\}$	$= 2n-2$	1	...	...	...	...	$2n-2$								
+	$^{1}V_1 + {}^{2}V_2$	$^{2}V_7$	$\left\{\begin{matrix} {}^{1}V_1 = {}^{1}V_1 \\ {}^{2}V_2 = {}^{2}V_2 \end{matrix}\right\}$	$= 3 + 1 = 4$	1	...	...	...	...	...	4							
+	$^{2}V_6 + {}^{2}V_2$	$^{1}V_9$	$\left\{\begin{matrix} {}^{2}V_6 = {}^{0}V_6 \\ {}^{2}V_2 = {}^{2}V_2 \end{matrix}\right\}$	$= \frac{2n-2}{4}$	...	...	...	...	...	$2n-2$	4	...	$\frac{2n-2}{4}$	...	$\left\{\frac{2n}{2} \cdot \frac{2n-1}{3} \cdot \frac{2n-2}{3} = A_2\right\}$			
×	$^{1}V_9 \times {}^{4}V_{11}$	$^{2}V_{11}$	$\left\{\begin{matrix} {}^{1}V_9 = {}^{0}V_9 \\ {}^{4}V_{11} = {}^{2}V_{11} \end{matrix}\right\}$	$= \frac{2n}{2} \cdot \frac{2n-1}{3} \cdot \frac{2n-2}{4} = A_3$	...	...	...	...	...	...	...	...	0					
×	$^{1}V_{22} \times {}^{4}V_{11}$	$^{2}V_{12}$	$\left\{\begin{matrix} {}^{1}V_{22} = {}^{1}V_{22} \\ {}^{2}V_{12} = {}^{2}V_{12} \end{matrix}\right\}$	$= B_3 \frac{2n}{2} \cdot \frac{2n-1}{3} \cdot \frac{2n-2}{3} = B_3 A_3$	...	...	...	...	...	...	...	...	...	...	0	$B_3 A_3$	.....	
+	$^{2}V_{12} + {}^{2}V_{13}$	$^{2}V_{13}$	$\left\{\begin{matrix} {}^{2}V_{12} = {}^{2}V_{12} \\ {}^{2}V_{13} = {}^{2}V_{13} \end{matrix}\right\}$	$= A_0 + B_1 A_1 + B_3 A_3$	...	...	...	...	...	...	...	...	...	...	.....	0	$\left\{A_2 + B_1 A_1 + B_3 A_3\right\}$	
−	$^{2}V_{10} - {}^{1}V_1$	$^{2}V_{10}$	$\left\{\begin{matrix} {}^{2}V_{10} = {}^{2}V_{10} \\ {}^{1}V_1 = {}^{1}V_1 \end{matrix}\right\}$	$= n-3\ (=1)$	1	...	...	...	...	...	...	...	...	$n-3$				

Here follows a repetition of Operations thirteen to twenty-three.

+	$^{4}V_{13} + {}^{0}V_{24}$	$^{1}V_{24}$	$\left\{\begin{matrix} {}^{4}V_{13} = {}^{0}V_{13} \\ {}^{0}V_{24} = {}^{1}V_{24} \end{matrix}\right\}$	$= B_7$	...	...	...	...	...	...	...	...	...	...	.....	.....	.....	
+	$^{1}V_1 + {}^{1}V_3$	$^{1}V_3$	$\left\{\begin{matrix} {}^{1}V_1 = {}^{1}V_1 \\ {}^{1}V_3 = {}^{1}V_3 \\ {}^{0}V_6 = {}^{0}V_6 \\ {}^{0}V_7 = {}^{0}V_7 \end{matrix}\right\}$	$= n+1 = 4+1 = 5$ ..... by a Variable-card. by a Variable card.	1	...	$n+1$	...	...	0	0								

```
main()
{
    printf("hello, world\n");
}
```

Brian Kernighan

Language (book of instructions)

Universal Turing Machine

@ m-state

IF (aware of) → **DO** (move, write/erase) → **NEXT** (next m-state)

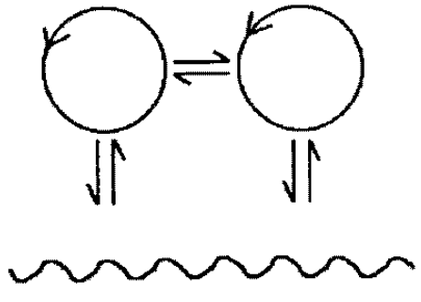
symbols

Video 3: The Art of Code

Dylan Beattie @ NDC 2020,
creator of the Rockstar programming language

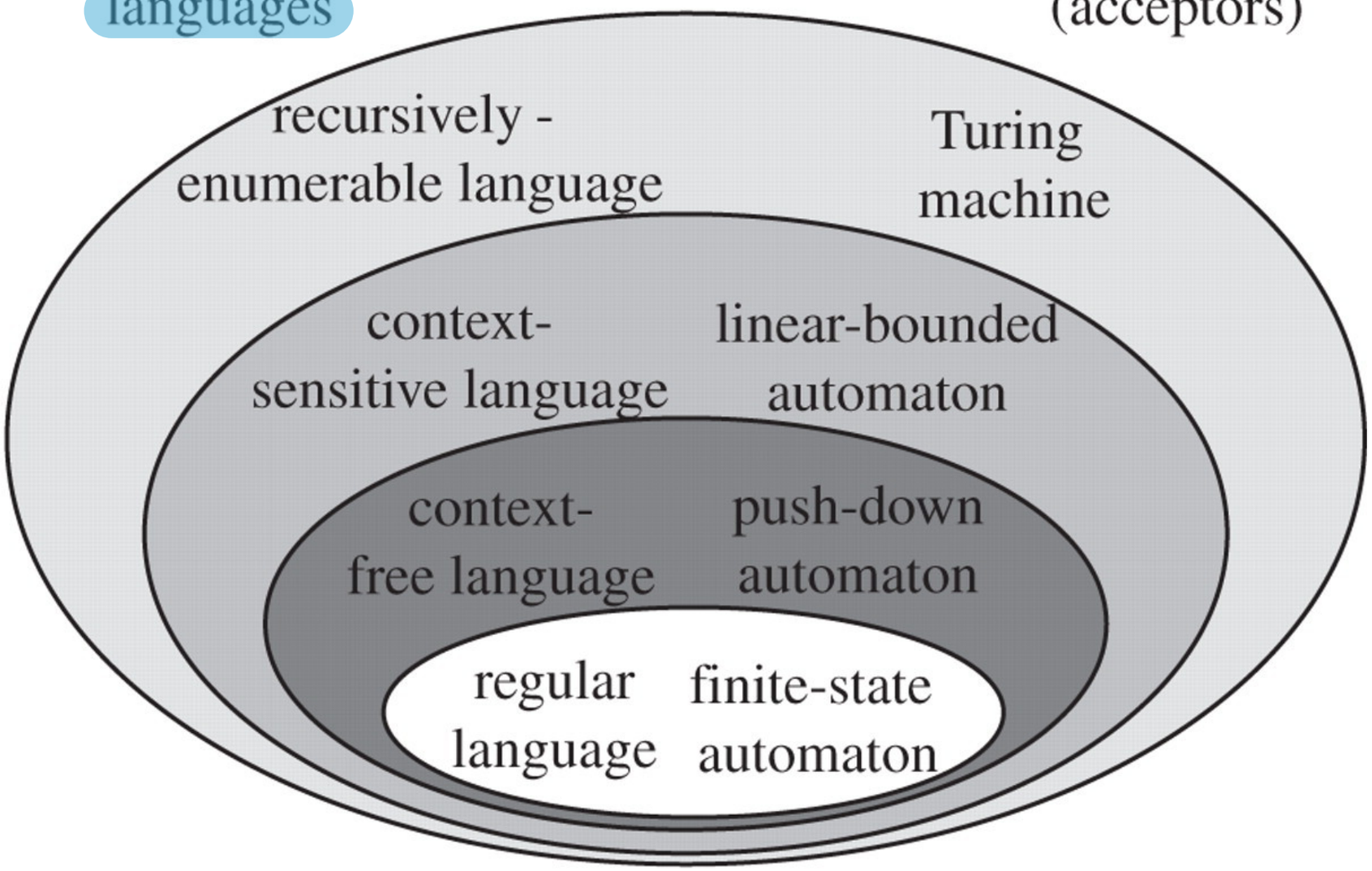
Code as Art

Code as a platform cross-**language** speculation

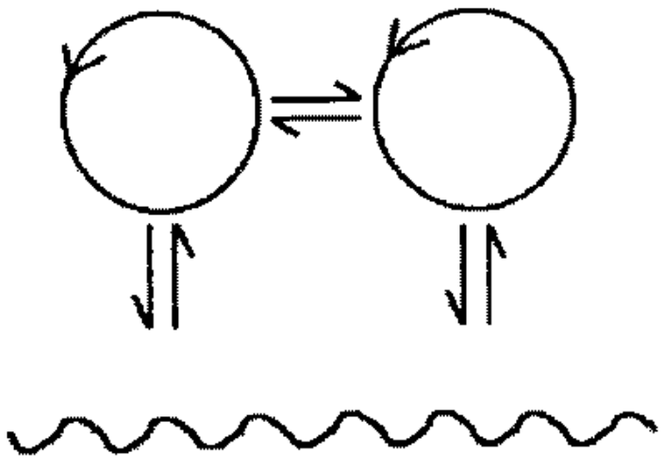


grammars (generators) and languages

automata (acceptors)



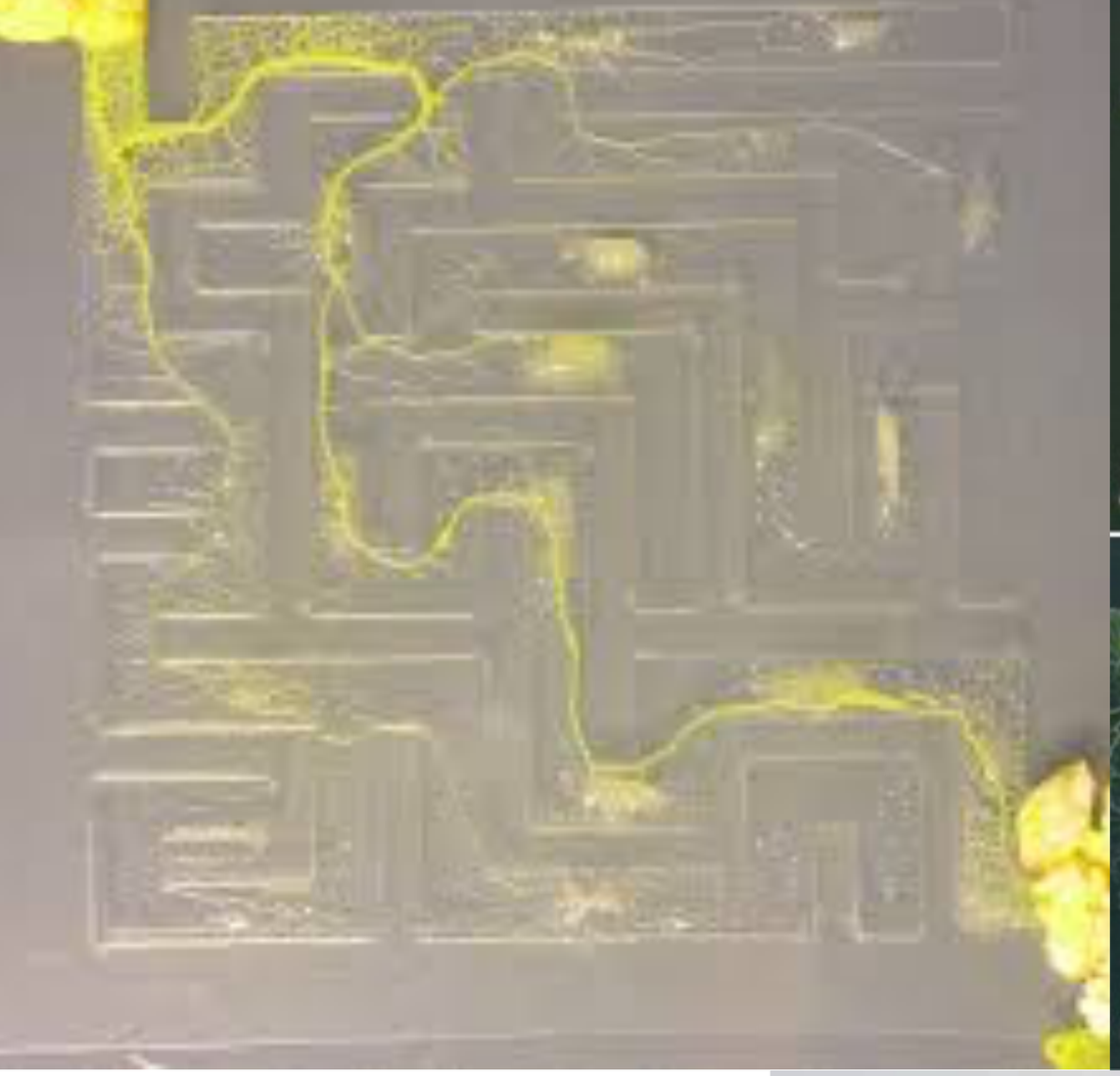
the traditional Chomsky hierarchy

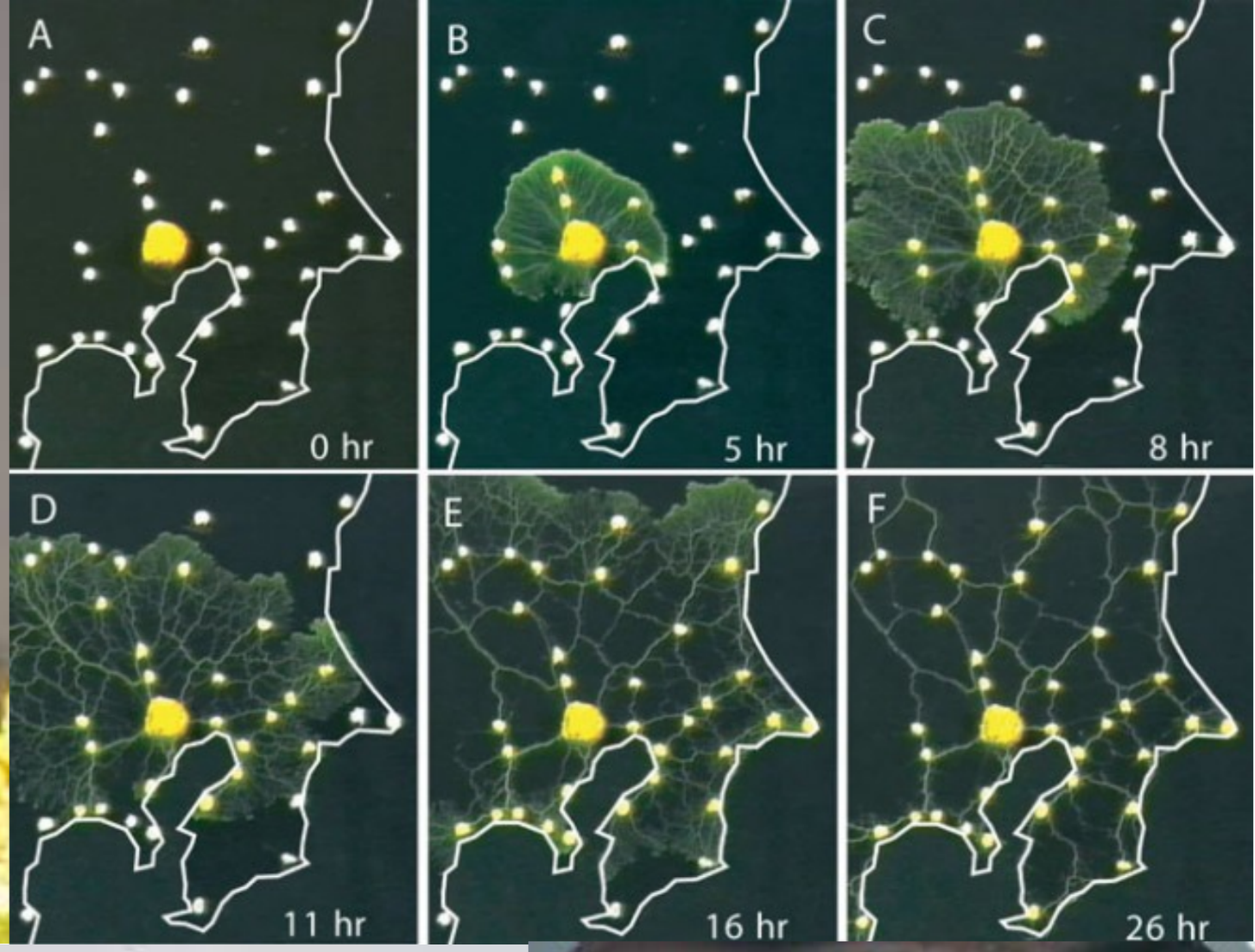


Talking is not the same as **Languaging**

Language

natural: ***human, animal, cells***;
formal: ***machines, math.***





Biological computation

PhyChip