

THE ART OF

# “TEACHING WITHOUT TEACHING”





---



mathmaze.

WHO ARE WE?

# ABOUT US

-  **For two years we have had an Apl class with 25 students from our liceum G.B. Grassi Saronno located in the north of Italy.**
-  **They also write functions during their boring lessons.**
-  **Our try in the apl contest.**
-  **The birth of the idea.**



mathmaze.

A BOOK:

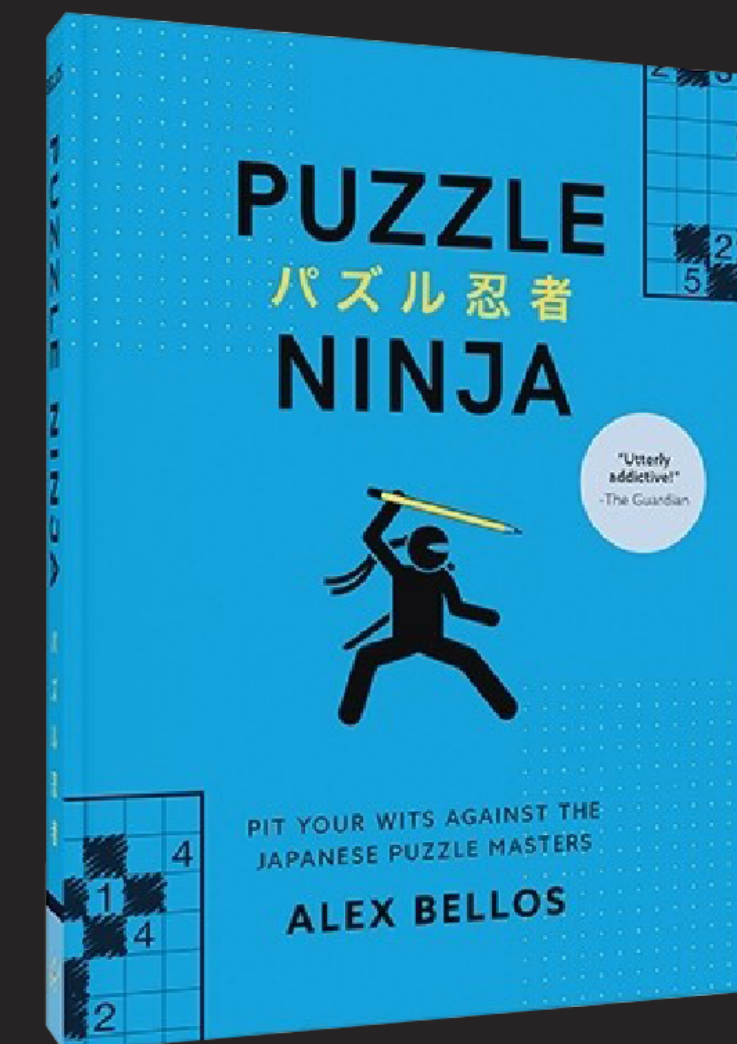
# OUR INSPIRATION



**Alex Bellos travels to Japan and meets the world's brightest puzzle inventors, awesome puzzle masters, and startling origami experts. The Puzzle Ninja is a delightfully brain-bending mix of history, reportage, and over 200 mind-boggling puzzles.**



**Alex Bellos is brilliant on all things mathematical. He has a degree in Mathematics and Philosophy from Oxford University. He writes a popular maths blog and a puzzle blog for the Guardian.**



mathmaze.

CONTRADICTIONS

# IDENTITY PROBLEM

**“ I am a teacher, but I do not like teaching.  
In fact, I do not teach.  
The art of teaching without teaching is my way. ”**

 **Tetsuya Miyamoto**  
Inventor of the KenKen puzzle.

FIGHTING AGAINST STRANGE CREATURES

# TEACHERS' ILLUSION

**“Do you think that students become smarter after a careful explanation?**

**No, not at all**

**After a careful explanation students have an illusion they can understand**

**They cannot solve the problems by themselves”**

 **Tetsuya Miyamoto**  
Inventor of the KenKen puzzle.



mathmaze.



HOW TO:

# SMARTER STUDENTS



**I give them interesting puzzles.**



**They enjoy to solve them, learning by themselves,  
each at his or her own speed.**



**No child should be forced to do anything, you need to accept that they are  
who they are.**



**Tetsuya Miyamoto**

Inventor of the KenKen puzzle.







mathmaze.



FIGHTING AGAINST STRANGE CREATURES

# TRANSPARENT TEACHER

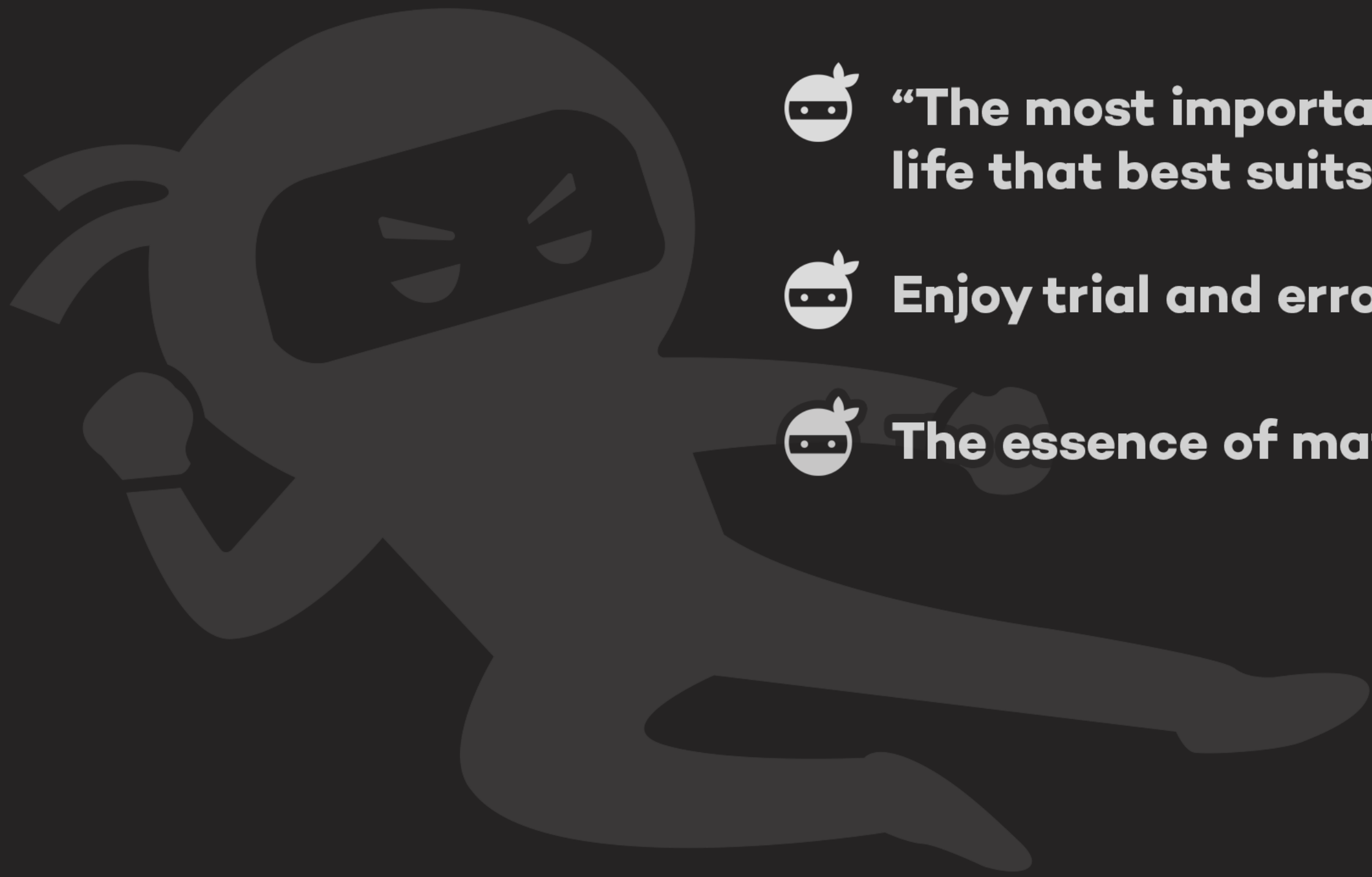
-  **“Children only care about whether something is fun or not”**
-  **“If we allow children to play freely with a variety of things, then children would never hate studying”**
-  **“If you see that they truly love or are truly immersed in something, try to maintain that environment”**
-  **“It is not whether they are good or bad at something but whether they are interested or not in something”**






mathmaze.

ENJOY CHALLENGES IN LIFE AS ENJOY TRIAL AND ERROR

# OVERCOME FRUSTRATIONS



-  “The most important thing for a child is to find solutions but to find a way of life that best suits their personality”
-  Enjoy trial and error, and the answer will come to you.
-  The essence of mathematics is to keep on thinking.



# APL'S ILLUSION



- 🤖 **Mathematical notation is a tool of thought, said K. Iverson**
- 🤖 **Using APL to think of a solution to a problem could be an effective way to progress yourself in mathematical and coding learning.**
- 🤖 **Apl is not enough.**








mathmaze.

THIS IS THE REAL CHALLENGE

# BY HAND OR BY PC?



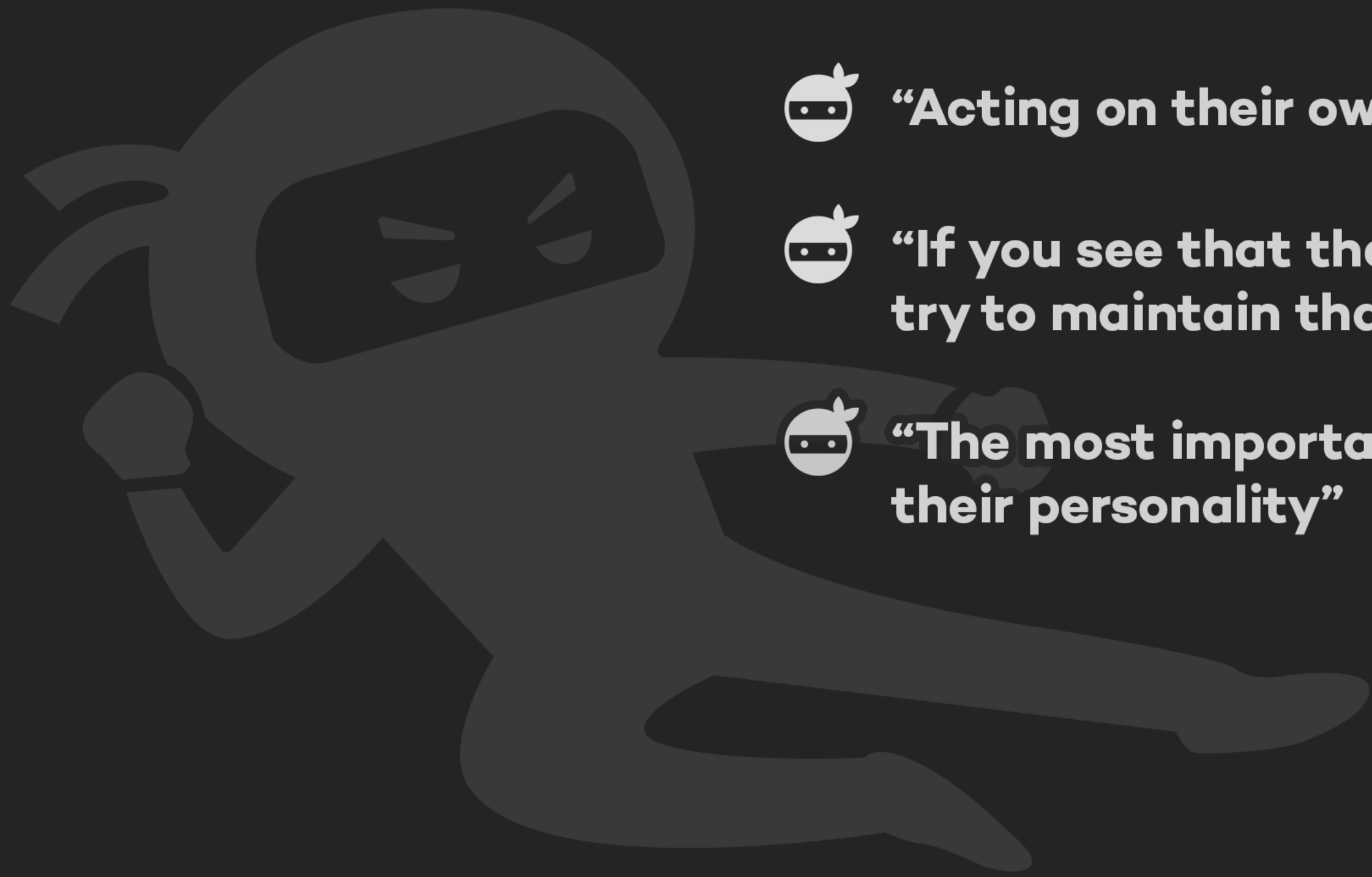
-  **By hand or By computer? Which is the best?**
-  **A mixed strategy is required in some situations.**
-  **Coding leads to do not think deeply to analyze the real issue of a problem.**
-  **We need a kind of problem solving contest where it must not be clear from the start if apl is the best approach.**
-  **Increase individual critical thinking**



mathmaze.

THE REASONS FOR AN APL PROBLEM SOLVING CONTEST

# A PUZZLE LEAGUE



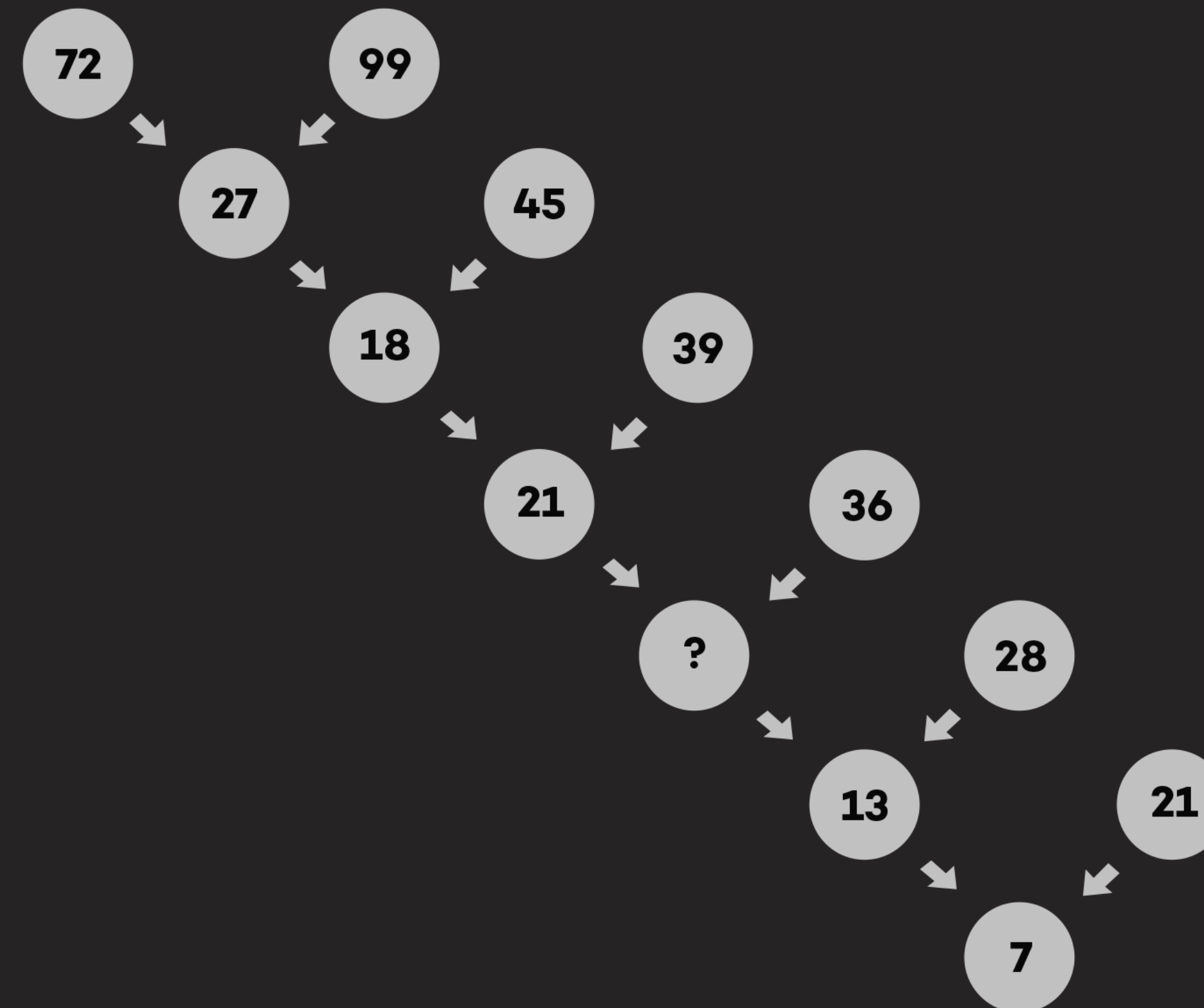
- “Acting on their own judgements and taking full responsibility for the result”
- “If you see that they truly love or are truly immersed in something, try to maintain that environment”
- “The most important thing for a child is to find a way of life that best suits their personality”



mathmaze.

THINGS DON'T HAVE TO BE AS THEY SEEM

# NOT AS IT SEEMS



**Yoshigahara Nob**




Inventor of puzzles, mechanical puzzles.

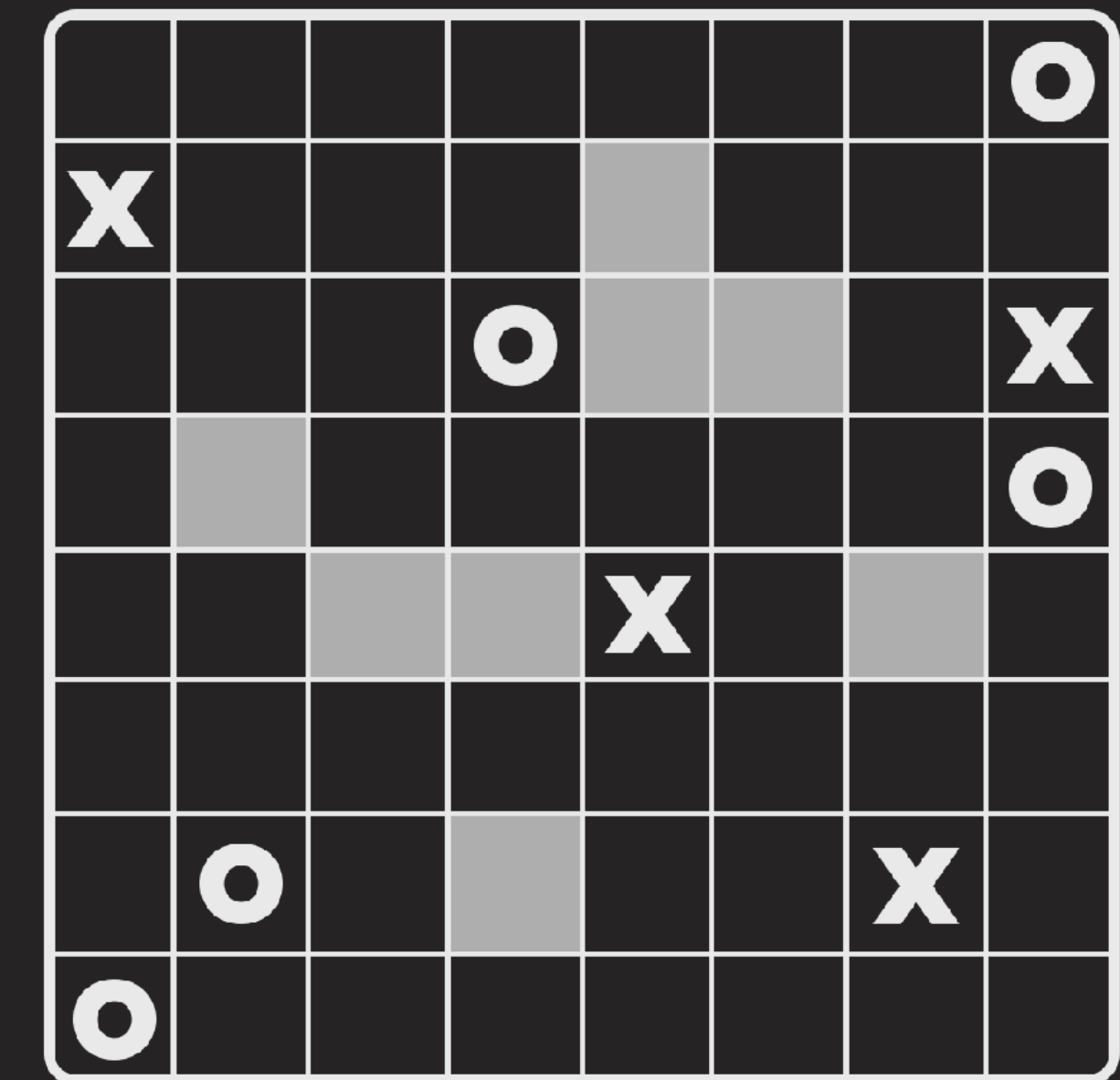


mathmaze.

WHY WE CHOSE A LOT OF

# GRID PUZZLES

-  The grid logic puzzles are a sort of middle ground.
-  You can create and solve puzzles by hand or by computer and apl language is an hybrid way to do this.
-  Puzzles represent the most interesting problems in which you should alternate hand and coding strategy.





THE PERFECT PUZZLE:

# SIMPLE RULES



«If I can't make a puzzle with simple rules, I quit that puzzle»



«The puzzle is like a simple equation and in a simple equation two things lead to a third.»



**Naoki Inaba**





Inventor of 'Area Maze' and Marupeke



mathmaze.

THE PERFECT PUZZLE:

# HERE IS IT

-  The solver should not have to do the same thing again and again.
-  It should be cultural-neutral.
-  The puzzle should be well balanced between the 'part' and the 'whole': the solver should alternate his attention between the individual step and the complete picture.
-  Pay attention to details but keep an overall sense of balance like the art of cultivating bonsai miniature trees.

						1			
			2			4	1	2	2
	2	3	1	1	5	4	1	5	2
1	2								
2									
1									
1									
2									
2	4								
2	6								
8									
1	1								
2	2								



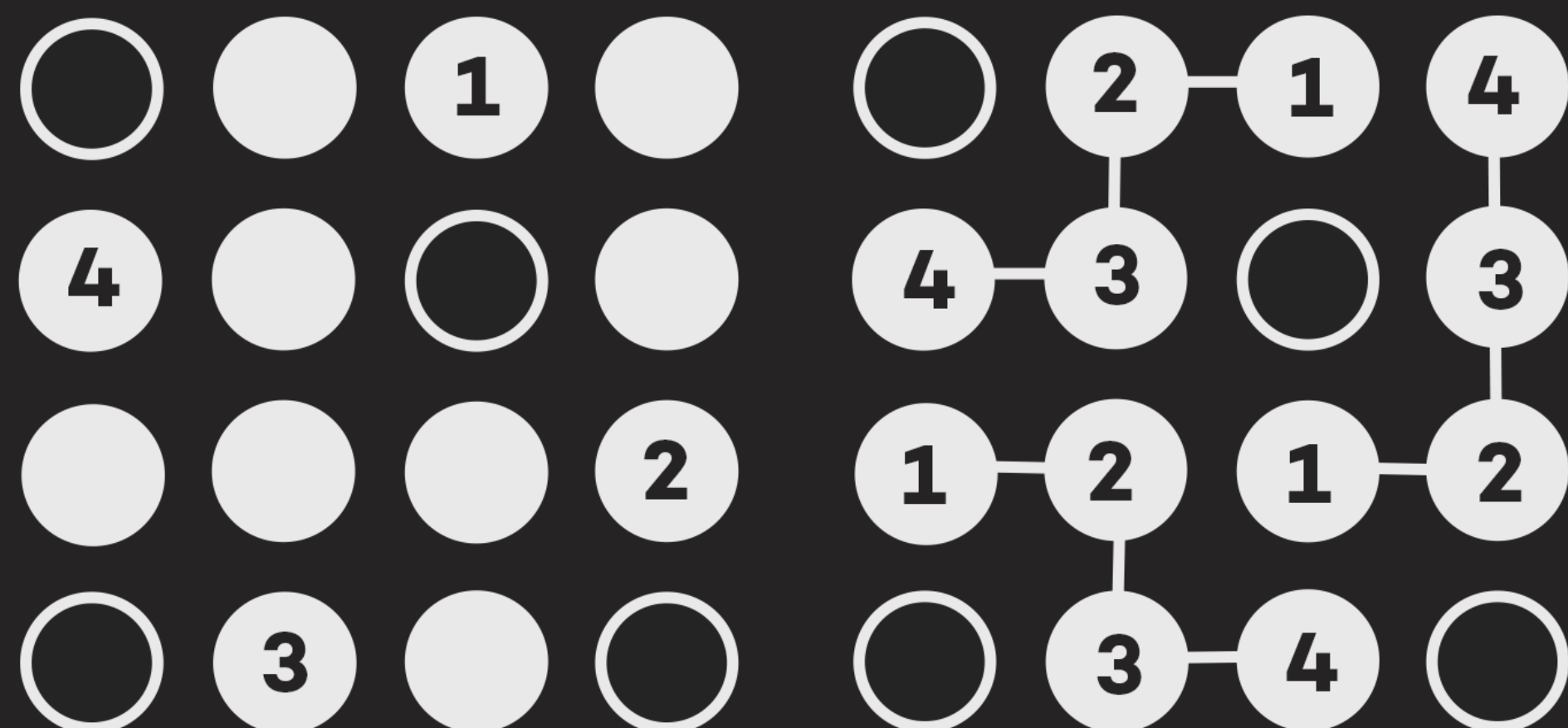
mathmaze.

SOLUTIONS:

# APL OR NAH?



Apl is not suitable



Apl is suitable





				4		
8						
2		2	3			3
3			9	2		4
						6
		3				

				4		
8						
2		2	3			3
3			9	2		4
						6
		3				



mathmaze.

# HOW TO: SOLVE PUZZLES

-  Freebies represent the first step , which lead you to a second step and so on.
-  Freebies are free moves that require almost no thinking so they are can be implemented in Apl.
-  After a freebie you have in front of you simplified puzzle from that point on you continue using your mind and the of the next step.
-  Go on by alternating computer and mind shots.



mathmaze.

HOW IT WORKS?

# ALGORITHMS



$$\text{GAINED} = \frac{100 \times \text{RIDDLEWEIGHT}}{\text{ATTEMPTS}} + \text{TIMEBONUS}$$

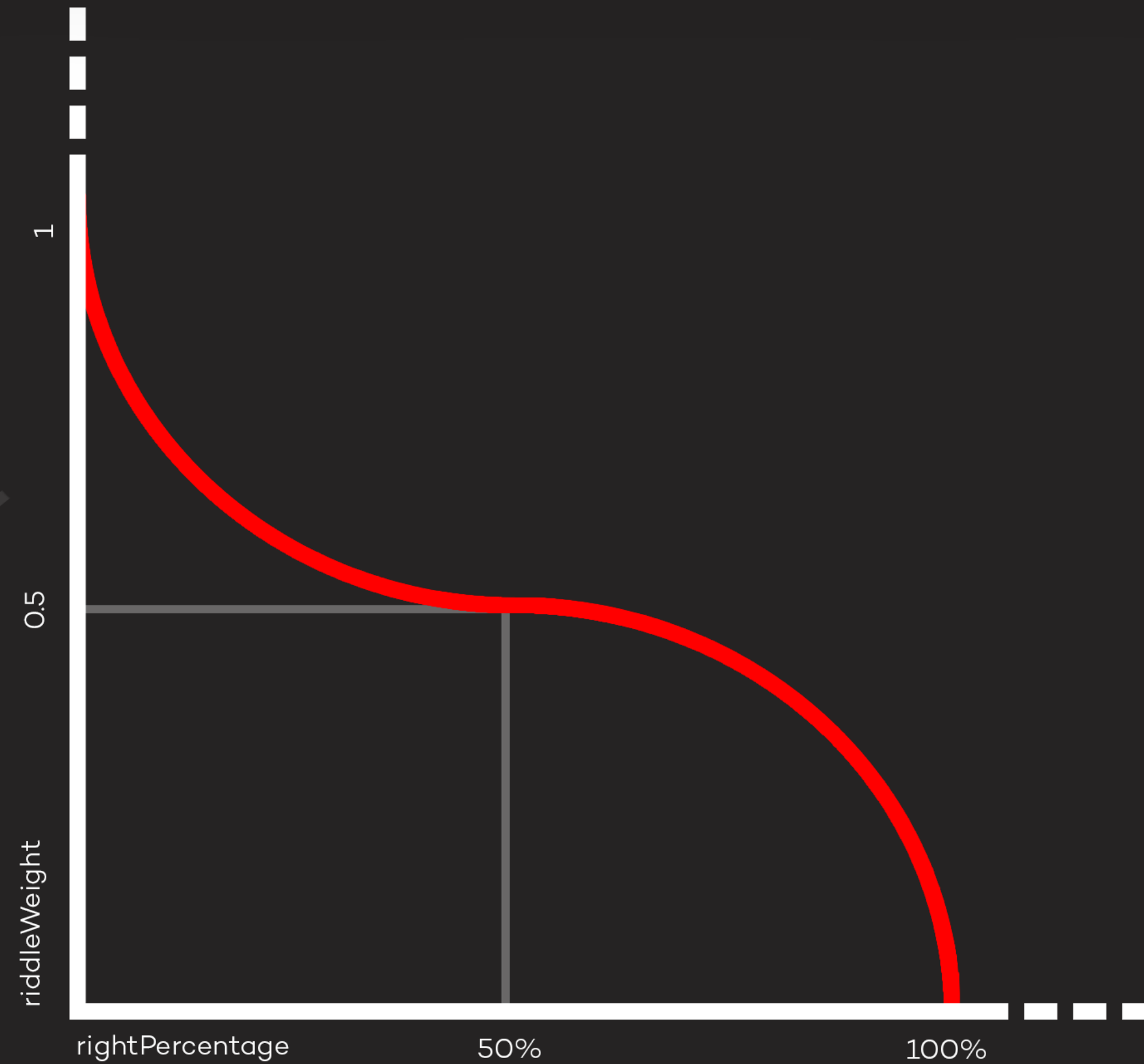


mathmaze.



HOW IT WORKS?

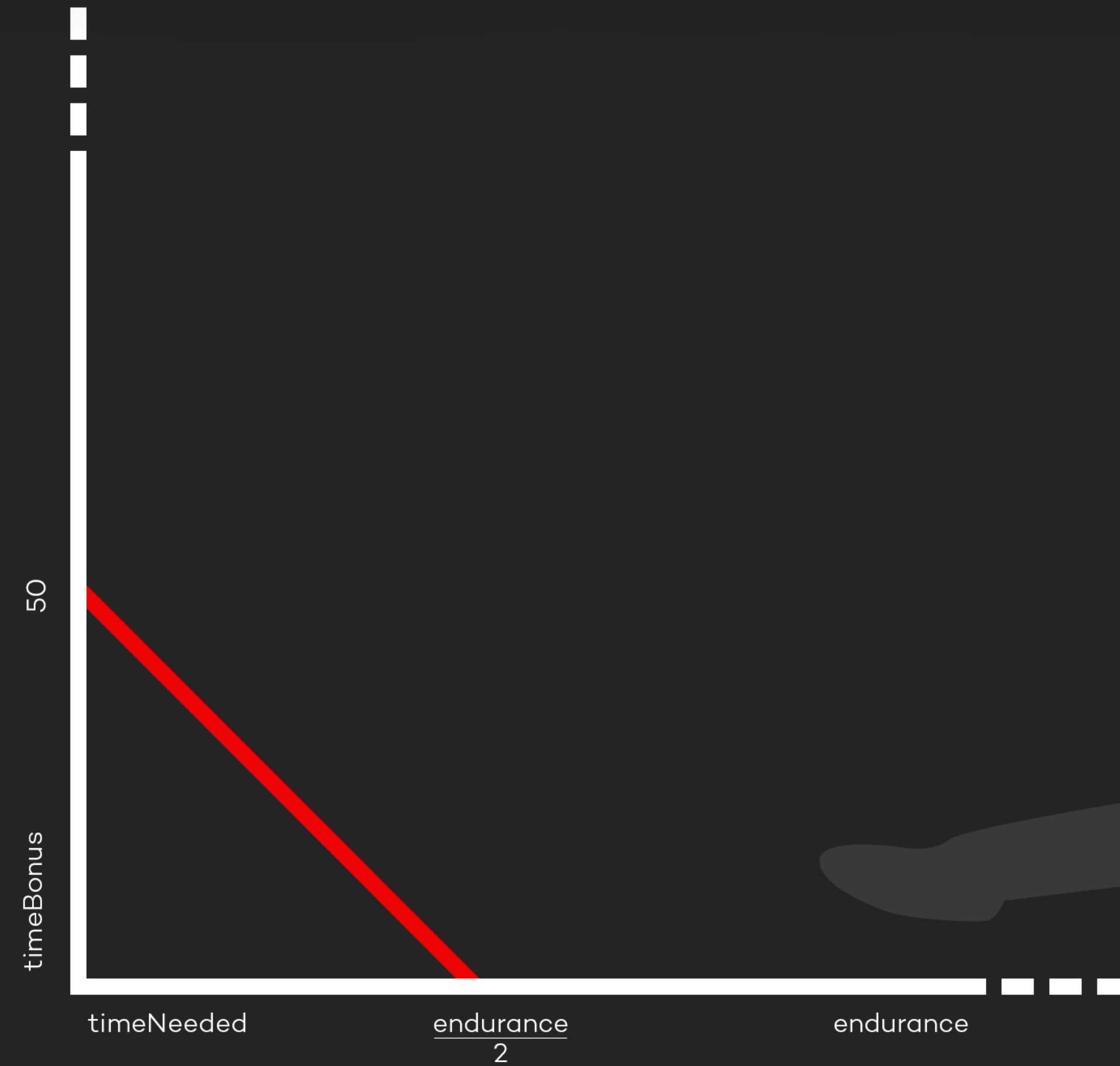
# RIDDLEWEIGHT



mathmaze.

HOW IT WORKS?

# TIMEBONUS



mathmaze.

YOU CAN SEE MY TEACHER OVER THERE!

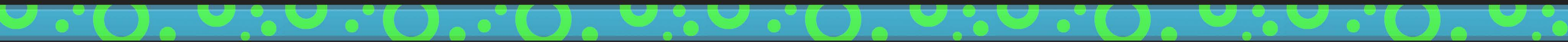
# I'M NOT A DEV



mathmaze.

OUR PROJECT

# MATHMAZE



mathmaze.

PYTHON - APL INTERFACE

# DJANGO



mathmaze.



PYTHON - APL INTERFACE

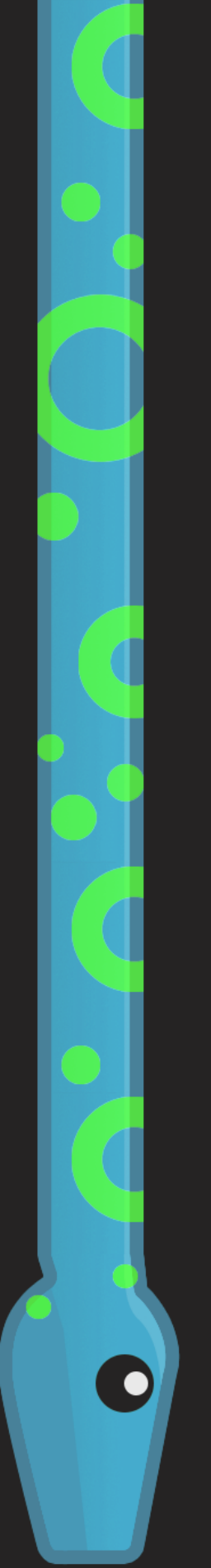
# PY'N'APL



mathmaze.

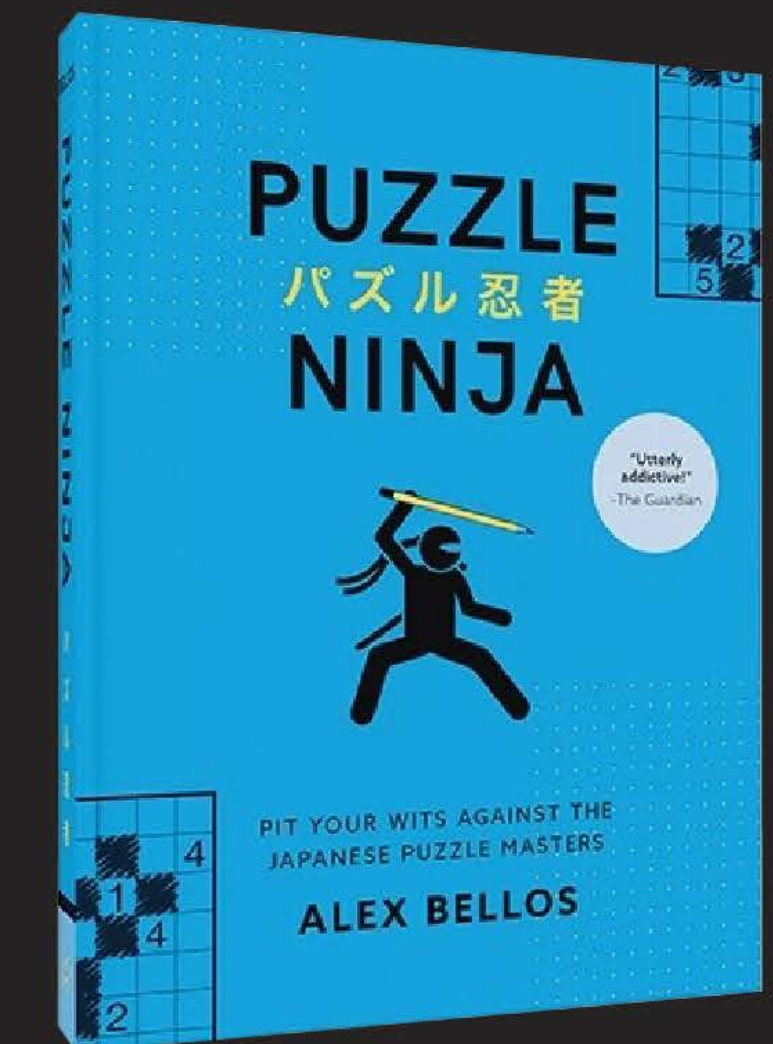
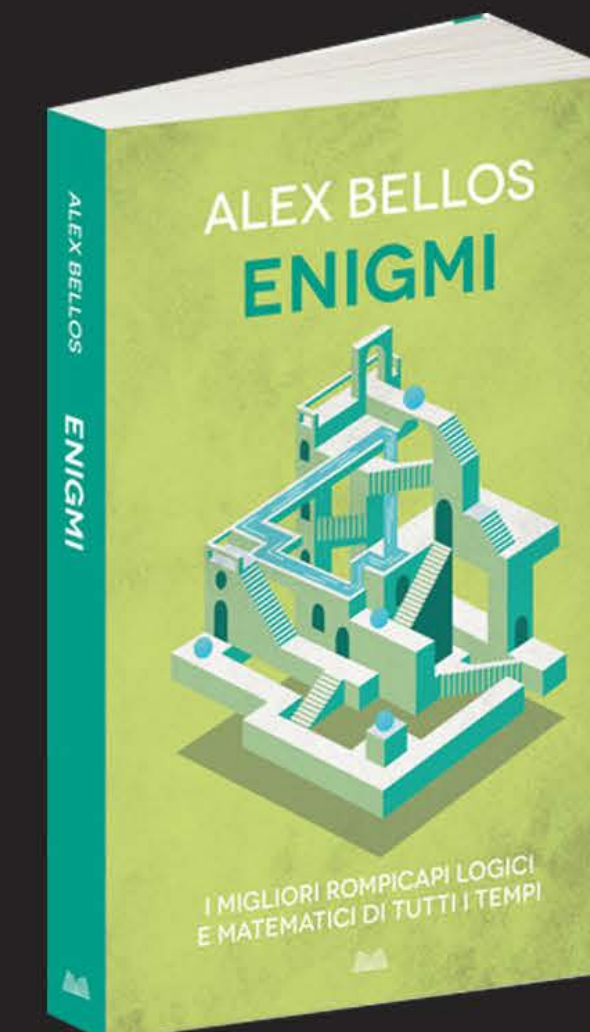
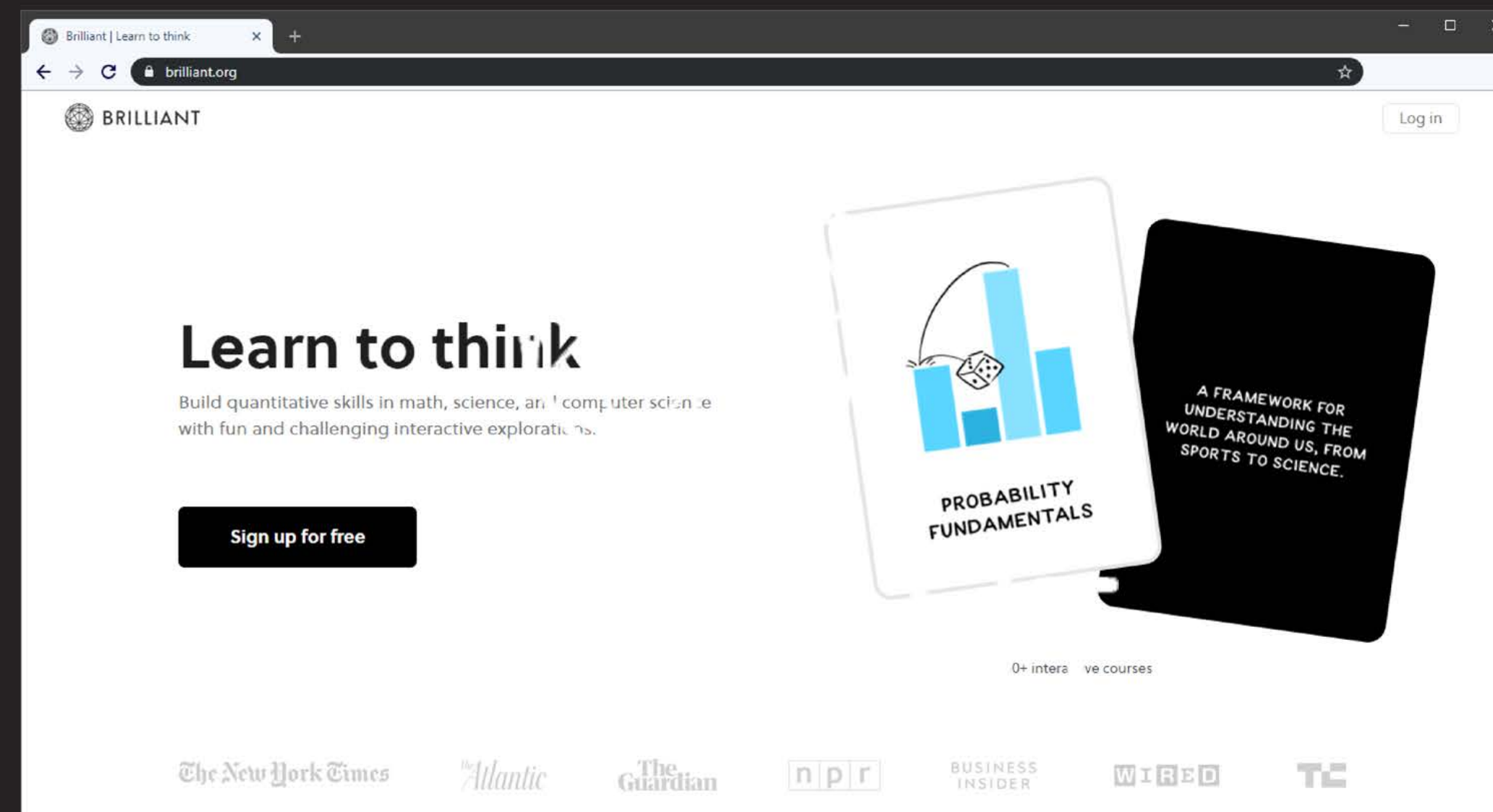
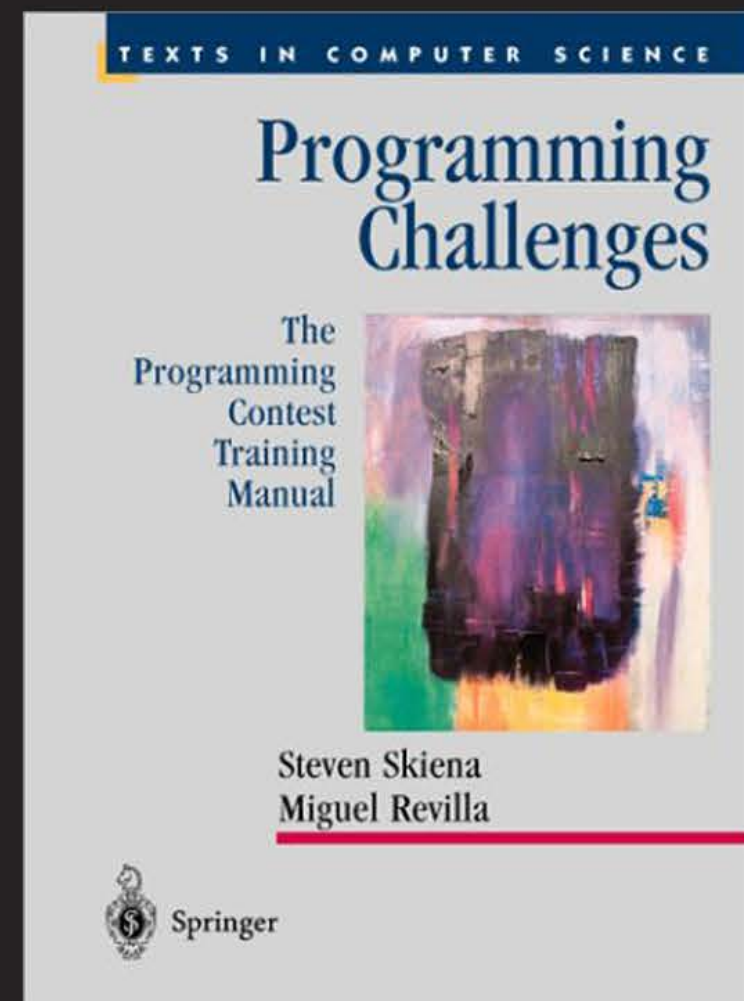
IT LOOKS TO BE COOL TOO!

# DESIGN



mathmaze.

# OUR REFERENCES



mathmaze.



**“Once i get on a puzzle, i can’t get off!”**



**Richard Feynman**

American theoretical physicist



mathmaze.