UNIVERSITÀ DEGLI STUDI
DI MILANO

Making Games
Concepts and Implementation

Dario Maggiorini (dario@di.unimi.it)

About the Teachers

- Dario Maggiorini
  - Assistant professor at University of Milano
  - dario@di.unimi.it
  - Expertise in multimedia transmission, network infrastructures, and protocols
  - Co-director of PONG lab – Playab fOr inNovation in Games
  - RPG specialist

Creating a Game is NOT …

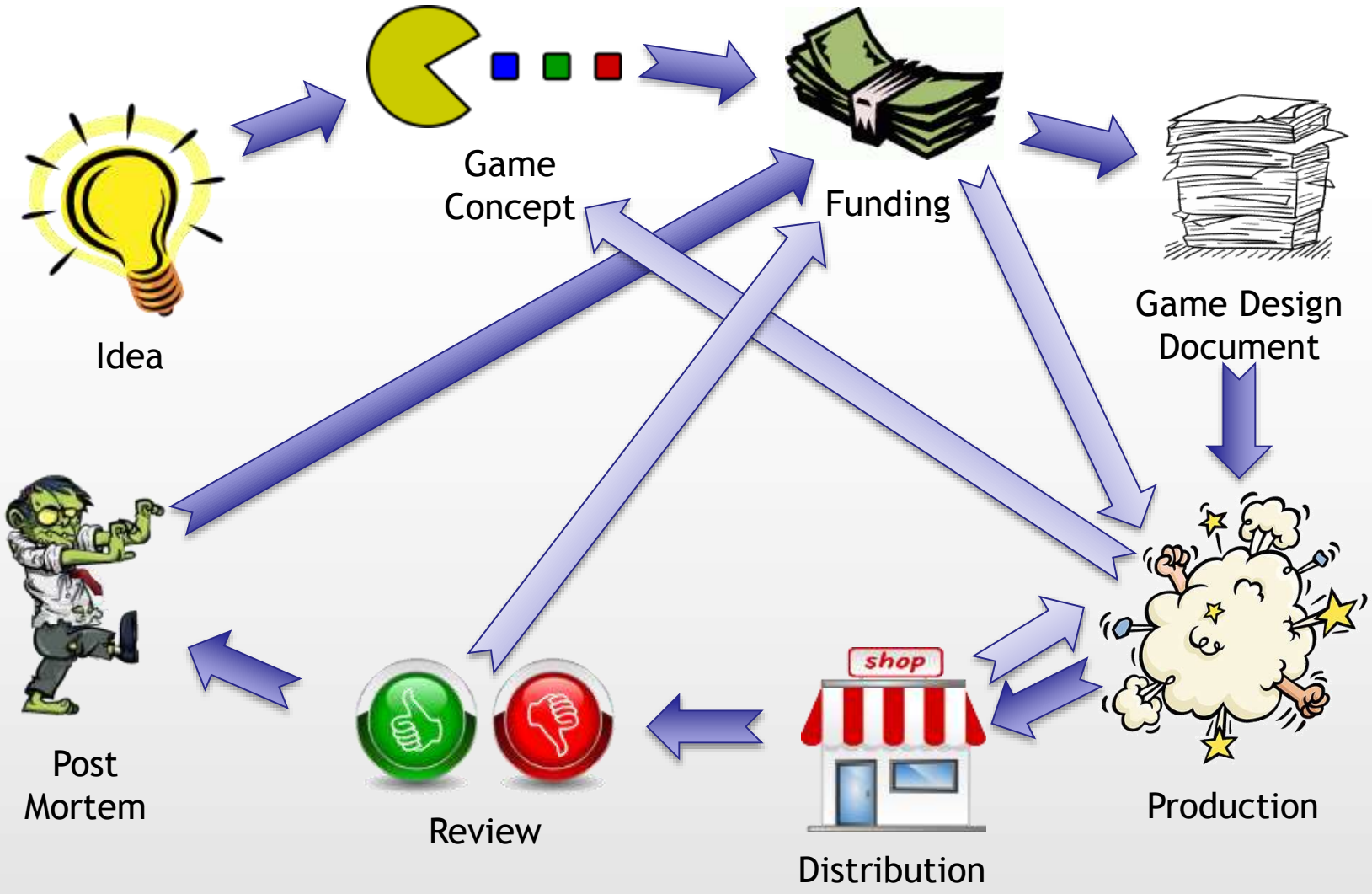
- … “just” about designing
- … “just” about multimedia
- … “just” about coding
- … “just” about network/system infrastructures

- It is not a “pure” computer science class

- Creating a game lies in a gray shade between computer science and education/art

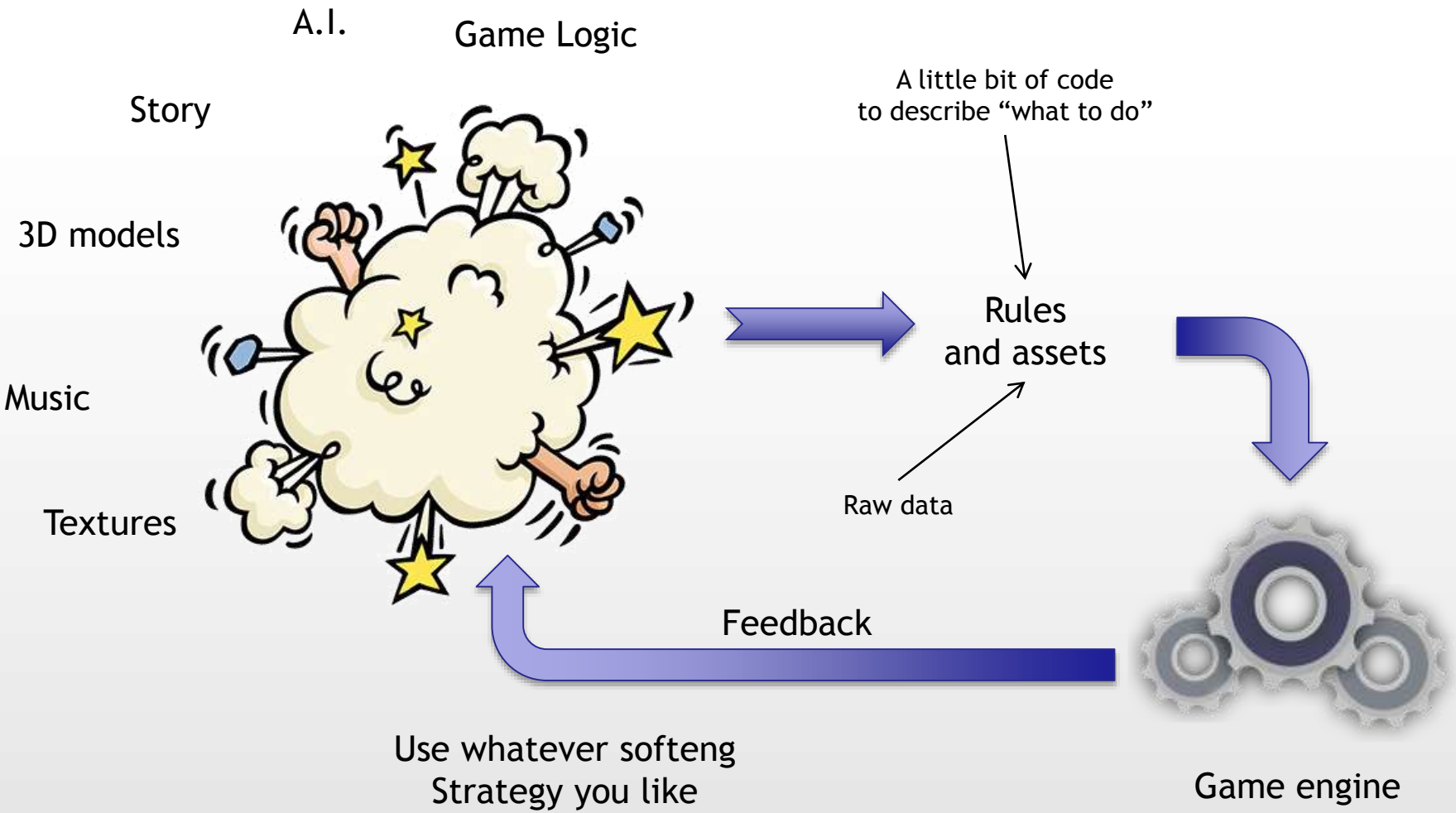
- Computer scientists creating games must know technical aspects and, at the same time, understand what is going on on the other side of the table

And it is not Really a Cycle



Who Does What

About Production



What is a Game Engine ?

- (Really) Technical description of game:

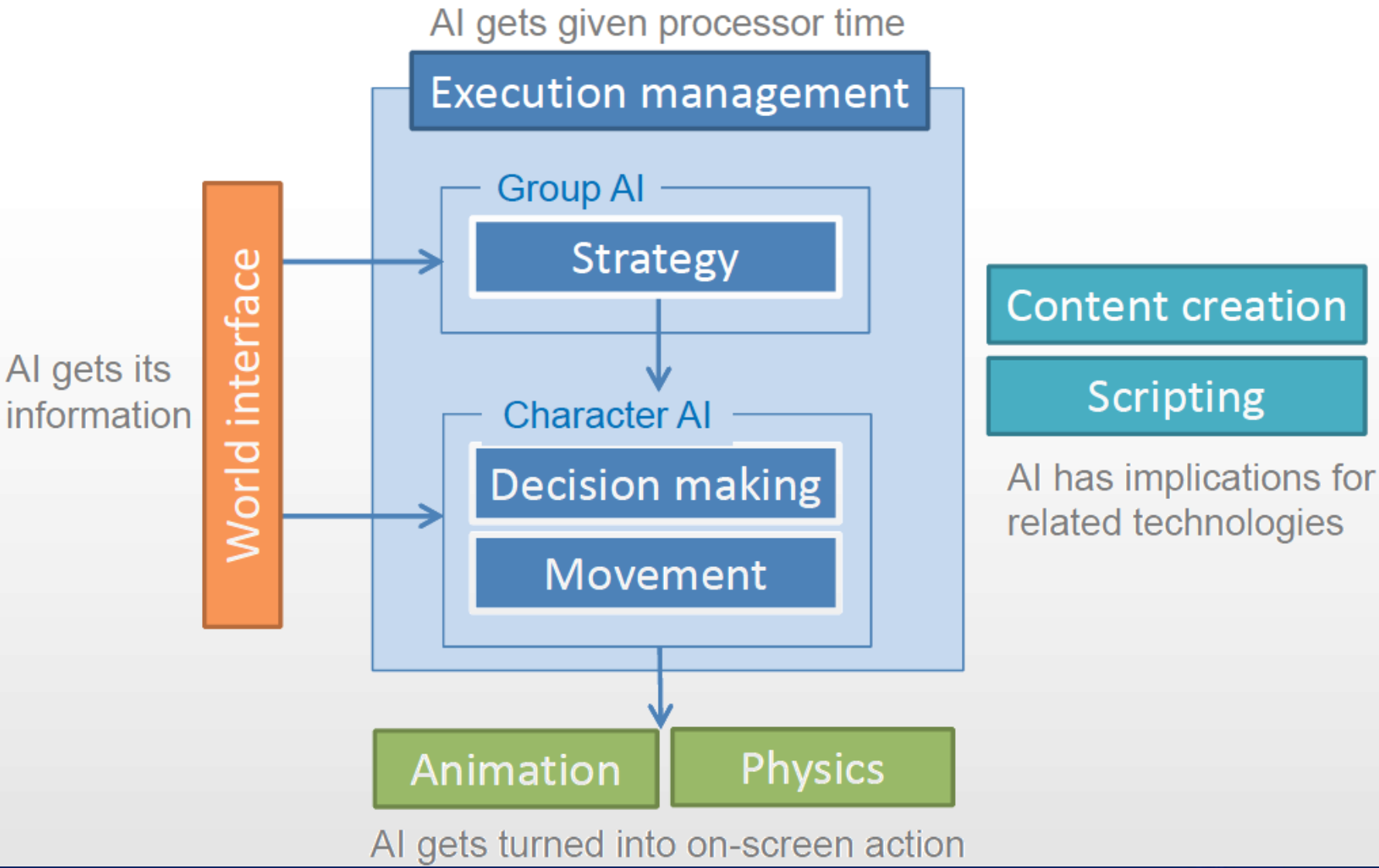
  A Soft real-time interactive agent-based computer simulation

- A game engine is a software made to implement such a system

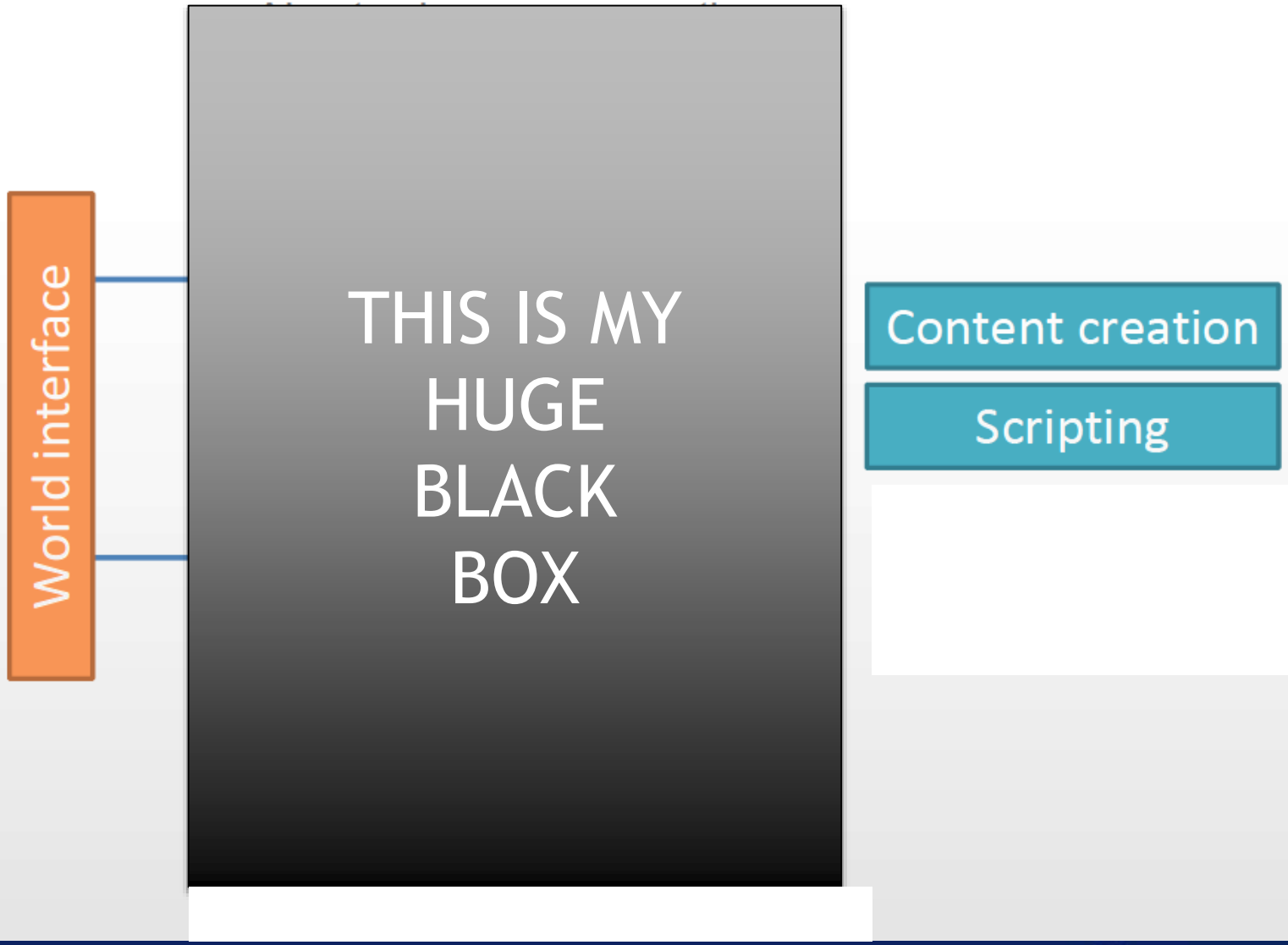
What is a Game Engine ?

- Real-time Interactive
  - Must respond to player input in real time
- Agent-based
  - Independent entities (agents) live and interact within the engine
- Simulation
  - It is capable to describe a model representation of a virtual world
  - It is a MATHEMATICAL description

A Generic Scheme



Let’s make it (much) simpler



A Black Box for Rules and Assets

- A Game engine is a container for RULES
  - You explain how the world is evolving, you do not write how to make it evolve

- The black box will follow your rules and apply them on the asset your provide
  - At every step, the rules will create a new set of assets, making your world magically evolving

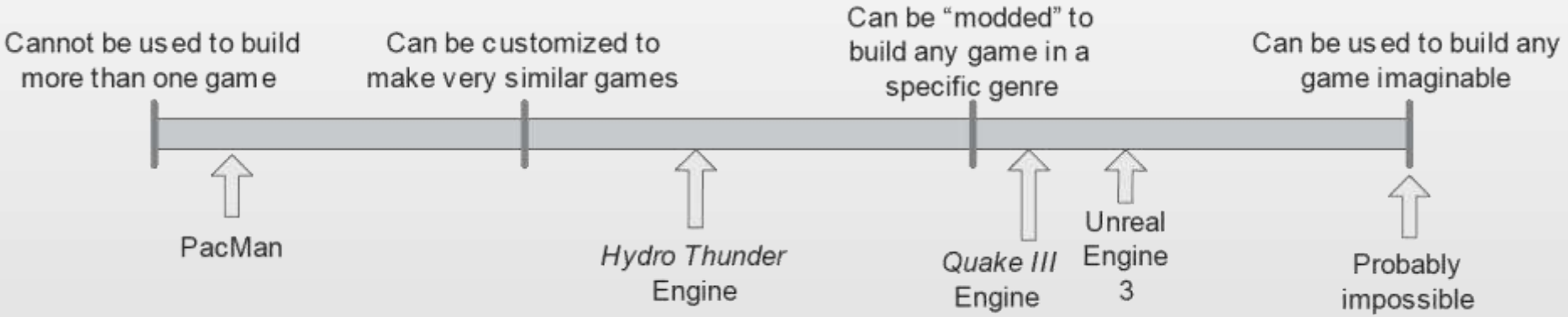
Runtime and Tools

- A game engine is made of two parts:
  - Tools
    - To compile software to work within the game engine
    - To help you describe rules
    - To manage assets
    - To create content
  - Runtime
    - A library/middleware/sandbox/virtual machine
    - This will run your rules on your assets
    - MUST be distributed with the game

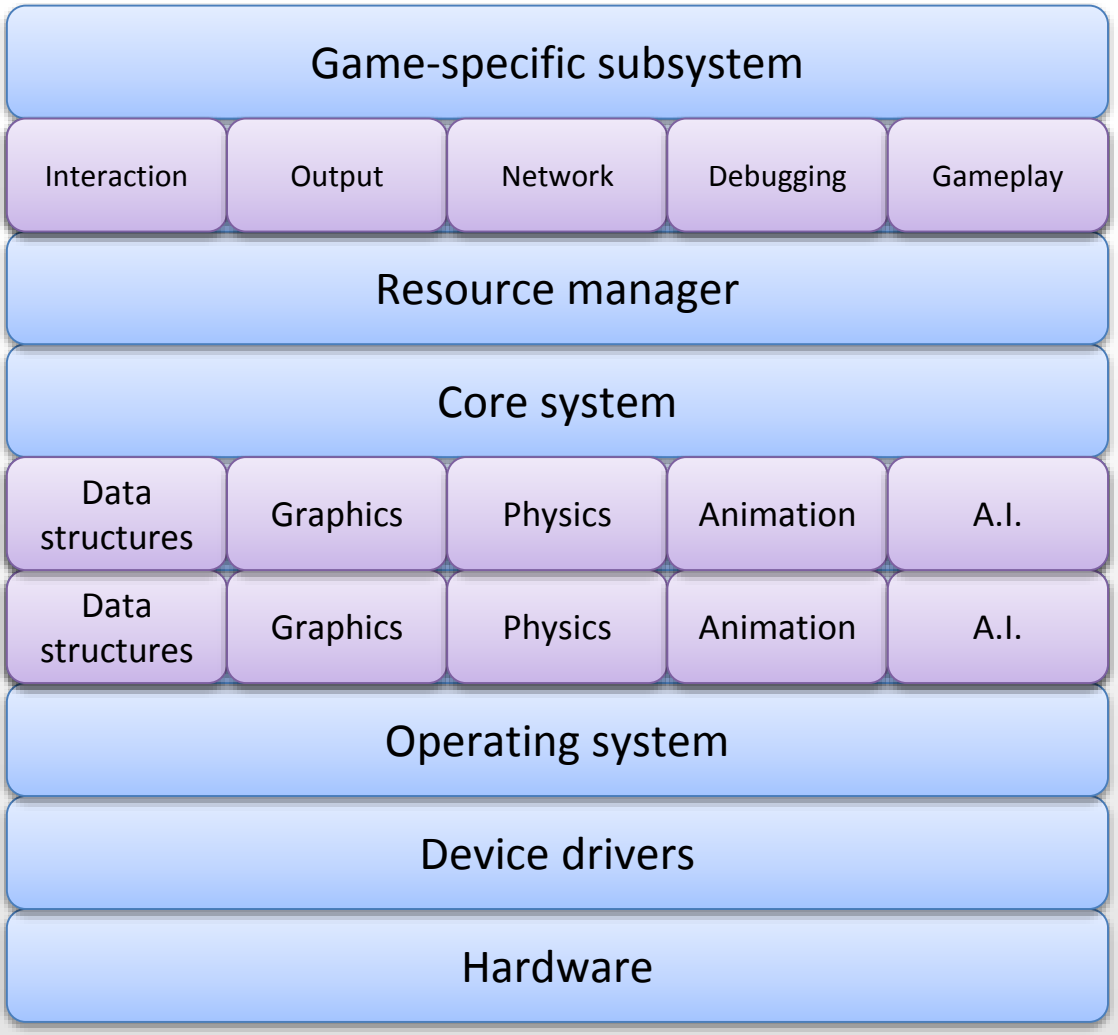
Game Engines are Strictly Data-driven

- A data-driven architecture is what differentiate a game engine from a piece of software that is a game but not an engine

- When a game contains hard-coded logic or employs special-case code to manipulate specific game objects, it becomes difficult or even impossible to reuse that software to make a different game

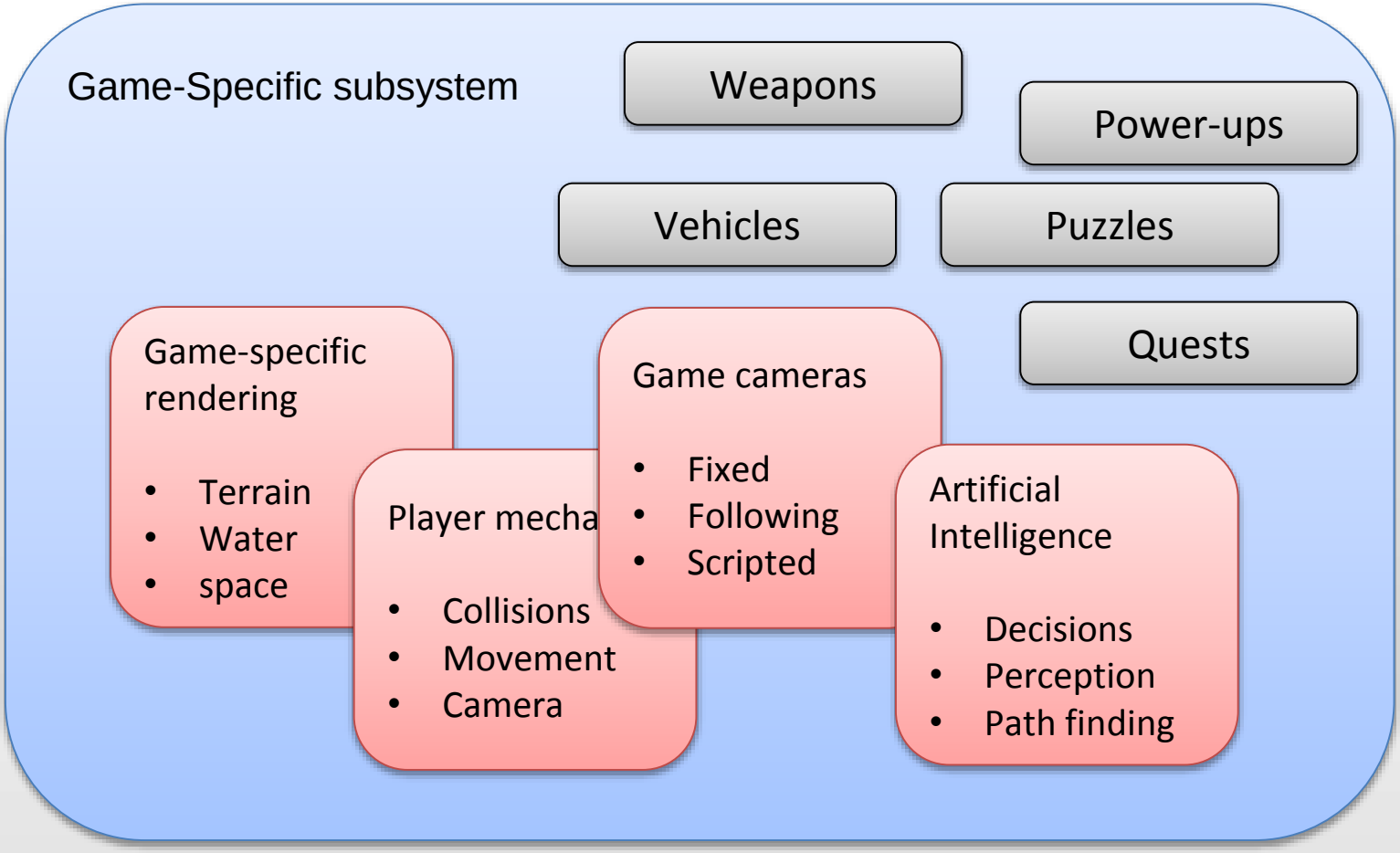


Let's Break it Down



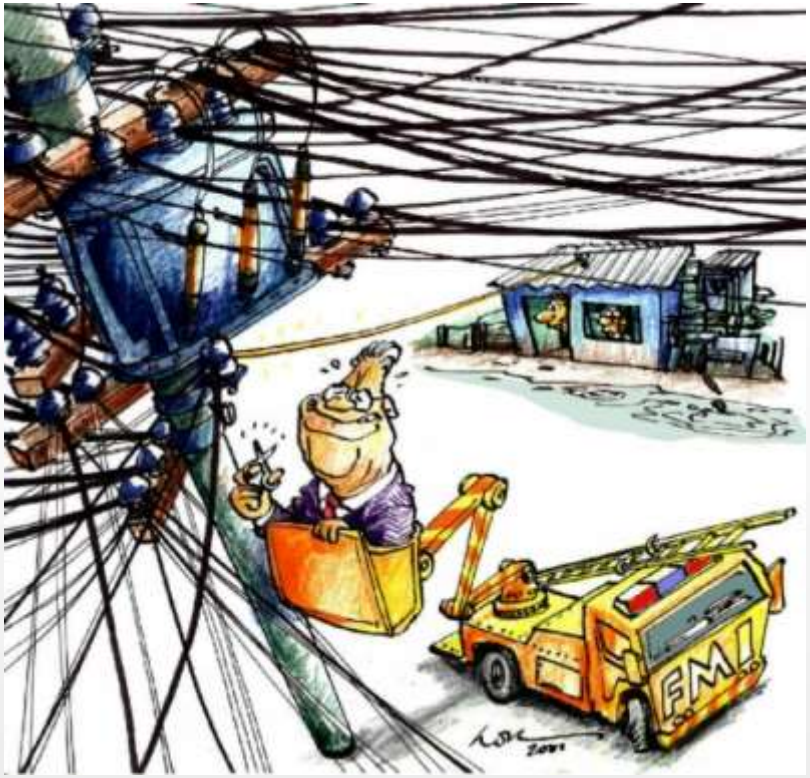
Game-Specific Subsystem

Is where the game designer lives



Game Engines are Specialized

- The more generic an engine is the less optimized for a certain platform/genre it will be
- There are specialized engine for certain kind of games
- USE THE RIGHT ENGINE FOR THE RIGHT GAME



But … Wait …

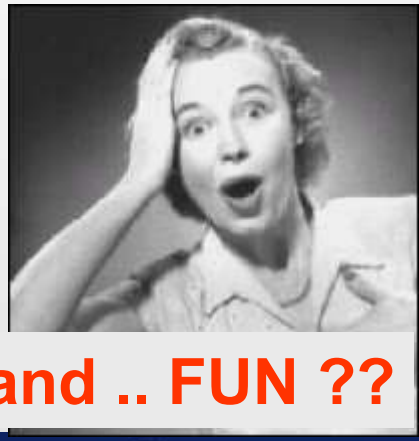
WHAT IS

A *GAME* ??????

Try to explain it to a martian…

Several Definition

- Activity which is voluntary, uncertain, unproductive, governed by rules (Robert Caillois)
- Free activity, outside “ordinary” life (Johan Huizinga)
- A game is a rule-based formal system with a variable and quantifiable outcome, where different outcomes are assigned different values, the player exerts effort in order to influence the outcome, the player feels attached to the outcome, and the consequence of the activity are optional and negotiable (Jesper Juul)
- Games are a subset of entertainment limited to conflicts in which players work to foil each other’s goals, just one of many leaves off a tree that includes playthings, toys, challenges, stories, competitions, etc. (Cris Crawford)
- One or more causally linked series of challenges in a simulated environment (Ernest Adams & Andrew Rollings)
- A series of meaningful choices (Cid Meier)
- A game is a system in which players engage in an artificial conflict, defind by rules, that results in a quantifiable outcome (Katie Salen & Eric Zimmerman)



... and .. FUN ??

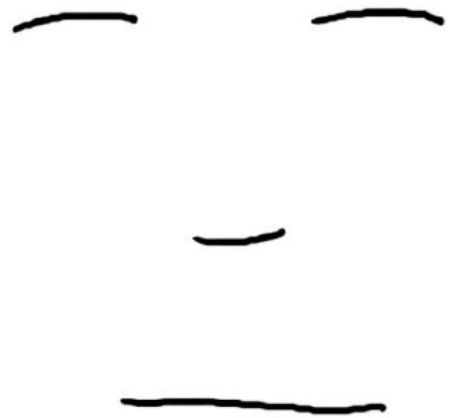
Why is a Game Fun?

Our brain is a voracious consumer of PATTERNS (e.g., ☺)

- Children learn by **errors & trials** (e.g., watch the same movie over and over and over and …) and not by being taught

- They try to figure out **PATTERNS**!
  That's how our brain learns

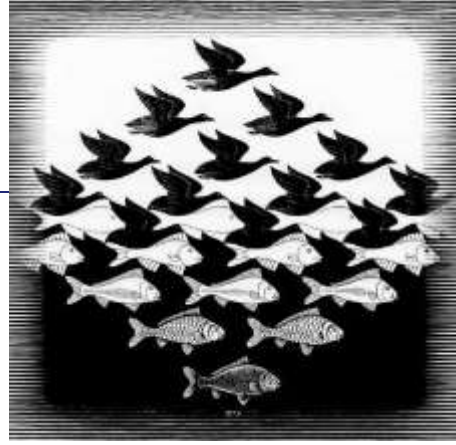
When we grasp a pattern, we usually get bored with it and iconify it



Why is a Game Fun?

- … our brain is made to fill in blanks:
  - We are not really “conscious”, we do many things on autopilot!
- … our brain is good at making assumptions:
  - Es. cross your eyes and your nose will disappear
- … our brain is good at cutting out the irrelevant:
  - Es.: count the girls and you will miss the pink gorilla
- … our brain notices a lot more than we think:
  - Es.: description under hypnoses are more accurate
- … our brain actively hides the real world from us:
  - Es.: we usually drow the iconified version of an object, not the actual one

Why is a Game Fun?



Games are iconic depiction of PATTERNS

- They are more related to the way our brain works, than to the actual world. Our brain:
  - Learns the underlying pattern
  - "Groks" it fully
  - Files it away (and reruns if needed)
- Games are iconified representation of human experience that we can (safely!) PRACTICE with and learn patterns from. But they are also LIMITED FORMAL SYSTEMS => boredom is inevitable

Why is a Game Fun?

That is to say:

Fun from games = **LEARNING**

It is the act of solving puzzels that makes games … **fun** !!

(and our brain releases endorphins)

"Fun is the emotional response to learning"

(C. Crawford, 2004)

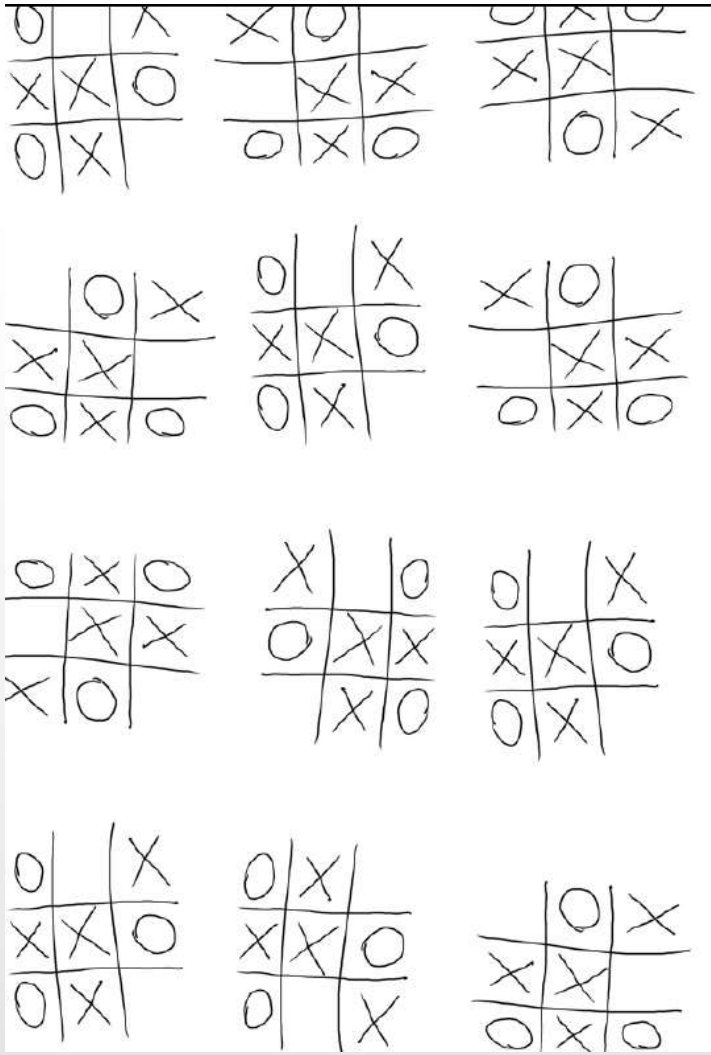
P.S. all this, incidentally, means that Deathrace and Pacman are … quite the same …

What is a Frustrating Game?

- When we meet “NOISE” we fail to see a pattern in it
- We get frustrated and give up

What is a Boring Game?

- … but once we see a **pattern** we delight in tracing it and in seeing it reoccur (this is “practicing”), since it is FUN to exercise your brain
- Games are puzzles (they are ‘bout cognition and learning to analyze patterns) …
- … when you are playing a game, you will play it untill you master the pattern: once you have mastered it, the game becomes BORING …



Boredom & Games

- Reasons for a game to become boring:
  - "too easy": player groks the game pattern in few minutes (tic-tac-toes)
  - "too hard": player can't grasp any pattern. The game is just noise
  - "it's repetitive": pace of variation in pattern too slow
  - "too hard too fast": pace of variation too quick
  - "I beat it": player masters completely the game pattern
  - "unuseful to me": too many variations in the pattern (tons of possible permutations, but below the player interest. E.g. learning baseball results of the last decades …)
- NB: boredom it's the signal you have **FAILED**

GOOD GAME = teaches everything it has to offer before player stops playing

Having *a Lot* of Fun ?

- And so what? … how does it feel

  "having a lot of fun"?

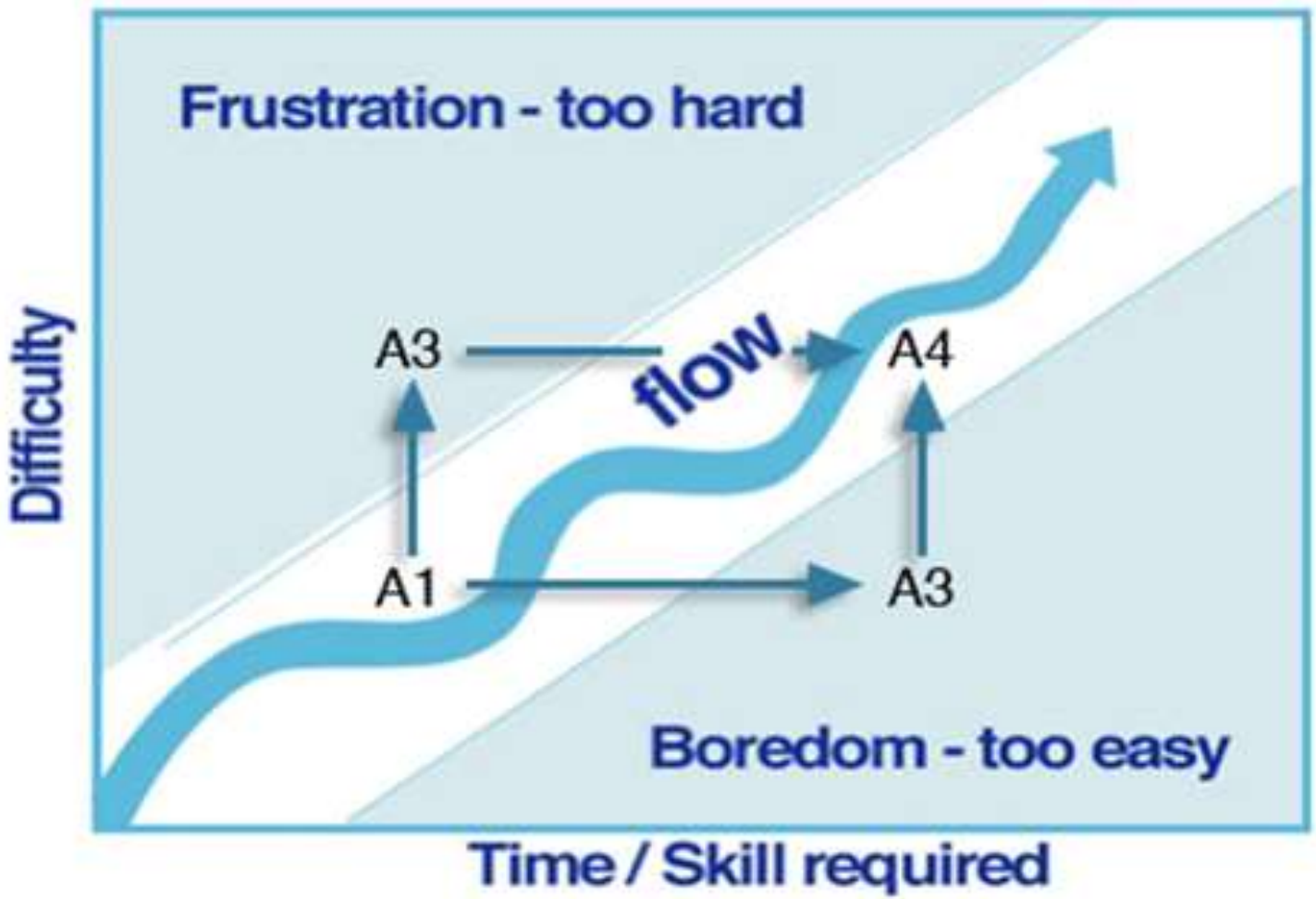
  - Players: "being in the zone"
  - Academics: "**flow**" (M. Csikszentmihalyi "Flow: The psychology of optimal experience"):

"the state you enter when you are experiencing absolute concentration on a task. When you are in absolute control, the challenges that come at you are met precisely by your skills"

How Does it Feel to Be in “Flow”?

1. Completely involved in what we are doing – **focused**, concentrated
2. A sense of **ecstasy** – of being outside everyday reality
3. Great **inner clarity** – knowing what needs to be done, and how well we are doing
4. Knowing that the activity is doable – that **our skills are adequate** to the task
5. A sense of **serenity** – no worries about oneself and feeling of growing beyond the boundaries of the ego
6. **Timelessness** – thoroughly focused on the present, hours seem to pass by in minutes
7. **Intrinsic motivation** – whatever produces flow becomes its own reward

Flow …


Frustration - too hard
Difficulty
A3
flow
A4
A1
A3
Boredom - too easy
Time / Skill required

There are Many Types of Game …

… each underlying a different pattern. They teach us:

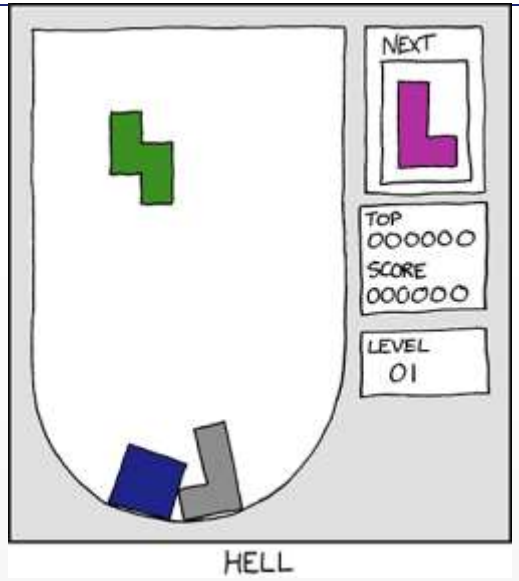
- to predict events
- to deal with power and status
- Spatial relationships/reasoning
- Toolmaking
- Classification
- To explore possibility spaces
- To exercise memory
- Power
- teamworking
- Etc.

… mainly primitive skills, functional to survival …

- Social interactions: manoevering for social status that all humans engage in is a cognitive exercise => essentially a game! => **VIRTUAL WORLDS** are fun!

Some Games Teach You … (examples)

spatial relationships



to explore

how to aim precisely

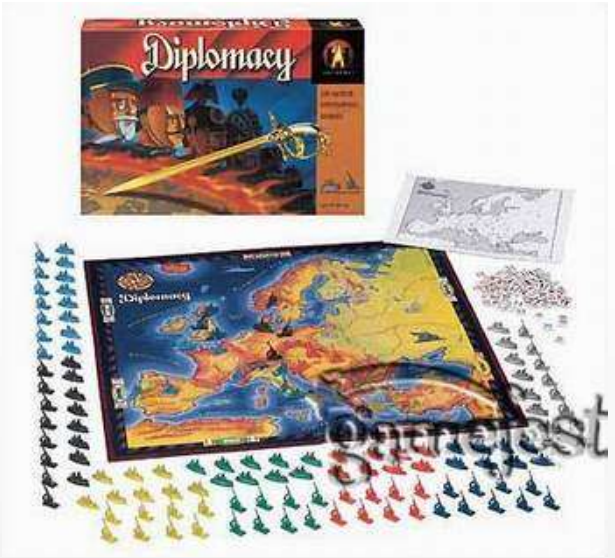
Some Games Teach You … (examples)

- Teamworking
  - (a deadlier tool than sharpshooting, useful in corporate settings… and in this course…)

- Social relations

Some Games Teach You …

- Anyway games underpin **math structures**:
  - They can excel at conveing only specific sets of contents
  - They can be used to model situations (e.g., Diplomacy)



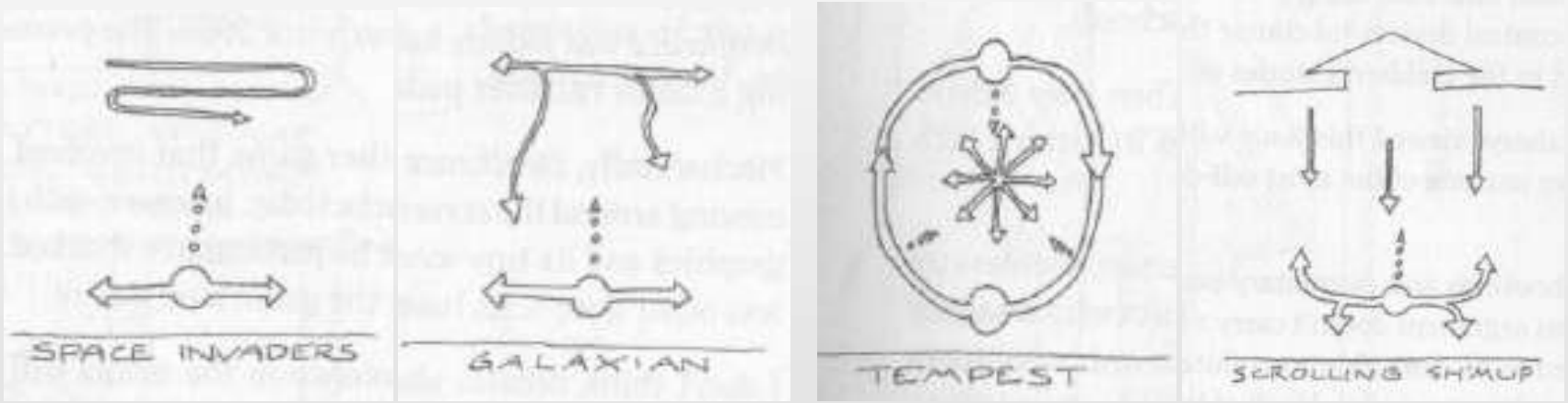
- But they may teach **obsolete skills**, among which also:
  - Blind obedience
  - Rigid hierarchies
  - Binary thinking
  - Force to solve problems
  - Xenophobia
  - …

We have increased the ***fidelity*** of the simulation, not what we are simulating !

What Games Aren't

- We rarely see abstrac sims in games, they adopt **metaphors**. Artwork has 2 main purposes:
  - Teach you to see the math problem past the fiction
  - Teach you to spot the same problem in different contexts

Games train you to IGNORE the fiction
to find the underlying pattern



The Issue of Violence: Hints to Reflect Upon

- For these reasons players are so dismissive of ethical implications of games …

Same pattern

- They don't see "get a b…..b from a hooker, then kill her", but they see a power-up …
- … also… they would never eat a plastic ball in real life …