Letting the past die slowly...

Design within genre

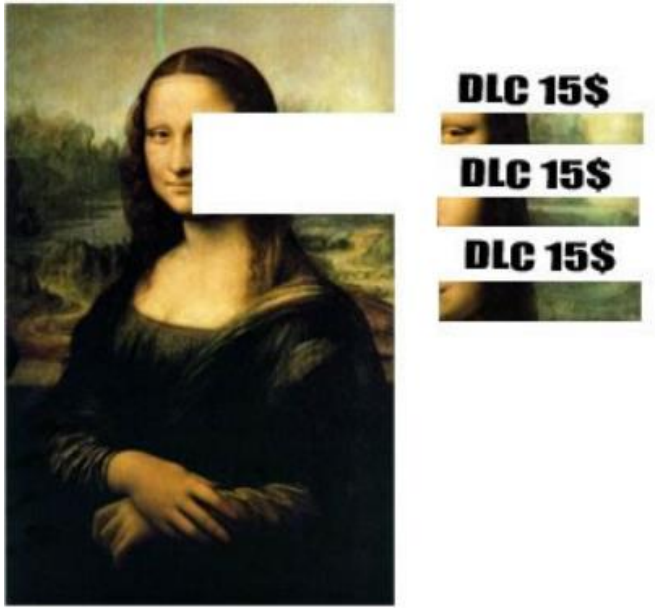
PART I

RIDDLE ME THIS

Is content king?

We’re giving player more polygons, guns and square kilometers than ever, but many feel they’re not getting their money’s worth.

Versus



Fix what isn’t broken?

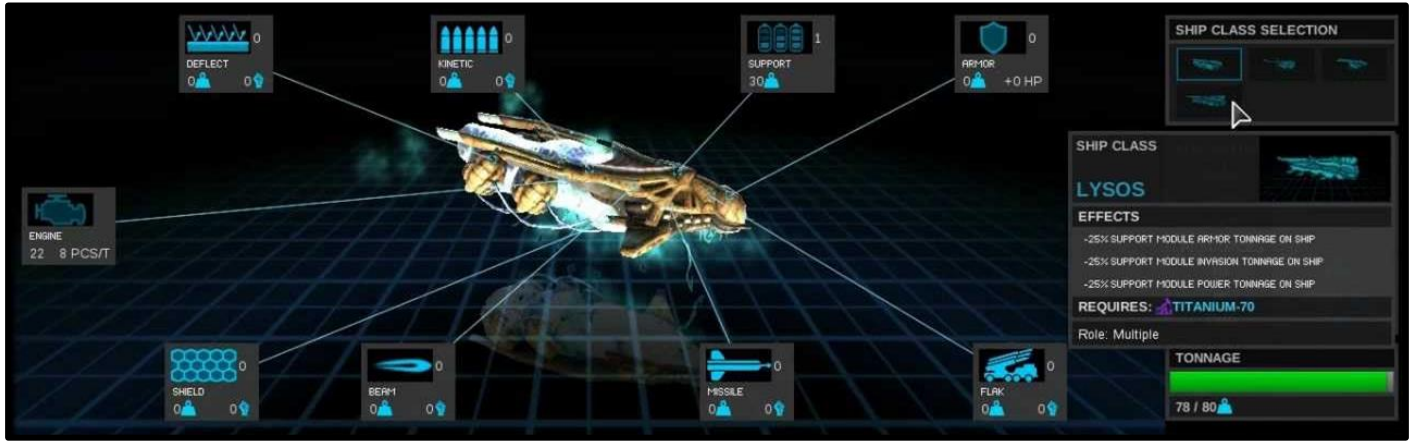
More content than ever is being produced by more talented people than ever, but somehow it doesn’t *feel* like *“more than ever”*.

Don’t touch anything?

There are cries for innovation, but woe betide the developer who tries to take their franchise in too new a direction!

Don’t fix what’s broken?

In fact patches that fix exploits and dominant strategies are not always well-received!



Question

How can we avoid frustrating our players when we design within genres and franchises?

PART II

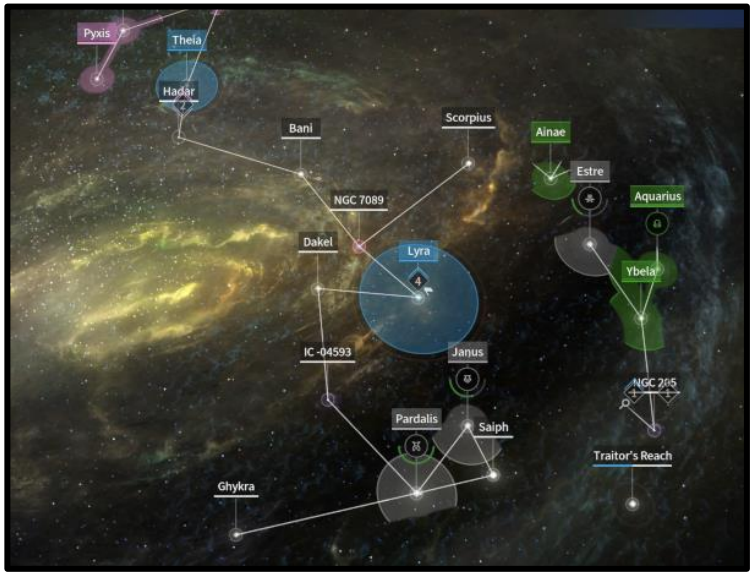
ME, MYSELF & AI

About.me

Hi, I’m William, and for 5 years I’ve been doing AI and system design at *Amplitude* for *Endless Legend*, *Endless Space 2* and *Humankind*.

Our genre of choice

These games all belong to the *“4X”* genre (Explore, Expand, Exploit and Exterminate): think *Civilization* and *Master Of Orion*.



The “fuzzle” genre?

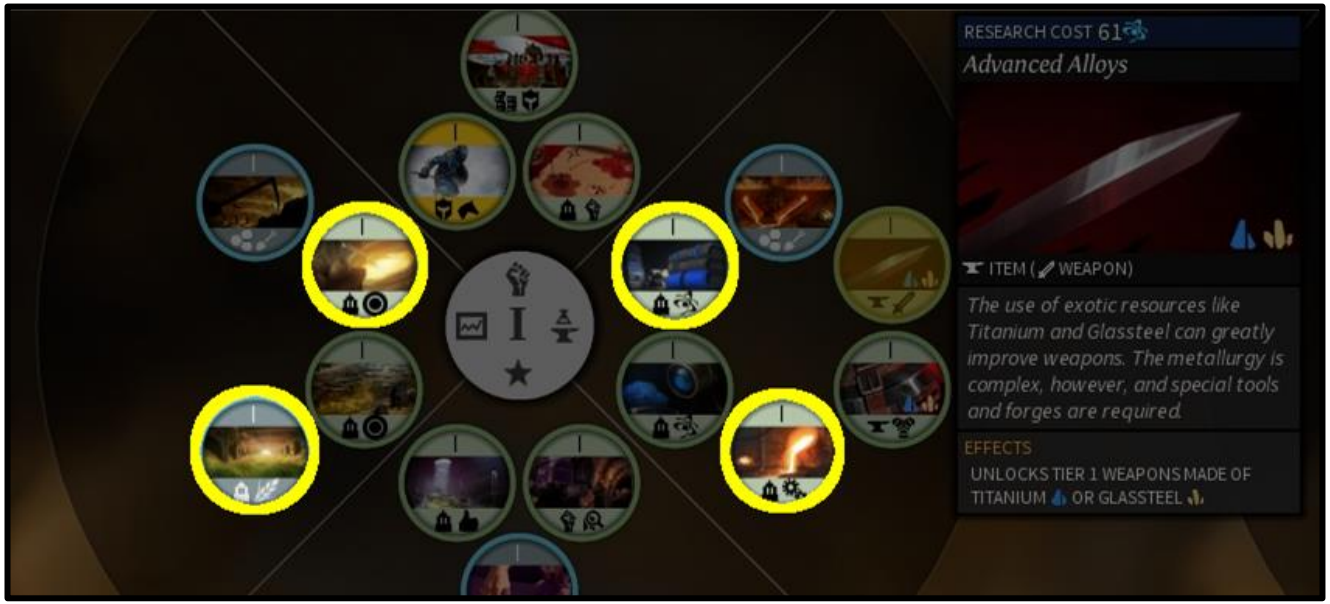
Our games are meant to be replayed: much of the fun comes from **creating and honing strategies with each play-through**.

Don’t panic...

For instance to play *EL* optimally, as with many 4X games, players should choose a technology to research **<u>on their very first turn</u>**.

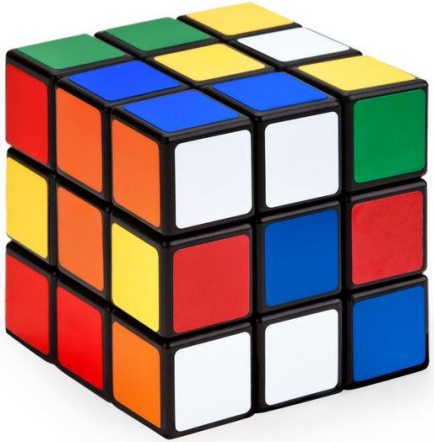
… it gets easier!

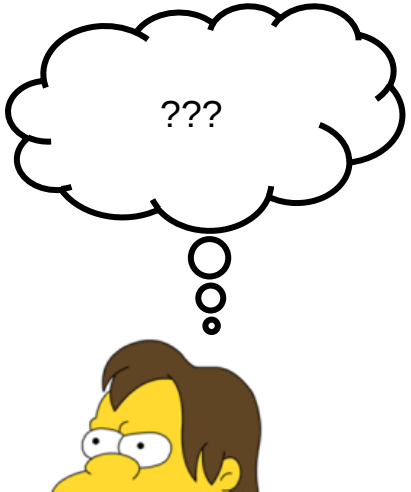
This choice of first technology might seem daunting to new players, but **the AI almost always start with one of the following**.



Obligatory Rubik

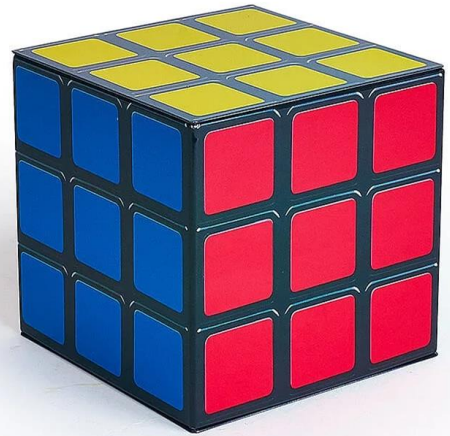
Working on the AI has meant constantly being confronted with gaps between **how complicated a game system seems** on the surface and **how simple a solver algorithm for it can be**.





Obligatory Singmaster

Simple solutions don’t mean there’s something wrong with the game though. I’d actually argue our brains **enjoy bridging this gap between perceived complexity and underlying simplicity**.

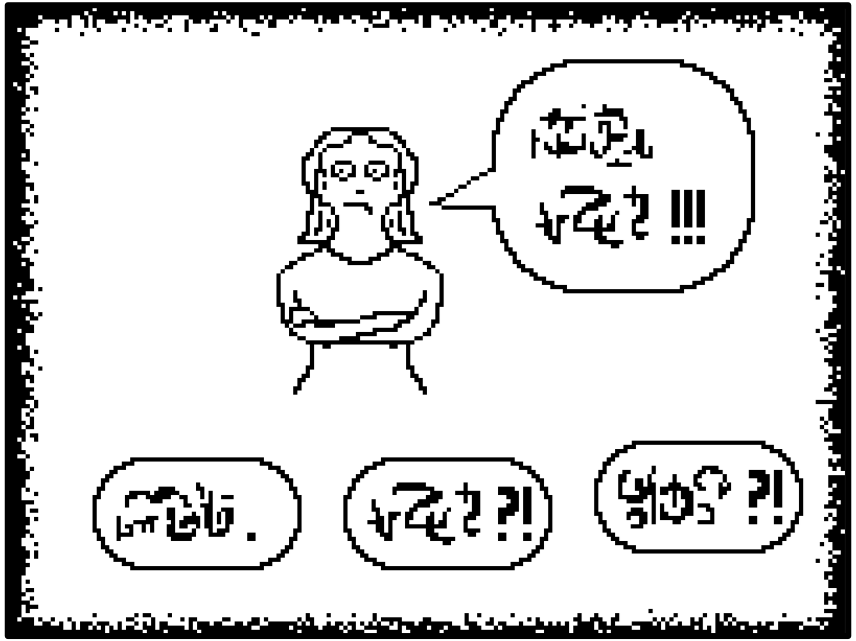


The Grinning Colossus

There’s an intuitive sense that we’ve been cheated somehow if there ends up being no gap to bridge.

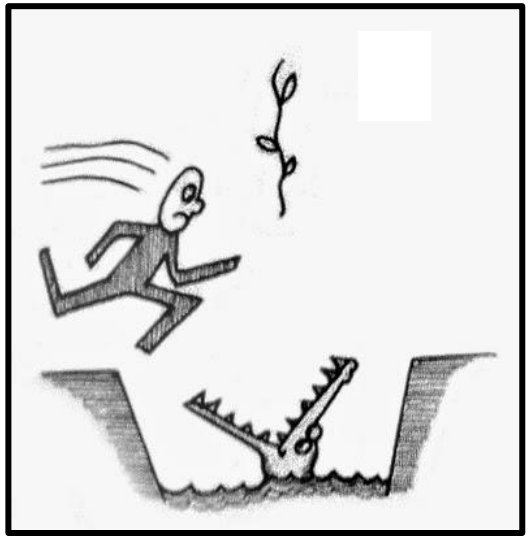
No, it’s not Japanese

We feel equally cheated if it turns out the gap is too wide for any human brain ever to come to terms with.



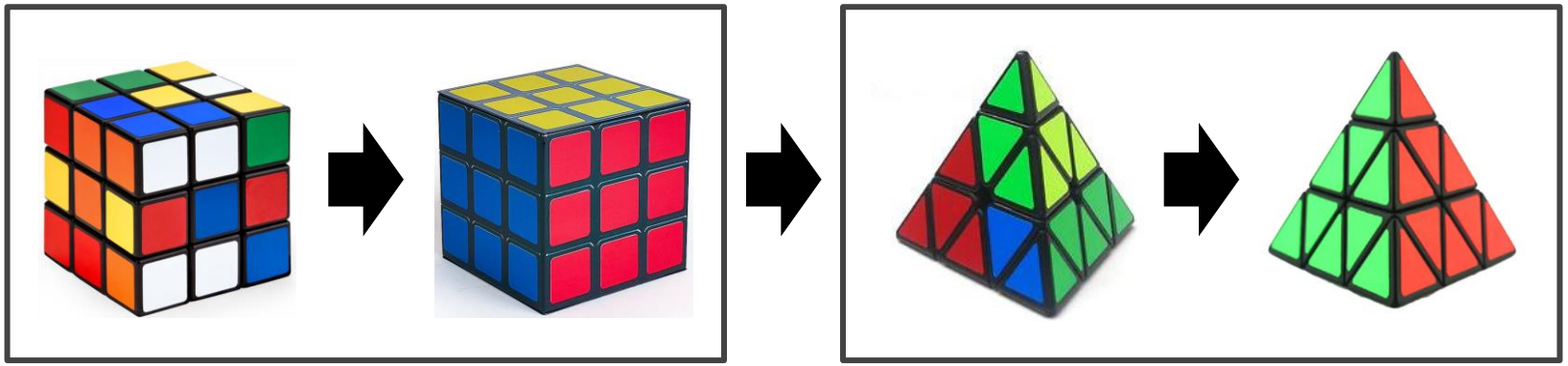
Gap design

So our job is essentially to build **the sort of gaps that player will enjoy trying to leap across**: not too wide, not too narrow.



Let’s get meta

Can this idea of *“optimally-sized gaps”* apply not just *within* games but also ***between* games within a given genre**?



Obligatory Last Jedi

If so it would explain the frustration players feel when a sequel either brings nothing new to the table or *lets the past die* overnight.

Question

How can we ensure our gaps are the right size? Is there a measure?

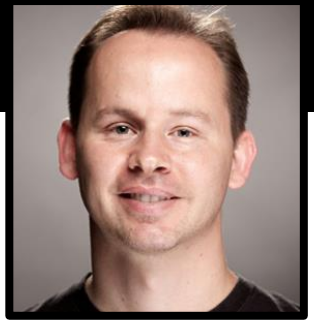
PART III

ALGORITHMIC ENTROPY

Keep it simple, not stupid

When it comes to polyrhythms and musical intervals, people tend to find simple ratios pleasing to the ear… but not *too* simple. Why?

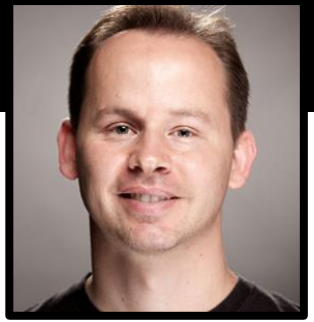
Too cold



*Having a brain is a luxury, brains are really expensive (…) Animals don't learn when a pattern is so **simple** that an innate strategy is possible because in this case evolution can slowly hard-code the entire reaction.*

-Matthias Worch

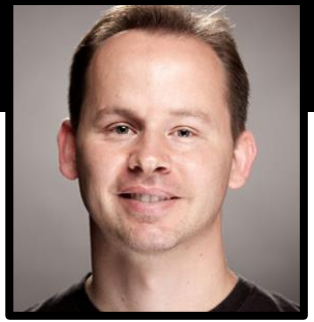
Too hot



*Animals also don't learn when the situation is so **complex** that a strategy is impossible to discern because the actual patterns underlying that situation are not discernible...*

-Matthias Worch

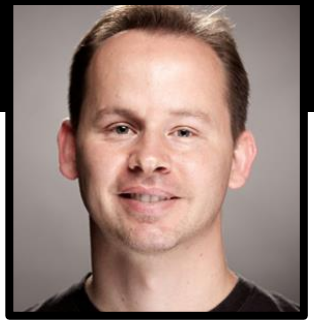
Just right



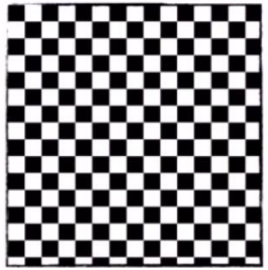
… [The sweet spot is] an environment that is so variable and complex that we can never actually develop an innate strategy for it but where the patterns themselves are still ***discernible*** *enough [that] we can actually learn the patterns.*

-Matthias Worch

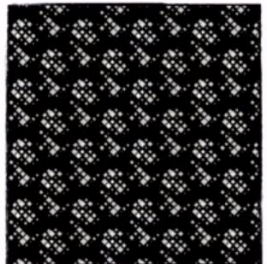
Goldilocks Zone



WHEN TO LEARN/MAKE DECISIONS



TOO SIMPLE



SWEET SPOT

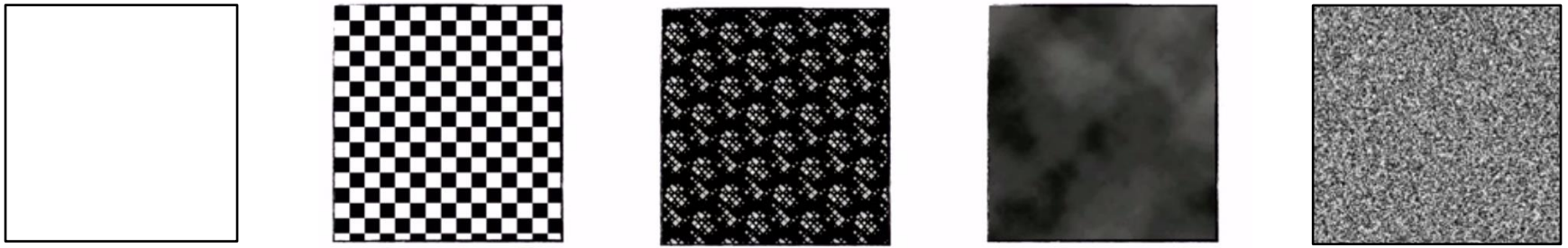
COMPLEX ENVIRONMENT
DISCERNABLE PATTERNS

TOO COMPLEX
(SEEMINGLY RANDOM)

-Matthias Worch

Human-discernibility?

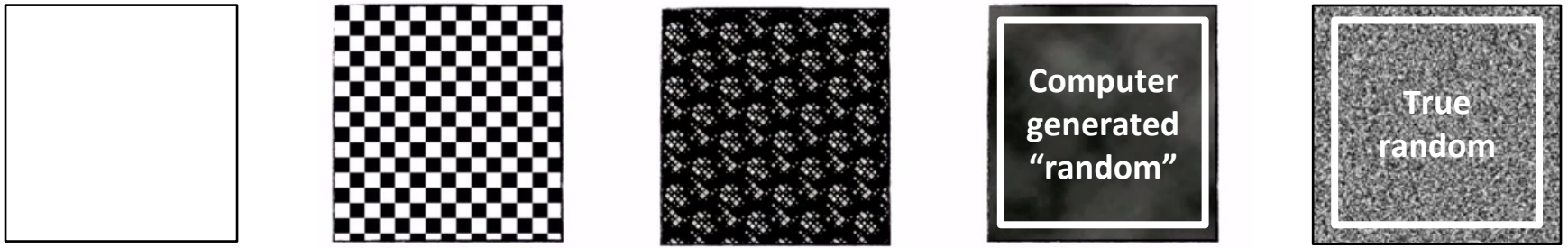
As Carlo Levi put it, *words are stones*: what is this thing that Worch variously refers to as *complexity*, *variability* and *discernibility*?



An answer can be found in **theoretical Computer Science**: *I too can use a seemingly unrelated field to inform my game design*.

The flesh is weak

“Entropy” in Information Theory is a measure of *complexity*, *chaos*, *incompressibility* or *quantity of information* of data.



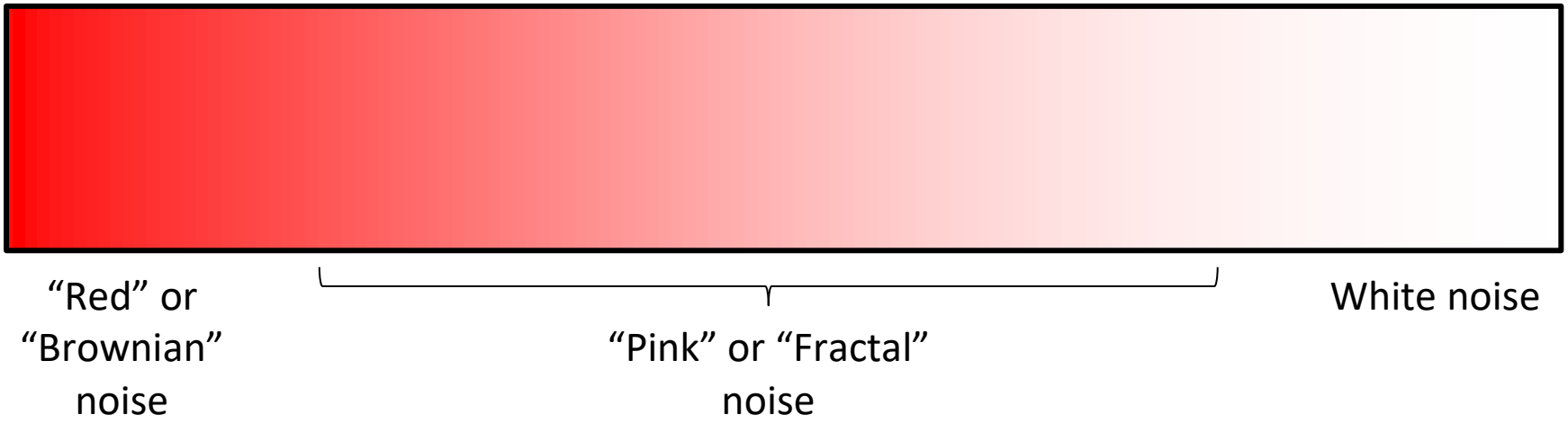
Null entropy

Finite entropy

Infinite entropy

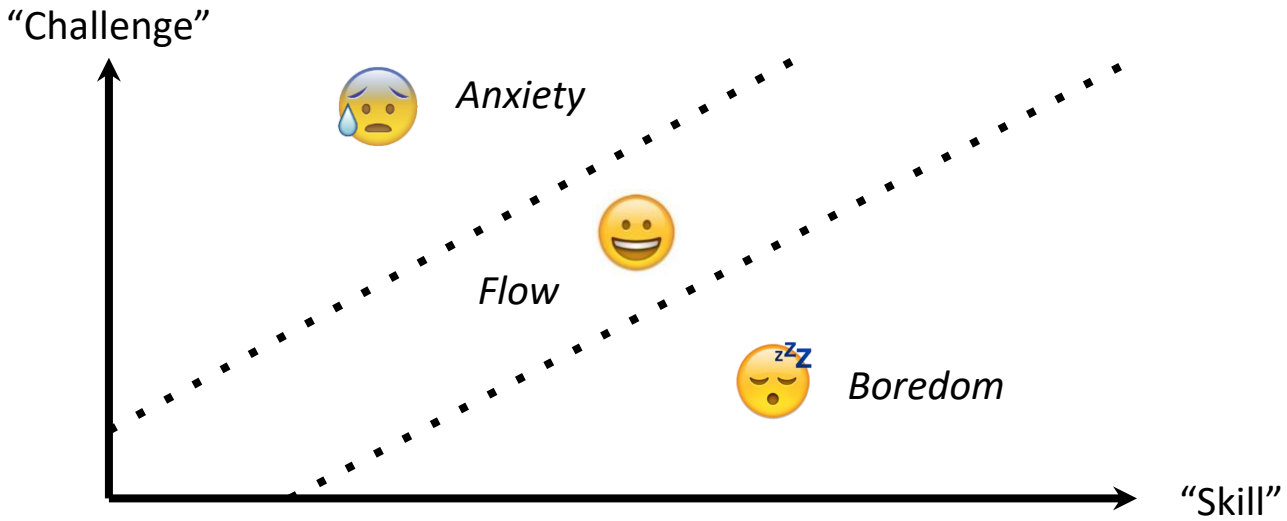
The colour of noise

This maps perfectly onto what Geoff Englestein calls *“the flavour of random”*: it’s all very simple, *“people like pink noise.”*



Flow by any other name?

<u>Flow Theory prescribes balancing “challenge” to “skill”</u>, but entropy helps us to understand *what* these words mean and *why*.



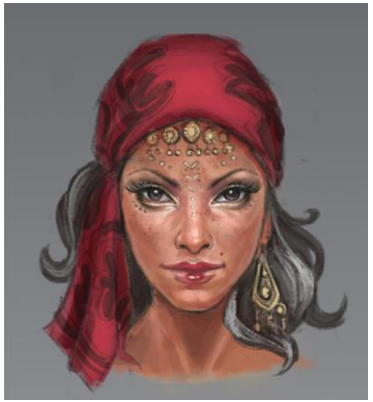
The oracle game

To understand entropy,
let’s play a game!

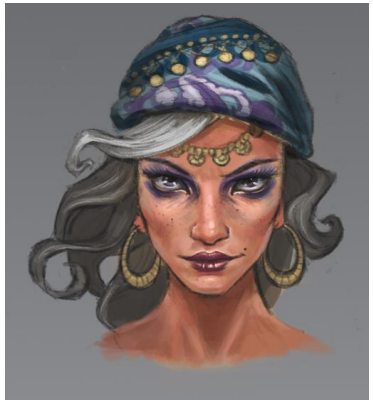
The oracle game

Which is the better oracle? What criteria should we use to decide?

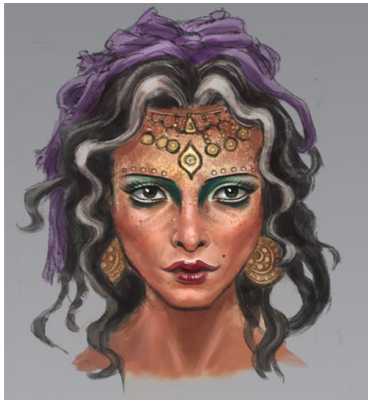
Easy mode



“I can predict the result of a coin toss.”

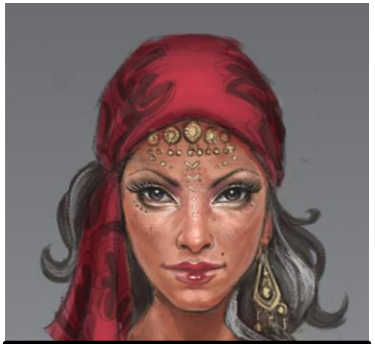


“I can predict the result of a draw from a deck of playing cards.”



“I can predict the result of a draw from a deck of 52 blank cards.”

Easy mode



1-in-2

“I can predict the result of a coin toss.”

1-in-52

“I can predict the result of a draw from a deck of playing cards.”

52-in-52

“I can predict the result of a draw from a deck of 52 blank cards.”

Data entropy

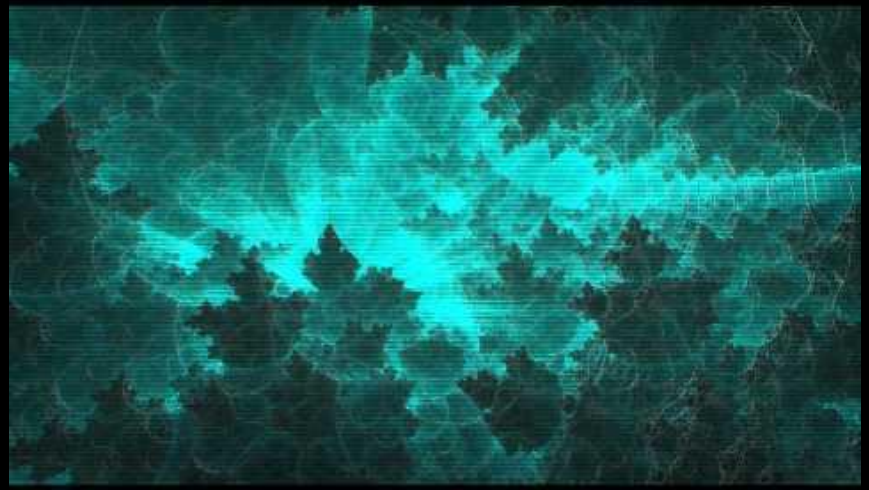
The “*algorithmic complexity*” or “*entropy*” of a data-set is the length of the shortest theoretical way of describing it possible.

Versus

A huge data-set might have a very low entropy if it has a large number of *redundant entries* in it.

Algorithmic entropy

In other words the entropy of a result, in bits, is the **length of the shortest possible algorithm able to generate said result**.

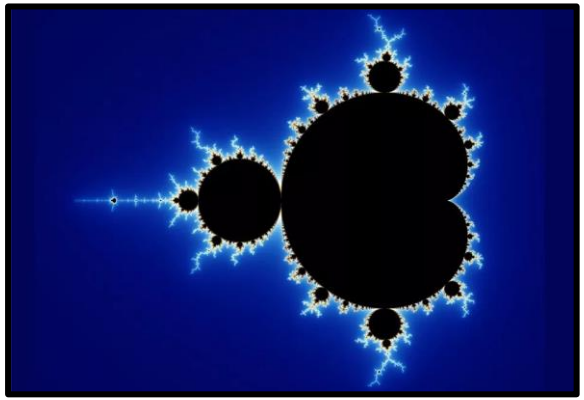


Warning

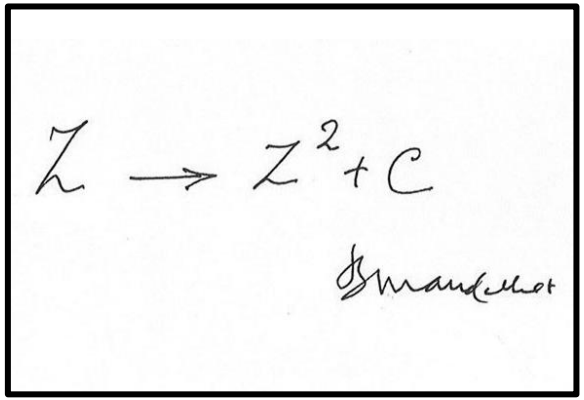
Some theory ahead - but I swear it won’t take long!

Almond-bread

The *compression* of a set of data can be seen as the search for the **minimal algorithmic *"seed"*** that will generate it.



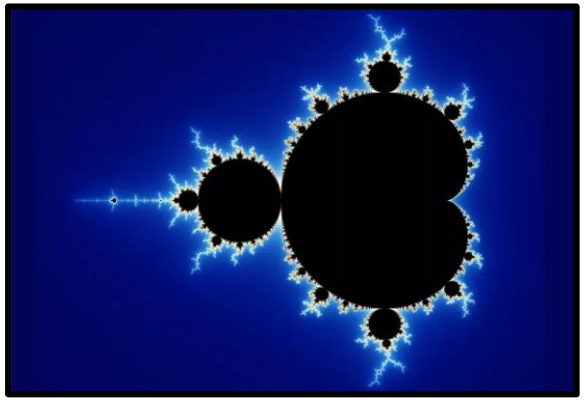
compression



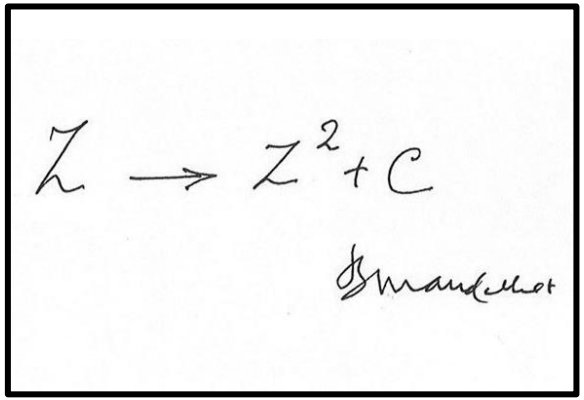
A description cannot be *more* succinct than the theoretical shortest possible description of what it is describing.

Almond-bread

Procedural generation can be seen as the expansion of this seed into a data-set. Generators create data, but **<u>can't create entropy</u>**.



inflation



A generator cannot be *more* concise than the theoretical most concise possible way of generating its output.

Question

How can ideas like entropy and compression help explain, and so avoid, player frustration?

PART IV

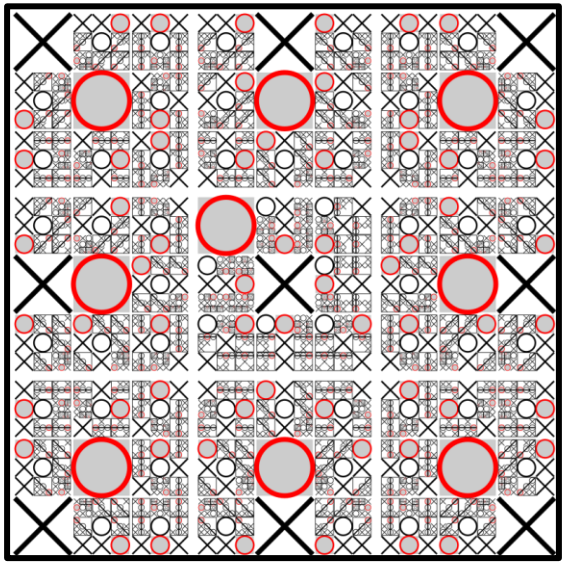
ENTROPIC GAME DESIGN

Strategic entropy

We can define a gamestate's *"strategic entropy"*, given a player goal, as **the size of the simplest plan that is guaranteed to succeed**.

God’s algorithm

To put it another way, it is **the size of the most concise possible AI opponent that always plays perfectly**, aka *“God’s Algorithm”.*

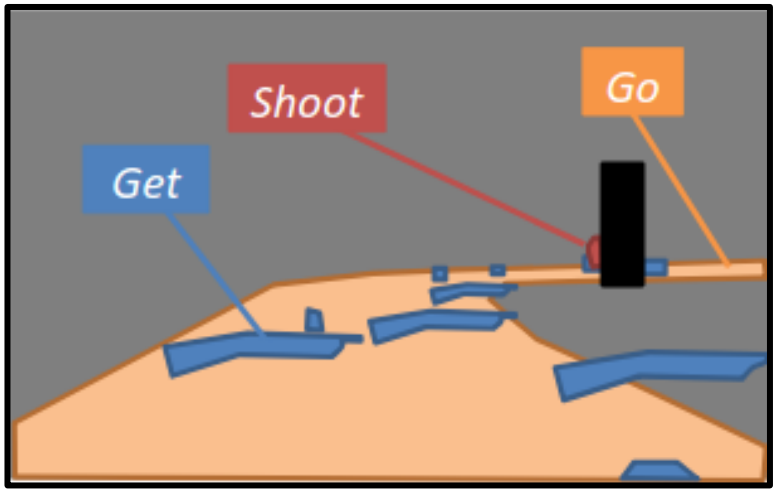


Perceived entropy

A player's *"perceived entropy"*, meanwhile, is **the size of the most concise workable strategy** they've come up with so far.

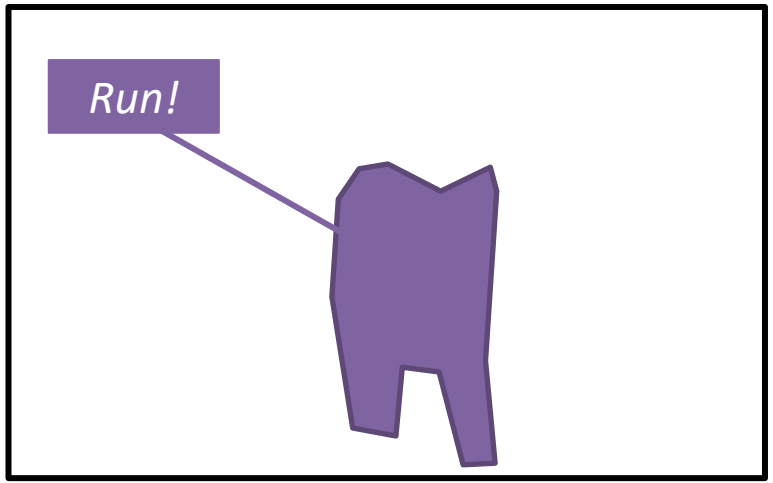
A parsimonious mind

Perceived entropy tends to **increase in a changing environment** and **decrease in a stable one** as more concise goto strategies are found.



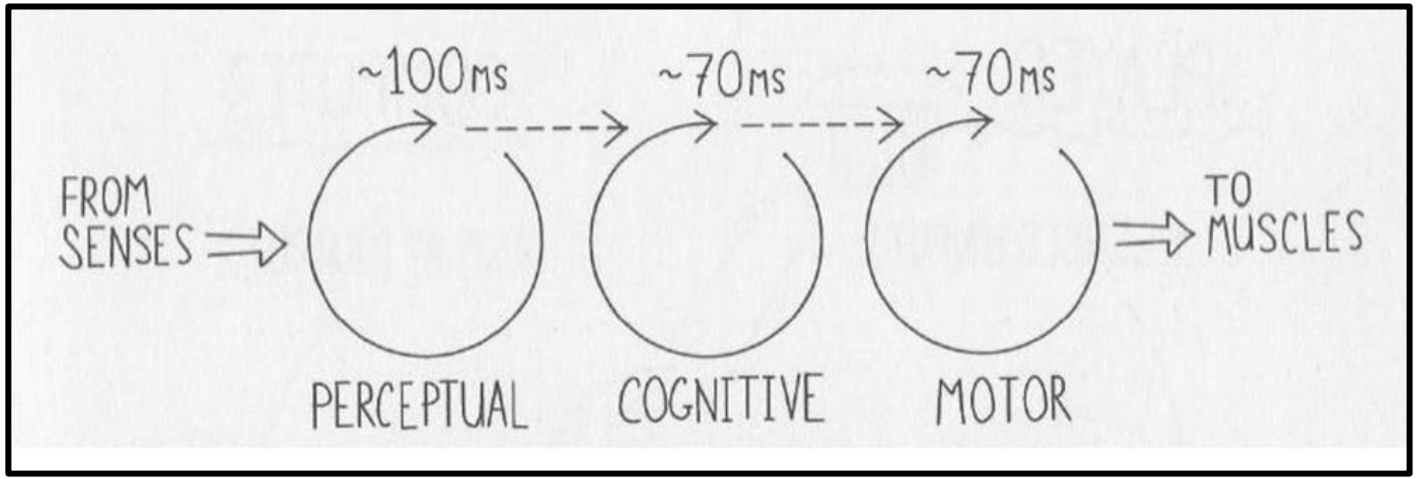
Appeal to nature fallacy

Managing to lower our perceived entropy means a **lower cognitive load**: nature rewards this optimisation process with engagement.



Game Feel

Less cognitive load means **more *"correction cycles"*** over the same amount of time. This can be a bad thing.

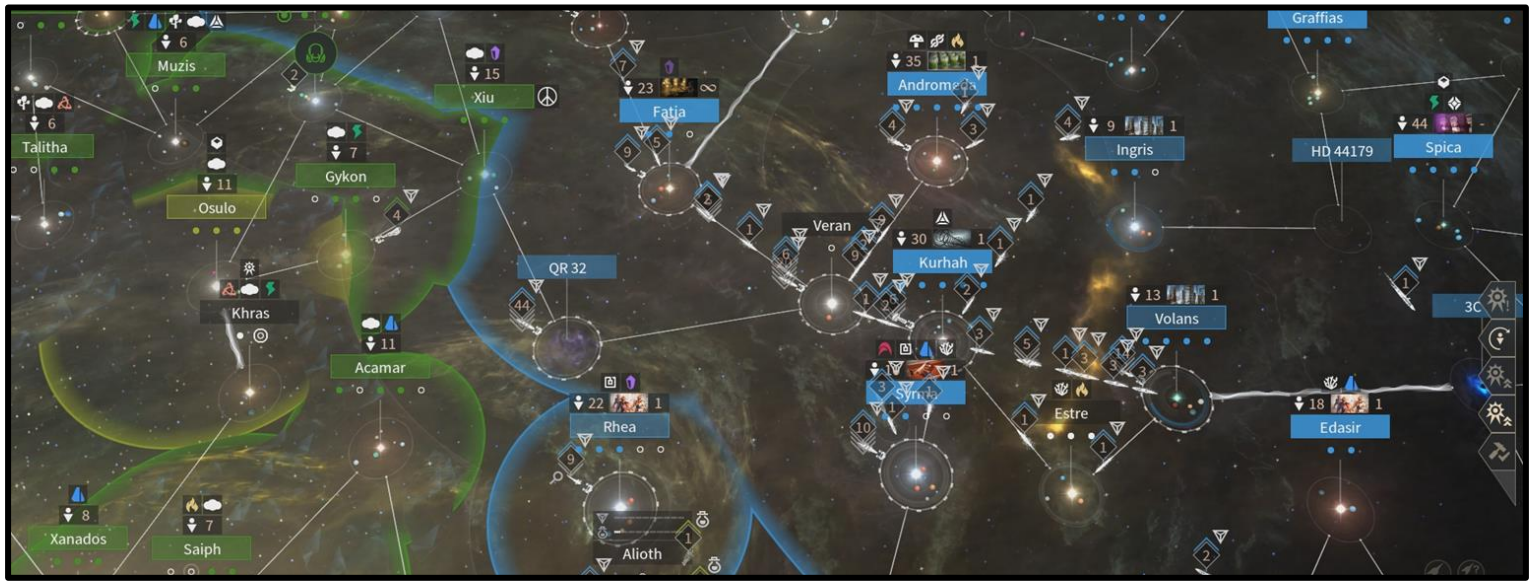


Input lag

If we're able to perform more correction cycles faster than the game can provide feedback, then it will feel *"floaty"*...

Trudge

… and any interaction that doesn't provide new information will feel like a chore, aka *"trudge"*.



Book-keeping

“The fun that you have when you’re playing chess is in this moment when you’re considering *- not when you are actually moving this piece, that’s just a bit of book-keeping.”*

-Brian Upton

Dominant strategies

There's no need to *consider* once a dominant strategy has been found: **perceived entropy stops decreasing and engagement is lost**.

No-brainers

To make sure players keep *considering* we need to inject more entropy using game elements that **call strategies into question**.

Level design

Thinking in terms of these *“game-changers”* can be a helpful way of **<u>designing late-game challenges</u>**. Take *Dungeon of the Endless*...

The final floors violently question players’ long-standing *“open doors one at a time”* and *“stay with your towers”* strategies.

Expansion design

Game-changers can also help **design expansions**. For example in *XCOM* playing cautiously was *always* better than rushing on ahead.

The *Enemy Within* expansion forced players to think more seriously about whether to push forward or to hang back.

Different, not harder

Game-changers *don't* need to make the game *harder* to win overall, they just need to **sabotage the current winning strategy**.




Each season in *Don't Starve* requires a different approach, as dangers and opportunities appear and disappear.

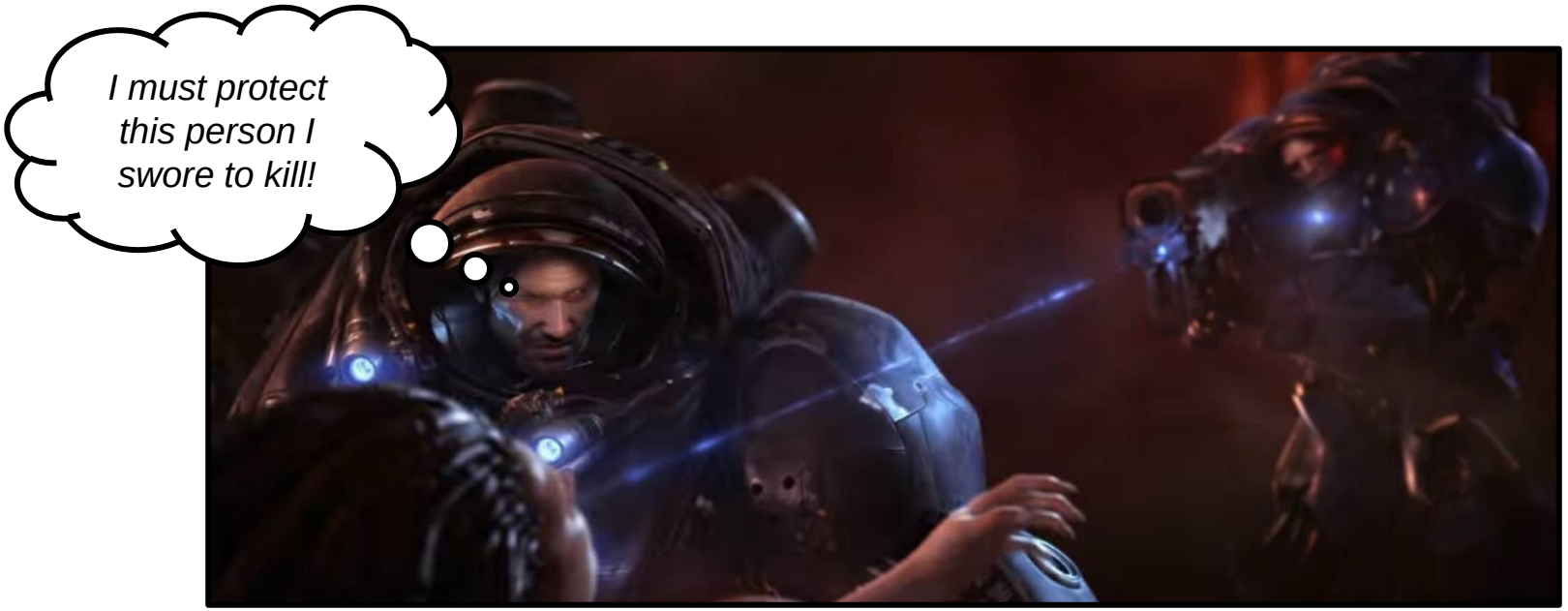
Loss aversion

Be careful though: **sabotaging a player strategy means destroying their hard work**, and *loss aversion* is a powerful force!

XCOM 2 added even more timers than *Enemy Within*, but the response to them was not altogether positive.

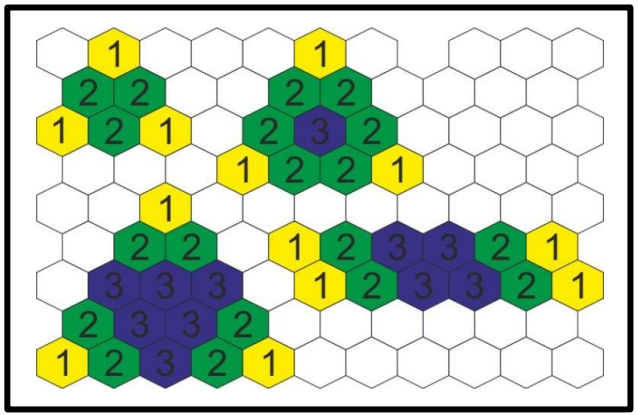
Question, don’t invalidate

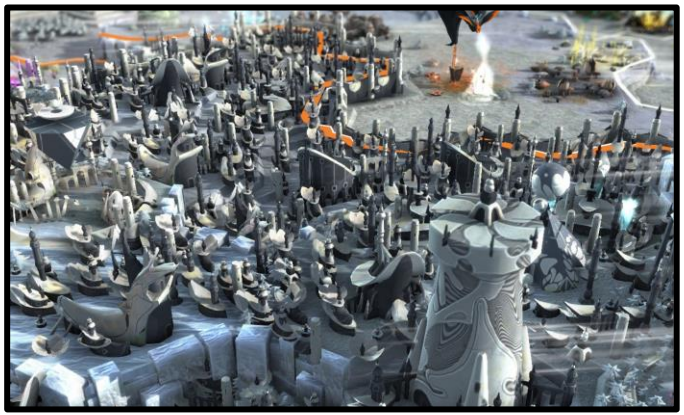
This is why you want to *question* rather than entirely *invalidate* your audience’s prior understanding.



“Always” into “sometimes”

To find good candidates we tend to look for places where an ***“always”*** **can be turned into a *“sometimes”***, not a “*never*”.





Endless Legend: Shifters took a stab at simplistic city layout patterns that players had been using by adding terrain-specific districts.

PART V

TAKEAWAYS

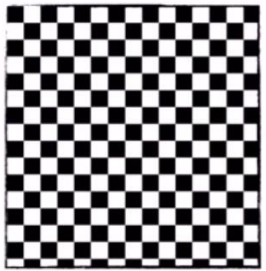
Think with entropy

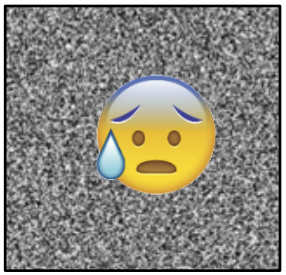
“Entropy”, ultimately, can be thought of **how much or *meaning* is encoded into a signal**. It’s a somewhat mystical thing IMHO.

Entropy is counter-intuitive: massive data-sets can be mostly redundancy while tiny files can concentrate enormous amounts.

Glut the maw

Human beings appreciate environments with **just the right amount of entropy**, *not too little, not too much*.

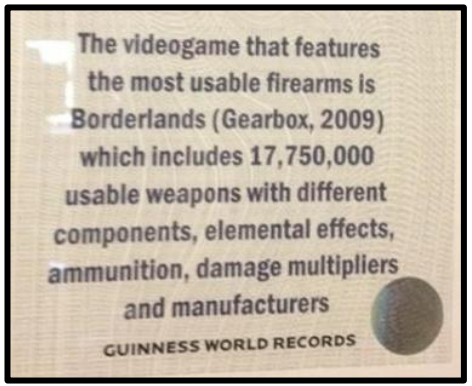



The voracious human mind gobbles up all the meaning it can find, leaving nothing but indigestible chaos in its wake!

Beware of processes

Automated processes can create more data but, by definition, **they can never create more entropy**. They can't *create* meaning.



If you can generalise your process then so can players. Your job is to create entropy, not data, so don't just follow an algorithm!

Nudge

If your games never change then players will eventually grow out of them. You need to keep **nudging them out of their comfort zone**.

This can be done by thinking in terms of meaningful, game-changing content: what *qualities* the content has, not its *quantity!*

Understand assumptions

Meaningful content is content that **invites players to question their assumptions** and change their (interpretative) strategies.

The design of meaningful content is predicated on **an understanding of what these assumptions are**, so *talk to your audience*!

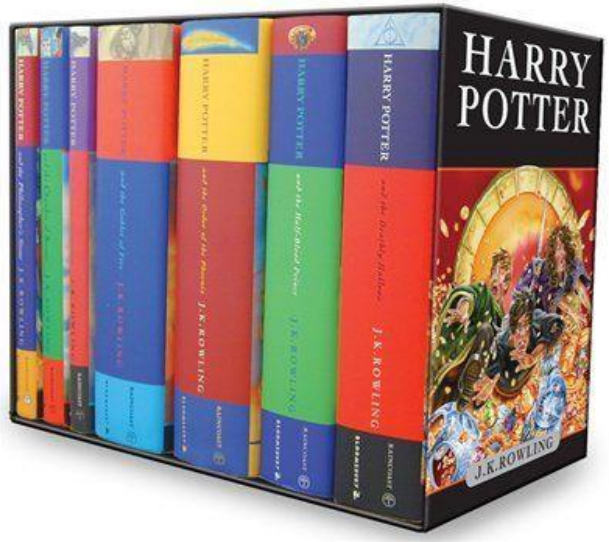
Avert losses

Don’t go overboard though! **Respect the hard work** players put in to discover their strategies. **Consult them about changes** if possible.

Clever tricks shouldn’t stop working over-night: **changes need to be made gradually**, players need a chance to get used to them.

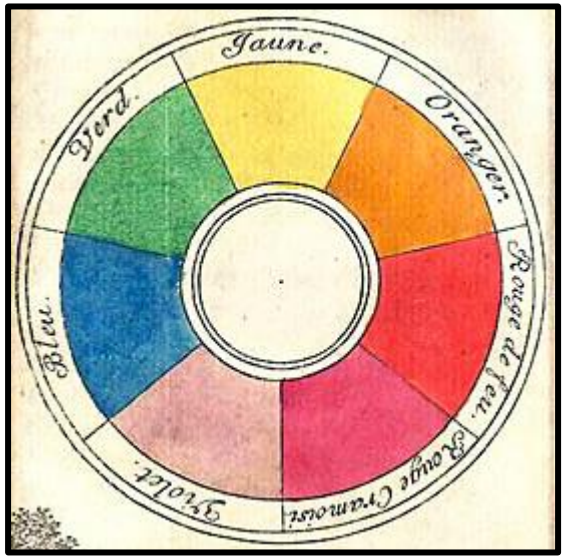
Watch Toy Story

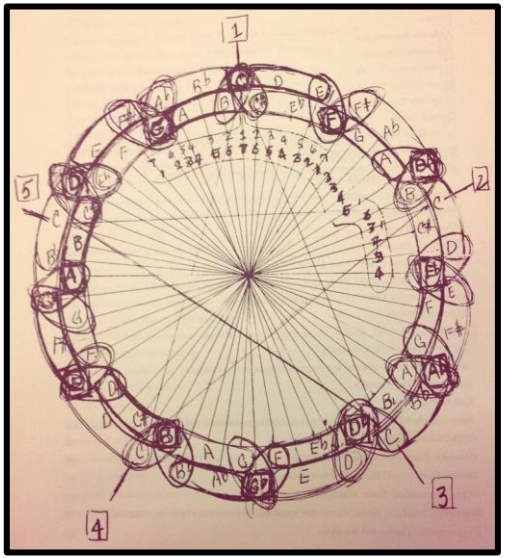
The ideal when designing within genre is **<u>new art in the *spirit* of the original</u>**, but which **<u>grows up as your audience does</u>**.



Read *everything*

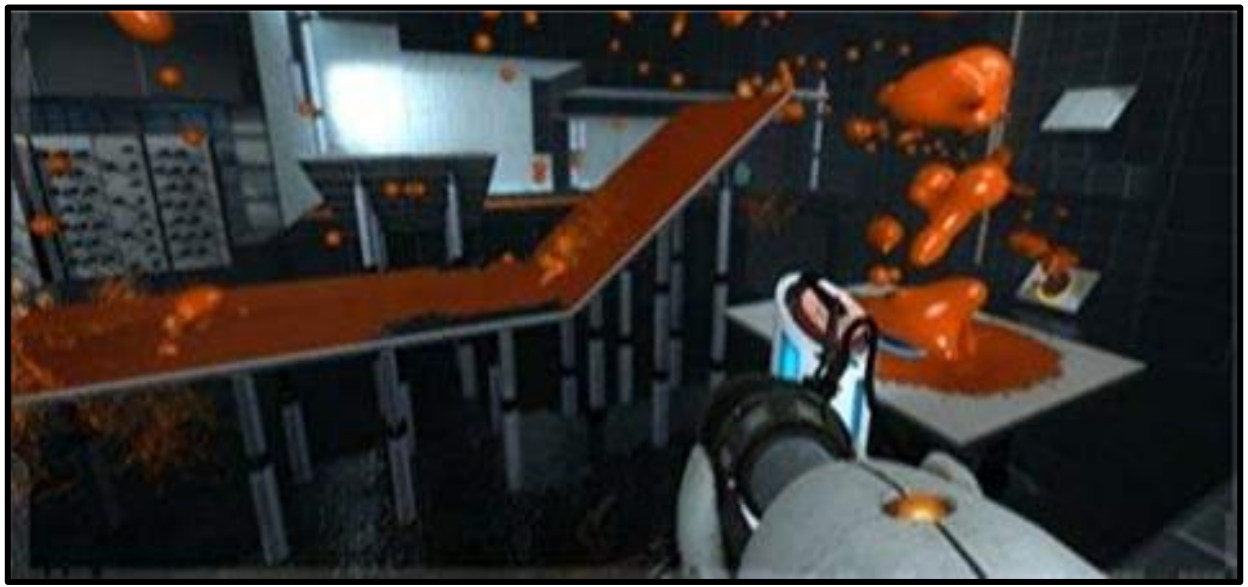
Many of these ideas grew out of **taking an interest in fields *outside* of game design**: *music, mathematics, aesthetics, psychology*, ...





Design within genre

This basically means **enough *new* ideas that stimulate in pleasantly *familiar* ways** but **not so many that the audience feels lost**.



Be happy

A person's life purpose is nothing more than to rediscover, through the detours of art or love or passionate work, those one or two images in the presence of which their heart first opened.

-Albert Camus