

Here's Why Game Design & Development is Applied Metaphysics ft. Entropy (Information Systems) Or, Or why science needs to take Game Design seriously.

On a high level, when does randomness become apparent in a game? I've been doing a lot of research on randomness and entropy (order to chaos & information systems) and found that RNGesus does exist. It's the local minima.

Which is like... think of the global minima as a permutation (combination) of all degrees of freedom (when rolling a d20, that's 19 degrees). Standard PRNGs, designed for statistical uniformity, often have attractor states (system settles into a pattern). This means they can hit a kind of ceiling, a local minima, where their behavior settles and becomes more predictable over long stretches, even if it's "fair" on paper. I'm not implying that the bias is bad inherently, BUT its more the bias is bad if it just goes to one thing. In an LLM this can look like "em dashes" or the verbiage, "That's not ____, it's ____."

Statistically, classical randomness is built to be uniform and fair. Video games are applied metaphysics and a probability simulation; stochastically, even at low levels unless an item is level-locked by the rules, an item should be obtainable depending on the sample size. A meaningful sample size, for rigorous observation, often requires iterations of testing well beyond 7k, sometimes even over 500k rolls. Now, when we're talking about items with truly low appearance rates, say below 1%, the "uniform fairness" of a typical PRNG might not translate into a player actually experiencing that event within a normal span of playtime if the system has settled into a restrictive pattern. The underlying mechanics might be "fair," but the emergent behavior over time can feel stale or stuck.

In a game where random is centric. You know? Pivotal, the core point, if most players generally find a specific item incredibly hard to find hundreds of hours in, when realistically they feel they should have encountered it, does that mean the local minima was hit for their particular seed or play history? It's like the system explored a bit, then stabilized into a "safe" pattern, and stopped truly venturing out. This isn't about just scattering numbers; real, deep randomness seems to pulse, return, and adapt. It can even appear to develop preferences or exhibit curiosity in structures before shifting again, rather than just flattening out.

All I'm saying is if I open over 100+ pc blocks in a game with 300 hours of playtime, I shouldn't organically find a needed item only at that 300th-hour mark, especially when the game's logic for loot tables and item spawning tries to emulate a kind of real-world persistence or history. It suggests a need for randomness that doesn't just reset with every call but unfolds, reacts, and responds over long sequences, possessing a kind of memory or fractal, scale-aware complexity that allows for both fairness and genuine, evolving surprise.

This is entropy as design.

In our physical realm of existence, how does it feel to jump? Its intent and then inertia, followed by the casual of commitment due to the action. In a game? It's effectively the same yet the rules must be applied—it's not hardcoded into the game as the reality of that instance of the digital verse is uncertain.

Once one jumps, does gravity curse them back down as it does in the physical realm, or does one float such as if outside of the dense mass of the earth's rotational pull. The interface of reality is continuity. The interface of a game is based on if the game is in reality—or if it's completely digital.

Gravity doesn't exist in the realm of games until it's a game that needs physics. This is true even with analog and physical games. I don't need gravity to play rock, paper, scissors or a verbal guessing game. So, in a platformer game in the digital realm the player initiates the consequence of the action of jumping.

By definition physics is, "a natural science that involves the study of matter and its motion through space in time, along with related concepts such as energy and force—it is the study of nature to understand how the universe behaves¹". Matter is not defined as chemically as that's chemistry, what things are composed of. Physics is function and matter is anything with mass and volume. In physics, a model is a representation of something that is often too difficult (or impossible) to display directly.

To bring that back to the concept of creating a video game—we are using natural science to create events that invoke a consequence (though that's not meaning bad—more—something happens). Digital video games allow us to modify the rules of our known reality for important what-ifs, things that shouldn't be glossed over in the pursuit of knowledge, otherwise where is the curiosity of knowing and learning about the universe? The universe says that gravity should exist with enough information density in mass within' a specific orbit, we can create an array that holds the meaning of the mass in chemistry to compose of our celestial body and that has an immediate effect on the orbit.

When we advance as a society where zero-gravity becomes a common environment we can then produce models of consequences in video games, examining the causes and what effects of the human bio happen. However this requires an extensive understanding of systems—that which, game designers, generally system designers explicitly have. We can design these systems down to the chemistry of how things interact microscopically. Which one might say that that's too much though the CPU and RAM cost of these models are more than worth it.

Because what then happens when we involve genuine pink-noise entropy – which has temporal memory overtime? A literal, natural memory encoding. The microscopic effects are then scale-inverted until it has a noticeable effect. Until we notice emergent behavior happening. This is not what Game Design or Development teaches because it thinks of itself as purely as psychology, or just a fun thing as determined by society. When it's also human-computer

¹ [Basics of Physics](#)

interaction.

Johan Huizinga wrote the book *Homo Ludens*, where the fundamental role of play as society and culture develops. Play elements are an essential part of Culture. Johan calls play, "It is a significant function—that is to say, there is some sense to it. In play there is something "at play"? which transcends the immediate needs of life and imparts meaning to the action. All play means something."

Much like how the missile knows where it is from where it is a meme. It's literally just a follow mechanic or go to target function in a video game. In play, we explore the rules of navigation, velocity, and correction. But what happens when I create a list of negative missileDeltaPath.self that takes the current delta after specific thresholds as a reminder of where its past self was? Now in a game, what if I add that to an NPC that's tracking the player? Then what if I add weights that score to what the player is currently doing, to give an intended consequence based on inputs?