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START STRANGE LOOP[i]

… "Digital Physics": An Essay That Uses Poetic License to Discuss A Few Theories in the Movie…

END STANGE LOOP

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Author Bio:

Jonathan Khanlian has a bachelor's degree in mathematics and is a Fellow of the Society of Actuaries. He has a love for soccer, science, music, open-minded discussions, and film. "Digital Physics" is his first feature film. For more information on the movie, which will hopefully play at a film festival or university near you, please check out www.DigitalPhysicsMovie.com.

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A Satirical Essay Abstract:

This essay will be an analysis of a few of Khatchig's theories as they are set out in "Digital Physics", an independent movie generated outside the formal system of Hollywood. Although Khatchig is merely a character in a movie, I will assume he exists in some platonic sense for the sake of this essay. Even though this foundational assumption may not be self-evident or true, it will allow me to effectively generate quotes that were Dedekind cut from scenes that don't exist. I expect the reader will observe nothing irrational about this operation which can be used to achieve completeness of the real "Digital Physics" story.

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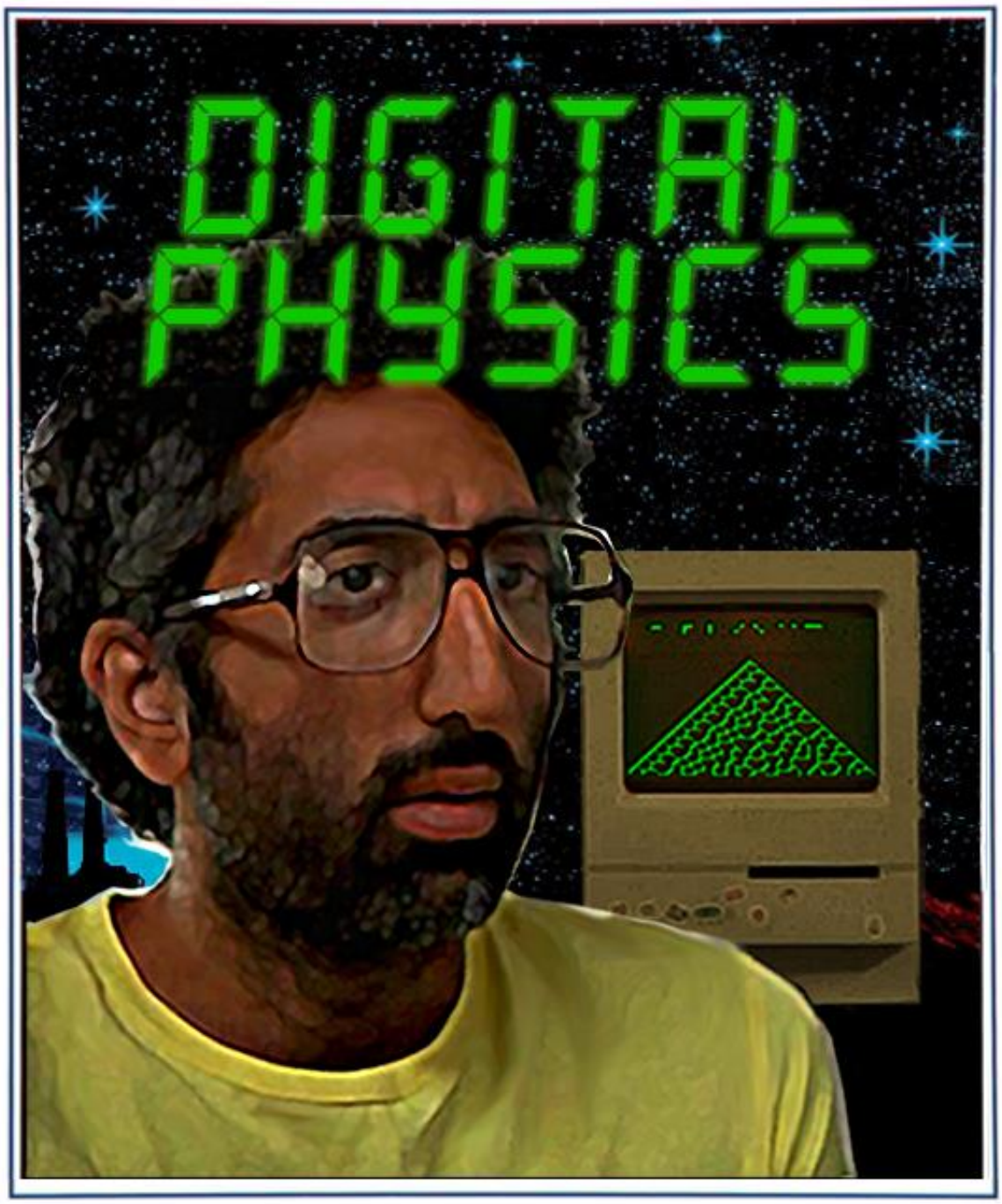
The "Dedekind cut quotes" in this essay, and the use of mathematics based on infinite precision "real" numbers by physicists, are both born out of a desire to overcome a logical impediment and reach a desired goal. Both are created for convenience sake. In the case of the "Dedekind cut quotes" used in this essay, this device allows me to fill in the gaps of some of the fragmented theories of the film's protagonist. In the case of physicists using continuous mathematics, this technique enables the power of

the infinite to be harnessed in order to create elegant closes-formed analytic solutions. Both serve a purpose but neither may be logical.

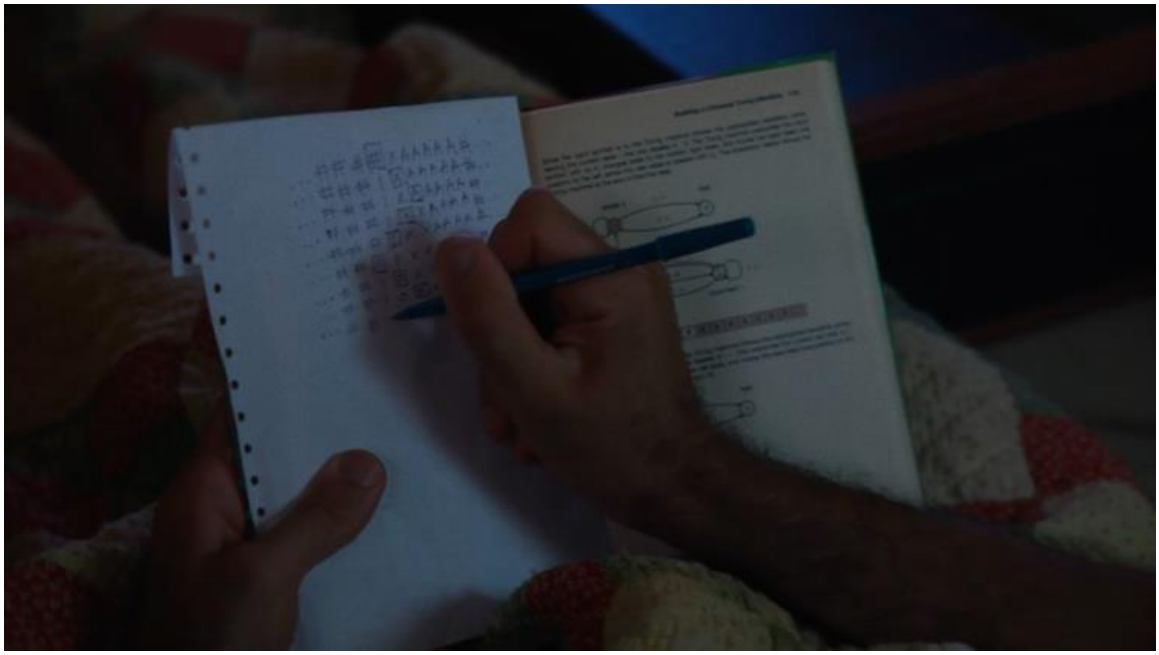
Although I am hesitant to interpret the meaning of a movie that I intentionally wrote to be somewhat cryptic on its first viewing, I feel as though I must balance this artistic intent with the reality that nobody may bother to analyze it (or see it) unless I get the ball rolling and really put it out there. My hopes of premiering the movie at a major film festival with eager critics waiting in the wings to expound on its themes have been dashed by the harsh realities of the independent film world, so I am taking this essay right to the community that I hope will appreciate the film the most. And despite this essay's focus on one specific tenet of digital physics, the movie was intended to be a much richer experience, with it first and foremost being a character study.

Without further ado, here are a few relevant quotes:



A Movie Quote from Khatchig: "Maybe you can't reconcile the world with calculus and continuous mathematics!"

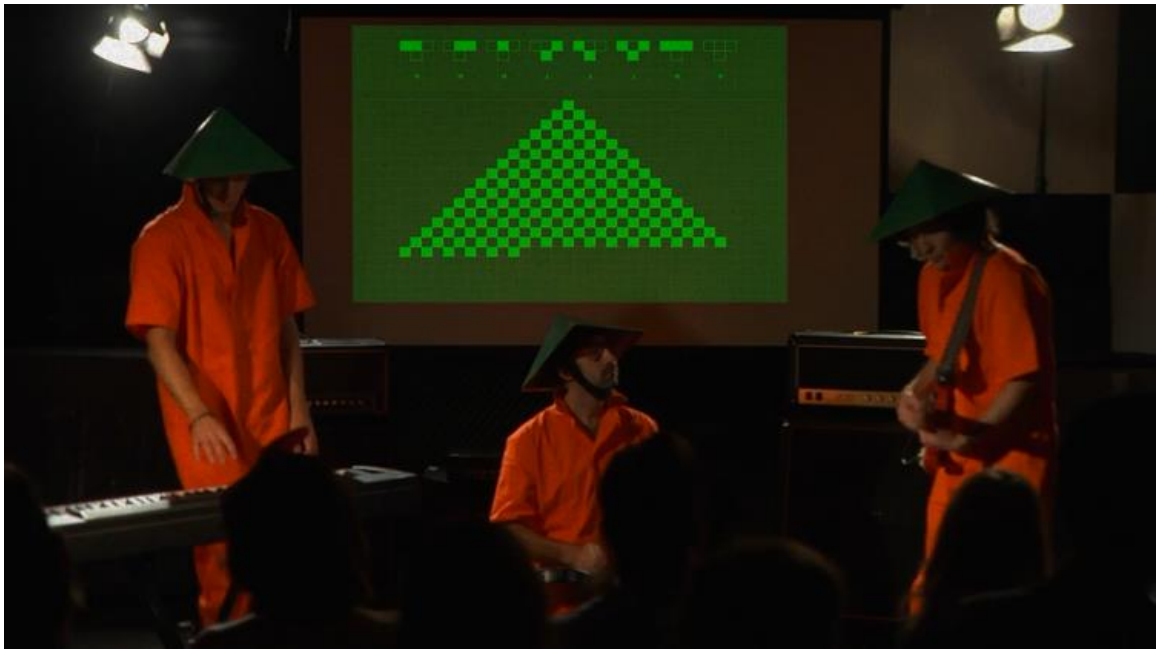
A "Real" Dedekind Cut Quote: "Ok fine, go ahead and use calculus if you are looking at it as just a tool to explain the world, but maybe this tool can only achieve a certain high-level form of understanding. Just because mathematicians want to use certain axioms to explore the platonic world, this doesn't mean physicists should adopt them for analyzing our world. Show me one place where infinity exists in the natural world! Show me one infinite or continuous process! ...Oh, and a waveform is only a continuous explanation for discrete experimental results."

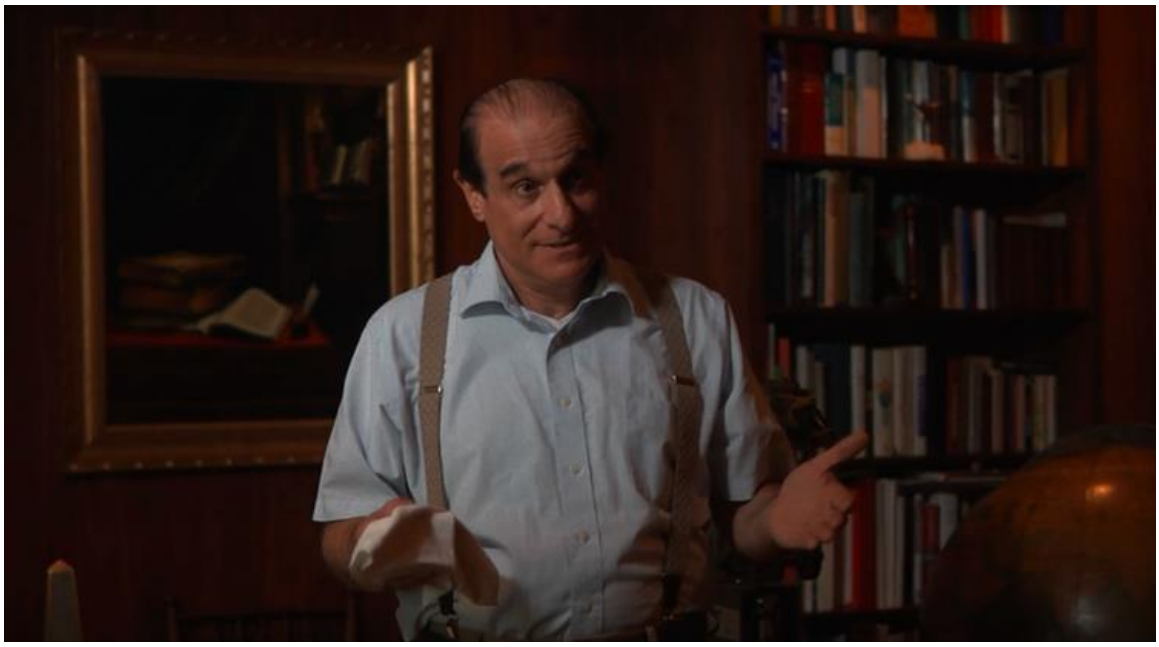


A Movie Quote from Khatchig: "A physicist looking at something that produced prime numbers in nature would probably use a formula like n/Log(n) to make predictions. They would say, 'Look how statistically accurate the model is… We can get it so close to the right answer… Only off by two parts in a trillion… It has to be right!"

A "Real" Dedekind Cut Quote: "Just because the prime number theorem allows us to look at the primes in a statistical way, this doesn't mean that the primes are generated probabilistically. In fact, we know the primes are only pseudorandom because there are deterministic processes such as Eratosthenes Sieve[iii] which will generate them. So how do physicists know that there isn't some underlying pseudorandom process that could reproduce the results of quantum mechanics in a classical, deterministic way? Even if Bell's Inequality[iv] rules out local hidden variables, this doesn't preclude determinism in general."

> [Note: "Digital Physics" takes place sometime in the late 1980s before Leggett's inequality[v] was discussed, or I am sure Khatchig would have mentioned that in his Dedekind cut quote.]





A Movie Quote from Khatchig: "Sure, statistics and probabilities may be our best tool for making predictions because the complexity of the system is just so overwhelming there is no way to get at the final answer without just letting it all play out! But that doesn't mean these statistical approaches are the fundamental rules that govern the universe!"

A Movie Quote from Khatchig: "It's just like Gödel's incompleteness! There's no way to out-compute the system!"

A "Real" Dedekind Cut Quote: "Like the allegory of the man searching for his keys under the lamppost even though they were dropped in the darkness[vi], have physicists stuck only to explaining the areas of natural phenomenon where they can make progress?[vii] …The places where the reason has a compressible structure?[viii] All explanations and proofs ever given have been finite, many of them made in an "intelligent"[ix] way, rather than mechanically reproducing the system. Is it possible that there isn't an intelligent, compressible way to explain all phenomena? Or might you even need to step outside the system, to a higher more powerful formal system, in order to understand it?"[x]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I think many of the ideas in this brief essay are not new to people in the FQXi community, so I've included the following questions that may offer better fodder for the discussion forum:

1) Will the exact "Pi Time" of 3/14/15 9:26:53.5897932… exist this year?
2) Can we logically prove things about our universe without having the technology to probe the very small and very large scales of it?
3) Is there an analogy between the following relationships: a "class" vs. a "set" and "true" vs. "provable"?
4) If quantum mechanics is a world where things can be both "yes" and "no" at the same time, should experimental results be analyzed with Zen Koans instead of logical inferences?
5) If the universe wanted to create structure, would statistical noise and error correction code be enough to bootstrap a slowly evolving universe, including space and time, into existence?
6) How can one-dimensional information contained in a string of mRNA be transformed into a three-dimensional protein in a two-dimensional holographic universe?
7) Can a human, which has no control over the genes it has inherited or its initial environment, ever develop free will according to a non-dualist physicist?
8) If nature is efficient, would it render a tree falling in a forest if there were no agents to hear the sound?
9) What is the relationship between informational and physical compression?

A) Is one alien's signal another man's noise?
B) How quickly could a tape be processed through a Turing machine and is this constraint physical or informational in nature?
C) Does time dilation occur when there is more computation to be done?
D) If actual infinities (as opposed to potential infinities) lead to inconsistencies, and if inconsistencies lead to all statements in a formal system being provable, then must all adversaries of digital physics believe in the multiverse?
E) If the previous question was vacuously true, then how does the informational content of it compare with other IF-THEN statements?
F) Can a formal system be created without traditional symbols? (e.g. chemistry)

10) Is the number of this question in base 10 equal to 16?
11) Gödel used self-reference in his proof of incompleteness, but could an alternate incompleteness proof in arithmetic be achieved by producing a statement that was mathematically ambiguous like the previous question?
12) If I created a very simple formal system in which almost every statement was undecidable, and then I took advantage of this fact by choosing some of the most counterintuitive independent statements to add as axioms, is there any value in physicists studying this area of mathematics?
13) On the other hand, how can some statements in a formal system be considered more intuitive or self-evident than others if any string of symbols should be looked at as being devoid of meaning?

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[i] http://en.wikipedia.org/wiki/Strange_loop

[ii] A couple modern mathematicians who have issues with real numbers:
https://www.youtube.com/watch?v=4DNlEq0ZrTo
https://www.youtube.com/watch?v=svzGGHdqst8

[iii] http://en.wikipedia.org/wiki/Sieve_of_Eratosthenes

[iv] http://en.wikipedia.org/wiki/Bell%27s_theorem

[v] http://en.wikipedia.org/wiki/Leggett_inequality

[vi] http://en.wikipedia.org/wiki/Streetlight_effect

[vii] https://www.youtube.com/watch?v=_eC14GonZnU

[viii] http://arxiv.org/pdf/math/0506552.pdf

[ix] http://ocw.mit.edu/high-school/humanities-and-social-sciences/godel-escher-bach/lecture-notes/MITHFH_geb_v3_5.pdf

[x] https://archive.org/stream/RickStrassmanDMTTheSpiritMoleculex/Rick%20Strassman%20-%20DMT%20The%20Spirit%20Molecule%20%28x%29_djvu.txt

[xi] http://mathworld.wolfram.com/Rule110.html