We are probably not Sims

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Abstract

In this article, I discuss the current state of the debate around the simulation hypothesis, the idea that the world we inhabit is a computer simulation existing in some other universe. Considering recent work from a range of authors, I suggest that statistical arguments in favour of a simulated world are naïve and fail to account either for Occam's razor or for alternative existential possibilities besides base reality and a simulation. Most significantly, I observe that it would be computationally impossible in our own universe to simulate a similar cosmos at fine granularity. This implies substantial differences in size and information content between simulating and simulated universes. I argue that this makes serious analysis of the simulation argument extremely difficult. I suggest that Christian theology has no reason to reinvent itself to accommodate simulism; the two should be viewed as mutually exclusive worldviews. Further, I note that the existence of a human soul or spirit, or indeed any non-reductionist explanation of human consciousness, would undermine the assumption of substrate independence that simulism requires.

Keywords

Simulation hypothesis, limits of computation, information, Occam's razor, substrate independence, soul, spirit, consciousness.

1 Introduction

Bostrom[1] formalised and popularised the simulation hypothesis. In his paper, he claimed that one of the following statements is true

A) Our species, or by extension a species like ours, is unlikely to survive long enough to reach a *posthuman* stage of highly advanced technology;
B) Species that do reach such a stage are unlikely to run a large number of simulations of societal evolution containing conscious simulated characters;
C) We are likely to be living in such a simulation.

His argument is known as the *simulation argument* and the scenario that our universe is in fact a simulation is called the *simulation hypothesis*. I illustrate an outline of Bostrom's line of reasoning in Figure 1.

Bostrom's paper has generated a substantial quantity of comment and discussion, with 674 total Google Scholar citations as of February 2019. Amongst these are some articles by respected thinkers in reputable publications, although only 153 are in academic journals indexed by Web of Knowledge. There are also sources and authors of the less rigorous or less mainstream varieties; within these, there are nonetheless some interesting ideas. Herein, I consider the various kinds of discussion that have been raised around the simulation argument and the simulation hypothesis. These ideas have also been aired in a seminar presentation which parallels this manuscript,[2] given at a meeting of the St Andrews Institute for Data-Intensive Research in August 2018 and in an undergraduate lecture on Science and Religion which is publicly available.[3]

2 State of the Field

2.1 Logical, Philosophical, and Probabilistic Discussions

Probabilistic arguments are widely used both in serious academic discussion and in less formal fora. Such approaches have been used to argue both for and against the existence of God, for a multiverse, to claim that life is widespread or rare in the universe, and so on. These arguments are very dependent upon the range of possible options that are considered, the values ascribed to *a priori* probabilities, and the models and assumptions (for example those regarding independence and contingency) used to compute likelihoods of various scenarios. A number of discussions of these kinds, including some Bayesian presentations, have been applied to the simulation argument.

Some papers draw on an analogy with the *doomsday argument*, including Lewis[4] and Aranyosi.[5] Much of this material relates to setting reasonable values of prior probabilities of different scenarios. Francheschi[6] raises some points related to the calculation of probabilities dependent on sets of states which occur at different times. Weatherson[7] criticised what he saw as Bostrom's implicit probabilistic assumptions underlying the degree of belief in certain propositions and the estimation of conditional probabilities; Bostrom[8] replied defending his original paper. In essence these are arguments about which states one should sum over, and what prior probabilities one should assign to them.

Ćirković[9] suggests that the existential risk to a civilisation of developing potentially powerful and hostile AI directly affects the simulation argument. Specifically, AI risk makes Bostrom's[10] condition (A), extinction before reaching a posthuman stage, more likely. One might surmise that mindfulness of this risk might also reduce the prospects of development of the kind of computer technology leading to *ancestor simulations*, hence also affecting condition (B). Ćirković[11] is fairly dismissive of the possibility of numerous simulations being

run by artificial intelligences themselves after the extinction of the precursor biological species, though other thinkers may consider that scenario realistic.

Some critics also raise the issue of summing over states corresponding to either known present or hypothetical future observers. Eckhardt[12] even argues that the simulation argument implies time-reversed causation. Bostrom himself acknowledged a numerical difficulty with the assumptions of the original argument in the case of a posthuman civilisation having an 'unusually brief pre-posthuman phase' and presented a slightly amended 'patched' version of his original argument.[13] Wehr[14] contends that even the patched simulation argument contains both vagueness and logical errors. Besnard[15] attacks the simulation argument on a number of grounds, though it does not appear that he has found a valid logical refutation. Sturman[16] uses Occam's Razor to argue against simulism, saying that the idea of our living in a simulated reality is unnecessarily complex. He also raises the objection that Bostrom's argument applies a conclusion from our familiar world to an entirely hypothetical universe about whose physical laws we know nothing.

One limitation of Bostrom's paper[17] is its expression of *Simulation v Base Reality* as a dichotomous choice between only two possibilities. The simulation hypothesis is a relatively new arrival on the intellectual landscape. For centuries, thinkers have wrestled with the idea of a single reality, whether created by God or otherwise, whether caused or uncaused, whether deterministic or stochastic. More recently, probabilistic arguments have been confidently made in favour of a multiverse[18] which could function as an explanation for fine-tuning; a somewhat related idea also appears in the *many worlds* interpretation of quantum mechanics.[19] The simulation hypothesis is a comparatively novel possibility, beyond imagination only a few decades ago. Like the multiverse, an apparently powerful probability-based argument can be made for it, an argument embraced by entrepreneur Elon Musk.[20] This line of reasoning is closely related to Bostrom's work, predicated on the idea that posthuman civilisations probably run very many such simulations containing vastly more observers than base reality. However, this thinking fails to account for all currently popular existential possibilities, let alone for whatever as-yet-unconsidered models of reality might be discussed alongside the unique physical universe, the multiverse, many worlds, and the simulation hypothesis in philosophers' future deliberations. For instance, advanced alien societies could create potentially very many real, not simulated, universes.[21]

2.2 Scientific ideas that impact upon the simulation argument

The original simulation argument[22] contains two assumptions which are not formally part of its logical trifurcation. Both of these assumptions are potentially points where critics might seek weaknesses in the simulation argument. The first is the *substrate independence* of consciousness, that the full experience of human consciousness could be faithfully reproduced by simulation within a computing device. That will be false if it is just not

possible to reproduce humanlike consciousness in a computer, and Bostrom's assumption of substrate independence would not hold. Sturman,[23] for example, argues against the plausibility of in *silico* consciousness. I suggest that consciousness will probably be impossible to recreate if there is something fundamental about the biological substance of our brains that cannot be replicated *in silico*, and consciousness then turns out to be an emergent property dependent on the biological substrate as well as the complexity of the computation. There is also an inherent requirement that the mind be nothing but computation in the brain; in terms of an ancient but familiar model, dualists may counter-argue that the machine simply cannot be conscious without its ghost. I discuss this idea of a human soul or spirit below in Section 3.3, and do so in a specifically Christian context.

The second main assumption of the simulation argument is that the future development of computer power will be sufficient to support such a simulation. Bostrom's original paper[24] contains a justification of this assumption, which however seems far from certain. Computation has both theoretical[25] and practical limits. Very possibly, such a simulation is not technically possible in our world because the amount of computation required in modelling the universe, or at least a character's observable and comprehensible universe, is infeasibly large. A number of authors have indeed attempted to oppose the simulation argument on grounds of the necessary kind or complexity or quantity of computation being inaccessible. Eckhardt[26] mentions the possibility that such a simulation is infeasible, though without full discussion. Beisbart[27] claims that the way in which computers operate is fundamentally different from, and incapable of replicating, the manner in which brains operate. Syropoulos[28] suggests that the universe is fundamentally incomputable. Lewis[29] argues that nested simulations within simulations, as sometimes advocated probabilistically by proponents of simulism, are impossible.

In order to present the simulation argument in a way that permits meaningful analysis, I claim here that it is necessary to assume that the simulating and simulated universes have similar physics. I read the core argument in Bostrom's original paper[30] as assessing in essence whether a species such as us in a universe like this one could feasibly develop to the point of creating ancestor simulations with conscious characters, who would then experience a reality similar to ours. While one could in principle attribute all manner of magical properties to the simulators' base reality, the existence of such a world would be untestable and would push simulism squarely into the realm of pseudo-religious rather than scientific beliefs. It would be almost impossible to have a sensible discussion of any of the relevant factors such as the physical limits of computation, the nature of consciousness, the life expectancy of an intelligent species, or the likelihood of their running ancestor simulations if the simulators' laws of nature were arbitrarily different from ours. Thus, we have little choice but to use feasibility in our universe as a proxy for feasibility in theirs, and limit our discussions to scenarios where the laws of physics in the simulation at least approximate those in the base reality.

However, this apparently necessary assumption that the two worlds are alike seems to be somewhat undermined by strong arguments suggesting that the two universes must be quite different in their extents. The simulating universe contains the simulated universe, plus very much else. Therefore, it is necessarily many orders of magnitude bigger in terms of its size and therefore of its information content. The relationship between the universe's size and its entropy is discussed in detail in reference, [31] but herein I make the assumptions that entropy density is at least an approximately meaningful concept and that the total information needed to describe a possible universe tends to increase roughly linearly with its volume. Our observable universe is estimated to be around 3.65×10^{80} m^3 in volume,[32] whereas even a large computer on which we might run a simulation will probably be significantly less than 1 m^3, only a fraction of which is devoted to the computer's memory. Lloyd,[33] for instance, suggests a volume of 10^{-3} m^3 for his hypothetical *ultimate laptop*. These scales differ by a little more than 83 orders of magnitude. This margin would be considerably greater without the assumption that most of the volume of the computer is information carrying.

Even for hypothetical planet-sized computers, there would still be a massive disparity with the size of an entire universe. In principle, one could imagine an alien computer whose information content approaches the Bekenstein bound[34,35] for its size, though such a device seems improbably exotic. This computer would be informationally equivalent to a black hole of the same size. Such a device would contain sufficient information to simulate a region of space substantially larger than itself, but still manifestly contains less information than an entire universe with the same physical laws. Although the disparity for such a device might be substantially less than 83 orders of magnitude, that disparity nonetheless remains very large indeed.

Thus we can safely conclude that a simulated version of our universe would not come anywhere close to fitting inside any feasibly imaginable computer. There are just far too few particles in the plausible volume of a computer to carry the requisite quantity of information. This suggests either that the simulated universe is necessarily vastly smaller than the simulating one, or else that it is represented at a very much coarser granularity. The latter possibility might correspond to a more pixelated or lower definition universe with a correspondingly smaller information density.

Ringel and Kovrizhin[36] recently published a paper on the complexity of simulating quantum effects, a somewhat superficial reading of which led at least one commentator to claim that "Physicists find we're not living in a computer simulation".[37] Others subsequently challenged that interpretation, suggesting instead that the results only ruled out simulating complex quantum systems on a classical computer and that simulation using quantum computing could not be excluded.[38] Estimating the cost of a simulation is complicated by the lack of knowledge of how extensive it needs to be. Does this involve simulating the whole universe at fine granularity, or only simulating at least billions of complex conscious minds? I

exclude from serious consideration the logically coherent but unproductive solipsistic possibility that the simulators generate only a single conscious brain, with the rest of universe and all other persons filled in in a convincing-enough way.

2.3 Potential tests of the simulation hypothesis

I now consider potential ways in which one might test the simulation hypothesis. By this I mean experiments feasible either now or in the future, and thought experiments, whose results and interpretation might significantly affect our best estimate of the likelihood of the simulation hypothesis. An initial observation is that we do not know whether the laws of physics in a hypothetical simulated universe correspond exactly, closely, or hardly at all with that of the simulators' real universe; though the earlier assumptions would exclude serious examination of the simulation hypothesis in the latter case. An exact correspondence would imply that the simulators knew their laws of physics very precisely, which Barrow[39] thinks unlikely. It would also mean that, given the purpose of the simulation and cost considerations, approximation was not warranted.

While of course we do not know for sure why a hypothetical simulator might run a putative simulation, we can think about why we ourselves run simulations. Our principal purposes are entertainment and scientific research; both categories can be interpreted broadly. If we were to simulate the development of a society or of a universe, we might do it for entertainment, for education, as scientific research into how civilisations or universes operate and evolve, or maybe as part of an exercise to predict possible futures or better to understand history. One might imagine investigating what physical parameters might lead to a universe in which life could evolve, or perhaps how a society deals with an environmental or existential crisis. This could be analogous to running simulations, and typically very many of them, in contexts we are more familiar with: to forecast the weather, to predict optimal investment strategies on the stock market, to determine the tactics most likely to be successful in a Formula 1 race, or for the military to understand the likely consequences of possible strategies in a war. Possibly the key facet of such a simulation might be studying the mind, brain or consciousness. It is not clear whether simulators would care about detection of simulated status by characters within the virtual world, and whether they would be careful to avoid leaving clues in the design of that universe.

Depending on the nature and purpose of the simulation, our own scientific and computing communities use different models of physics in different contexts. Mostly, we use broadly Newtonian physics, though there are circumstances such as modelling a chemical reaction[40] where we need to include quantum mechanics; relativistic simulations also exist. Generally, the physics is required only to be good enough for the purpose at hand, and Barrow[41] suggests that this might be the case in a simulated universe. For example, video games will

render water in a way that looks visually credible, but does not reflect the true complexity of fluid mechanics.

In the event that we are in a simulation with only approximately real physics, it is possible that the starting point of the simulation is not the temporal origin of the universe and hence that the physics of our universe need not be adequate to describe its earliest stages. This might suggest that, if at some future time we appear to have exhausted new physics, our best theories would still fail to describe cosmology accurately. A simulated world that did not start from t=0 might endlessly puzzle its cosmologists.

I also note that, if the simulating of minds is a substantial part of the cost of the whole simulation, then finding large numbers of sentient alien species in our galaxy would raise our best estimate of the expense of the computation required. Finding even one independent origin of sentient life cosmically close to ourselves would shift the assumed parameters of the Drake equation[42] towards suggesting that the universe contains very many minds indeed. This would be less relevant if the cost is largely that of simulating the physical universe.

Beane *et al*.[43] discuss the physics implied by a simulated world. Their work assumes that the simulation is based on an underlying three-dimensional grid of cubic symmetry. In principle, such a world would contain preferred directions, and hence not be rotationally invariant. Beane *et al*.[44] argue that this would imply breaking of both parity and Lorentz invariance. They also suggest that a lattice spacing larger than around 10^{-27}m would result in rotational asymmetry in the distributions of high energy cosmic rays. Their model requires quantisation of both space and time on some scale, neither of which has currently been observed. The Planck length is around 10^{-35}m, about eight orders of magnitude smaller than the threshold lattice spacing they discuss. The Planck time is around 10^{-43}s. Besnard[45] briefly mentions these issues of symmetry breaking and granularity or quantisation of space and time. Analogies with our own simulations might suggest that a simulated universe would probably either be finite or have periodic boundary conditions, rather than being infinite. However, it is also quite possible that a simulation would not use a cubic grid, or any other regular array of points. One might also speculate on whether the effects of the chosen coordinate system or of the finite precision of the computer's arithmetic might be detectable to the simulated beings as asymmetry, finite granularity, or indeed errors. Barrow[46] suggests that, in so extensive a simulation, numerical inaccuracies and inconsistencies would build up over time and that the simulators would be required to intervene to correct such errors. He proposes, speculatively, that errors might appear as inconsistencies and changes in the constants of nature. He posits that such occasional interventions might appear to us as glitches, observations that appear to contradict normal laws of physics. He does not use words like *miraculous, supernatural,* or *paranormal* to describe such events, but some might.

Campbell *et al.*[47] suggest that if we assume that the major cost of the simulation is simulating brains rather than modelling the physical universe, then a major saving could be made by rendering reality only when information becomes available for observation by a character. This, naturally, affects our interpretation of quantum mechanics, implying that the cat need not be either living or dead until someone looks into the box. They suggest a number of quantum mechanical experiments, using double slits rather than poisoned felines, to help elucidate whether our world resembles that which they would expect under simulism. They also mention that a simulation could easily permit non-local causation and faster than light transmission of information, since the computer would hold the states of objects arbitrarily distant, which could interact *in silico*, or more likely in some other computing medium, rather than through real space.

2.4 Determinism and the simulation hypothesis

We can run either simulations such as Molecular Dynamics, which emulate deterministic Newtonian physics, or those like Monte-Carlo that emulate a stochastic process. Notwithstanding its association with randomness, the progress of a Monte-Carlo simulation is in practice deterministic once its random seed has been chosen, as it is based on pseudo-random numbers.[48] This allows a failed or corrupted calculation to be replaced by one which will obtain the same result as if the original had proceeded as intended. However, this feature probably would not be obvious from the inside. As an alternative to an algorithm modelling deterministic or indeterministic physics, we can also run interactive programs. Many games are examples of this kind, with the course of events depending on inputs from users. If a simulation were of this type, some turns of events would depend on simulators' decisions.

Within the context of a broadly Monte-Carlo style simulation emulating random behaviour, one might speculatively suggest that any conscious characters would perceive their universe to operate stochastically. This seems essentially consistent with our current understanding of our own universe, though the opposite would have been the case through much of the history of scientific thought. Though the stochastic Copenhagen interpretation is the working assumption of many scientists, there are multiple different available interpretations of quantum mechanics. It is still not definitively established whether our own world is best described as deterministic or random at a fundamental level.

3. Relationship to Christian doctrine, theology and apologetics

3.1 God and the simulators

The notion that simulators are our God or gods, discussed for example by Steinhart,[49] seems superficial. God in the Christian understanding, possessing the full attributes of deity, is loving, omnipotent, omnipresent and eternal. Simulators, in contrast, are presumed by adherents of simulism to be *posthuman*, or indeed *postalien*, mortal and fallible creatures, though with high levels of intelligence and technological development. Their moral or ethical characteristics are unknown; beyond firstly their having been sufficiently benign to one another to survive technological development without blowing themselves up, and secondly having no scruples about playing masters to a simulated universe. While simulators could in principle have virtually unlimited power over our universe, such a version of omnipotence is far from being the same thing as true divinity in the Christian understanding. As discussed above in Section 2.4, a simulation could either start from defined initial conditions and be left to run by itself somewhat like the world conceived of in a deist view, or else be set up such that the simulators could actively intervene. Such intervention would, however, be more akin to the interaction between a player and a computer game than to the relationship that theologians consider God to have with the world.

My view is that there is no benefit in Christian theologians or apologists making any attempt to accommodate such an alien notion of divinity. The Christian and simulist worldviews have quite different notions of the nature of the Creator or creators, and indeed of the nature of reality itself. It is most realistic to see them as mutually exclusive accounts of the world.

3.2 A digital afterlife?

Authors including Steinhart,[50] Graziano[51] and indeed Bostrom[52] have discussed the idea of a so-called digital afterlife. In this context, the phrase means preserving or reconstructing an individual's conscious mind after death within a computing device. This is the meaning I address here, although confusingly the same phrase is sometimes used to describe a deceased person's continuing footprint on the internet and social media platforms. While Christian views of the afterlife are not uniform, containing varying emphases on an immortal soul or bodily resurrection, this digital afterlife is something quite different from any of them. This notion depicts a technological attempt to prolong either a form or facsimile of life, more conceptually akin to cryopreservation than to the Christian belief in salvation. From the Christian viewpoint, perhaps this is an afterlife – but not as we know it.

3.3 Substrate independence and Christian belief

There is a tension between traditional Christian belief and the simulation argument's assumption of substrate independence, that human consciousness could be generated directly by computations of sufficient complexity within a computer. In a fully reductionist worldview, substrate independence would seem a highly rational assumption. I indeed claim that the simulation argument relies on a substantial dose of *nothing-buttery* in one's view of human consciousness. This term *nothing-buttery*, meaning over-zealous application of reductionism, is familiar to many students of the science-religion dialogue from its 1993 use by Holder.[53] Its origins go back somewhat further, having been referenced in 1955 by Pfeiffer[54] and attributed by him to an unnamed earlier source; more modern authors sometimes refer to the same idea as *greedy reductionism*. This is the kind of thinking that says that because thoughts can be described as signals in a network, therefore the mind *must be entirely described* by these impulses transmitted between neurons.

The existence of a human soul or spirit, something that could not be described fully as a set of electrical impulses in a network of neurons, would undermine this key assumption of simulism. This is the case, at least, if we assume that the soul does not automatically come into existence as a consequence of computational complexity. Belief in such a soul is not limited merely to dualist philosophies of the kind advocated by Descartes, but includes any theological or metaphysical viewpoint that goes beyond a purely material description of human consciousness. Acceptance of the existence of such a soul or spirit is widespread amongst Christians, other than a small physicalist minority, and also in many other major religious traditions. Amongst academic thinkers, such belief is however much less prevalent; in 1998 Larson & Witham reported only 7.9% of leading scientists as believing in an immortal soul.[55] The assumption of substrate independence is likely to seem more plausible to people without a prior conflicting belief, and is unsurprisingly not widely seen in academic circles as a major obstacle to the development of self-aware artificial intelligence.

3.4 Intelligent design for humanists?

Even if it is meaningful or potentially factual to say that we live in a simulation, would this be knowable or scientifically testable? Metere argues that it is not, that simulism is more akin to a religious belief.[56] Philosopher and theologian Keith Ward wrote: 'The question of God is certainly a factual one, but certainly not a scientific one'.[57] The same would apply to the existence of simulators if this did not have observable consequences, implying that the question could not be addressed by the scientific method. A related point refers not so much to the validity of the simulation argument as to the perceived need for it. Is some specific explanation required to account for the putative unlikeliness of the universe, for instance in terms of the apparent fine tuning of physical constants to precisely the values that permit the evolution of life?[58] The putative need to rationalise something so allegedly

improbable is often used as an intellectual justification for Christianity or other theistic belief systems. In an analogous way, simulism could be seen as *intelligent design for humanists*. That is, simulism provides a rationale for our world's existence, but does so without making any specific moral or behavioural demands of its believers. As discussed above, the characteristics usually ascribed to the hypothetical simulators are those of a highly intelligent and technologically advanced civilization, not those of a deity. Fine tuning could potentially be rationalised in other ways too, for instance through either a multiverse[59] or the anthropic principle. Simulism could equally well be seen as a 21st century variant of the dream hypothesis, taking the ancient idea that reality is some kind of illusion and couching it in the technological language of science fiction. The dream hypothesis itself does not appear to be scientifically testable, and is probably too nebulous for formal refutation. Nonetheless, few people would consider it to be a serious or productive theory of the world.

4 Conclusions

Firstly, I claim that considerations of universe size, and in particular information content, make the simulation argument difficult to sustain. I note that Bostrom's argument[60] is an essentially statistical one. It assumes that we can sum over real observers whom we know to exist now and hypothetical simulated observers who might exist at some time in the future, while counting each alike. Clearly it is meaningful to ask whether our own descendants could one day run a simulation containing conscious characters. However, I argue here that our observable universe is 80 or more orders of magnitude bigger than a computer, yet information in the simulation must be carried by real particles in the real world. Thus, a universe like ours could not be simulated at fine granularity in a computer within our world. This suggests that simulated universes must be much smaller or simpler than real ones. Hence, any conscious characters that we or our descendants simulate in the future would perceive themselves to inhabit a universe containing much less information than does our own. Similarly, any creatures simulating us must inhabit a universe containing significantly more information than ours. I argue that one cannot meaningfully evaluate how the propositions comprising the simulation argument would apply to such a larger universe. I contend that the inevitable information disparity between simulating and simulated universes violates the assumption of similar worlds that is required meaningfully to assess the plausibility of ours being a simulated world. This implies that we cannot reasonably infer very much about a hypothetical simulating universe from comparison with our own. I claim that, under these circumstances, the simulation argument is not applicable to the world in which we live. We can infer nothing remotely quantitative about the likelihood of our being Sims.

Secondly, the simulation argument takes no account of the complexity of the simulation hypothesis. I argue that the simulation argument is unnecessarily complicated, which implies that it is disfavoured by Occam's razor. While not a new insight,[61] this aspect has

been underemphasised in the existing literature discussing simulism. We have no reason to prefer simulism over other simpler explanations for our existence.

Thirdly, and without attempting to enumerate all possibilities, I suggest that it is unsafe to treat the question as if base reality and simulation are the only two kinds of universe that could exist. A *multiverse* model[62] might not strictly affect the logic of the simulation argument, but it would reduce the need for a complex explanation of the apparent unlikeliness of our world and the ostensible fine-tuning of the physical constants. As another example, technologically advanced aliens might be capable of creating physically real universes.[63] A Christian worldview, and indeed other theistic belief systems, will also meet this requirement to provide a reason for our world's existence.

Finally, I note that since the nature of a simulators' universe is unknown, and probably unknowable, it is impossible fully to refute the simulation hypothesis. However, meaningful analysis of the simulation hypothesis seems impossible if the simulators' universe is allowed to have magically unphysical properties. In that scenario, simulism would be more akin to a religious belief than a scientific one.

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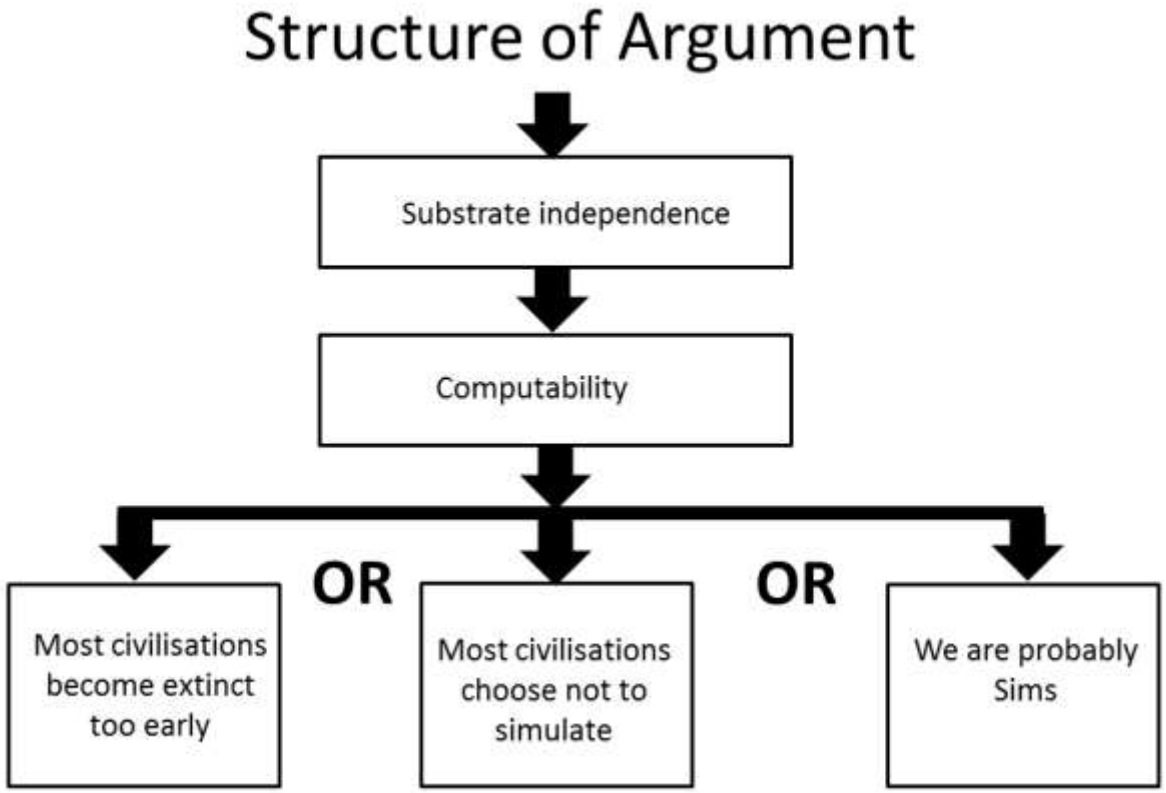

Figure 1. Structure and assumptions of the simulation argument.

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