The Grabby Alien Observer Paradox:

An Anthropic Argument against the Grabby Alien Hypothesis

Walter Barta

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0. Introduction

In his article "If Loud Aliens Explain Human Earliness, Quiet Aliens are also Rare", Robin Hanson proposes the Grabby Alien Hypothesis, which proposes that extraterrestrial civilizations (ETIs) exist outside of our observable universe and are gradually expanding to fill the universe.[i] The existence of such grabby aliens in our future expanding to fill all available niches puts a cosmic deadline on independently originating sources of life. This cosmic cutoff offers an explanation for why human observers seem to be relatively early in spacetime, why the red dwarf stars seem to be inadequate for independently originating life, and why the Fermi Paradox remains unsolved.[ii] However, we should worry about Hanson's proposal, since the Grabby Alien Hypothesis has its own paradoxical implication, namely that most observers in most reference classes should be grabby aliens themselves (Bostrom, 2002).[iii] Thus, oddly, finding ourselves not to be grabby alien observers, it seems Hanson is beholden to explain why we are not. Some possibilities for grabby alien observer alternatives can be offered, though none are particularly explanatorily appealing. In what follows, we will 1) attempt to restate in simple terms Hanson's assumptions, and then 2) reassemble Hanson's arguments, showing they lead to a paradox, and 3) consider which assumptions should be rejected and at what cost.

1. Hanson's Assumptions

The following premises must all be assumed for Hanson's arguments to follow.

1.A The Observer Reference Class

First, we can follow Hanson by assuming something like a shared reference class of observers in the universe:

> **Shared Reference Class (SRC)**: Observers are part of a shared reference class.[iv]

Within this reference class one can select a sample of observers at random:

> **Random Sample Observers (S)**: Observers picked as a random sample from the total set of observers in the universe.

Because different observer types will almost certainly be of different probabilities in the distribution of the reference class, a distribution may have both very common and very uncommon observer types, selecting a random sample from reference class should both specify what the most common type of observer is as well as what other kinds would not be a common type of observer:

Hanson proposes different hypothetical observers in this reference class that could be random samples:

> **Yellow-sun Observers (Y)**: Observers originating from planets orbiting short-lived, early universe yellow-suns (empirically where earthlings seem to find themselves).
>
> **Red Dwarf Observers (R)**: Observers originating from planets orbiting long-lived, late universe red-dwarfs (theoretically the most common and longest live stars).
>
> **Grabby Alien Observers (G)**: Observers originating from interstellar civilizations of grabby aliens, aliens spreading throughout the observable universe (hypothetically the observer type that the universe will eventually be filled with).

These observer types represent what Hanson considers the three most important types in the universe.

1.B Theoretical Models

Second, we can follow Hanson by assuming several reasonable theoretical models of the universe: the self-sampling assumption, the hard steps model, and the grabby alien model.

1.B.i Self-Sampling Assumption

Hanson considers the data point of human existence on earth to be our only available empirical observation of life in the universe. Human observers originate from a planet that orbits an early-universe short-lived medium yellow sun. This further seems to suggest that elsewhere in the universe observers of this type may, early-universe short-lived medium yellow sun orbiting observers, are possible and perhaps probable. Hanson uses anthropic reasoning:

> **Self-Sampling Assumption (SSA)**: One is a random sample from the set of all observers in one's reference class.[v]

Hanson uses these principles set against the probability distribution of different kinds of possible observers in the universe, and the data points of whether these different kinds of observers seem to exist at all. Hanson uses these premises to draw the conclusion that yellow-sun observers (like ourselves) are a random sample of observers in the universe.

1.B.ii Hard Steps Model

Hanson also assumes a mathematical model of evolutionary development that presupposes hard-steps (improbable chances), the "Hard Steps Model" (HSM). Each necessary development towards observers—the first prokaryote, the first eukaryote, the first multi-cell organism, the first intelligent organism—is modeled as a hard step that must be passed. Hanson's formulation roughly is:

> **Hard Steps Model (HSM):** Observers evolve in a stepwise fashion, passing certain hard-step, improbable chance thresholds, thus favoring late-universe long-lived star observers, the "Hard Steps Model" (HSM).[vi]

Hanson uses the HSM to argue for the hospitality of red dwarf stars for life: under most assumptions, the plentitude and longevity of red dwarves should be hospitable enough to permit evolution. Hanson uses these premises to justify the conclusion that late-universe long-lived red-dwarf observers must be extremely probable in the observer reference class, if such observers are indeed possible in the first place.

1.B.iii Grabby Alien Model

Thus, feeling that he must find some mechanism explain the apparent impossibility of late-universe red-dwarf observers, Hanson proposes a barrier to entry for such observers. Hanson suggests a generic mathematical model of interstellar expansion that imposes a cosmic cutoff on life:

> **Grabby Alien Model (GAM)**: The universe fills up with grabby aliens making for a cutoff point for the independent origination of observers, making impossible long-lived late-universe star observers.[vii]

Before the cosmic cutoff, independent origination of life on planets is possible because it can proceed uninterrupted by colonization; after the cutoff, independent origination of life on planets is impossible because it is preempted by the colonization by extraterrestrial life. Hanson uses these premises to show how red dwarf observers are vanishingly improbable to evolve, because they do not make the cutoff.

2. Hanson's Arguments

Given the above premises are all assumed, Hanson's arguments roughly follow. (Note: we deliberately simplify Hanson's arguments to exclude complex mathematical models, though we do not believe our critique requires that level of detail to become apparent.)

2.a Human Representativeness:

First, Hanson observes that it is reasonable to use the data point of life that we observe, the data point of ourselves, as roughly representative:

> **Human Representativeness**: Amongst the observer-originating planets and stars that have existed, do exist, and will exist in the universe, the early-universe short-lived yellow sun orbiting earth that humans inhabit appears to be a representative random sample.[viii]

Human Representativeness emerges from the SSA and the observation that we are observers of a early-universe, and short-lived yellow sun. Hanson's argument for it follows:

P1	If the SSA is true and we are Y observers, then the probability of being a Y observer *is* the probability of being a S observer which *is also greater than zero*.	$SSA \cap Y \rightarrow (P(Y) = P(S) > 0)$

2.b The Red Sky Paradox:
Hanson then poses a problem for cosmology related to the apparent human earliness that emerges from our self-observation:

> **Improbable Human Earliness**: Amongst the observer-originating planets and stars that have existed, do exist, and will exist in the universe, the yellow sun orbiting earth that humans inhabit appears to be on the earliest and shortest lived end of the distribution, which is a highly improbable position to occupy in the universe, but we occupy it.[ix]

This problem can also be framed in terms of red dwarf commonality:

> **The Red Sky Paradox**: Amongst the observer-originating planets and stars that have existed, do exist, and will exist in the universe, red dwarves appear to be on the latest and longest lived end of the distribution, which is a highly probable position to occupy in the universe, but we do not occupy it.[x]

Improbable Human Earliness and the Red Sky Paradox emerge hand-in-hand from the assumption of the HSM and the observation that red dwarfs are common, late-universe, and long-lived. Hanson's argument for it follows:

P2	If the HSM is true and R observers are possible, then the probability of being R *is much more than* the probability of being Y.	$HSM \cap R \rightarrow \big(P(R) \gg P(Y)\big)$
C1	Given P1 and P2, the probability of being R *is much more than* the probability of being a S observer (an improbable result, since the random sample is very uncommon in the population).	$P(R) \gg P(Y) = P(S) > 0$

2.c The Grabby Alien Hypothesis:
To resolve this problem Hanson proposes a solution, in the form of the Grabby Alien Hypothesis:

> **The Grabby Alien Hypothesis**: Some number of alien-originating planets form "grabby aliens", aliens who spread outwards across the universe, colonizing every habitable zone, exhausting the planets and stars available for the origination of new aliens, thus putting a hard deadline on the origination of observers, aborting all late evolutionary development, making the only viable evolutionary development early.[xi]

This hypothesis solves the problem of Improbable Guman Earliness and the Red Sky Paradox by setting a deadline on the cosmic origination of observers, thus making earth less early relative to the deadline. It also solves the Fermi Paradox by postulating that ETIs are simply too far away to observe yet—though someday will not be.[xii]

The Grabby Alien Hypothesis emerges from the Grabby Alien Model and the observation that a cosmic cutoff imposed by grabby aliens would disfavor long-lived, late-lived red dwarf observers. Hanson's version of the argument for it follows:

P3	If GAM is true and G observers are possible, then R observers are impossible and the probability of being R *is effectively zero.*	$GAM \cap G \rightarrow \sim R$
C2	Given P1, P2, and P3, the probability of being R *is less than* the probability of being a S observer (a probable result, since the random sample is probable in the population).	$P(Y) = P(S) > P(R) = 0$

2.d The Grabby Alien Observer Paradox:
However, what might be noticed is that Hanson's assumptions seem to prove too much. We can rule out grabby alien observers in precisely the same way that we ruled out red dwarf observers, leading to a Grabby Alien Observer Paradox.

> **A Grabby Alien Observer Paradox**: yellow-sun observers are our random sample of observers in the cosmos, thus grabby aliens must exist in vast enough numbers to set a time limit for red-dwarf observer emergence; however, because yellow-sun observers are our random sample of observers in the cosmos, Grabby Alien Observers cannot exist in vast enough numbers to dominate random sampling. Therefore, grabby aliens must not be observers.

The Grabby Alien Observer Paradox emerges in exactly the same way as the Red Sky Paradox. Our version of the argument for it follows:

P4	If the GAM is true and G are possible, then the probability of being G *is much more than* the probability of being Y.	$GAM \land G \rightarrow \left(P(G) \gg P(Y)\right)$
C3	Given P1 and P4, the probability of being G *is much more than* the probability of being a S observer (an improbable result, since the random sample is very uncommon in the population).	$P(G) \gg P(Y) = P(S) > 0$

The argument is akin that made by Toby Periera about artificial general intelligence (AGI), which uses a version of the SSA to counter the future existence of AGI by suggesting that if such AGI existed, we would most probably find ourselves being that AGI.[xiii] Similarly here, we have used the SSA to counter the future existence of grabby aliens, by noting that if such grabby aliens existed we would probably find ourselves being grabby aliens. However, the argument here is more grounded than Periera's for at least two reasons: 1) we are only assuming a traditional version of the SSA, unlike Periera who assumes a special modified version (a version which makes extra assumptions about specific densities of mental states of observers); 2) we are only assuming the version of the SSA that the Hanson's argument itself assumes, leading to a paradox, since per the SSA grabby alien observers both seem to exist and not exist. (Notice that the structure of Hanson's argument for the commonality of red-dwarf observers is parallel to the structure of our argument for the commonality of grabby alien observers.)

This paradox leads directly back to the problem of human earliness. Before, we found ourselves early relative to the reference class that includes red-dwarf observers; now we find ourselves early relative to the reference class that includes grabby alien observers. Either way, as members of the observer reference class, we find ourselves oddly early. Thus, the Grabby Alien Hypothesis does not seem to explain what it was intended to explain, and instead it poses a dilemma. The hypothesis cannot be arrived at unless some observer selection bias like the SSA is assumed, to account for the absence of red-dwarf observers, because if red dwarf observers existed then humans would probably be them; however, assuming something like the SSA also seems to exclude the presence of grabby alien observers, since if grabby alien observers existed then humans would probably be them. Either way, we are left with the question: why are we yellow-sun observers, not red dwarf observers and/or grabby alien observers?

3. Objections and Responses

In order to overcome the apparent Grabby Alien Observer Paradox, there are several possible premises we might reject, though each with cost.

Reject SSA: No Self-Sampling Assumption:

We might simply reject the self-sampling assumption, rejecting that we are random sample from all observers. This would be to embrace improbable earliness, simply accepting that human civilization may be very early relative to the cosmic timeline,

However, this would be to bite the bullet on wild improbability. Hanson suggests that our current conditions indicate that we are at least "10% surprisingly early" even under favorable assumptions.[xiv] Thus, unfortunately, we throw the Grabby out with the bath water. Furthermore, the SSA seems to be consistent with many of our intuitions about the universe.[xv] Specifically, the SSA seems to be necessary to explain fine-tuning parameters that are observed in physics.[xvi] Therefore, abandoning this assumption comes at significant probabilistic and theoretical cost.

We might also reject a non-uniformly distributed class, assuming yellow-sun, red-dwarf, and grabby alien observers are all (reasonably) equally common in a random sample, a near-uniform distribution.

However, because of the ubiquity of red-dwarfs over yellow-suns, red-dwarf observers would seem to be much more common in the distribution unless red-dwarfs were proven disproportionally more inhospitable.[xvii] Also, because grabby aliens would be radically expansionary by definition, Grabby Alien Observers would seem to be much more common in the distribution than yellow-sun observers in spacetime, unless something keeps them from reproduction.[xviii] These stipulations do not favor a flat distribution.

Reject SRC: No Shared Reference Class:

We might reject one or more sets (yellow sun, red dwarf, or Grabby Alien Observers) of observers from the shared reference class from which we are randomly sampling.[xix] For Hanson's argument, the reference class seems to be "originary planetary observers". Thus, red-dwarf and yellow sun planetary civilizations can be included and compared in the same random sample but would exclude grabby alien civilizations.

However, any stringent reference class specification (like Hanson's) seems to tri-directionally expand in generality, specificity, and adjacency.

1) **Generality**: It is not clear why a planetary civilization of grabby aliens would not count in a more general reference class. We could stipulate a more general reference class to include and compare all "planetary observers". This reference class would include red-dwarf and yellow-sun and grabby alien observers. Earth is still early in this reference class.
2) **Specificity**: It is not clear why planetary yellow-sun observers would not belong to a more specific reference class. We could stipulate a more specific reference class to include and compare all "yellow-sun originary planetary observers". This reference class would include only yellow-sun originary observers and exclude grabby aliens and red-dwarf observers. Earth is trivially typical in this reference class.
3) **Adjacency**: It is not clear why yellow-sun observers would not belong to an adjacent reference class. We could stipulate an adjacent reference class to include and compare all "yellow-sun planetary observers". This reference class would exclude red-dwarf observers, but would include yellow-sun originary and yellow-sun grabby alien observers. Earth is still early in this reference class.

In other words, as yellow-sun observers, we might reject Grabby Alien Observers from the reference class because we know we are not Grabby Alien Observers, but by the same logic, we can also reject red-dwarf observers from the reference class because we know we are not red-dwarf observers. So, in any case, why can't we use alternate reference classes? And, if we can, then why aren't we grabby or red-dwarf observers?

Reject HSM: No Hard Step Model:

We might reject the Hard Step Model, assuming that evolution goes through a series of very easy steps. This would mean that earthling observers are not in the improbable range of the distribution of life-bearing planets. Hanson considers several alternative models for the evolutionary process,[xx] but he has consistently concluded that the hard step model is the prima facie most credible, barring future developments in evolutionary science.[xxi]

Reject GAM: No Grabby Alien Model:

We might reject the Grabby Alien Model, assuming that something prevents the model from being accurate.[xxii] For example, if grabby aliens never impose a cosmic cutoff and thus allow for evolution to continue around Red Dwarf stars. However, this would seem to require that *almost all* grabby aliens follow such a prime directive, something that Hanson seriously doubts.

Reject Y: No Yellow-Sun Earliness:

We might simply reject that we are early-universe short-lived yellow sun observers, dispensing with our observations and with them the human earliness problem altogether.

However, this would seem to require that we either become radical skeptics about our own observed environment or else develop a substantially different astrophysical and cosmological model explaining our environment, one in which the universe is much older and yellow suns much longer lived than we suppose.[xxiii]

Reject R: No Red Dwarf Hospitability:

We might reject that red dwarves are hospitable enough to have observers on grounds other than grabby aliens, assuming them highly inhospitable, that they either never accommodate the evolution of lifeforms and/or extinguish lifeforms too regularly to result in civilizations. This would also mean that yellow-suns would be much more common places for observers to originate, in spite of their short lifespans and early emergence. Hanson thinks that these explanations lack imagination because they do not consider a possible "range of paths" of alien evolution.[xxiv] However, some believe that the inhospitality of red-dwarf planets is overdetermined, making this objection bear credence.[xxv]

Reject G: No Grabby Alien Observers:

We might simply accept the apparent paradox that there are grabby *aliens* but no grabby alien observer*s*. There are a handful of ways to explain such a disjunction, though all of them are somewhat unappealing:

Accept Grabby Sterilization:

Grabby Alien Observers do not reproduce quickly relative to yellow-sun civilizations, and thus are not a likely random sample from the reference class. Perhaps low populations of Grabby Alien observers are possible if we imagine robotic engineering projects expanding without any observers inhabiting them. Indeed, due to the inhospitality of space, perhaps the only objects that expand are engineering projects that beam pure light energy back to their civilizational center. This might be accomplished using automated technology like Von Neuman Probes.[xxvi] Earth's earliness would be normal in this situation, because it would be uniquely observer rich relative to grabby domains.

However, if the nature of grabby aliens is to expand indefinitely throughout the known cosmos, then even an infinitesimal Grabby Alien Observer reproduction rate would seem to far exceed non-Grabby Alien Observer reproduction rates. According to Hanson's models, grabby aliens will dominate enormous swaths of "spacetime distributions".[xxvii] Thus, imagining low population grabby civilizations seems counterintuitive in that it paradoxically postulates extremely expansionary aliens that nonetheless do not populate their own expanse with observers.

Accept Grabby Extermination:

Grabby Alien Observers have a zero population; they never arise because they exterminate all observers in their observable universe. Such a "Late Great Filter" doomsday argument have been offered as one solution to the Fermi Paradox by others and hinted at by Hanson himself.[xxviii]

Perhaps civilizations of observers inevitably produce some form of expansionary and destructive matter, like vacuum phase transitions, that envelops their region of spacetime, rendering future observers impossible in the given light cone. Perhaps this extermination tendency is cosmically significant and reboots the big bang for the local light cone.[xxix] This results in the same prediction of cosmic loneliness as Guth, though via a different selective mechanism.[xxx] Or perhaps doomsday is perfectly banal, triggered by an experiment in high-energy physics, routine to any sufficiently advanced civilization (as imagined in *Slaughterhouse Five*'s Tralfamadorian apocalypse scenario).[xxxi] Or, perhaps some doomsday is local in scope, but late-universe observers do not arise for some additional reason (hard evolution, red-dwarf inhospitality, etc.). Earth's earliness would be normal in this cosmological model, because if technology is eventually lightcone-annihilating, then the vast majority of technological ETIs will be the first and last ETI within its light cone.

However, the normal terrestrial doomsday scenarios we are familiar with (asteroids, climate change, and nuclear weapons) are not cosmic in scope, and so would not seem enough to explain human earliness. Presumably many more planetary civilizations would arise after earth falls. A cosmically exterminating physical processes would have to be empirically or theoretically established. But, verifying complete cosmic extermination is far beyond the capacity of contemporary physics, and (disturbingly) may be unverifiable without triggering the exterminating event, at which point it would be too late.[xxxii]

Accept Grabby Zombification:
Grabby aliens are not observers; rather, grabby aliens are unconscious but functional philosophical zombies, of the kind that Chalmers and others have conceived.[xxxiii] They expand throughout the cosmos, animate but completely insentient.[xxxiv] In other words, to make earthling observers more probable in the random sample of their reference class, but to still assume that grabby aliens exist, we can speculate that grabby aliens can exist but cannot be counted in the *observer* reference class. We would not randomly find ourselves being grabby aliens because there is nothing it is like to be a grabby alien.[xxxv] This seems prima facie unlikely if we do not believe that the idea of an unconscious zombie (unconscious intelligence) is strictly possible. Note though, this need not be a strong philosophical zombie, that is physically identical but phenomenally different; this merely needs to be a behaviorally sophisticated zombie, something with minimally sufficient grabby qualities to become an ETI, but lacking in the physical characteristics necessary for consciousness.[xxxvi]

The notion that grabby aliens might be zombies would seem to require its own extraordinary explanation, but some are available:

1) The grabby aliens might be unconscious artificial intelligences, a la Searle's Chinese Room.[xxxvii]

2) The grabby aliens might have evolved beyond consciousness and have become organisms that are unconscious biological automata, if the evolutionary role of consciousness becomes unnecessary perhaps not unlike humans have often viewed non-human animals, (perhaps like that described in the novel *Blindsight*).[xxxviii]

3) The grabby aliens might have a form of consciousness that is unitary, thus improbable in the reference class (perhaps like the collective minds of the Borg from *Star Trek* and other such speculative hive organisms).[xxxix]

4) The grabby aliens might hibernate for the majority of spacetime, awaiting some more favorable eon of the universe (perhaps like the species in *Darwinia*).[xl]

5) The grabby aliens might have transcended consciousness in some manner beyond our current conceptions of metaphysics (perhaps like the aliens in *Childhood's End*).[xli]

5. Conclusion

The Grabby Alien Hypothesis is perhaps the most interesting and ambitious explanation of the Fermi Paradox in recent memory.[xlii] However, the hypothesis seems to lead to another apparent paradox, a Grabby Alien Observer Paradox. Namely, the Grabby Alien Hypothesis does not seem to solve the problem of human earliness, the very problem it proposes to solve; rather, it just reframes our earliness in a new cosmos of ubiquitous late-universe grabbiness, instead of being early relative to red dwarf observers reorienting us as early relative to grabby alien observers. We have some options for avoiding this problem. On the more banal end of the options is a rejection the self-sampling assumption, a shared reference class of observers, the hard-step evolutionary model, the Grabby Alien Model, yellow-sun earliness, or red-dwarf hospitality. On the more exotic end of the options is a rejection of grabby alien observers: either such observers have vanishingly small reproductivity, produce cosmically encompassing doomsdays, or are unconscious zombies. Of course, none of these options are particularly appealing since they all seem to require theoretical sacrifices an/or render the universe a bleaker place.

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