Chance, Chaos and the Principle of Sufficient Reason

Alexander R. Pruss

Department of Philosophy
Baylor University

October 8, 2015

Contents

The Principle of Sufficient Reason (PSR)

- Why are there extremely few cubical galaxies?
- Even if we could find no explanation, we would think there was one (unlike when we search for a sock in a drawer)...
- ... rather than an explanation we haven't found.
- Historical roots: Parmenides, causal principles, Clarke, Leibniz.
- Thesis: Need the PSR to investigate our chancy but not chaotic world in order to epistemically privilege chance over fundamental chaos.

Formulation, I

PSR

Every contingent truth has an explanation (perhaps unknown or unknowable).

- Why restrict to contingent truths?
  - We don't understand mathematical explanation well enough.
  - Plausible that $\langle 0 = 0 \rangle$ is a necessary truth with no explanation.
  - Maybe necessary truths are explained by their necessity?

Formulation, II

PSR

Every contingent truth has an explanation (perhaps unknown or unknowable).

- Leibniz famously has: sufficient explanation. Should we?
  - Does this mean: logically sufficient?
  - If so, PSR is incompatible with chance. And hence false. (Also, van Inwagen argument.)
  - But Leibniz insists that this world is contingent, yet he seeks to explain it in terms of the divine nature.
  - I say: We want something sufficient to explain, not sufficient to entail.

Why does the PSR matter?

- If PSR is true, then the following kinds of facts have explanations:
  - Why do we have the laws of nature we do?
  - Why is there something contingent?
  - Why do these contingent things exist?
- The PSR plus these questions call for deep metaphysics:
  - Theism
  - Optimalism (Leslie, Rescher)
  - Spinozism

Van Inwagen's *reductio ad absurdum*

1. Every contingent truth has an explanation. (PSR)
2. So, the Contingent Whole has an explanation.
3. Nothing contingent is explained by a part of itself.
4. So, the explanation of the Contingent Whole cannot be contingent.
5. So, it must be necessary.
6. But necessary truths cannot explain contingent ones.
7. Absurdity!

Necessary doesn't explain contingent?

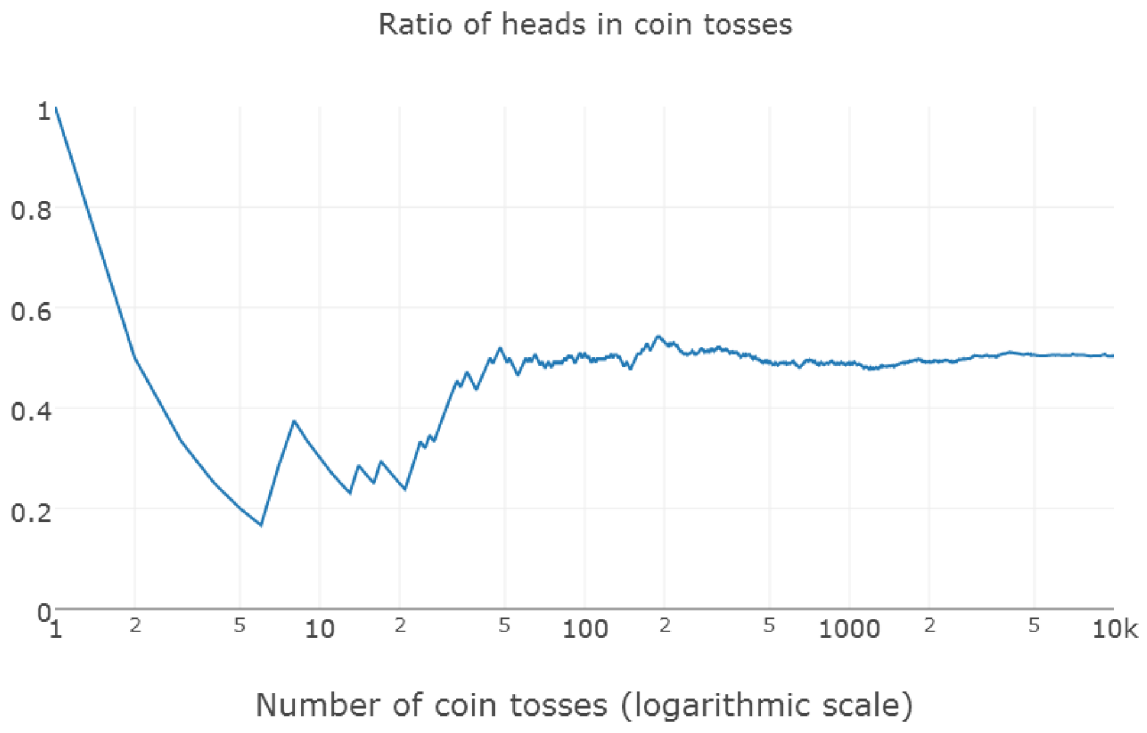
- Argument: If p is a necessary truth, and q is contingent, then p can be true even if q is false, and so p doesn't explain q.
- The "and so" seems to presuppose:
  - If p explains q, then p suffices for the truth of q.
- But this principle is false.
- Jorge's kind invitation explains why I am here, but the invitation did not guarantee my speaking. I had a choice to make.
- If a necessary first cause made a choice, the first cause's necessary reasons could explain the Contingent Whole.

Chance

- Another argument against PSR:
  1. There is chance. (E.g., Quantum Mechanics.)
  2. If there is chance, the PSR is false.
  3. The PSR is false.
- Response: (2) is false. And science needs something like the PSR.

Chance isn't chaos, I

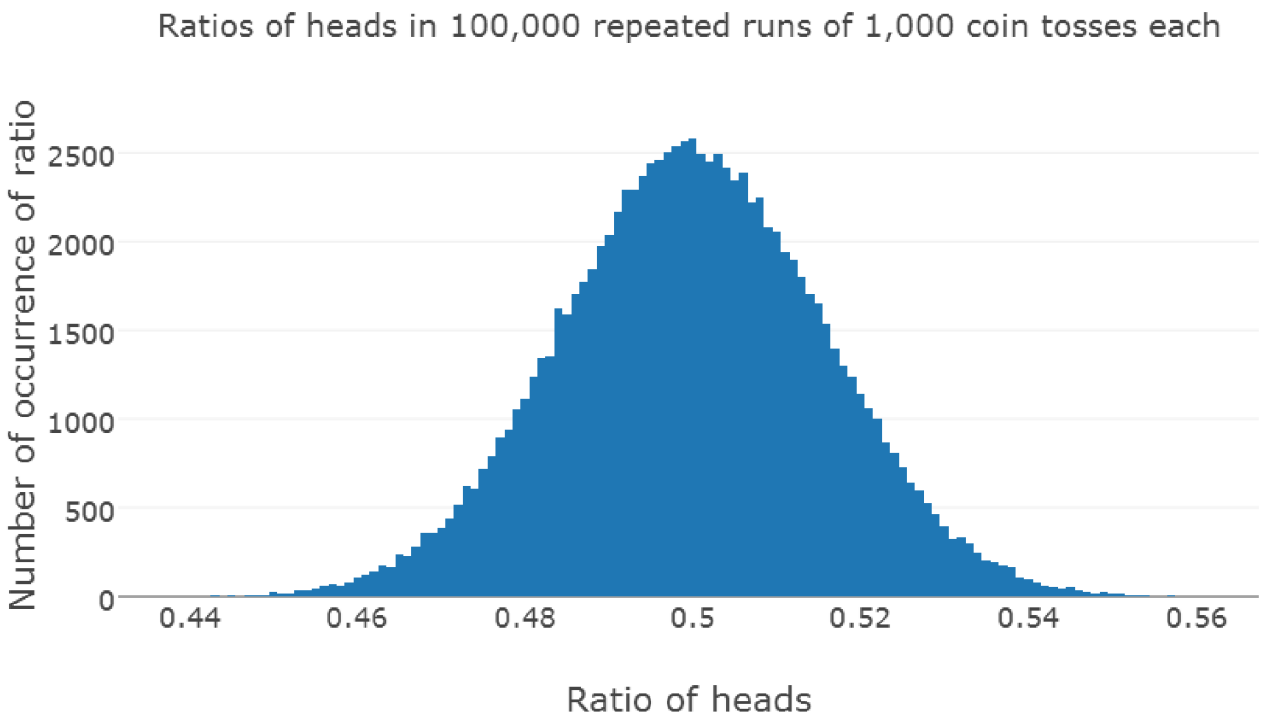
- Given independence, long-run frequencies converge.



- So casinos make money. And we can explain why (Law of Large Numbers).

Chance isn't chaos, II

- Even frequencies of deviations from the mean have an elegant pattern as well.

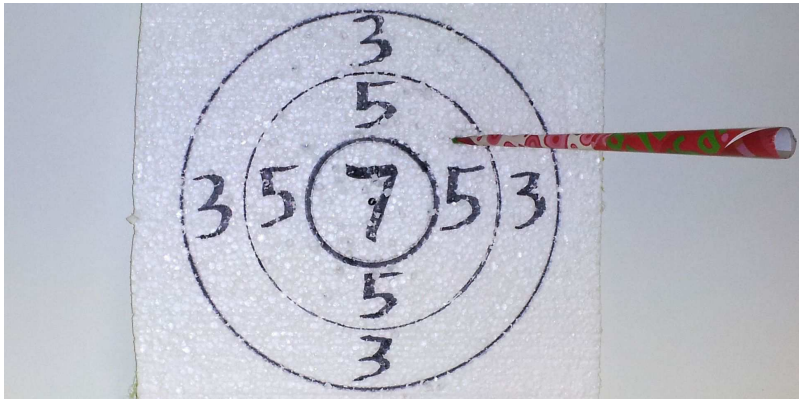


- And, again, we can explain why (Central Limit Theorem).

Individual cases?

- So chance isn't chaos in the long run.
- But maybe chance is chaos in individual cases?
- No! If individual events were genuinely chaotic, and independent, how could there be an explanation of the whole?
- Can explain chancy results by the causal order in random processes.
- (Can one have chance without causation? I doubt it, but don't need to settle the question.)

Probability quantifies chance



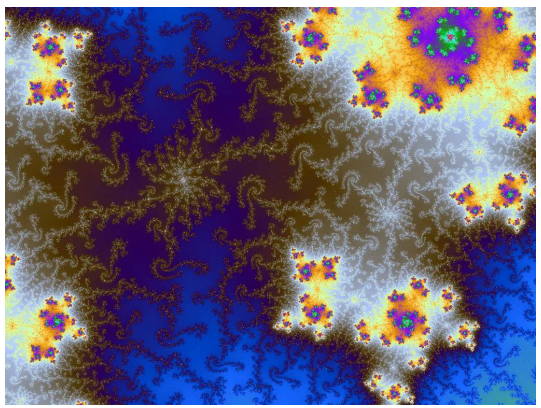
- In a uniform random dart shot, probability of score is proportional to area with that score.
- Got 5 points because one randomly shot at target and 5 ring occupies 1/3 of the target.
- Why *this* exact point? Harder! Maybe: have a genuine causal process which could equally hit each point. No chaos, no mystery.
- Explanation is not prediction.

Science needs chance

- Do an experiment ten thousand times and 7941 times get outcome A.
- Conclude the process objectively has a chance close to 80% of producing outcome A.
- Need this conclusion in order to be confident that in the next ten thousand runs, we will also be getting A about 80% of the time.
- What justifies the conclusion?
  - If the chance were far from 0.8, I would be unlikely to get A about 80% of the time.
  - And... crucial assumption: We have chance and not chaos in the world.
- How do we know the crucial assumption?

What is chaos?

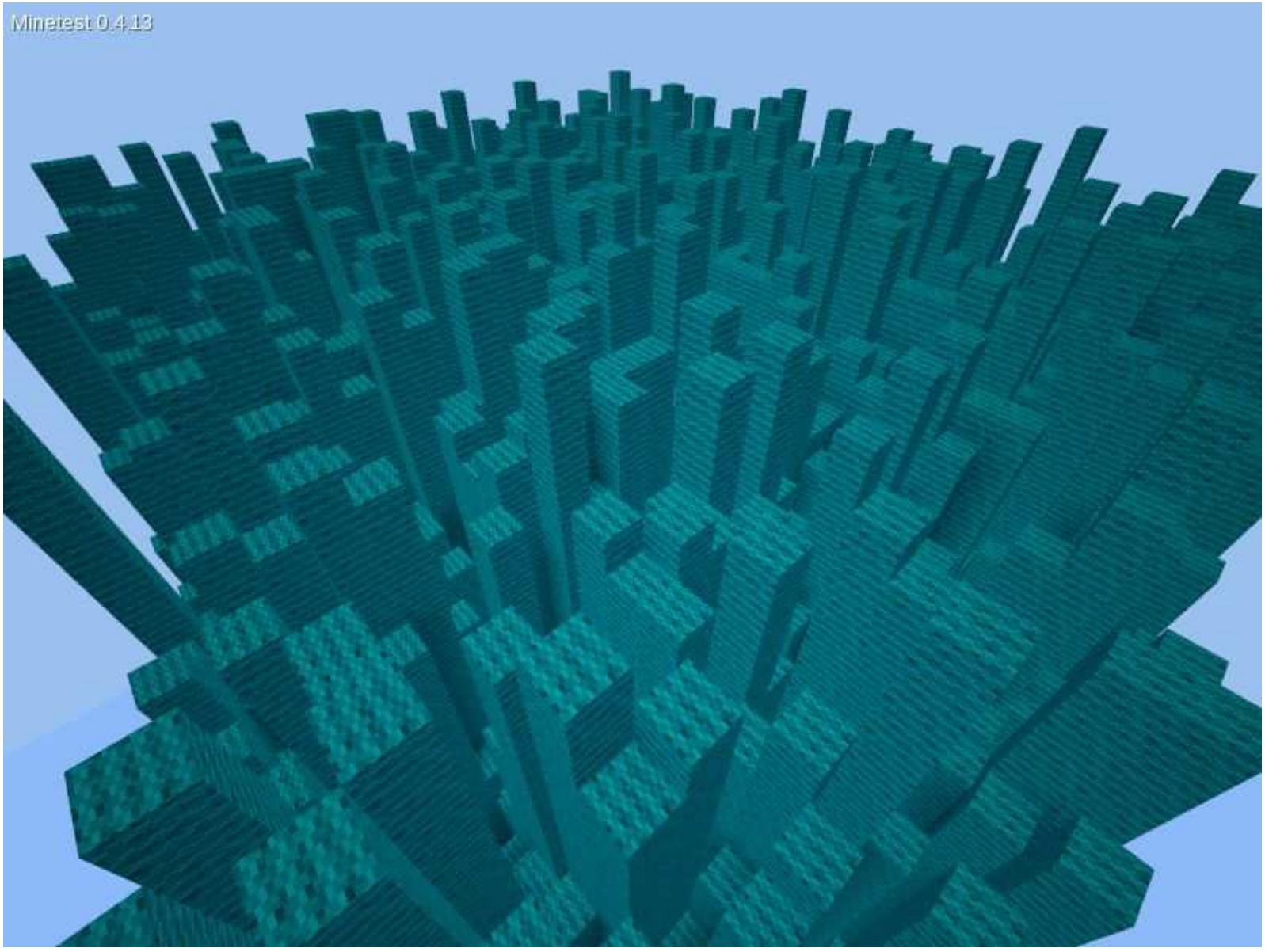
- Chaos is contingent stuff that happens for no reason at all.
- Not chaos in the sense of "chaos theory" (hard-to-predict but fundamentally orderly and often deterministic processes).



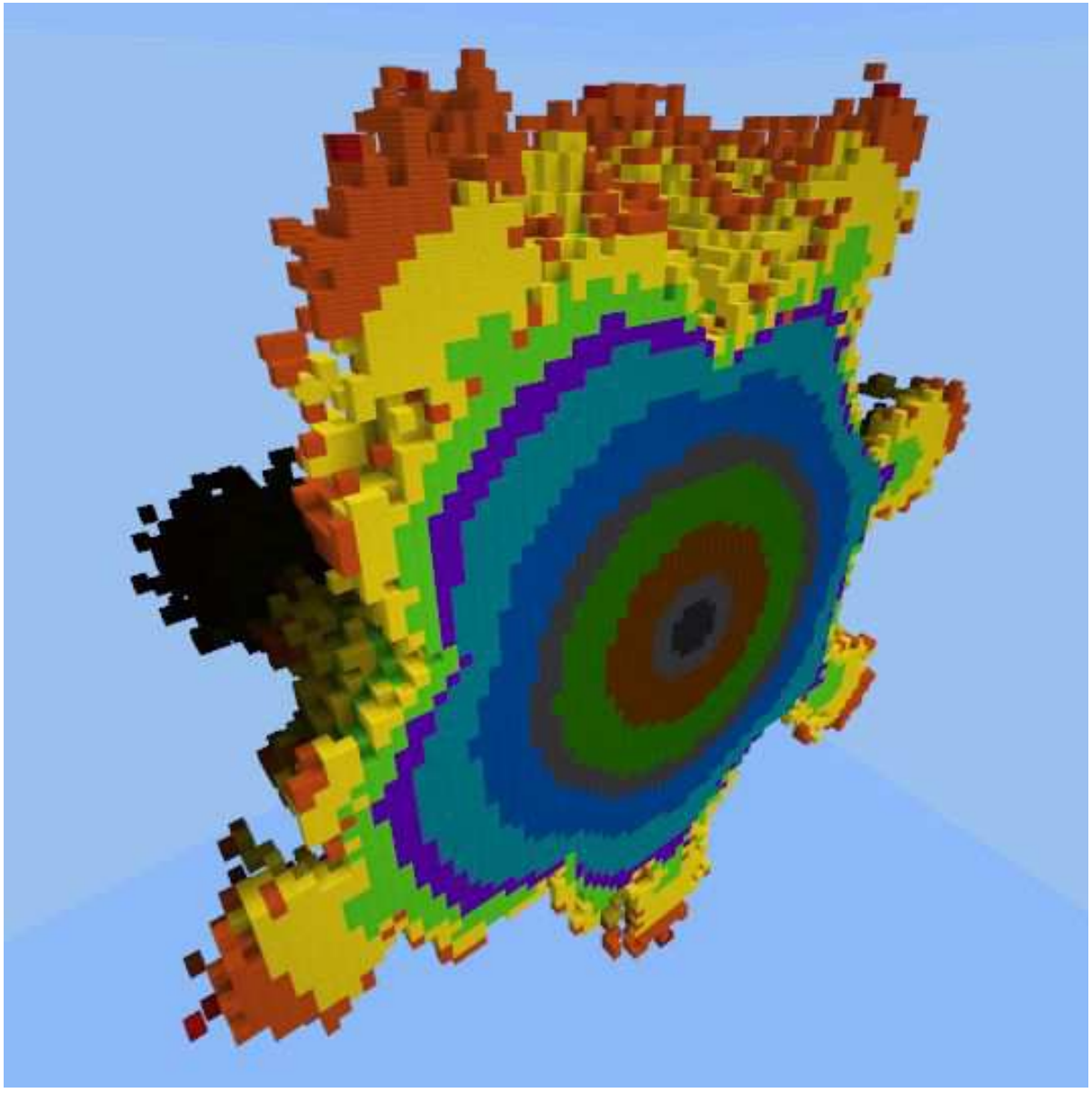
- I could call what I'm after: *fundamental* chaos. The term "brute fact" is used.
- There is chaos if and only if PSR is false.

What would chaos look like? This?

Or like this?



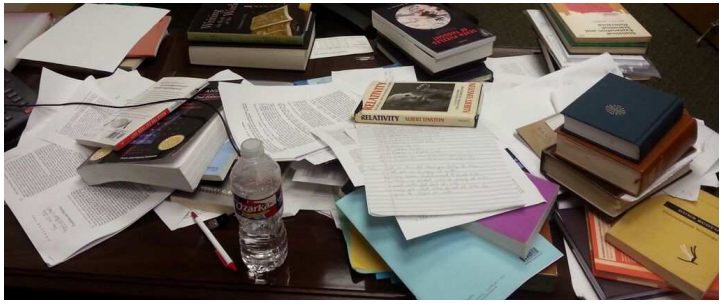
Or maybe like this?



Or perhaps?

Observability of chaos

- Intuition: In a world of (fundamental) chaos, things would have to look messy.



- So, could tell this isn't a world of just chaos.
- False! Things might for no reason look neat.
- Revised intuition: In a world of chaos, things would probably look messy.
- Still false! No probabilities in chaos.
- Chaos could look neat and elegant.
- All my pictures could be chaos.

No probabilities in chaos

- Chaotic events are utterly unpredictable... both individually and *en masse*.
- Infinitely many coins appear for no reason.
- Is it likely that about half will show heads?
- No! There's no Law of Large Numbers for independent events with utterly no probability.
- Can we say that it's *unlikely*?
- No! There's no opposite to the Law of Large Numbers either. (Pruss, *Bull. Polish Acad. Sci. Math.* 61 (2013) 161–8)
- Chaos hypothesis fits with any statistics.
- Hence cannot be refuted *a posteriori*.

From chaos to PSR

- Science needs to presuppose falsity of chaos hypothesis to get chance rather than fundamental chaos.
- It cannot get this by observation.
- Best bet: Principle of Sufficient Reason.
- And PSR fits with chance, because explanation aligns with understanding, and we can understand chancy events (even unlikely ones—they are not less understandable: Richard Jeffrey, 1969).

Objection: Indifference

- If a sequence of coins appears for no reason, all heads/tails sequences are equally probable by Principle of Indifference.
- It follows mathematically that we expect the frequency of heads to be about 50% as most sequences are about half heads.
- So chaos implies probabilities in the aggregate without PSR.

Response to Indifference

- Response 1:
  - Why believe Indifference?
  - Because there is no reason for one sequence to be more likely than another.
  - But what if it's more likely for no reason?
  - Indifference presupposes PSR.
- Response 2:
  - Grant: No heads/tails sequence is more probable than any other.
  - It only follows that they are equally probable if they have probabilities.

Scepticism (Robert Koons)

- Without PSR, possible that:
  1. I am an uncaused brain alone in an otherwise empty cosmos, and my states of mind are causeless illusions.
- Probabilities cannot be assigned to reasonless events.
- So, if PSR is false, scenario (1) is not improbable.
- If scenario (1) is not improbable, then I don't know I have two hands.
- But I know I have two hands.
- So, PSR is true.

Evaluation

- PSR rules out fundamental chaos.
- Chance is not fundamental chaos: it has a real order.
- Fundamentally chaotic events have no probabilities individually or in aggregate.
- Something like PSR is needed for scientific inference in our chancy world.
- This is needed not just given scientific realism but pragmatism as well. Unless we can rule out chaos, we can't tell that science is useful.

Local PSR?

- Could something less controversial than the PSR do the job we need?
- Most controversial part of the PSR is its globality and the cosmological implications.
- Without a cause for contingent reality as a whole, we can say nothing about the probability that contingent reality cooperates with science.
- Or even that it locally cooperates with it.
- Or even that it does so given our observations.
- Need to take really seriously the fact that a fundamentally chaotic global level will in no way be subject to probability.

Contingency of local PSR

- Also, if it's possible for there to be global violations of PSR, it's possible for there to be local violations.
- So a local PSR would have to be contingent.
- But there will be no explanation why there are no violations of local PSR.
- So there will be no probability for local PSR.
- But we shouldn't *a priori* believe something that is contingent and yet not probable.