From: Joscha Bach [redacted]
Sent: Sunday, January 21, 2018 1:33 AM
To: Jeffrey Epstein
Subject: Happy Birthday! And a great time!
Attachments: signature.asc

Dear Jeffrey,

I hope this one will be an inspiring, healthy and in every way worth =ile year to you!

I don't know what your mind is up too these days and I always interested =o hear about it. I just thought a bit about time, this weird thing...= Subjective time can be abstracted into the mentally represented events, =hich are partially ordered by relations that encode (in degrees of =ncreasing distinction) non-simultaneity, succession, interval and =emporal distribution, and anchored to temporal events by co-occurence =elations. Subjective time spans that are not anchored to neural clock =enerators tend to reflect the density of novel elements we experienced, =ecause these are disproportionally stored in the temporal protocol of =ur attention that we remember as our stream of consciousness. It seems =hat due to a decreasing frequency of novelty in the course of our life, =he subjective middle of the life of an 90 year old would be around 18, =erhaps echoing the ubiquitous law of Pareto.

Our physical time is relativistic, of course: the rate of change an =bserver witnesses in its environment, which is relative to the rate of =hange in the observer itself. Particles that don't undergo state change =on't witness relativistic time, and from my computationalist =erspective, that corresponds to all underlying computation being =pplied to their momentum, i.e. the rate at which they are copied along =he computational graph of the universe. The higher the rate of state =hanges in a particle, the slower the rate at which it propagates =elative to its environment.

Time is crucial, because it captures change, and without change, =nformation has no meaning. Nothing has a discernible property unless =his property can be compared to something: information is discernible =ifference, and all discernment requires a computable function that =equires a change of state. The meaning of information is its =elationship to changes in other information.

Computationalist time may be just this: elementary state change of a =omputational substrate. From the perspective of an embedded observer, =e won't be able to discern the nature of that change itself, because =rom the perspective of the emergent patterns that form the causal =tructures of our own dynamics, they are functionally the same. Yet its =ascinating to speculate about the ground truth of change.

In eternalist time, all time points are simultaneously instantiated (yet =s embedded observers only see one of them, or rather, we are =onstituted in the relation between adjacent states).
If a universe has multiple possible timelines, these might be =nstantiated in parallel; let's call it "fat time". Embedded observers =on't know about the other parts of the instantiated space of =ossibilities, but only about the parts looping back to its trajectory =n the computational graph.
Dual state time may be an implementation of a universe where only input =tate and output state if the universe transition function exist.
There might also be a just a global single state time, where the =niverse transition function alters the present state in-place all at =nce, and only a single time slice of the universe does actually exist.
And of course, there could be also a local single state time, a giant =ubstrate graph, in which a single read/write head only ever changes one =it at a time.

Most models of foundational physics operate with a continuous temporal =imension, but I think I can see how we get Lorentz invariance in a =iscrete universe, too. I am wary of continuous time, because it is =ypercomputational; it requires Turing machines that run to infinity in = single step, which means that the gods have to buy infinitely more =xpensive computers when they build their universes, and worse, it =reates ugly wrinkles in our axiomatic systems that we don't know how to =ix. It is not just that we have difficulty building hypercomputers as =hysical objects, I also have trouble to abstractly build them from =irst principles in all other universes I can think of. I think that is =elated to the my suspicion that our exploration of mathematics is =xclusively done via processes of construction that all turn out to be =omputational themselves, not hypercomputational, but I will have to =ind out much more about this before I think I could prove that =ypercomputers are indeed and surprisingly also a mathematical =mpossibility, and our universe must be fully discrete.

Regardless of this, and with my fondest regards to you, and deepest =hanks for your support, I wish you a great time!

Joscha