From: [redacted] on behalf of Seth Lloyd [redacted]
Sent: Monday, July 6, 2015 7:59 AM
To: jeffrey E.
Subject: Re:

Dear Jeffrey,

My apologies for not resp=nding sooner. I took an email vacation for a week plus which =urned out to be a mistake because I fell irrevocably behin=.

That was a very fun conversation with Noam in C=mbridge: he is an amazing thinker (if a tad inflexible at times).

Your question about entropy is an important one. Th= second law of thermodynamics tells us that systems go to states=of high entropy where events are random and uncorrelated, so that thermal<=div> fluctuations appear to be statistically independent. Howev=r, if you look under the hood of the second law, you find that w=at is really going on is that the dynamics that leads you to thi= high entropy state is actually generating huge amounts of correlations between the different parts of the system. In f=ct, the apparently random and independent fluctuations of the pa=ts reflect large correlations with the other parts of the system. B=t these correlations are effectively smeared out over the whole =ystem: to reveal the fact that they are not truly independent, o=e would have to make measurements on all the parts together, and

For example, even though the apparent high entrop= of a gas of molecules reflects all the correlations that are ge=erated by the collisions of molecules over time, if one looks at=just two molecules in the gas, their motions will be statistically indepen=ent to a high degree of accuracy.

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On your second question, quantum superposition is indeed closely =nalogous to a chord in music: the strangeness and power of quant=m superposition arises out of the interference between the diffe=ent waves in the superposition. A classical computer can o=ly register one set of logical values for its bits at any given =ime. So a classical computation is like plain chant: a <=div> single sequence of tones without interference. By co=trast, a quantum computation is like a symphony: its power comes=from the rich sequence of quantum `chords.'

T=ere is a difference, however. The more waves that participate in a =uantum superposition, the smaller the amplitude of each wave: th= sum of the square of the amplitudes is always 1. =C2 So unlike music, where the volume can change, the total `vo=ume' of a quantum chord is always the same not matter how ma=y tones are added.

Hope these answ=rs help.

You wrote earlier about l=fe being a process of functors acting on functors. Amen!
= am working on trying to prove that sets of ordinary differential equation= of the kind that underlie chemical dynamics will spontaneously =ive rise to such a functorial dynamics. Not so easy=. . .

Hoping you are well. I=am currently at the physics center in Benasque, in the high Pyre=ees, where physics is done primarily on long hikes in the mountains.
=div>Very nice.

Hoping our paths cross soon,
=div>Seth

On Tue, Jun 23, 2015 at 6:42 AM, jeffrey E. <jeevacation@gmail.com=/a>> wrote:

s=th, Ive been having many email exchanges with noam. great fun.=C2 I am stumped. on the concept of a large probabitli=y space? entropy. . ? if the space is =arge enough , how does one know if there is independent events. . as=the information would take so much time to travel between each and or obse=ver. ? quesiton 2. in music , one has = dominant tone and then harmonics. . a chord is a combination =f those . lets say 1st third and fifth? . is that =quivalent to a superpostion at the quantum level? your ear per=orms a transform to tease out each tone afther the fact. ?

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=A0 please note