
From: jeffrey E. <jeevacation@gmail.com>
Sent: Monday, July 6, 2015 10:53 AM
To: [REDACTED]
Subject: Re:

thanks, I met with misha gromov. . =if we are talking about the space of probablites and i underst=nd its only a metaphor. but if the information is widely dispe=sed. are their truly independent probabilites.? =A0 and music is also probably constrained by an upper volume, =C2 i never thought of it . some limitation on sound waves interacting.=C2 my guess is there is an upper limit, certainly ver= loud would drown out very soft. etc. great work thanks<=r>

On Mon, =ul 6, 2015 at 9:59 AM, Seth Lloyd <[REDACTED]> wrote:
<=lockquote class="gmail_quote" style="margin:0 0 0 .8ex; border-left:1px=#ccc solid; padding-left:1ex"> Dear Jeffrey,

<div>My apologies for not responding sooner. I took an email v=cation for a week plus which turned out to be a mistake be=use I fell irrevocably behind.

That was a very f=n conversation with Noam in Cambridge: he is an amazing thinker (if a tad =nflexible at times).

Your question about entropy =s an important one. The second law of thermodynamics tells us that<=div> systems go to states of high entropy where events are random and =ncorrelated, so that thermal fluctuations appear to be statistic=llly independent. However, if you look under the hood of t=e second law, you find that what is really going on is that the dynamics</=iv> that leads you to this high entropy state is actually generating h=ge amounts of correlations between the different parts of the sy=tem. In fact, the apparently random and independent fluctuations of the parts reflect large correlations with the other=parts of the system. But these correlations are effective=y smeared out over the whole system: to reveal the fact that they are not truly independent, one would have to make measurements on all the=parts together, and tease out the extensive but subtle correlati=ns between them.

For example, even t=ough the apparent high entropy of a gas of molecules reflects all the correlations that are generated by the collisions of molecules over t=me, if one looks at just two molecules in the gas, their motions=will be statistically independent to a high degree of accuracy.<=div>

On your second question, quantum su=erposition is indeed closely analogous to a chord in music: the =strangeness and power of quantum superposition arises out of the =nterference between the different waves in the superposition. <=iv>A classical computer can only register one set of logical values for it= bits at any given time. So a classical computation=is like plain chant: a single sequence of tones without in=erference. By contrast, a quantum computation is li=e a symphony: its power comes from the rich sequence of quantum 'chords.&#=9;

There is a difference, however. The mor= waves that participate in a quantum superposition, the smaller =he amplitude of each wave: the sum of the square of the am=plitudes is always 1. So unlike music, where the volume <=iv>can change, the total 'volume' of a quantum chord is always the sam= not matter how many tones are added.

<=r>
Hope these answers help.

<=iv>You wrote earlier about life being a process of functors acting on functions. Amen!
I am working on trying to prove that sets of ordinary differential equations of the kind that underlie chemical=dynamics will spontaneously give rise to such a functorial dynamics. Not so easy . . .

high Pyrenees, where physics is done primarily on long =ikes in the mountains.
Very nice.

Hopin= our paths cross soon,
Seth

seth, I've been having many email exchange= with noam. great fun. I am stumped. on the =oncept of a large probabitlity space? entropy. . ? =C2 if the space is large enough , how does one know if there is i=dependent events. . as the information would take so much time to tr=vel between each and or observer. ? quesiton 2. =A0 in music , one has a dominant tone and then harmonics. . =A0 a chord is a combination of those . lets say 1st third and fifth?=C2 . is that equivalent to a superposition at the quantum le=el? your ear performs a transform to tease out each tone afthe= the fact. ?

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please =ote

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