From: Joscha Bach [redacted]
Sent: Sunday, August 14, 2016 11:03 AM
To: Jeffrey Epstein
Cc: Joi Ito; Nowak, Martin
Subject: Re:

Jeffrey, there are several sides to this:

1. Computers that are technically different from our current digital =omputer architectures, but can do the same things, because they can =athematically be proven to be equivalent, and we can build a digital =quivalent. Examples are computers with ternary logic, neural networks, =actor graphs etc.

2. Probabilistic computers: instead of deterministic state transitions, =hey change state with a certain probability. We can get them to =pproximate determinism with arbitrary precision by stacking the =robabilistic gates. Many cognitive scientists and AI researchers =elieve that brains are in that category. (We can also reproduce their =ehavior on a digital computer by adding random noise.)

3. Computers that are technically different from our current digital =omputers, but are still mathematically equivalent, yet it may not be =ractical to build a digital equivalent, because it would be too large =r too slow. Examples are DNA computers, chaotic computers etc. Digital =hysicists (Steven Wolfram, Ed Fredkin) believe that even the universe =s in this category. Chris Eliasmith thinks the brain is in this =ategory (we need to build electronic simulations of spiking neurons).

4. Quantum computers: they still cannot do anything but manipulate =nformation, but they can (hopefully one day) do a few things =fficiently, like factoring large numbers, so they are in principle more =owerful than conventional computers. Seth Lloyd thinks the universe is =n this category, and Penrose thinks the brain is in this category.

5. Hypercomputers with true continuum dynamics. Such computers can solve =he 3 body problem with infinite precision in finite time etc. (Most of) =raditional physics believed that the universe must be continuous, and =ven contemporary physics usually has continuous time etc. Such =omputers can be approximated to an arbitrary degree by digital =omputation, but not reproduced exactly. Most computer scientists with =n opinion on the matter think that such hypercomputers cannot exist.

6. Hypercomputers with true infinities, which can use an infinite number =f inputs to compute a result in finite time. For instance, in this =iew, all of the universe (not just a finite amount of information in =ts lightspeed cone) could affect a single point.

7. A-causal computers: For instance, a universe with time machines could =end information that you compute today to help you in your past. =athematically, such computers can be described, but there is no =ndication that they could exist.

0. Reversible computers: A reversible computer cannot delete =nformation, i.e. every state has exactly one preceding state. =eversible computers can be easily implemented in a normal digital =omputer, but a reversible computer that tries to implement a digital =omputer will accumulate entropy in the form of garbage bits. I believe =hat our universe is a reversible computer (our brain is obviously not).

The list is not exhaustive, but I think these are the most relevant =ategories of unconventional/alternative computation, from a theoretical =erspective. Additionally, there are notions of things that are "more =han computation" in any of the senses above. They involve referential =emantics, normative/social semantics and other dark magic. Leibniz, =earle and

many other philosophers believe that our brains and the =niverse do "more than computation", but they do not have good concepts =o explain or formalize their ideas. They probably cannot have such =oncepts, because they would have to leave the domain of mathematics =i.e. formal languages) for them, so there is very little to talk about =xcept for negative claims ("computers cannot do X").

> On Aug 13, 2016, at 15:55, jeffrey E. <jeevacation@gmail.com> wrote:
>
> =ttp://uncomp.uwe.ac.uk/LCCOMP/Anuncios/Entries/2015/8/31_UCNC_2015.ht
> ml
>
> On Sat, Aug 13, 2016 at 6:36 AM, Joi Ito [redacted] wrote:
> Looks interesting. Haven't seen it before. Sounds like =omething Joscha would know.
>
>> On Aug 13, 2016, at 6:23 AM, jeffrey E. <jeevacation@gmail.com> =rote:
>>
>> Natural/Unconventional Computing and Its Philosophical Significance -
>> =DPI MDPI › pdf
>>
>>
>> Have you guys looked at this?
>>
>>
>> --
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