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**From:** Joscha Bach <[REDACTED]>  
**Sent:** Wednesday, August 24, 2016 4:48 PM  
**To:** Jeffrey Epstein  
**Subject:** Re:

> On Aug 24, 2016, at 06:09, jeffrey E. <jeevacation@gmail.com> wrote:

>

> do you believe a bunch of chemicals has a goal, ?

It depends a bit on how we use the words; do you think that a bunch of chemicals can do mathematics or be money? I think it makes sense to say "yes".

A goal is part of a causal model that we use to describe an agent that can commit to pursuing a world state. Outside of this model, the word "goal" has no meaning. Within the model, it makes the behavior of some bunches of chemicals somewhat predictable on a particular level.

I think most chemical systems do not have goals, in the sense that we cannot meaningfully ascribe to them that they have agency. For that, they need

- some kind of preference system,
- a way to determine and represent world states,
- a way to make decisions for world states based on the preferences,
- a way to act on decisions so that the preferred world state becomes more likely.

For instance, a corporation is an agent in this sense, and a cat is too. Perhaps George Church would say that cells can have goals, too.

A Roomba cleaning robot is a particularly good example: when it cleans the room, it has no goal, because it has no model of the cleanliness of the room, and no preference to make it cleaner. We can test for this: if its dirt container is full, it will happily make a clean room more dirty, because it just moves randomly around while rotating its brushes. The cleaning is an emergent result.

On the other hand, when it runs low on battery, it will explicitly search for its power station and drive there to recharge, and after that, it will continue cleaning. It explicitly represents the charging state, and when starved for power, it commits to a goal that makes it direct its actions on entering that state.

Valentino Braitenberg, in his classical book "vehicles", looks at different kinds of cybernetic feedback systems, and at different kinds of agency that can be implemented in them. My own thinking is mostly shaped by the ideas of social agency, by the Italian computer scientist Cristiano Castelfranchi, and by Aaron Sloman.

> isn't that in your words just one of the stories we tell ourselves.? why is it not merely chemicals

I would say that a goal is part of a "software specification". Nature can get a bunch of chemicals to enact this specification. But it can also be done mechanically, electrically or socially.

> . like in a magnetic field forced to line up with other chemicals in the vicinity, . more like magnets lining up.

Do you think there is a lowest level, and that it makes sense to speculate what it is?

Fundamental physics explores the idea of the lowest causally closed level. I made an online survey during the FQXi conference, and got 49 responses from the participants. 18 believed that the universe is fundamentally just mathematics or information (8 of those think it is just information). 19 believe in a material universe (4 of those think only space or spacetime exists). 15 respondents hold that a conscious observer or God is necessary (some of them overlap with the materialists).

For what its worth, the idea that only information is real does not seem to be especially strange. What is your view/intuition?

You are right when you say that my view is strongly influenced by being a computer scientist. Once I made the leap that our observations of the world are fundamentally not different from what a computer game player is an observer on his screen, and that we can produce every conceivable sequence of observations via a computer program, I saw no way out again, especially after I got to see observers/minds as computer programs, too. Everything we know about ourselves, we know through sequences of observations, too, and observations are sets of discernible differences (bits of information).

Cheers,

Joscha

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