

Robots, Supply and Demand
by Jeff Schmitz (schmitzjm@aol.com)

The universe itself might not have a purpose, but science, one of the ways we try to understand our universe, needs a purpose. The purpose of science affects this seemingly dispassionate pursuit.

My students will sometimes ask why science is important and more to the point, why do they as non-science majors need to study science? To me that was like asking why is there music or art. But, in a sense, they are right in asking question and I am wrong for seeing science for science sake. Science has a consumer and that consumer is the why to science. Science starts with a problem and tries to find a solution. The consumer drives science but also limits the process, because questions we ask limits where we are looking.

To be a science, the scientific method must be followed. The scientific method is a continuing process - A pattern is recognized in observations, a hypothesis is created to explain the pattern then experiments or further observations test this hypothesis. Most hypotheses fail under the weight of experiments and observations, which require new hypothesis to replace the failed attempts. Those hypotheses that survive many and varied tests get the rare title of theory. "Only" a theory is the best science can do because the scientific method can disprove a hypothesis or theory, but it cannot prove beyond all doubt. A true proof of a theory would require something outside of science and at that point the "theory" would no longer be a scientific theory and could not be a part of the scientific method.

There was talk of a "Robot Economy" were intelligent machines would push out human workers making the humans unnecessary and leading to robots taking over. The flaw with the idea of robots completely displacing humans is that, robots have no need to take over. Animals and other people might try to take our food and shelter, but machines do not need or desire these. Needs and desires drive our economy and our society. A product is there for the consumer, without a market, no device no matter how advance would sell. In a similar way, science needs the questions generated by need or desire.

Computers are part of science and their part will only increase, perhaps one day, all science might be done by machines. The consumer who asks the question is still the reason for the process. The answer must be in a form the consumer can use. A machine or a super-intelligent rock that has a result that is not in a form that humans understand would be useless as an answer. A machine with no desires will not have a need to develop new questions, so a machine could not do anything with the result to continue the scientific process.

The scientific method meets at the intersection between three categories - our physical universe, hypotheses and communication. We do not normally think of hypotheses as separate from communication, we normally think in words, but hypotheses can be separate from words.

The word "intelligence" is used often and we even have ways of measuring IQ, yet there is not a clear definition of intelligence. We confuse intelligence with self-awareness and high rate data processing - intelligence is something separate. We can think of intelligence as what it does to give an imprecise working definition -

formulate questions then find answers then use the results to adapt to new situations. The scientific method can be a part of intelligence, but it is not the whole thing.

Are computers intelligent? A computer can follow a method of reasoning like the scientific method, but a computer has no needs, no reason to ask new questions beyond what we have asked and no reason to adapt to change its own program. A computer is not a consumer. An insect with clear, but broad goals could be intelligent. A computer that could process orders of magnitude more information than an insect might not be intelligent unless the computer has some broad goal. Robots that could be cold and hungry could be intelligent, but that is not the only way to become intelligent. Knowledge for knowledge's sake (which some of my students seemingly do not have) could be another of many drivers of intelligence. We are surrounded by animals and machines that can perform a change not specified in a goal to fulfill that goal. We should think of intelligence as something common and obtainable.

As an example: Life has a goal to keep living and to reproduce. Genetics tries out hypotheses (the genetic code of a life form) by which code survives and it formulates new hypotheses by random chance. Unintentional random variation might not be an efficient way to create a hypothesis, but this method is evenhanded. The results of testing need to be recorded and communicated. Every living cell here on Earth is part evolution's record. Genetics only records successful results with failures being lost. As a model for experimental science, evolution is a poor system, but countless attempts, over a remarkable length of time has overcome the flaws with this system.

In evolution we have another intelligent system to compare with human intelligence. Our thoughts can be complex, the mechanism of random variation is easy to understand and we are starting to understand the communication system of DNA. Evolution is not a self-aware intelligence. Self-awareness would only hurt this system. A wing can be designed by aerodynamics and can be discovered by the trial and error of evolution. Evolution can give us no insight as to why something works, but it can give working examples that might not be imaged by the human mind. Classic kinematics is wrong. Classical equations for projectile motion do not account for relativity, but are not even consistently wrong. A projectile shot from a launcher does not land in the same place every time; instead there is a distribution. Factors like air resistance and changes in the launcher due to factors like temperature and wear create part of this distribution. You could call these factors noise. The ability to see a pattern and create a hypothesis despite the experiment noise is a triumph of data analysis. Not all uncertainty is noise; some of the distribution is the universe. The spread of projectile lands is also due to changes in gravity. Since there is no anti-gravity (as far as we know), the change in position of all the material that is part of our Earth and the rest of the observable universe would have an effect on the projectile. Here is where we want (or need) a "law" because our experiment can never be perfectly repeatable we find an overall pattern that is "better" than our experiment. This is the basis for Newton's "laws", a self-consistent mathematical system, and this system leads to understanding why objects move, not just the

shape of the trajectory. The speed of light is not a part of Newtonian mechanics, yet we know that a finite light speed does affect gravity and the trajectory of a particle. Mathematical systems like kinematics imperfectly intersect with the physical universe. Quantum mechanics embraces noise. There is always an uncertainty in quantum mechanics where results are part of a statistical average. As far as a workable model it is not important if uncertainty is due to the nature of matter at the smallest level or due to the structure of the universe at the largest scale or a mixture of both. The idea that the whole of the observable universe is part of the wobble of uncertainty of each particle holds the possibility of a vast store of information. Even a "binary" universe with a finite grain size of information could be average over many interactions to detect the infinitesimally small probability of any observable object. We can see stars, as they were thousands of years ago and galaxies as they were billions of years ago. Some distant life form could be observing dinosaurs on Earth through their telescope. Since the universe contains so much information, one might ask if one could ask the universe about itself. The universe itself is not intelligent, even with the very low bar I place on intelligence, because there is no broad goal for the universe. There is a possibility of multiple universes and if they are somehow competing universes then a possibility exists for intelligence, but we would be so hopelessly inside this intelligence that we could not detect this system.

Rene Descartes used the scientific model of reasoning to explore the inner world. "I think therefore I am" proves existence without external data needed in the rest of science. His next step proved a creator because if one exists something must create that existence. Non self-aware intelligence of evolution was most likely not what he was looking to find. Exploration of physical relationships by complex interconnected computer network without connection to the physical world is the same as a single person thinking by candlelight hundreds of years ago. The results would be complex, but in substance the same – a proof of self-consistency and existence. Through brain research we can start to understand how thoughts are formed and bring the inner world out. In a similar vain, science to be science, must continue to look out and relate to the physical universe. The information age gives us new possibilities of intelligence, but it cannot bypass the scientific method.

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