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The Cosmic Creation Process

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Cosmic creation is horrendously wasteful. In the existential balance between the forces of destruction and the forces of construction, there is no contest. The dark side is overwhelming. By quantitative physical measures of matter and energy content, there is far more chaos than cosmos in our universe. But it is the cosmos that we prize.

As we saw in the introduction, my philosophy focuses on the qualitatively valuable **information** structures in the universe. The destructive forces are entropic, they increase the entropy and disorder. The constructive forces are anti-entropic. They increase the order and information.

The fundamental question of information philosophy is therefore cosmological and ultimately metaphysical.

What creates the information structures in the universe?

At the starting point, the archē ($\dot{\eta}$ $\dot{\alpha}\rho\chi\dot{\eta}$), the origin of the universe, all was light - pure radiation, at an extraordinarily high temperature. As the universe expanded, the temperature of the radiation fell. When the first material particles formed, they were quickly destroyed by energetic photons of light. But at low enough temperatures, the quantum cooperative constructive forces were able to overcome the destructive non-material particles of light energy, the radiation field of photons.

The great stability of the material world is thus the result of quantum mechanics, which most philosophers and even scientists normally view as disruptive and uncertain. Quantum **indeterminacy** is involved in everything new, including our creativity and free will. Let's see how.

As the universe expands (see Figure 1-3), negative entropy is generated. Most of this degrades to normal thermodynamic entropy, which is known as the Boltzmann Entropy. But some survives as what is often called the Shannon Entropy, a measure of the information content in the evolving universe. sal

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Chapter 30

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DAVID LAYZER showed how entropy and information can increase at the same time in the expanding universe.¹ There are two information/entropy flows. In any process, the positive entropy increase is always at least equal to, and generally orders of magnitude larger than, the negative entropy in any created information structures, to satisfy the second law of thermodynamics.



Figure 30-1. Information flows into Boltzmann and Shannon Entropy.

Material particles are the first information structures to form in the universe. They are quarks, baryons, and atomic nuclei, which combine with electrons to form atoms and eventually molecules, when the temperature is low enough. These particles are attracted by the force of universal gravitation to form the gigantic information structures of the galaxies, stars, and planets.



Figure 30-2. Cosmological information flows.

Microscopic quantum mechanical particles and huge selfgravitating systems are stable and have extremely long lifetimes, thanks in large part to quantum stability.

See page 10 in the Introduction.



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Stars are another source of radiation, after the original Big Bang cosmic source, which has cooled down to 3 degrees Kelvin (3°K) and shines as the cosmic microwave background radiation.



Figure 30-3. Sun to Earth information flow.

Our solar radiation has a high color temperature (5000°K) and a low energy-content temperature (273°K). It is out of equilibrium and it is the source of all the information-generating negative entropy that drives biological evolution on the Earth. Note that the fraction of the light falling on Earth is less than a billionth of that which passes by and is lost in space.

A tiny fraction of the solar energy falling on the earth gets converted into the information structures of plants and animals. Most of it gets converted to heat and is radiated away as waste energy to the night sky.



Figure 30-4. Information flows into life.

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Every biological structure is a quantum mechanical structure. DNA has maintained its stable information structure over billions of years in the constant presence of chaos and noise.



Figure 30-5. Information flows in a human being.

The stable information content of a human being survives many changes in the material content of the body during a person's lifetime. Only with death does the mental information (spirit, soul) dissipate - unless it is saved somewhere.

The total mental information in a living human is orders of magnitude less than the information content and information processing rate of the body. But the information structures created by humans outside the body, in the form of external knowledge like this book, and the enormous collection of human artifacts, rival the total biological information content.

Man Is Not a Machine

And the mind is not a computer, running evolved computer programs. The proper way to view man, indeed any organism, is as an incredible information processing system.

A biological information processor is vastly more powerful and efficient than any computing machine. We can divide the human body into layers, with the mind at the top. The amount of information processing going on in the lower layers is, like the other entropy/information flow diagrams above, vastly greater than the mental stream of consciousness.

We philosophers like to think that the mental activity is somehow most important, perhaps even prior in some essential sense. PLATO thought the ideas come first, the instances later, as did the neo-Platonists and the Christian tradition. In the beginning, was the logos. Έν ἀρχή, ἑν ὁ λόγος. But we shall see that the logos is the end result of a vast layering of biological processes.

From ARISTOTLE to the Existentialists, some philosophers knew that existence precedes essence. And if bare existence were not organized into information structures, there would be no intelligence to contemplate their essences.

The information processing going on in a human body is over a billion times the amount processed in the mind. To appreciate this, let's consider just one maintenance function. Every second a significant fraction of our red blood cells die and must be replaced.

100 million red blood cells die each second x 300 million hemoglobin proteins in each RBC x 100s of amino acids in each hemoglobin = 100,000 terabytes of information per second

Hemoglobin protein



Every time a tRNA adds a new amino acid to the growing polypeptide chain it is a *quantum event*!

Figure 30-6. Information processing to maintain our red blood cells.

Chromosomal information is being processed from our DNA to messenger RNA to transfer DNA to the ribosome factories where a chaotic soup of randomly moving amino acids are sorted out to select exactly the right one to add to the rapidly growing polypeptide chain of a new protein.

Quantum cooperative phenomena account for the phenomenal speed and accuracy of creating new macromolecules.

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It is helpful to distinguish at least four levels of information processing, from the bottom physical layer of bodily maintenance to the top layer in the thinking mind.



Figure 30-7. Four levels of information processing.

Bodily motions consume a great deal of information processing. Perceptions somewhat less, but they are the subject of a great deal of psychological and philosophical speculation. There is little room in a work on free will to go into detail, but note that WILLIAM JAMES' notion of focusing attention is easy to understand in information terms.

Consider a hawk flying over a field of waving grass, who can instantly pick out a field mouse by its unique pattern of motion. Consider our ability to distinguish the recognizable voice of a friend in a noisy party. Our brain can separate that voice from nine others of equal volume (a 10 decibel ratio of signal to noise). If we can see the lips, we can go down 20db, to understand sounds that are 1/100 of the crowd noise.

In BERNARD BAARS' Theater of Consciousness, there are untold numbers of perceptions and conceptions that are vying for the attention of the decision-making executive function. Baars and Dennett picture these as individual agents or homunculi with special knowledge who are processing the information in parallel. The information data rate of this unconscious parallel perceptual level is thus orders of magnitude higher than the serial processing rate of the conscious mind.

James called the lower level a "blooming, buzzing, confusion" and the upper level a "stream of consciousness." Thus our conscious ability to communicate information, with others in speech, with ourselves in thoughts, is practically restricted to a small amount of information per second, compared to the bodily information at the lower levels being processed at rates comparable to today's best computers and communication systems.

Cosmic Creation and Free Will

How does this picture of information processing levels relate to the **two-stage model** of free will? The lower levels, driven in large part by chaotic processes and always involving quantum cooperative phenomena to create information, are the biological source for the first stage that generates **alternative possibilities**.

It was convenient to introduce the two-stage model as a temporal sequence. And it is easy to teach it this way, drawing heuristic diagrams on the white board to illustrate it for students.

But as was mentioned in Chapter 13,² the random generation stage is going on constantly, driven by internal proprioceptions and external environmental perceptions.

Visualizing the information processing in layers provides a deeper understanding of how behavioral freedom in lower animals has evolved to become free will in higher animals and humans.

Recall from Chapter 12 that MARTIN HEISENBERG has found evidence that the lowest animals and even bacteria have a kind of behavioral freedom.³ They can originate stochastic actions and are not simple Cartesian stimulus-response reactive machines.

I propose that there are four levels in the evolutionary development of free will. In all four levels, the source of the random generation of alternative possibilities in the first stage of my twostage model is the same. It is the essential chaos and noise that is characteristic of information processes at the lower levels of the organism as shown in Figure 30-7.

But in the second stage, I argue that new methods of selecting the best possibility are added in the upper levels.

² p. 201.

³ p. 184.



Figure 30-8. The evolution of behavioral freedom to become free will.

At the lowest level, selection is instinctive. The selection criteria are transmitted genetically, shaped only by ancestral experiences.

At the second level are animals whose past experiences guide their current choices. Selection criteria are acquired through experience, including instruction by parents and peers.

Third-level animals use their imagination and foresight to estimate the future consequences of their choices.

At the highest level, selection is reflective and normative⁴ Conscious deliberation about community values influences the choice of behaviors.

If we go back and compare the information-processing levels of Figure 30-8, we see that bodily maintenance uses only the lowest level of instinctual information to operate. Everything the cells know comes to them via DNA and inherited cell processes.

Bodily motions at the next level can be learned, muscle memory for example. The parallels break down for the upper two levels.

But the highest level of information processing in humans helps us to see the essential difference between humans and other animals. Many animals have evolved mirror neurons that allow them to feel what other animals are feeling. And altruistic genes in many organisms may explain why some animals sacrifice themselves for their communities.

But the ability to translate our thoughts into language and communicate that information to others is unique. We may not be the only species that has thoughts, but we are the only ones that can share our thoughts.



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Information and Love

We began Chapter 1 asking what is information?

We have seen that the creation of information involves quantum mechanics to form structures, followed by the transfer away of entropy to allow those structures to be stable against the second law of thermodynamics.

We found that the un-pre-determined information created in a decision is the basis of human freedom.

We saw that information is immaterial and likened it to spirit, the soul in the body, the ghost in the machine.

We showed that information is the stuff of thought, and that it is our thoughts that are the origin of human freedom and creativity.

We found that humans are unique in that they can share their thoughts with other human beings.

I want to end by arguing that sharing information has an astonishing resemblance to another human characteristic.

Like love, information is not consumed when we give it to others, but increased. Both love and information do not follow the usual economic laws of scarcity.

CHARLES SANDERS PEIRCE made evolutionary love, his agapē, the third and ultimate step in his philosophy. For Peirce, it was *sharing* information with other thinkers in an open community of inquirers that assured the advance of knowledge.

For me, it is *caring* for the work of others that matters even more for that advance of knowledge. I want to provide my forebears with the maximum measure of information immortality.

If we don't remember the work of our colleagues in the past, we don't deserve to be remembered by future colleagues.

Forgetting is entropic. The moral foundation of information philosophy is very simple. All things being equal, choose the option that preserves the most information.