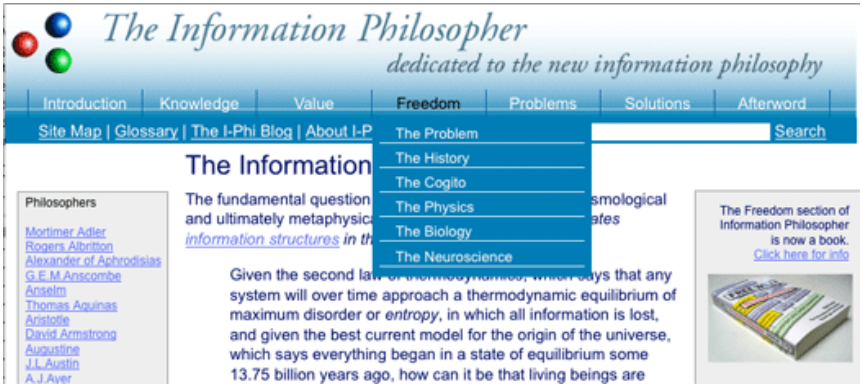
How To Use This Book With The I-Phi Website

The content of the book comes primarily from the FREEDOM section of the INFORMATION PHILOSOPHER website. Please refer to the website for more details than there is room for here.

You will find multiple entry points into the website from this book, with URLs for the chapters and in many of the footnotes. I hope that you agree that the combination of printed book and online website is a powerful way to do philosophy in the twenty-first century.

The FREEDOM section has a drop-down menu for the major sub-sections - Problem, History, Physics, Biology, etc.

In the left-hand navigation of the Freedom section there are links to the core concepts needed to understand the free will debates. These are followed by links to the hundreds of philosophers and scientists who have contributed to the history of free will.

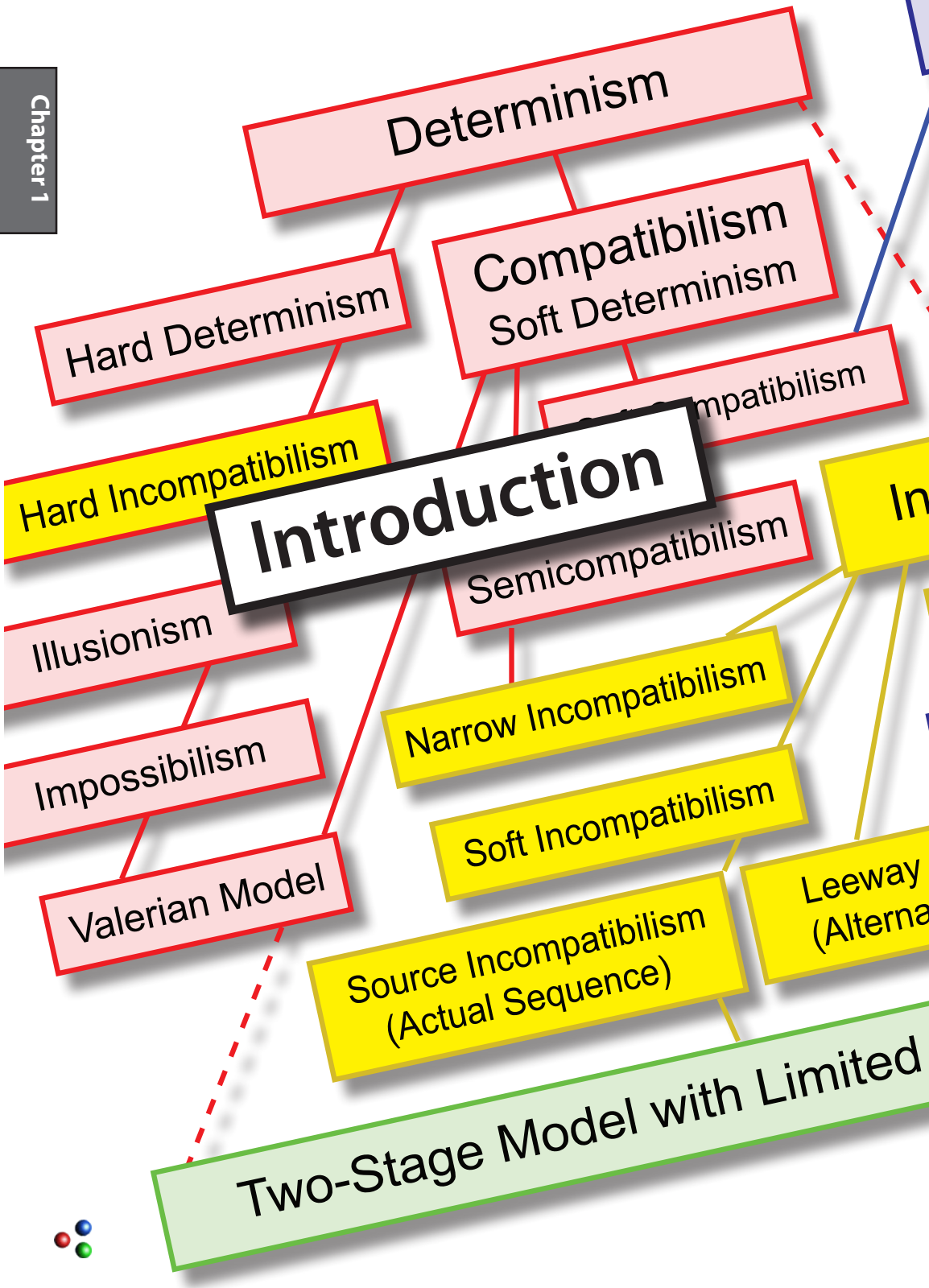


Words in **boldface** in the text refer to core concepts. Many of these have entries in the Glossary and are good Google search terms.

You will find a list of these core concepts on page 441.

Names in SMALL CAPS are the philosophers and scientists with web pages on the I-PHI website. They are listed on page 440.

It is not easy to navigate any website, and I-PHI is no exception. A fast way to find things of interest is to use the Search box on every page. Once on a page, a "Cite this page" function generates a citation with the URL and the date the page was retrieved in APA format.


Determinism
Compatibilism
Soft Determinism
Hard Determinism
Hard Incompatibilism
Introduction
Semicompatibilism
Illusionism
Impossibilism
Valerian Model
Narrow Incompatibilism
Soft Incompatibilism
Source Incompatibilism
(Actual Sequence)
Two-Stage Model with Limited

Introduction

Of all the problems that information philosophy may help to solve, none is more important than the question of **free will**. There is little in philosophy more dehumanizing than the logic chopping and sophisticated linguistic analysis that denies the possibility of human freedom.

Many philosophers go further. They claim deterministic laws of nature deny even the possibility of **alternative possibilities**. Only the actual is possible, there is only one possible future, say some philosophical voices over the twenty-two centuries from Diodorus Cronus to Daniel Dennett.

Even the Cartesian dualism that reduced the bodies of all animals to living machines left room for a non-mechanistic, immaterial, and indeterministic mind above and beyond the deterministic limits set by the laws of nature.

Information philosophy hopes to show that information is itself that immaterial "substance" above and beyond matter and energy that Descartes and Kant were looking for.

What is Information?

Information is neither Matter nor Energy,
But it needs Matter for its Embodiment,
And it needs Energy for its Communication.
Information is the modern Spirit.
It is the Ghost in the Machine
It is the Mind in the Body.
It is the Soul, and when we Die,
It is our Information that Perishes.

Please go to the Information Philosopher website for more on information. (www.informationphilosopher.com/introduction/information)

To understand the role of information in human freedom, you need to know that information cannot be created without an **indeterministic** quantum process known as the "collapse of the wave function." I explain more about information creation in the universe in Chapters 1 and 31, and more about information physics, wave-function collapses, and free will in Chapter 15.

Quantum physics in the twentieth century opened a crack in the wall of physical **determinism**, through which a "chink of daylight" could be seen by Arthur Stanley Eddington in 1927. But academic philosophy reacted to **quantum indeterminacy** the same way as the Academics and Stoics had reacted to the idea of an Epicurean "swerve" of the atoms.

Ancient and modern academics were appalled at the idea that **chance** could play a role in generating **alternative possibilities** for **adequately determined** decisions that are "**up to us**," as Aristotle called them.

Chance is atheistic, said the Stoics. It denies the omnipotence of Nature and Nature's God - Reason. How could humans be exempt from universal laws that govern the macrocosmos and microcosmos, from the stars and planets down to the atoms themselves?

The illusion of chance is a consequence of human ignorance, the product of finite minds, say many ancient and modern thinkers. Chance is *epistemic* and not *ontologically* real, they say.

An infinite and omniscient mind can comprehend everything, and foresee the future with a God's-eye view, as clearly as it sees the present and the past. But our human and finite mind's-I views are limited. You will find this anti-humanistic thought in much theologically inspired philosophy.

Note that John Duns Scotus preferred a God capable of random miracles to Thomas Aquinas' vision of a God constrained by his own Reason, like the Nature/God of the deterministic Stoics. See the sidebar on omniscience and omnipotence.

On Omniscience, Omnipotence, Benevolence

In passing, it is worth noting that the idea of God as an omniscient and omnipotent being has an internal logical contradiction that is rarely discussed by the theologians.[1] If such a being had perfect knowledge of the future, like **Laplace's demon**, who knows the positions, velocities, and forces for all the particles, it would be perfectly impotent. Because if God had the power to change even one thing about the future, his presumed perfect knowledge would have been imperfect. Omniscience entails impotence. Omnipotence some ignorance. Prayer is useless.

As to benevolence, Archibald MacLeish said in J.B, "If God is Good, He is not God. If God is God, He is Not Good."

1 Anselm was an exception. See Sorabji (1980). p. 126.

With so much talk of **probability** and statistics after Pierre-Simon Laplace in the nineteenth century, it was becoming more respectable to discuss the possibility of absolute **chance**. Charles Darwin's theory of evolution included chance variations that could be inherited by an organism's offspring to allow the natural selection of new species. Genuine novelty in the universe needs chance to generate those new possibilities. Otherwise, the existing species would be the **pre-determined** consequence of laws of nature and events in the distant past. Determinism accommodates the view of an omniscient intelligent designer.

In Cambridge at Harvard, Charles Sanders Peirce and his colleague William James followed the Darwinian arguments closely. Peirce was undoubtedly more familiar than James with the statistical arguments of the physicists. Peirce's main attack was on the idea of logical and necessary truths about the physical world. Peirce was the strongest philosophical voice for absolute and objective chance since Epicurus. For Peirce, **chance** was ontological and real, not epistemic and merely human ignorance.

Peirce argued that chance liberated the will from determinism, but he gave no definite model, and in the end he compromised and wanted to manage and control the chance with a form of rationality that he called "synechism" or continuity. He dreamed of "evolutionary love" and a God who kept the chance in Darwin's "greedy" evolution in check.

Although Peirce is famous for promoting the reality of chance with his Tychism, his overall opinion of the role of chance was negative. We shall see that it is William James who in the end found a measured and constructive role for chance in his attempt to defend freedom of the will. Where Peirce saw chance as a negative force, James, like Darwin, saw it as a positive and creative one.

About the same time Darwin was introducing chance into biological evolution, James Clerk Maxwell and Ludwig Boltzmann were applying the ideas of probability and statistics to a model of gases as untold numbers of particles, the atoms of the ancients Democritus and Epicurus.

Social scientists like the mathematician Joseph Fourier in France, the astronomer Adolph Quételet in Belgium, and the historian Henry Thomas Buckle in England applied the calculus of probabilities to the statistics of social phenomena like marriages and suicides. They found regularities scattered about mean values (often following the bell curve of a normal distributions). The mean values seemed constant from year to year. They concluded that these regularities were proof of rigorous, though unknown, laws controlling chance.

Scientists like Maxwell and Boltzmann, inspired by the collective properties of many random social events, showed that the same distribution applied to physical properties, like the velocities of individual particles in a gas. (The word "gas" was coined from the "chaos" of the particles.) Unlike the social scientists, Maxwell and Boltzmann did not assume that the gross regularities meant the constituent particles were determined by unknown laws.

Instead, they had shown that trillions of trillions of trillions of atoms moving randomly average out to produce the regular laws

of large bodies. Deterministic classical mechanics became indeterminate statistical mechanics. Once the microscopic world was found in the 20th century to include quantum indeterminacy, the regular laws of nature for macroscopic systems were seen to be irreducibly statistical laws. Nature is fundamentally stochastic. But how do we reconcile such indeterminate chaos with the regularities of nature and the rational operations of the human mind?

Contemporaries of Epicurus would have been appalled by these developments. The Stoic Chrysippus wrote:

> "Everything that happens is followed by something else which depends on it by causal necessity. Likewise, everything that happens is preceded by something with which it is causally connected. For nothing exists or has come into being in the cosmos without a cause. The universe will be disrupted and disintegrate into pieces and cease to be a unity functioning as a single system, if any uncaused movement is introduced into it."

This perfect causal necessity of Chrysippus is still the ideal of many philosophers today. Although they no longer think they can *prove* Laplacian determinism, sobered by the indeterminacy of quantum physics, they reserve judgment and call themselves agnostics on determinism.

The disruption and disintegration of the universe predicted by Chrysippus if atoms were to swerve randomly was in some ways realized by the discovery of the second law of thermodynamics in the mid-19th century. The confirmation of the ancient idea that matter, and chaotic gases in particular, is made of atoms forever swerving, looks in many ways like a universe disintegrating.

Boltzmann's statistical mechanics explained how probabilistic processes would lead to the rise of entropy. Orderly systems would run down into disorder. Information would be lost.

The deep challenge for information philosophy is to explain the emergence and maintenance of so many rich macroscopic information structures when the microscopic world is as utterly chaotic as Chrysippus could have possibly imagined.

About Information Philosophy and Physics

By information we mean a quantity that can be understood mathematically and physically. It corresponds to the common-sense meaning of information, in the sense of communicating or informing. It is like the information stored in books and computers. But it also measures the information in any physical object, like a recipe, blueprint, or production process, as well as the information in biological systems, including the genetic code, the cell structures, and the developmental learning of the phenotype.

> Information is mathematically the opposite of entropy. It is sometimes called negative entropy. The same formula is used for the quantity of entropy or information.
>
> $$S = k\Sigma\, p_n \log p_n.$$
>
> where k is Boltzmann's constant, p_n is the probability of the state n, and the summation is over all states.

It is of the deepest philosophical significance that information is based on the mathematics of probability. If all outcomes were certain, there would be no "surprises" in the universe. Information would be conserved and a universal constant, as some mathematicians mistakenly believe. Information philosophy requires the ontological uncertainty and probabilistic outcomes of modern quantum physics to produce new information.

But at the same time, without the extraordinary stability of quantized information structures over cosmological time scales, life and the universe we know would not be possible. Quantum mechanics reveals the architecture of the universe to be discrete rather than continuous, to be digital rather than analog.

Creation of information structures means that in parts of the universe the local entropy is actually going down. Creation of a low-entropy system is always accompanied by radiation of energy

and entropy away from the local structure to distant parts of the universe, into the night sky for example.

From Newton's time to the start of the 19th century, the Laplacian view coincided with the notion of the divine foreknowledge of an omniscient God. On this view, complete, perfect and constant information exists at all times that describes the designed evolution of the universe and of the creatures inhabiting the world.

In this God's-eye view, information is a constant of nature. Some mathematicians today argue that information must be a conserved quantity, like matter and energy.

We represent this picture of constant information in Figure 1-1.

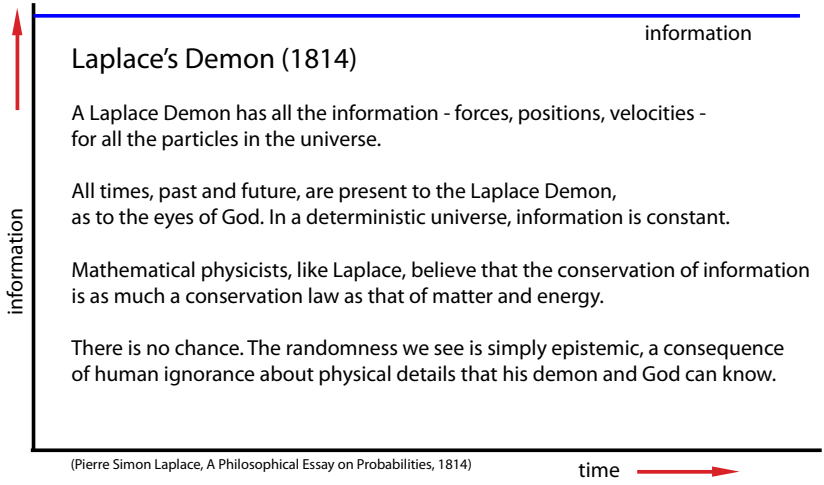


Figure 1-1. For a Laplace demon, information is a constant of nature.

If information were a universal constant, there would be "nothing new under the sun." Every past and future event can in principle be known by the super-intelligent demon of Pierre Simon Laplace, with its access to such a fixed totality of information.

But midway through the 19th century, Lord Kelvin (William Thomson) realized that the newly discovered second law of thermodynamics required that information could not be constant, but would be destroyed as the entropy (disorder) increased. Hermann Helmholtz described this as the "heat death" of the universe.

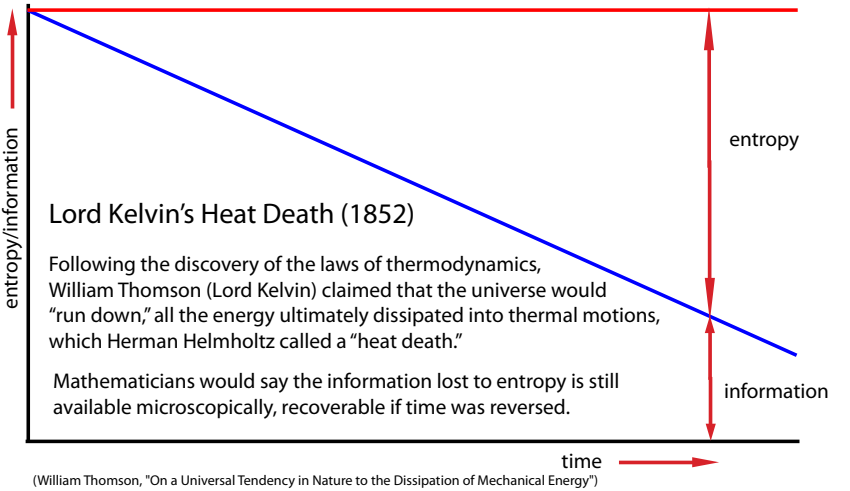


Figure 1-2. The second law requires information to decrease in a closed system.

Mathematicians who are convinced that information is always conserved argue that macroscopic order is disappearing into microscopic order, but the information could in principle be recovered, if time could only be reversed.

This raises the possibility of some connection between the increasing entropy and what Arthur Stanley Eddington called "Time's Arrow." [1]

Kelvin's claim that information must be destroyed when entropy increases would be correct if the universe were a closed system. But in our open and expanding universe, my Harvard colleague David Layzer showed that the maximum possible entropy is increasing faster than the actual entropy. The difference between maximum possible entropy and the current entropy is called negative entropy, opening the possibility for complex and stable information structures to develop.[2]

In Figure 1-3, we see that it is not only entropy that increases in the direction of the arrow of time, but also the information content of the universe.

1 www.informationphilosopher.com/problems/arrow_of_time/

2 Roger Penrose described this as 'standard." Penrose (1989) p. 328-9

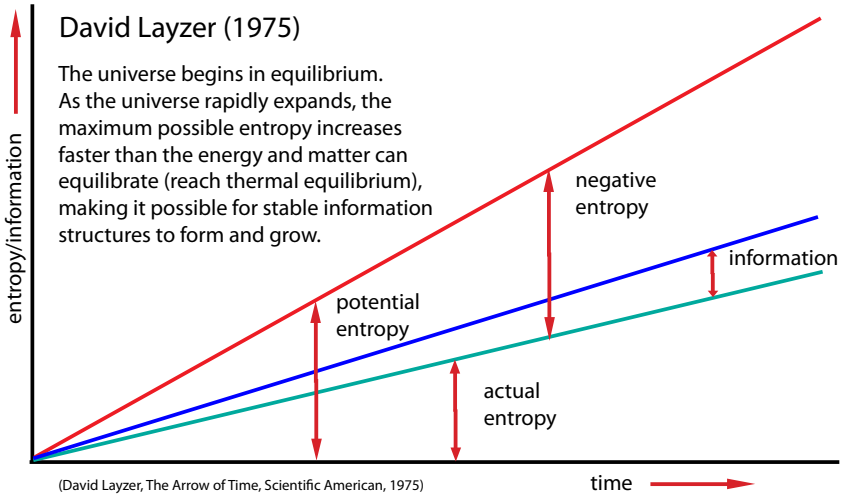
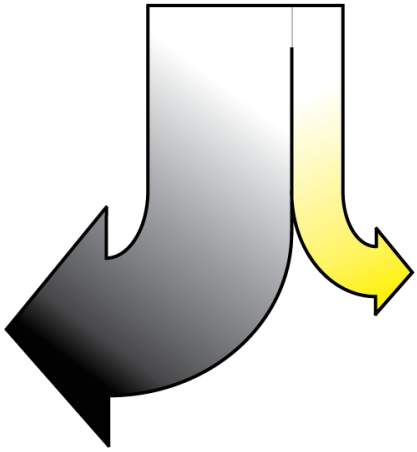


Figure 1-3. Information increases as entropy increases in our universe.

Despite the second law of thermodynamics, stable and lawlike information structures evolved out of the chaos. First, quantum processes formed microscopic particulate matter – quarks, baryons, nuclei, and electrons. Eventually these became atoms,. Later, under the influence of gravitation – macroscopic galaxies, stars, and planets form. Every new information structure reduces the entropy locally, so the second law requires an equal (or generally much greater) amount of entropy to be carried away. Without the expansion of the universe, this would be impossible.



The positive entropy carried away (the big dark arrow on the left) is always greater than and generally orders of magnitude larger than the negative entropy in the created information structure (the smaller light arrow on the right). See Chapter 30 for more details.

Figure 1-4. Entropy/Information Flows

The Two-Step Cosmic Creation Process

Every material object created since the origin of the universe has involved two physical steps, first quantum events that form structures, then thermodynamical energy/entropy flows away from the structures so they can be stable.

The first step is the collapse of a probability-amplitude wave function.[3] Wave-function collapses are usually associated with measurements. Measurements produce new **information**. So the new structure is in some sense "measuring itself."

In the second step, binding energy of the new structure must be radiated, conducted, or convected away, carrying some positive entropy, or the new structure will be destroyed. In a closed box, thermal equilibrium will destroy any new information structure.

These two steps are found in all creative processes, from elementary particles to ideas in our minds.

With the emergence of teleonomic (purposive) information in self-replicating systems, the same two-step core process underlies all biological creation. But in biology some information structures are rejected by purposive natural selection, while others reproduce and maintain their low entropy states.

Finally, with the emergence of self-aware organisms and the creation of extra-biological information, the same process underlies communication, **consciousness**, **free will**, and **creativity**.

By creation we mean the coming into existence of recognizable information structures from a prior chaotic state in which there was no recognizable order or information.

Creation of information structures means that today there is more information or order in the universe than there was at any earlier time. Of course there is also more entropy or disorder, as Layzer's picture (Figure 1-3) and entropy flows (Figure 1-4) shows.

This fact of increasing information describes very well an undetermined universe with an open future that is still creating itself. In this universe, stars are still forming, biological systems are

3 informationphilosopher.com/solutions/experiments/wave-function_collapse.

creating new species, and intelligent human beings are co-creators of the world we live in.

All this creation is the result of the one core creative process. Understanding this process is as close as we are likely to come to understanding the creator of the universe, a still-present divine providence, the cosmic source of everything good and evil.

The creative ideas of individual human beings are a miniscule part of the cosmic information, but they can have enormous impact. And William James has a message we need young people to hear. As momentous as our ideas are, the neuroscientists will never see them in our brain scans.

> "Although such quickening of one idea might be morally and historically momentous, if considered dynamically, it would be an operation amongst those physiological infinitesimals which calculation must forever neglect." [4]

Information and Predictability

The future is now unpredictable for *two* basic reasons.

First, quantum mechanics has shown that some events are not predictable. The world is causal, but not **pre-determined**.

But second, and this is new and philosophically significant, the early universe does not contain the **information** of later times, just as early primates do not contain the information structures for intelligence and verbal communication that humans do, and infants do not contain the knowledge and remembered experience they will have as adults.

This second reason for unpredictability means that complete information or knowledge about our choices does not exist in the human brain/mind until the will has actually made a decision.[5]

In this simple fact lies human freedom.

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4 James (2007) vol.2, ch.XXVI, p. 576

5 Thus the Frankfurt-style cases of an intervening demon (discussed in Chapter 7) are complete nonsense, as first noted by Robert Kane (1985) *fn*, p. 51