5. Integrating the Nature and Meaning of Information

Symbolic information, with symbols, media, and interpretational infrastructure, is the fundamental concept of information for the life sciences, social sciences, cultural studies, and information technology. The symbols are states created in physical media by living entities for processes of perception, memory, communication, or planning. The use of symbols requires an interpretational infrastructure that encodes and decodes consistent, shared meanings for the symbols. Symbolic information is the basis for living entities to reproduce, to develop, to interact with their environments, and to evolve.

On the other hand, the concept of information typically used in physics is based on *physical information* that is a descriptive property of the distribution of matter and energy. Physical information is conceptually related to entropy in physics and does not consider whether different physical states have meaning for living beings or were created by living entities for use as symbols.

The failure to distinguish between symbolic information and physical information often results in ambiguous, misleading concepts that (a) imply nonliving processes have properties of life, (b) undervalue the essential role of interpretation for symbolic information, and (c) do not recognize the creative potential for symbolic information processing.

5.1 Information and Life

Symbolic information processing is the foundation for biological, psychological, social, technical, and cultural processes. Life consists of many layers of symbolic information processing, including genetics, perception, behavior, memory, learning, communication, imagination, creativity, technology, and culture. Symbolic information allows living entities to generate variability, adaptability, and creativity from the fixed, relatively deterministic forces of physics.

One of the most obvious empirical facts throughout all the life sciences is that evolution produces increasing layers of symbolic information processing. Once the basic information processing to support evolution was in place, the evolution of enhanced information processing abilities could be expected, and creativity and culture may have been inevitable. However, the origin of the information processing needed to support evolution remains a profound mystery.

An information processing entity does not exist in isolation. Interactions among many different entities, components, and layers of information processing are an intrinsic part of the

processes for setting the symbols in media to encode a message and subsequently interpreting the meaning of the symbols.

Recognizing the components of information as symbols, media, and interpretational infrastructure clarifies the relationship between information and matter. The symbols and interpretational infrastructure of information can provide meaning, value, and effects that are far beyond the physical properties of the media. The leap from matter to information via symbols and interpretational infrastructure creates a basic dualism.

The meaning of symbols has a different nature and different properties than the physical media that hold the symbols. The subjective impression that our thoughts are more than the matter in the brain is correct. At the same time, if the media are damaged, information processing is also damaged. The brain serves as media for many layers of information processing, and different layers of information processing serve as the interpretational infrastructure for other layers.

The controversies about human consciousness (see e.g., Donald, 2001) may result from differing emphasis on physical media versus symbolic functioning. Those drawn to deterministic materialism may focus more on the physical media of the brain, whereas others may focus more on the virtually unlimited degrees of freedom and creativity of the symbols and interacting layers of interpretational infrastructures. It appears to this writer that human consciousness, including self-awareness, imagination, creativity, and unconscious processes, is an expected evolutionary step resulting from the basic information processing capabilities of life.

5.2 Information in Physics

Quantitative information theory as utilized in physics and engineering tends to promote the dubious implication that any situation where uncertainty or probability is involved has information processing capabilities similar to living systems. These mathematical models are based on probability and do not consider whether the different states are actually symbols with meaning and an interpretational infrastructure. The failure to distinguish between symbolic information and physical information generally confuses rather than clarifies the relationship between matter and information, and obscures the profound mystery of the creation of life.

The pivotal concept of which-path information in quantum physics has been described in terms of the environment serving as media for symbolic representation of the state of a system. The emerging evidence indicates that this is an example of ambiguous terminology and concepts. The effects attributed to which-path information are increasingly recognized as due to quantum entanglement rather than to symbolic representation registered in media.

One model that appears consistent with the emerging findings is that quantum superpositions endlessly shift to higher order interactions as particles interact, and the classical world emerges behind this moving front of increasingly complex entanglement. The outcome that becomes manifest may be determined by the state of quantum fluctuations when an outcome inducing interaction occurs. Clarification of vague, ambiguous concepts for information may be an important step for achieving better understanding of quantum physics.

5.3 Information and Nonliving Systems

All currently known symbolic information-processing systems are a function of life. I find it impossible at present to conceive of symbolic information processing that is not ultimately a function of living systems. This situation makes the origin of life a profound mystery and may indicate that fundamental properties of the universe remain to be discovered.

Hypotheses in quantum physics that imply symbolic information processing appear to assume dimensions of life that are beyond current scientific understanding. Such speculations have significant implications for spirituality and religion as well as for science, and require tangible empirical evidence. Any speculations about symbolic information being a fundamental part of nonliving processes must address these important implications.

References

Donald, M. (2001). *A Mind So Rare: The Evolution of Human Consciousness*. New York: Norton.

Previous Section: 4. The Nature and Meaning of Information in Quantum Physics

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