

data are not transmitted incorrectly, which is expensive both in time and cost.

In 1948, Shannon published what came to be the defining paper of communication theory. In this paper he investigated how noise imposes a fundamental limit on the rate at which data can be transmitted down a channel. Early in his paper he wrote:

The fundamental problem of communication is that of reproducing at one point either exactly or approximately a message selected at another point. Frequently the messages have *meaning*; that is they refer to or are correlated according to some system with certain physical or conceptual entities. These semantic aspects of communication are irrelevant to the engineering problem. (p.379)

The irrelevance of meaning to communication is precisely the point that encoding and the transmission of information are not intrinsically connected. Shannon realized that if one wishes to transmit the binary sequence 0100110 down a channel, it is irrelevant what it means, not least because different encodings can make it mean almost anything. What matters is that what one intends to transmit—as a binary string—should arrive “exactly or approximately” at the other end as that same binary string. The assumption is that the encoding process that produces the binary string and the decoding process that regenerates the original message are known both to the transmitter and the receiver. Communication theory addresses the problems of ensuring that what is received is what was transmitted, to a good approximation.

See also INFORMATION; INFORMATION TECHNOLOGY

Bibliography

Shannon, Claude E. “A Mathematical Theory of Communication.” *The Bell System Technical Journal* 27 (1948): 379–423, 623–656.

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INTEGRATION

See also SCIENCE AND RELIGION, MODELS AND RELATIONS; SCIENCE AND RELIGION, METHODOLOGIES

INTELLIGENT DESIGN

Intelligent Design is the concept that some things—especially some life forms or parts of life forms—must have been assembled (at least for the first time) by the direct action of a non-natural agent. Proponents of Intelligent Design argue that there is empirical evidence that the universe’s system of natural capabilities for forming things is inadequate for assembling certain information-rich biological structures. And if the system of natural capabilities is inadequate, then these biological structures must have been assembled by the action of some non-natural agent, usually taken to be divine.

See also CREATION; CREATIONISM; CREATION SCIENCE; DESIGN; EVOLUTION; SCOPES TRIAL.

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INTERNET

See INFORMATION TECHNOLOGY

ISLAM

Six centuries after Jesus Christ, the religion of Islam was born in Arabia. By the beginning of the twenty-first century, Muslims, as its followers have always called themselves, number more than 1.2 billion worldwide.

According to Muslim tradition, in 611 C.E. at the age of forty, Muhammad of Mecca received a revelation from God during a spiritual retreat in a cave on Mount Hira outside the city. God’s special envoy who brought the message was the archangel Gabriel. At Gabriel’s instruction, the illiterate Muhammad recited five short verses that portrayed the spirit of the new religion. In this first revelation, Muhammad—thus by extension all humans—is called upon to know the unknown in the name of God, whose nature is to create things. Humans are then reminded of how, from their lowly animal origin, they became thinking and knowing creatures thanks to God’s generous gifts of instruments of knowledge that are best symbolized by the pen. Knowledge is the supreme symbol of