Chapter 49
Effectively Communicating With Group Decision Support Systems Using Information Theory

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ABSTRACT

This chapter describes the results from a case study using information theory to examine the effectiveness of communicating using group decision support system (GDSS) technology. At its most basic level, information theory provides the means to measure the efficiency of communication systems. Using information theory as the theoretical foundation, this chapter examines how the use of GDSS facilitated computer-mediated communication (CMC) for one particular business with respect to entropy, redundancy, and noise, which are key components in information theory.

INTRODUCTION

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BACKGROUND

As originally articulated, information theory is actually a mathematical theory grounded in the field of electrical engineering designed to evaluate the performance of communication systems (Mahowald, Fedorenko, Piantadosi, & Gibson, 2013; Ziemer & Tranter, 2002). Claude Shannon was an electrical engineer and mathematician working at Bell Laboratories in the 1940's. In 1948 he published his landmark paper, "A Mathematical Theory of Communication" (Shannon, 1948). This seminal work was concerned with the transmission and storage of information (Lafrance, 1990), and provided "the analytical tools to evaluate the amount of information contained in message signals, and to compare the performance of actual systems" (Carne, 1999, p. 172). According to Gallager (2001), Shannon's theory established a conceptual basis for modern digital communications, particularly with regard to data compression, data encryption, and data correction (Gappmair, 1999).

Information theory has been applied to many disparate disciplines, such as computer science, statistics, cybernetics, physiology, psychology, library science, biology, physics, economics, music, and art (Asadi, 2015; Dahling, 1962; DeFleur & Larsen, 1987; Overstreet, 1984; Pierce, 1980). In the field of communication, information theory has been applied to such areas as speech, linguistics, forensics, broadcasting, journalism, and even animal communication as studied by animal scientists (McCowan, Doyle, & Hanser, 2002; Scott-Phillips, 2015; Stephens, Barrett, & Mahometa, 2013; Watt & Krull, 1974).

There is some disagreement among scholars as to the applicability of information theory to the field of communication, in the non-technical, non-engineering sense (Cherry, 1957; Devlin, 1999; Weaver & Weaver, 1965; Young, 1987). Shannon himself initially cautioned against applying his theory to human communication (Haken & Portugali, 2015, p. 33; Rogers & Valente, 1993). But Shannon, in conjunction with Warren Weaver, did express some "optimism as to its wider applicability" (Warner, 2001, p. 24). In subsequent years other communication scholars have also explored more general applications of information theory (Pierce, 1980; Rogers & Valente, 1993). Indeed, Shannon's simple yet elegant model of communication systems forms the basis of many introductory communication courses.

At its most basic level, information theory provides the means to measure the efficiency of communication systems. An information source sends a message (of any type) using a transmitter that carries a signal through a channel. The receiver then receives that signal, and the message arrives at its destination. There are additional factors, however, impacting the effective operation of that process, including entropy, redundancy, and noise.

Entropy, as defined by information theory, is concerned with the many different ways a message can be constructed, depending on the circumstance. An ambiguous or vague message, for example, has a high degree of entropy because the receiver cannot accurately interpret the message that the sender intended, and there is a measure of uncertainty and unpredictability regarding the message (Heath & Bryant, 2000). A message that is clear and concise will reduce the amount of entropy in a given situation.

Redundancy also reduces entropy. The more the same information is conveyed in a particular message, the more certain the receiver is of the interpretation of the message as the sender originally intended. There must be a balance of entropy and redundancy in an effective communication, but that balance is often impacted by the amount of noise present in the channel used to convey the message (Severin & Tankard, 2001).

Noise is simply some sort of interference that occurs in the transmission of the message between sender and receiver (Perry, 2002). Noise can take many forms, including extraneous information that causes a loss of intended information. The noisier the channel, the greater the need for redundancy (Cragan &

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