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A HISTORICAL PERSPECTIVE ON THE PHILOSOPHICAL FOUNDATIONS OF INFORMATION SYSTEMS

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INTRODUCTION: The rapid growth in the capabilities of computer based information systems (CBIS) and their

deployment in organizations has prevented the development of a coherent philosophical perspective and a logical foundation

for their intellectual justification. Since CBIS analysis and design methods have relied heavily upon traditional scientific

and engineering paradigms of problem solving, information systems (IS) practitioners have an inadequate appreciation of

the philosophical foundations of this discipline. There is also a growing awareness that the "scientific" method is

fundamentally inadequate to solve the complex problems of organizations encompassing numerous social, technological,

psychological and economic dimensions. An increasing volume of practical and academic discourse on CBIS is making

the need for a philosophical understanding of the subject more apparent for enunciating its basic principles, furnishing a

common basis for the interpretation of discourse, and providing the rules of logic to examine the validity of discourse. An

incipient discipline like IS can use its epistemological and philosophical foundations to provide the intellectual justification

for its practice, methodologies, tools, and techniques. The lack of an appropriate philosophical perspective tends to create

a "technology driven" IS design which ignores the emergent human dimensions in organizations. This article discusses the

philosophical and historical aspects of IS concepts and suggests a new information systems architecture based on the

framework of general systems theory and classical Greco-Roman architecture.

A COMPARISON OF SCIENTIFIC AND SYSTEMS WORLD-VIEWS: The two prevailing approaches to information systems design, "traditional scientific", and "systems", have fundamentally different assumptions about organizational

reality. The systems world-view assumes a holistic focus, teleological purpose, synergistic/multiway interactions, dynamic

organization, open environment, synthetic solutions, proactive response, internal stimuli, and external consequences. The

traditional scientific view of organizations is characterized by elemental focus, functional purpose, liner/causal interactions,

static organization, closed environment, analytical solutions, reactive response, external stimuli, and deterministic

consequences. The holistic perspective requires a simultaneous understanding of the environmental, organizational,

technological, and human dimensions of the system. Teleology implies that systems possess an ostensible "purposefulness"

inherent in their behavioral properties and design. Teleological activity demonstrates the presence of sensitivity and

persistence while non-teleological activity is merely "functional." The scientific view, on the contrary, assumes that systems

follow a predefined set of rules to achieve their objectives which are externally determined. Synergistic interactions generate

an immensely greater effect than the sum of the individual effects. Aristotle's dictum, "The whole is more than the sum of

its parts," expresses the essence of this property of systems. The systems view recommends synthetic solutions to complex

problems while the scientific view, based on empirical observation, methodical analysis, and laboratory techniques,

emphasizes the analytical approach. The planning responses generated by organizations, in scientific approach, are

essentially reactive since the stimuli are assumed to be external. On the other hand, the systems view encourages proactive

planning responses in organizations.

THE PHILOSOPHICAL FOUNDATIONS OF THE "SCIENTIFIC" WORLD-VIEW: Since the 18th century, the

prevailing paradigm of scientific inquiry has been the "analytical," "mechanistic," or "reductionist" approach. The three pillars of the foundation of the scientific method are Cartesian philosophy, Newtonian physics, and the Baconian method.

Ren, Descartes, a famous French philosopher of the 17th century, laid the foundations of the conventional scientific view

of reality in his famous work Discourses on the Method. In the second part of this book Descartes expounds the four rules

of his scientific and logical inquiry into the nature of truth. These rules are: (i) doubt as the inspiration to investigate the

truth, (ii) dividing up problems into manageable components, (iii) bottom up understanding - from the simplest and smallest

to the most complex and the whole, and (iv) complete enumeration and review of the problem. In part IV of this book,

he posits his most famous dictum cogito ergo sum (I think therefore I am). By thus emphasizing the primacy of the mind

over body he reduced the human body to a mere mechanical organism to which the mind, or the soul, connects at the pineal

gland. According to the prevailing belief, this single observation has done more to create the perception of duality between

mind and body than any other philosophic formulation of the western world. This dichotomy leads to the pervasive

scientific argument that reality is a collection of discreet components associated with linear causal relationships based on

mechanistic principles. The mechanistic view of Descartes, defining the human body and the cosmos, also extends to

organizations, societies and the smaller systems operating within them, in the realm of conventional scientific practice.

Francis Bacon proposed a new method of scientific inquiry in his seminal works Novum Organum and De Arguments

Scientiarum, and argued for collection of large amounts of data through experiments and observations, and a judicious

interpretation of this data to discover the patterns, laws, and secrets of nature. The argument was primarily for the

"empirical" method of observation which precludes any active involvement of the observer's subjective understanding, intuition or imagination in the inquiry. Similarly, Newtonian or classical mechanics is inextricably linked with mechanistic

models of nature and organizations. With his three laws of motion and the conception of gravity, proposed in Philosophiae

Naturalis Principia Mathematica in 1687, Newton provided a purely mechanistic explanation of all movement in the

universe based on linear and causal relationships. Despite his argument in the General Scholium that these principles can

also apply to metaphysical hypotheses, it is widely believed that the most conspicuous organizational shortcoming of

Newtonian physics is that it provides extremely narrow and simple explanations of inherently complex phenomenon.

Newton's ideas constitute the third pillar in the foundation of the scientific world view.

THE PHILOSOPHICAL FOUNDATIONS OF THE "SYSTEMS" WORLD-VIEW: The protagonists of the systems

theory of organizations trace the origins of this approach to the works of numerous philosophers from ancient Greece to

modern Europe. Pythagoras, Anaxagoras, and Parmenides are credited with the discovery of the teleological movement

of the cosmos, and Socrates is identified with "synergy" as an integral property of systems. Hegel's dialectical materialism

and the suggestion that thesis, antithesis, and synthesis are the fundamental forces behind human progress, with Theodore

Fechner's formulations on psychophysical systems are also considered the foundation stones of systems thinking. In the

contemporary systems context, the prolific writings of Ludwig von Bertalanffy on "General Systems Theory" comprise the

nucleus of the systems discipline. Bertalanffy, exposed the glaring weaknesses of the "mechanistic" approach as applied

to the behavior of living organisms and complex organizations. He believed that complex organisms and organizations

display intricate patterns of behavior, synergistic interactions, and innate purpose. Consequently, the mechanistic view that

organisms are mere automatons with randomly determined goals without discernible design and purpose cannot adequately explain their phenomenology. He viewed organisms as "whole" entities whose distinctive characteristics and organizing

principles cannot be reduced to simple and isolated components. These speculations were the precursor of the modern

systems theory which is considered the philosophical infrastructure of information systems. Bertalanffy's claims were

considered preposterous by some skeptics in the early stages of the development of the systems theory but his ideas have

become widely accepted since the early 1960's. The growth of computer and communications technologies and the

complexities of developing software for these systems have made the theory extremely relevant to the discipline of

information systems. It is widely accepted by information systems professionals that organizations and information systems

must be viewed as open, dynamic, and purposeful systems for effective development and deployment of information and

communications technologies. Recent studies of the characteristics of "conscious" systems have also demonstrated the

relevance of Bertalanffy's ideas to living systems. It has been found that conscious systems cannot be reduced to

phenomenology of matter-distribution and energy-flux in space and time. Their interrelationships and the existential holistic

dimension play a pivotal role in defining their organization and autonomy. Gestalt psychology, practiced and popularized

by three German psychologists, Kurt Koffka, Wolfgang Kohler, and Max Wertheimer in the early part of the 20th century,

emerged from their experimental investigations in psychology, logic and epistemology. The school of gestalt psychology

has also made a remarkable contribution to the development of the systems theory and practice by arguing against the

"simple dichotomy of science and life." Gestalten, a German language term, means "pattern" or "configuration" and gestalt

psychologists believe that perceived visual patterns demonstrate unexpectedly arising properties that are drastically different from their static images. Gestalt psychologists also believe that both the organization of the nervous system and the images

projected on the retina play an indispensable role in the visualization of objects. Again, this holistic view of psychology,

diametrically opposite to the analytical and fragmented view of traditional psychology, is essentially a "systems" view of

psychology. Wertheimer performed elegant experiments on the perception of movement and organization of perception,

and Kohler studied insight and learning in apes. In addition to the experimental proofs of the presence of a holistic

perspective in the mind, the gestalt psychologists also proposed the "systems" philosophy of the mind. According to Gestalt,

the brain is primarily an open and dynamic system possessing a natural tendency towards achieving an equilibrium of

energy. This suggestion is very similar to the prevailing theoretical assumptions of strategic level organizational information

systems based on artificial intelligence. Due to these similarities, the ideas of gestalt psychology are now being utilized

in neural networks and artificial intelligence, and modern cognitive psychology is considered extremely close to gestalt

psychology. The third pillar of the systems discipline is "cybernetics," a term coined in 1947 by the famous mathematician

Norbert Wiener at MIT from the Greek word kybernetike which was, in turn, used by Plato to mean "helmsmanship". The

theory of cybernetics is explained in Norbert Wiener's well-known work, Cybernetics, or Control and Communication in

the Animal and the Machine and it is now widely used to study the problems of signal processing, information transfer,

artificial intelligence, servo mechanisms, and even linguistics. Cybernetics is "essentially an attempt to bring together and

reexamine lines of research that had formerly been pursued in isolation." The synthetic techniques of cybernetics can be

eventually applied to the analytical problems in specific disciplines. In cybernetics, the terms "control and communication" have a much broader meaning. Control implies the influence exerted by the components of a system upon one another and

communication is considered an essential property of the internal relationships of an organization. Complex information

systems are very similar to servo mechanisms since both are characterized by a high degree of interaction among their

components, equilibrium seeking and goal directed behavior, networks of relationships, and "feedback" as the fundamental

means of control. Cybernetics, therefore, remains highly germane to computer based information systems, although it was

initially conceptualized for industrial control. It is believed that the motivation for cybernetics came from the work of James

Clark Maxwell on governors for different types of machinery. These ideas were further elucidated, in connection with

building architecture, by Jaque Lafitte, a French architect, who explained the operation of more complex forms of machines

in which the sources of energy and sources of information are very closely associated. Modern computer based information

systems are a perfect example of these mechanisms. Due to this connection with architecture, I discuss, in the following

section of this article, how the ancient ideas of a famous architect of the classical age can be applied to the formulation of

a comprehensive management information systems architecture in organizations.

VITRUVIUS AND THE ARCHITECTURE OF INFORMATION SYSTEMS: Systems philosophy is extremely

relevant to the principles, planning, architecture and design of CBIS in organizations. The "systems" architecture was most

successfully used in history by the Roman empire for its sophisticated communications and transportation infrastructure,

and monumental construction. Perhaps the oldest known treatise on architecture is by Marcus Vitruvius, the Roman

architect of the 1st century B.C. who designed roads, viaducts, and state buildings for Julius Caesar and Augustus Caesar.

Vitruvius required all architects to be philosophers and argued that philosophy will improve the purpose of architecture while science improves its means and instrumentalities. A successful architecture of information systems in organizations

requires this broad based approach. In his famous book De architectura, Vitruvius takes a systems view of architecture

emphasizing the harmony of its three dimensions: FERMITAS (strength), UTILITAS (utility), and VENUSTAS (aesthetics).

The concepts behind the majestic simplicity and stability of Greco-Roman architecture can be employed to construct stable,

effective, and aesthetically pleasing information systems. FERMITAS of information systems comes from (a) computer and

communications technology platforms, (b) deployment of information technology at strategic points in the organization, (c)

sound systems, procedures and personnel, (d) reliable applications software, and (e) robust information infrastructure.

UTILITAS is obtained from (a) organizational efficiency, effectiveness, and innovation, (b) competitive advantage and

competitive response, (c) group work coordination, and (d) organizational and individual learning. VENUSTAS of CBIS,

can be derived from (a) user friendly systems, (b) ergonomic technology, (c) graphical user interfaces, and (d) information

policy conducive to individual freedom and organizational flexibility - ethics, security and privacy.

CONCLUSION: A glaring deficiency of paradigmatic thinking is raising some serious questions about the raison d'ˆtre

of Information Systems discipline in the academic circles. Although the eclectic nature of this discipline is widely

recognized, the sources of its tradition remain obscure. The identification of its philosophical roots in natural sciences,

psychology, history and other academic areas can enhance the prestige of this discipline and clear some of the confusion

prevailing about its boundaries, sources, structure, and traditions. This paper represents a step in this direction. The

interdisciplinary perspective of this paper extends the frontiers of information systems research and imparts greater relevance

to the proliferating tools and techniques of the CBIS trade.

REFERENCES:

Available upon request from the author.