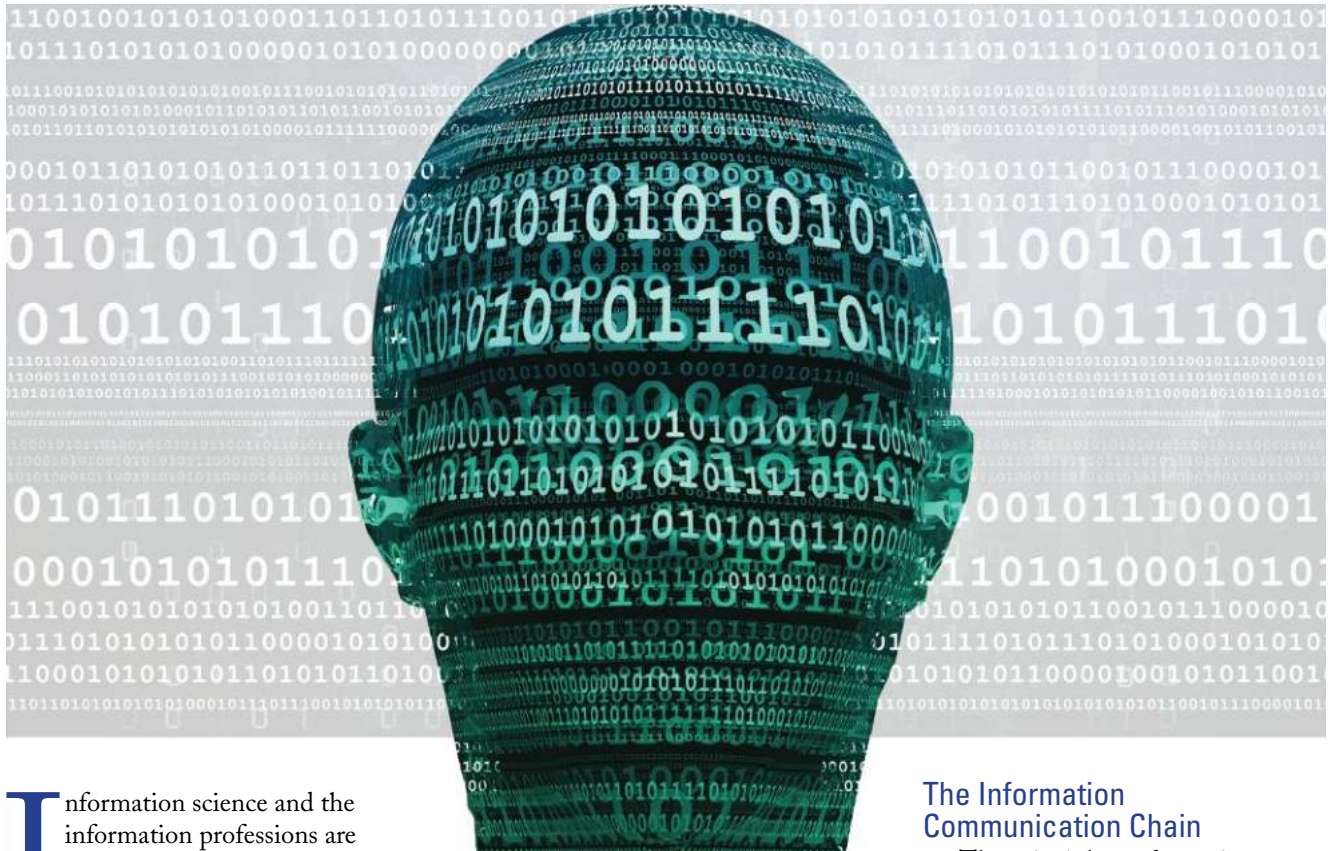A Conceptual Framework for

UNDERSTANDING INFORMATION

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Information science and the information professions are specifically concerned with the information communication chain, including its creation, generation, production, collection, organization, management, interpretation, analysis, storage, retrieval, dissemination, transmission, transformation, and use.

But what is information? What does it look like? What is it composed of? Where, how, and why does it exist? What is the basis of the information science discipline and the professions based on information?

Even those who are studying, working with, or otherwise using information have different definitions of it; further, their understanding of information is often confused or incomplete. These are significant gaps that should be bridged to help develop some common ground in understanding this "thing" called information.

This article is meant to bridge those gaps by focusing on what makes something "information." It refers often to Michael Buckland's framework – *information as process, knowledge, and thing* – to help explain the phenomenon of information. The goal is to help equip information professionals to better explain their focus and work.

The Information Communication Chain

The principles and practices of information management are inherently enmeshed with many kinds and formats of information. As David Bawden and Lyn Robinson write in *Introduction to Information Science*, the discipline and practices of information "can best be understood as a field of study [and work], with human recorded information as its concern, focusing on the components of the [information] communication chain."

While other and related disciplines and professions may deal with some aspects of this complex chain, it is the information science discipline and the information professions

(such as information management) that are interested in and work with this chain in its entirety.

This interest in the entire information communication chain poses three fundamental questions that information scholars and professionals seek to answer:

1. What are the characteristics, components, and features of information? This is about information's *materiality*.
2. How and why do individuals organize, manage, locate, retrieve, understand, and use information? This is about information's *sociocultural dimensions*.
3. How is information presented, formatted, and displayed, and how can it be designed to maximize efficiency and efficacy? The is about information's *design*.

Though the answers to these three questions provide some understanding of the "things" that are considered or treated as information, they do not on their own adequately answer the question "What is information?"

A Framework for Common Ground

Can or should there be a universal definition or understanding of information? Claude Shannon, one of the founders of information theory and author of *Mathematical Theory of Communication*, did not believe in or appeal to universality. He wrote:

The word 'information' has been given different meanings by various writers in the general field of information theory. It is likely that at least a number of these will prove sufficiently useful in certain applications to deserve further study and permanent recognition. [But] it is hardly to be expected that a single concept of information would satisfactorily account for the numerous possible applications of this general field.

Information: A Flexible, Polysemantic Concept

Information is an 47 in the ambiguous concept. It:
- Can be in many forms and have many applications, meanings, and uses
- Can be defined in diverse ways, depending on the approach, perspective, and criteria adopted
- Has competing, contested, and complementary definitions employed in different contexts (e.g., everyday human experience; sociocultural interactions; institutional governance and operations; and statistical, systems, and technical analyses)
- Can be different types with different definitions (e.g., semantic, syntactic, structural, factual, mathematical, physical, biological, cultural, economic, ethical)
- Can be objective or subjective, depending on the context, the approach followed, the definition adopted, and the kind in use
- Can be considered and treated as a material, physical, concrete substance or understood as an abstract property or metaphor
- Can be seen as a naturally occurring phenomenon whose existence is not (necessarily) the result of human action or a human-made artifact
- Can be a part of nature or reality whose identity does not depend on its being identified or used for human activities, or it can be part of a sociocultural construct used for human activities

Can be without meaning and not depending on human interpretation or use, or it can be something whose meanings are constructed, interpreted, or applied by some kind of interpreter (e.g., human, machine, algorithm)

Information's content is also multifaceted. In "What is Information? A Multidimensional Concern," Dias Nafria argues for separating information concepts according to each one's properties.

The first property is the *syntactical content of information* (how it is expressed) where "messages that…[comply] with all syntactic requirements" are treated as informative even if "false, incorrect, useless, [or] redundant."

The second property is the *semantic content of information* (what it represents and what its truth value is) "whereby the signals or symbols considered by the MTC [Claude Shannon's classic *Mathematical Theory of Communication*] are necessarily referred to something."

The third property is the *pragmatic content of information* (its utility value) "whereby information is [considered] the foundation for action, whether by intentional actors, living beings or automatic systems."

Information's flexible and polysemantic nature thus permits pluralistic interpretations and uses. Warren Weaver, a pioneer of information theory and computer science, provides a tripartite analysis of the main problems this raises. First is the *technical* problem, which concerns the quantification of information. Second is the *semantic* problem, which concerns meaning and truth. And, third is the *influential* problem, which concerns the impact and effectiveness of information on human behavior.

It is debatable if these three problems can or should be reconciled or taken together to simultaneously approach each angle. As Buckland argues in *Information and Society,* "any simple assertion in the form 'Information is…' has little meaning and encourages confusion unless it is made clear which of the meanings is intended." Context will determine which one is ultimately pursued.

In "Information as Thing," published in *Journal of the American Society for Information Science,* Michael Buckland provides a clearer framework for understanding information, as this article explains.

Perhaps a universal definition or understanding is not possible or even desirable. Nevertheless, Buckland's information framework provides a way to find common ground among many divergent perspectives, including those described in the sidebar "Information: A Flexible, Polysemantic Concept" – if not in definition, then in an approach.

Especially in information-intensive environments, actors of all kinds – such as humans, machines, and algorithms – are concerned and deal with documents, or information-as-things.

Information: Process, Knowledge, Thing

In "Information as Thing," which was published in *Journal of the American Society for Information Science* in June 1991, Buckland provides arguably one of the clearest, most foundational approaches on which to better understand information and to expand other such approaches. It therefore serves as a useful tool, providing both a point of departure for further analyses of information and a convergence point where divergent paths can meet. This framework distinguishes three main components or uses of information: as *process*, as *knowledge*, and as *thing*.

Information-as-process involves the alteration of an individual's knowledge state. It is the process of becoming informed. When people are informed, what they know is changed. Information is thus an act of informing: the action of telling, or of being told, something. This process, in other words, is the communication of knowledge.

Information-as-knowledge involves equating the information with the knowledge it imparts. Information and knowledge are, in many instances, closely related. The information that is communicated is consumed, perceived, and understood by individuals as knowledge, which simultaneously changes their knowledge state.

Information-as-thing involves information's materiality, usually associated with documents. Information becomes a synonym for document. It is manifested in and exists, or is contained, within some kind of material object such as bits, bytes, books, or other physical media. Information-as-thing applies to all kinds of tangible objects, particularly those that are considered and used as documents.

Indeed, information-as-thing is central to many activities and undertakings. Especially in information-intensive environments, actors of all kinds – such as humans, machines, and algorithms – are concerned and deal with documents, or information-as-things.

Buckland notes that this approach is particularly relevant for information science because both the discipline and its professions deal directly with information in the form of documents. He states that "the means provided, what is handled and operated upon, what is stored and retrieved, is physical information."

Information systems, for example, are directly concerned with information in this sense: libraries collect and manage books and other information resources; computer-based information systems generate, manage, and handle digital data; museums deal with diverse kinds of objects; and records and information centers steward information in its myriad forms and formats. What is created, handled, organized, managed, provided, accessed, retrieved, stored, preserved, and used is a type of information-as-thing.

When considering, explaining, and using any kind of information, a person should understand that, regardless of its kind, it is a *process* that changes a *knowledge* state using some *thing*. Put differently, when engaging with information in the form of an object, usually a document, one is in the process of changing a knowledge state (one's own or another's), and that information becomes a part of knowledge.

Information Illuminated

Information is central to the information science discipline, information professionals' work practices, and ultimately the world we live in. Buckland's framework of information as process, knowledge, and thing provides a clear direction in which to approach this concept and consequently to more fully inform work with and refine concentrations of information.

Approaching information with this framework helps illuminate what it is that is being created, generated, produced, collected, organized, managed, interpreted, analyzed, stored, retrieved, disseminated, transmitted, transformed, and used. Indeed, it helps illuminate the very thing – according to Buckland, information-as-thing – that is so central to information professionals' focus and practical work. Ⓔ

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