INFORMATION AS ABSTRACT

AN EXPLORATION OF THE CONCEPT OF INFORMATION

Alec Millman
LIS 4010 Organization of Information
Winter Quarter 2020
March 19

Abstract:
The nature of the definition of information has been long debated in the LIS field. An exploration of the application of the DIKW hierarchy reveals its widespread use across disciplines and thus the importance of a conceptual understanding of "information." Through review of scholarly work using semiotics, veridical reasoning and other logics, the notion that information is confined to the physical can be refuted and that Information-as-abstract is a better fit to the nature of information.

Introduction

In the seminal 1991 work "Information as Thing," Michael Buckland delivered perhaps the most influential exploration on the concept of information itself to date, and it may still well be the case. Remarkably, despite its original publication date, the concepts have held up for the most part, though he can be forgiven for not foreseeing outcomes like the term "tokens" taking on added and very specific meaning within the digital world. Because of its influence, there has been a plethora of scholarly works about not only the subject, but critiques of the original article itself as well as pieces that elaborate on its central theme- what is the "concept of information" (Information)? It wasn't the first piece on the subject, and it won't be the last, but it started a thread of dialogue that continues to this day.

A deep dive into a conceptual understanding of Information such as that 1991 Buckland piece also reveals the importance of such an understanding in relation to the data-information-knowledge-wisdom hierarchy (DIKW); obviously since information is in the title of the hierarchy, but also because of how far reaching the DIKW hierarchy is; critiques, as well as explorations and studies, of the practical applications of the DIKW hierarchy show just how applicable it can be. Correspondingly, it also displays how influential Information can be. Naturally, as with Information-as-[x] developing since its inception, the DIKW hierarchy has had its own revisions and critiques over its existence as well; there has been an evolution of both Information and the DIKW hierarchy, and they are intertwined.

Through research into scholarly works over the last 2 decades, it can be shown that the while concept of Information has evolved, a comprehension of a generalized "information-as-concept" is imperative given Information's importance to things like the DIKW hierarchy and its

ubiquity. Moreover, that a comprehension of Information yields the realization that information is in fact abstract.

Methodology & Research

The topic calls first for an audit of the general term “information" through some basic questions. Is Information something that must be confined to a physical entity as Buckland suggests (1991)? How has the perception of information-as-thing evolved over time? What are the repercussions of those developments? How is Information applied in the real world? Knowing full well of its place in another fundamental of the LIS field, the DIKW hierarchy, another line of leading questions followed: what implication does an understanding of Information have for the hierarchy, as well as its own practical applications outside of the LIS field?

Being so theoretical in nature, it is appropriate to look at recent scholarly work in the style of Buckland’s Information-as-Thing (1991): philosophical in nature and asking the reader to push their conceptual boundaries a bit, but follow in the scholarly mold of building upon existing peer reviewed work and knowledge (a loaded term, admittedly.). Though many of the papers contained figures computational in nature (Yang, et al., 2019..), the need for such graphs or charts is unnecessary for the purposes of a research paper of this kind. Searching for work concerning the ontological or philosophical nature of information (so as to work towards a common understanding of Information) yielded the most interesting results from conferences, journal articles, and book chapters.

Findings

Interestingly, it worked somewhat better to work backwards: to start with an examination of the prevailing attitudes around the DIKW hierarchy and its practical applications. Regarding the latter, the applications of the hierarchy outside of the LIS field are wide and varied, but have a

common thread in the being relevant in the age of Big Data: its subsequent analytics (Batra, 2014.); database creation (Yang, et al. 2019.); data sharing between governments (Tungkasthan, et al., 2019.); but also business management theory (Intezari, et al., 2016.), (Yusof, et al., 2018.), to name just a few.

A potential understanding of Information yields more nebulous results, unsurprising considering just how theoretical it is. The most interesting findings were around a relatively new field of the Philosophy of Information and some scholarly attempts to home in on a structural understanding of Information.

A critique of the hierarchy is necessary to understand some of its shortcomings (indeed, even the most sound theories usually have them). Martin Frické's 2009 piece contains 3 points in particular that seem to ring most relevant today. Firstly, the notion that information must flow from data, which must be observed to exist, is inherently flawed: subatomic particles or electromagnetic waves, neither of which can be backed up by "observable data." Secondly, referring to Russell Ackoff's information seeking questions, if information is partially defined by those questions used to find it, it ignores the question of "why?" Thirdly, that the DIKW theory "seems to encourage uninspired methodology."(p. 135..) Namely, that data is collected en masse and without mercy, merely with the "hope that one day it will ascend [in the hierarchy] to information;" the processing en route to becoming information becomes rote.

DIKW in…

Big Data

Big Data Analytics and its reflections on DIKW hierarchy (Batra, 2014.) takes a novel approach to the hierarchy: in contrast to Frické's position, Batra argues that in the era of Big Data, "the already fragile conceptual boundaries between information and knowledge have been almost totally demolished with the advent of big data analytics." More assertively, the work argues that "the ability to analyze vast volume, variety and velocity of the entire population of data in real

time and to generate value and actionable information based on the same has rendered the intermittent steps of data being processed into information and information being further processed into actionable information as redundant."(p.5..)

Database Creation

A 2019 report concerned the application of the DIKW hierarchy in the creation of a graph database. Within the field of nutrition science, graph databases are used to store nutritional research, but "the development of various specific graph databases may cause difficulties for data integration and decrease human-readability." (p. 5202..) Their solution was to use the hierarchy, using the 4 attributes as layers in the database and its interface, which required some theoretical insight into the nature of the hierarchy.

Data Sharing

Another 2019 piece focused on the importance of governments holding vast amounts of "public sector data" and proposes a framework based on the DIKW hierarchy to offer guidance as to how share that data securely. In essence, it advocates for using the hierarchy to determine levels to which the data can "ascend," to use Frické's term, and for what purpose or need does the data need to move up the hierarchical levels?

Business Management Theory

3 Scholars from Massey University in New Zealand produced a work from a conference on System Sciences in which they propose that the hierarchy can be mapped to Knowledge Management theory, specifically how the hierarchy's attributes contribute to decision-making within business management. Among other points, the authors admit that the hierarchy "does not provide an explanation of the process through which knowledge is transformed into wisdom." (Intezari, et al., 2016, p. 4195..) However, the crux is that a better understanding of how information becomes wisdom can help aid in the decision making process of business leaders.

Another fascinating work focuses on transfer of acquired situational knowledge from one generation to the next of MILOBS (known in the west as United Nations Military Observers or UNMOs), where they attempt "to interpret knowledge and wisdom in the DIKW hierarchy into the knowledge based framework with situational awareness analysis." (Yusof, et al, 2018, p. 1111..) They discern the difference between explicit and tacit skills, and focus on the difficulty in the passing on of the latter. In relation to the topic at hand, the paper crucially identifies that information has been processed from raw data and that "information can also be inferred from data, it does not have to be immediately available." (p.1113.)

Information

The nature of information- how it comes into being, what happens to it, how it is stored (within the individual; analog; digital)- is self-evidently crucial to the organization and preservation of knowledge. Tackling such an issue as defining information is hardly novel in the scholarly world. Much has changed since Buckland's work, though its basic conceptual framework remains strong. A common critique of information-as-thing is that it is too limiting in its scope, and there are a variety of methods in which scholars have attempted to reach a comprehensive understanding of what information is. In the late 90's, Luciano Florini first disseminated (or at least popularized) the Philosophy of Information, which generally frames information as an abstract and more ethereal concept than merely that information is confined to an entity (physical or digital). A few attempts to further distill this notion are as follows:

Semiotics

Semiotics is the study of symbols and signs and how they are used and/or interpreted. A conceptual paper out of Denmark tries to tackle the nature of information through an analysis of lens of C.S. Pierce's semiotic. (Thellefsen, et al., 2017..) It is an intricate paper of heady abstract thinking, but in essence they fundamentally reject the idea that information must involve "an

epistemological dimension," and through Pierce's concept of "dynamic" and "immediate" objects, reaches a conclusion that the confusion is driven by conflation between the "objective and subjective perspectives" and that a concept of information "should be defined ontologically having certain epistemological consequences." (p. 381.) Information is signaled by signs that have context, which is in turn interpreted.

Information is *not* a Thing

Another prominent critique of information-as-thing is actually is a logical fallacy. One particularly convincing argument is that identical objects can yield differing information, and vice-versa, which in turn would mean that a physical object cannot in fact *be* information. (Dinneen & Brauner, 2017.) The example the use is effective and convincing: if information were confined to the physical, then a book returned to the library would mean the reader would lose all of the information they processed into their knowledge upon losing possession of the book. Additionally and crucially, the authors identify that Floridi views data as having the potential to be abstract, and thus creating abstract information as well.

Information is true

A third exploration of the nature of information is that it is "objective and veridical." (Mingers & Standing, 2018.) Touching a bit on semiotics itself, the paper posits that information must be objective and true, or it is not information at all. It determines that "information must ultimately be manifest in physical differences" and that while many of these differences can be observed by human senses, those signals that exist beyond our comprehension are still information (not data; the implication is that the imperceptible information is comprised of data). The break the concept into the subset Differences>data>information and "argue that information is objective whilst accepting that the same information may well have different

meanings or import for different receivers." (p.16..) The authors point out much of the same argument as the library book example in the Dinneen and Brauner piece: (2017.) that to say information is subjective is to say something like the Rosetta Stone contained "no information until it was translated." (p. 18.)

Analysis

"Information," speaking generally, is a daunting subject to broach; the term is used so ubiquitously and often that it may in fact lose some meaning or importance to the layperson. But that ubiquity is certainly apparent, manifest not only early-life examples such as obtaining information from childhood on, school libraries being full of information, and the like, but also in more modern staples of the current socioeconomic landscape, like Big Data and its resulting analytics (Batra, 2014.) Buckland's original '91 piece identifying *as* the physical, while offering the caveat that information must have the experienced, nevertheless focus of information-as-thing is that information is contained purely within a physical object or representation. An astute line of critique of the model posits that this view confining information to almost being captured within a physical object (or representation) is too limiting.

The idea that a person who has read a book now has a quasi-phsyical "copy" of that information in their brain (information-as-knowledge) with the book itself being the information means that the information would be lost from the receiver upon returning the book, if we are to maintain that information-as-knowledge is still defined by information-as-thing. Furthermore, to use Dinneen & Brauner's example, if a book about gardening causes the reader to not to create a garden but instead kills all the vegetation, the book is not information at all. However, if information is viewed as abstract, then distilled into that physical manifestation, the individual still has that information after the source (the book) is out of their possession and still allows for the

book about gardening to be wrong (misinformation) while allowing that there is veridical information about gardening that exists ethereally.

Buckland's original position falls short by rendering information being an end result of experience- there is too little attention paid to the possibility of the information-as-thing not being veridical (a misinterpretation or misrepresentation of data) and would therefore not be information at all. The position that information is necessarily objective (Mingers & Standing, 2018.) seems the most accurate in regards to the practical application of how information is actually obtained and disseminated. Using semiotics, the idea that information must be objective to actually be information and that confining the term to the physical is too limiting, an intentionally simplistic framework can be laid out:

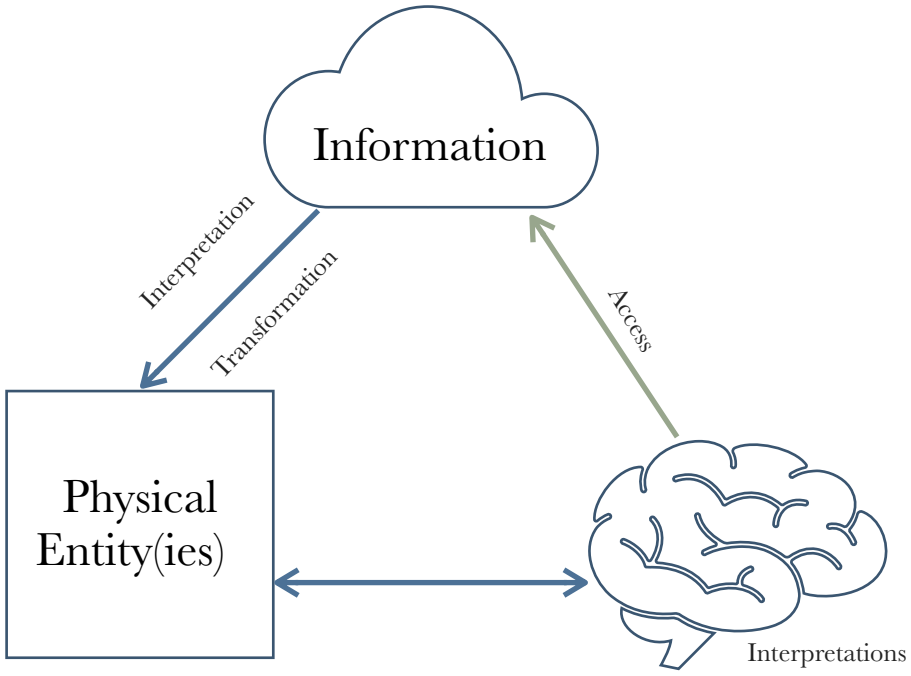

Fig 1

In this model, "Information-as-abstract" exists ethereally, is interpreted *into* physical representations, which an individual mind takes in and processes into a personalized knowledge base, but (crucially) that the veridical information itself remains intact in an abstract position that

the individual can now access on command. It allows for mistakes to be made in the transfer of information to physical entities, which could in turn mistakenly "inform" an individual, who could themselves misinterpret accurate information or accurately interpret misinformation. But crucially, the information itself (which is made up of the data, which is signals/signs: the Differences discussed in the semiotic POV) remains intact at the abstract level.

Conclusion

The prevalence of using the DIKW hierarchy throughout the LIS field, and beyond, displays how important a building block it is to those disciplines and its influence in relation to common facets of society. Nuanced understandings of the hierarchy's attributes is necessary to optimize the impact of its application, and arguably "information" is the most important of all the attributes since it is the first step past the raw data. Without an understanding of Information and, the knowledge can theoretically be flawed to a dangerous degree; there is hight potential for physical entities taken as information that are not.

Within this context, the nature of Information requires deep exploration, as Frické did in his critique of the hierarchy. While both the hierarchy and information-as-thing remain foundational elements of the LIS discipline and their content remains relevant and not inaccurate, it is clear that Information requires elaboration. In times of such confusion, a better understanding the difference between information and misinformation could mean, and how we can access Information confidently. But even merely within something that is so widespread like the DIKW hierarchy, understanding how to pass on Information-as-abstract so it may become accurate knowledge (which could then be wisely applied)- to be used in private business decisions or something as instrumental as UNMOs- is paramount. It's what makes developments like the haphazard and careless nature in which data is aggregated and the lines between data and information are obscured or not respected so scary.

Sources

Intezari, D. Pauleen, J., Taskin, N. (2016). The DIKW Hierarchy and Management Decision-Making. 49th Hawaii International Conference on System Sciences (HICSS), Koloa, HI, 2016, pp. 4193-4201. DOI: 10.1109/ICTKE47035.2019.8966872

Buckland, M. (2005). The Philosophy of Information. *Journal of Documentation*, Vol. 61 No. 5, pp. 684-686. DOI: 10.1108/00220410510625921

Mingers, J., Standing, C. (2018). What is information? Toward a theory of information as objective and veridical. *J Inf Technol* 33, 85–104. DOI: 10.1057/s41265-017-0038-6

Thellefsen, M., Thellefsen, T. and Sørensen, B. (2018). Information as signs: A semiotic analysis of the information concept, determining its ontological and epistemological foundations. Journal of Documentation, Vol. 74 No. 2, pp. 372-382. https://doi.org/10.1108/JD-05-2017-0078

Batra, S. (2014). Big Data Analytics and its Reflections on DIKW Hierarchy. Review of Management, Vol. 4, No. 1/2, June 2014, pp. 5-17 ISSN: 2231-0487

Dinneen, J.D. & Brauner, C. (2017). Information-not-thing: further problems with and alternatives to the belief that information is physical. Proceedings of 2017 CAIS-ACSI Conference

Frické, M. (2009). The knowledge pyramid: a critique of the DIKW hierarchy. Journal of Information Science, 35(2), 131–142. https://doi.org/10.1177/0165551508094050

Tungkasthan, A. Poompuang, P., Intarasema S. (2019). "Government Data Sharing Framework based on DIKW Hierarchy Model," 2019 17th International Conference on ICT and Knowledge Engineering (ICT&KE), Bangkok, Thailand, 2019, pp. 1-4. doi: 10.1109/ICTKE47035.2019.8966872

Yang, C. Baets, B. D. Lachat, C. (2019). "From DIKW pyramid to graph database: a tool for machine processing of nutritional epidemiologic research data," 2019 IEEE International Conference on Big Data (Big Data), Los Angeles, CA, USA, 2019, pp. 5202-5205. doi: 10.1109/BigData47090.2019.9006469

Yusof, W. S. E. Y. W., Zakaria, O., Zainol, Z., & Ananthan, S. (2018). DIKW Application on Knowledge Based Framework with Situational Awareness. International Journal of Academic Research in Business and Social Sciences, 8(6), 11101120.