Can Knowledge be Quantified and Qualified?

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Abstract

The opinion defended in this paper is that the interrelationships between the phenomena of data and information can provide a strong basis for analyzing knowledge as a quantified and qualified construction. As other models (e.g., Augusto's General Theory of Knowledge) suggest, it is important to distinguish knowledge from both data and information in the complicated trio composed of data, information, and knowledge (DIK). However, data and information can be combined into informative data. Taking into account quantified and qualified informative data, I speak here of quantified and qualified knowledge structures.

Key words: Theory of knowledge; Data, Information, & Knowledge (DIK); Knowledge structures; Qualified knowledge structures; Quantified knowledge structures

1 Introduction

For millennia, the term *knowledge* has been very volatile and complicated in different scientific and philosophical contexts, and it has been difficult and troublesome to offer a precise notion, let alone a single consensual definition, of knowledge. According to Halpern (1995), there is not (and there cannot be) a unique right notion of knowledge: the appropriate notion is dependent on specific applications. Also, for Dalkir (2005) a good-enough (i.e. satisficing) definition is an *effective* notion of knowledge. From a pragmatic point of view, human knowledge agents always attempt (i) to apply (and, in fact, to *industrialize*) what they know, and (ii) to make proper associations,

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in order to share what they know and to communicate with each other in various contexts. Aspects (i) and (ii), as well as their strong interrelationships, have supported the creation, and modelling, of human knowledge based on the kindred *data* and *information*, even when these are considered as largely independent phenomena (see Augusto, 2020).

My main reference to the theory of knowledge is Augusto's (2020). Augusto proposes a *General Theory of Knowledge* (GToK) that distinguishes knowledge from both data and information from the perspectives of "quality" (knowledge is constituted by *true* justified beliefs) and "quantity" (knowledge, just like data, is characterized by *0 entropy*, unlike information).

Inspired by Augusto's GToK, I sketch here a conceptual model for the trio <Data, Information, Knowledge> (DIK) based on my own analysis of quantified and qualified informative data and, respectively, quantified and qualified knowledge structures. My model, however, goes against some of Augusto's central tenets.

2 A New Approach to DIK

In my view, knowledge is an insightful and meaningful structure of information-based (i.e. informative) data collections; in other words, knowledge emerges out of data collections that are experienced and/or perceived by some knowledge agent as information-carrying. For Augusto (2020, p. 68), "The bit [(which is a unit of information)] is always a quantitative measure, whereas the value of a random variable X in a datum [(which is a unit of data)] can be nominal, quantitative, or qualitative." But informative data can be either quantitative or qualitative, or both. More specifically, informative data are data that have been quantitatively and qualitatively upgraded based on some knowledge agent's insights and developed with regard to the given/experienced information.[1]

According to Augusto (2020, p. 66), "[The] distinction [among data, information, and knowledge] often assumes the form of a pyramidal hierarchy with data at the base, knowledge at the top, and information in the middle, making believe that somehow information intermediates between data and knowledge" and allowing for slogans such as "We turn your data into knowledge".[2]

Against this criticism, I do believe that the distinction of these phenomena can be conceptually represented in the form of a *cubical-conical* model (see Fig. 1) with data at the foundation of the model, as well as at the base shared by the cone and the cube, knowledge at the top (i.e. vertex) of the cone, and informative data in the middle (i.e. over the curved surface) of the cone. Informative data are produced when given/experienced data are supported, and surrounded, by some information. As it can be seen in Figure 1, the phenomenon of knowledge is interpreted to be constructed out of informative data. Although I, too, place information between data and knowledge, (i) I have turned a pyramidal model into a conical hierarchy, and (ii) I have introduced informative data in the hierarchical model.

[1] An insight can be regarded as the capacity to gain a deeper comprehension out of some structure or phenomenon.

[2] The view in Augusto's GToK is that no intermediation between data and knowledge exists. In fact, in Augusto's model data become knowledge immediately (upon justification) and knowledge becomes data immediately (upon absence of justification).

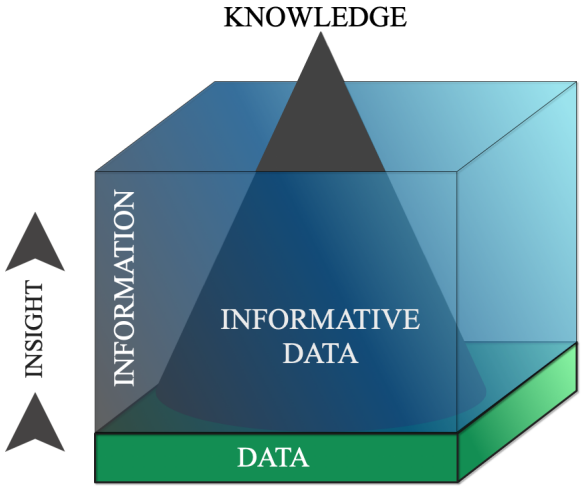

Figure 1: Cubical-conical model of DIK.

3 Quantified and Qualified Knowledge Structures

I shall be bold enough to ask the reader to accept two novel notions: *Quantitative informative data* are informative data that are quantitatively and quantificationally concerned with what some knowledge agent has perceived and, subsequently, recognized. On the other hand, the most significant characteristic of *qualitative informative data* is that of containing (for a knowledge agent) qualificational levels and contingent degree(s) of compatibility of what they have recognized and what they have perceived. Here is an example.

Let John flip a fair coin a large number of times and at each flip let him write down the outcome: H if it is heads, and T if it is tails. Assume that $C = \{H, T, T, H, ..., H\}$ is the very large (but finite, i.e. $|C| < \aleph_0$) collection of his data. The elements of C are data which are experienced by John. Let a gambler, say, Bob, need some data for his future gambling. So John's experienced data collection C may provide information to him. I claim that informative data distinguishes itself from both data and information in the sense that every datum intrinsically contains a number of bits (1/2 exactly) that for the gambler represents a "good" or "bad" outcome. Obviously, the numerical values of the outcomes are *quantities* and the contingent values thereof are *qualities*. Hence, C can provide some quantitative and qualitative informative data to John, in order to support him through *quantitative* and *qualitative knowledge construction*.

Note that quantitative informative data can provide us with *probabilities* of (the existence(s) of) some correlations between some knowledge agent's experienced data and constructed knowledge. C provides (or may provide) Bob with the probability of the occurrences of "H" and "T" in different trials. Also, qualitative informative data provide us with *possibilities* of how there are (or might/can be) some consistencies between some knowledge agent's experienced data and their constructed knowledge (e.g., see Badie, 2020a; 2021). Regarding C, the outcomes "good" and "bad" are qualitative informative data that can make Bob be concerned with the possibility of

"success" or "failure" in his future gambling.

Let "Ag" stand for some knowledge agent. In my opinion, knowing (by Ag) is an active and dynamic process of knowledge construction in their mind or knowledge base (see Badie, 2020b). Knowing (by Ag) is not just experiencing (and also finding out about) some data; it is actually constructing a mental structure based on those data. Hence, knowing (by Ag) is a process of constructing their knowledge structures based on their informative data in their mind as well as in their knowledge base. I shall summarize my ideas as follows:

1. In the cubical-conical model of DIK, informative data intermediate between data and knowledge. Correspondingly, the phenomenon of knowledge is interpreted to be constructed out of informative data.

2. Knowledge structures are informative and insightful structural models of knowledge which are constructed [by Ag] based on their experienced and perceived data.

3. Informative data are data that have–quantitatively and/or qualitatively–been upgraded and developed (in Ag's mind or knowledge base). It can be said that informative data make quantitative or qualitative (or both) junctions between what Ag perceives and recognizes (i.e. becomes aware of) based on their insights.

4. Ag's quantitative informative data are concerned with quantificational compatibility of what Ag perceives and recognizes based on their experienced data. Quantitative informative data support Ag's process of quantitative knowledge construction.

5. A quantified knowledge structure based on some data in Ag's mind (or knowledge base) is made up of the probabilities (as well as certainties) of (the existence(s) of) the correlations between their experience and recognition.

6. Ag's qualitative informative data are expressible as how and to what contingent level Ag can make a compatibility out of what they have perceived based on those data and of what they have recognized about them. Qualitative informative data support Ag's process of qualitative knowledge construction.

7. A qualified knowledge structure based on some data in Ag's mind (or knowledge base) would be constructed based on the possibilities (as well as necessities) of how Ag's experience and recognition are (or would be) correlated together.

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References

Augusto, L. M. (2020). Toward a general theory of knowledge. *Journal of Knowledge Structures & Systems*, *1*(1), 63-97.

Badie, F. (2020a). Towards contingent world descriptions in description logics. *Logic and Logical Philosophy*, *29*(1), 115-141.

Badie, F. (2020b). Logic and constructivism: A model of terminological knowledge. *Journal of Knowledge Structures & Systems*, *1*(1), 23-39.

Badie, F. (2021, forthcoming). Possibilistic and probabilistic eventual descriptions in description logics.

Dalkir, K. (2005). *Knowledge management in theory and practice*. Amsterdam, etc.: Elsevier.

Halpern, J. Y. (1995). Should knowledge entail belief? *Journal of Philosophical Logic*, *25*(5), 483-494.

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