



Journal of Documentation

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Article information:

To cite this document:

Luís Miguel Oliveira Machado, Daniel Martínez-Ávila, Maria da Graça de Melo Simões, (2019) "Concept theory in library and information science: an epistemological analysis", Journal of Documentation, Vol. 75 Issue: 4, pp.876-891, <https://doi.org/10.1108/JD-11-2018-0195>

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Concept theory in library and information science: an epistemological analysis

Luís Miguel Oliveira Machado

*Department of Philosophy, Communication and Information,
Universidade de Coimbra, Coimbra, Portugal*

Daniel Martínez-Ávila

*Department of Information Science,
São Paulo State University (UNESP), Marília, Brazil, and*

Maria da Graça de Melo Simões

*Department of Philosophy, Communication and Information,
Universidade de Coimbra, Coimbra, Portugal*

Abstract

Purpose – The purpose of this paper is to discuss the literature on concept theory in library and information science (LIS) from an epistemological perspective, ascribing each paper to an epistemological family and discussing their relevance in the context of the knowledge organization (KO) domain.

Design/methodology/approach – This paper adopts a hermeneutic approach for the analysis of the texts that compose the corpus of study following contingency and categorical analyses. More specifically, the paper works with Bardin's contingency analysis and follows Hjørland's families of epistemologies for the categorization.

Findings – The analysis corroborates the observations made for the last ten years about the scarcity of studies on concept theory in LIS and KO. However, the study also reveals an epistemological turn on concept theory since 2009 that could be considered a departure from the rationalist views that dominated the field and a continuation of a broader paradigm shift in LIS and KO. All analyzed papers except two follow pragmatist or historicist approaches.

Originality/value – This paper follows-up and systematizes the contributions to the LIS and KO fields on concept theory mainly during the last decade. The epistemological analysis reveals the dominant views in this paradigm shift and the main authors and trends that are present in the LIS literature on concept theory.

Keywords Knowledge organizations, Knowledge organization

Paper type Conceptual paper

1. Introduction

The organization of concepts and the development of knowledge organization systems (KOS) cannot be dissociated from the historical aspects and the pragmatist values that affect the epistemology of the library and information science (LIS) field. We understand KOS as “a generic term used for referring to a wide range of items (e.g. subject headings, thesauri, classification schemes and ontologies), which have been conceived with respect to different purposes, in distinct historical moments. They are characterized by different specific structures and functions, varied ways of relating to technology, and used in a plurality of contexts by diverse communities” (Mazzocchi, 2018). KOS should be understood as systems that organize concepts and their semantic relations (Hjørland, 2009). In this vein, any concept theory would be framed within one of the following four epistemological “families:” rationalism, empiricism, historicism, or pragmatism (Hjørland, 1998, 2003, 2005, 2009, 2017a). Within empiricism, concept theories would rely on the induction of concepts from



observations that are not theory-dependent, such as in the induction of clusters of similar objects without any theory or hypothesis guiding their selection and matching; concept theories in rationalism would rely on the deduction of concepts and sub-concepts from primitive concepts and rules that are given *a priori*. Logical divisions of concepts and facet analysis are characteristic traits of rationalist concept theories; concept theories within historicism seek to comprehend the concepts considering their historical transformations. This genealogical approach to concepts would define them in their cultural and social contexts and reveal them as dependent on theories and discourses; pragmatist concept theories would consider the goals, values, and consequences when defining concepts. In this sense, pragmatism does not regard knowledge or the development of concepts to be neutral as they are also theory-laden and fixated into the signs that best serve a given purpose. The four epistemological families and the concept theories they embrace coexist competitively in every domain of knowledge (Hjørland, 2009). The construction of KOS and the application of concept theories to other areas of LIS will inevitably follow one of these epistemologies.

Although in the present paper we do not aim to provide a comprehensive overview of these epistemological families and the different concept theories ascribed to them (Hjørland, 2009, is a fine review within LIS), a quick non-systematic literature review revealed the prevalence of rationalist approaches to the study of “concept” before 2010 (e.g. Motta, 1987; Dahlberg, 1992, 2009; Khoo and Na, 2006; Nonato, 2009)[1]. Several studies published after 2010 suggested a greater diversity of approaches (e.g. Kobashi and Francelin, 2011; Marradi, 2012; Derqui, 2014; Hjørland, 2015; Maculan and Lima, 2017). From both periods, we also highlight two papers (Thornley and Gibb, 2009; Guedes and Moura, 2016) whose approach, although related to the study of the concept, is focused on the role of the “meaning” in LIS.

In spite of the diversity of approaches and theories that exist in LIS, knowledge organization (KO) and classification (see Hjørland, 2016, 2017a, b, 2018a, b, respectively for their discussion), according to Maculan and Lima (2017), there are two theories that are commonly taken for granted and discussed in the LIS literature on concepts: Dahlberg’s analytical concept theory and Ranganathan’s faceted classification theory. In these two theories we can find, in the words of Kobashi and Francelin (2011, p. 15), “the premises of normative effect for the organization of concepts in information retrieval systems.” In this sense, these two theories have functioned as rationalist epistemological canons for LIS, leading to the establishment of the analytical-synthetic approach as a model (Dahlberg, 1972, 1978).

Ingetraut Dahlberg (1928–2017) is acknowledged to be one of the founders of the KO field as we know it (Ohly, 2018), being one of her most famous contributions the “analytic, object-related conceptual theory.” In the present paper, we aim to analyze the literature that acknowledges the influence of Dahlberg’s concept theory in order to understand the ways it has been understood and its impact in the KO/LIS field. Our objectives are: (i) to present and discuss the epistemological bases of the concept theories, in particular Dahlberg’s analytic-synthetic theory; (ii) to identify the literature on concept theory in the database library and information science source (EBSCO); (iii) to analyze and classify the epistemological approaches in those papers related to concept theory. We conducted a qualitative descriptive/comparative study, following a hermeneutical approach in the analysis of the texts, and using, in particular, a technique of categorical analysis (Bardin, 2011; Kuckartz, 2014). The structure of the paper and the correspondence with the objectives are as follows: after the introduction, we proceed with two subsections of the introduction that address the objective (i); next, we present a description of the methodology that is used in the empirical part of the study to address the objectives (ii) and (iii); these aspects are also discussed in the third section of the paper; finally, we end the paper with some final remarks.

1.1 *The underlying epistemological positions of concept theories*

Although concept theories are of paramount importance for LIS, there are three fields that are traditionally associated with this topic: Philosophy, Psychology and Linguistics. According to Hampton (2016, p. 655), these areas are reflected on the three “most useful” ways to discuss the concept, i.e., their relationship with the objects of the “real world;” their relationship with mental representations; and their relationships with the use of language. The author also advocates for the integrated influence of the three aspects in the development of concepts (Hampton, 2016, p. 672). While the influence and epistemological traditions of these fields on LIS could also be linked to the different views on concept theory (for instance the tension between structural linguistics and sociolinguistics in Linguistics and its relation to concept theory in LIS), it is important to review first the four epistemological families that can be used to analyze stances in LIS and KO.

Table I presents a systematization of the four epistemological families proposed by Birger Hjørland. Although these four epistemological families have been used to analyze studies and authors in the KO field (e.g. Beak *et al.*, 2015; Mattos *et al.*, 2015; Martínez-Ávila and Beak, 2016), we also acknowledge several challenges and reservations for their application. First, there has been some discussions and criticisms of this classification of epistemologies, as well as some authors have shown resistance to ascribe their research to any of Hjørland’s categories (e.g. Herre, 2013). This might be connected to two more objections: the complexity of attributing single authors or papers to a certain epistemological position (as Bird, 2004, p. 338, put it “Questions such as ‘Is thesis T a positivist (empiricist, idealist, realist etc.) thesis?’ are notoriously difficult”), and the discrepancy between the epistemological positions authors claim to follow and the positions they actually follow. Bird’s solution for this problem (p. 339) was expressed as follows: “One might take thesis T to be essentially positivist, meaning that only positivists hold T. Or one might take thesis T to be aetiologically positivist, in that the historical explanation of the prevalence or holding of thesis T is because it was held by positivists or that it developed historically from positivist theses. Whether the theoretical context account of meaning is essentially positivist I am not sure. However, I do believe that its prevalence among philosophers of science in the 1950s and 1960s is due to the fact that it was developed by positivists. So the thesis is aetiologically positivist.” Bird’s aetiological solution was also linked to the problem of ascribing one author to a position historically, i.e., within the causal relationship of History and the construction of discourse. While some of the problems of identifying the discourse and epistemological stance of an author as a whole, considering different moments, was discussed by Hilário *et al.* (2018), we agree that it is important to focus on what methods the author uses or advocates for classification over how they classify or consider themselves (as done in the aforementioned studies by Beak and Martínez-Ávila).

For the present analysis and systematization we considered the followings categories: ideal basis for the construction of knowledge, stance toward observations, the way concepts should be identified and established, the way “parts of reality” are fixated, methods of KO/LIS, the role of language in KO/LIS, the different concept theories that can be included in each family, how concepts are considered/defined, their views on how a concept is learned and their view on cognitive mechanisms. The values for each category are text excerpts taken from our corpus of study. The comparison of those values shows a great overlap and connection between, on the one hand, rationalist and empiricist stances, and, on the other hand, historicist and pragmatist stances. This is especially evident for the categories of analysis number 2, perspective of the researchers/stance toward observations, number 7, role of language and number 11, cognitive mechanisms, for which common excerpts were selected.

1.2 *Dahlberg’s referent-oriented, analytical concept theory*

During the 1970s, Dahlberg presented a theory for the extraction of knowledge units: the analytic, object-related conceptual theory. As Dahlberg’s biographer Peter Ohly (2018)

	Rationalism	Empiricism	Historicism	Pragmatism
1. Ideal bases for the construction of knowledge are	Logics, principles, rules, and idealized models	Observations and on respective inductions	Social contexts, on historical developments and on the explication of researchers' pre-understanding	Analysis of goals, purposes, values, and consequences
2. Observations are	Seen as neutral and "objective"		Assumed as contextual and "theory-laden"	
3. Concepts should be identified by studying	Priori principles	Individual users	Discourses	
4. Establishing concepts by	(a) Constructing, <i>a priori</i> , their properties and relations, generally by drawing from analytical and formal logic methods (b) Rational reconstruction of concepts and relations based on logical deductions	(a) Looking in concrete and available texts which are to be analyzed (b) Empirical studies of folksonomy-tags and terms in documents	(a) Capturing them in their historical development, as well as in their use in a given "world horizon" (b) Loops between documents, terms, pre-understanding and horizons in the course of time	(a) Deciding which class of things best serves a given purpose and then to fixate this class in a sign (b) Defining goals and purposes of metadata and knowledge organization systems
5. The "parts of reality" are fixated by	Logical division or similar rules	Similarity	Genealogy	Functional equivalent classes of things
6. methods of KO/LIS include	(a) Facet theory (b) Formal concept analysis	(a) Artificial neural networks (b) Cluster analysis	(a) Hermeneutical approach (b) Concept instances (c) Subject ontogeny	(a) Holistic approach (b) Domain analysis
7. The role of language in KO/LIS is	Descriptive/objectivist approach		Interpretive approach	
8. Concept theories include	(a) Conceptual Atomism (b) Classical Theory (c) Wüster's General Theory of Terminology	Prinz's Concept Empiricism	(a) Cultural Historical Activity Theory (b) Rosch's Prototype Theory	(a) Theory Theory (b) Cabré's Communicative Theory of Terminology (c) Peirce's Sign Theory
9. Concepts are	Abstractions of reality in the sense that they are Products and instruments of man's ability to think and speak about reality	Entities learned on the basis of observed relations of similarity between things and through conventions acquired between these things and words	Tools formed to think and communicate about human practices	Socially negotiated meanings
10. To learn a concept, we	Match a sensory input with a set of logical categories	Associate a word with objects with some specific combinations of physical and chemical properties	Grasp something about is function and of humankind's accumulated experiences regarding him and their functions	Uncover the discourses in which it has been developed and used as well as its underlying set of assumptions
11. Cognitive mechanisms are	Biologically given		Culturally or socially developed	

Table I.
Systematization
and contextualization
of the four
epistemological
families

pointed out, the main reference for her theory was to the work of Frege (1969). Gottlob Frege (1848–1925) was a German philosopher and logician whose work has been a huge influence in analytic philosophy and mathematics, especially arithmetic. His approach to concepts (for instance, in "On Concept and Object," Frege, 1892) clearly follows a rationalist approach and was a big influence in Dahlberg's logic. In this vein, Dahlberg gave the following definition of concept that has been consistent in time: "A concept is a knowledge unit, comprising verifiable statements about a selected item of reference, represented in a verbal form" (Dahlberg, 1978, p. 143); "A concept is a unit of knowledge that is made by making substantial and verifiable statements about a reference object that summarize them in a short and descriptive denomination (name or code) for the purpose of communicability" (Dahlberg, 2014, 37ff cited in English translation in Ohly, 2018).

Dahlberg's concept theory can be regarded as a rationalist and essentialist concept theory, in line with what Hjørland presented as Aristotle's "classical theory" (Hjørland, 2009, p. 1520), and consistent with Hope Olson's depiction of the contribution of Aristotle to classification (Olson, 1999), especially in relation to the hierarchy of classes. Dahlberg never hid her admiration for the Aristotelian model: "The scheme which I found most helpful is the one established along the lines of Aristotle's categories, through which all items of reference may ultimately be sorted into four form categories, each of which may then be subdivided into three subcategories" (Dahlberg, 1978, p. 144).

Although Dahlberg seemed to be unaware of the contemporary developments in object-oriented programming in the computer science field in the previous decades ("this work so far has not as yet found the necessary attention, especially also regarding the new terminology drifting into our field from the area of the computer sciences which 'discovered' the need of KO for their field," Dahlberg, 2009, p. 169)[2], the truth is Dahlberg's concept theory presented many similarities with the rationalist approach of computer science and it could have made a great impact on the cognitive/structuralist aspirations that reigned the KO field until the mid-1990s. Many of these similarities are consequence of a common importance given to validity and logics, via Freger in the case of Dahlberg, and the need for robust logics in the computer science and artificial intelligence fields in the development of languages such as Lisp and Smalltalk.

The social aspects of the approaches to the formation of concepts were disregarded as ineffective in the case of artificial intelligence (Martínez-Ávila, 2015) as well as in Dahlberg's concept theory. Ohly (2018) comments on Dahlberg's theory that, in contrast to the formation of concepts, "the linguistic aspect prevents the analytic aspect of concept formation and conceptual knowledge" (Dahlberg, 2017, p. 13). Dahlberg's rationalist ideal and its effectiveness in the natural sciences is reflected in the following quote: "the capacity of the natural sciences to coin neologisms for new concepts provides a motive and possibility for normalization not available to social scientists. By contrast, clearly, the only sanctions available to social scientists are those of peer pressure exercised via the discourse communities into which the numerous fields of knowledge in the social sciences are divided. Moreover, the almost exclusive reliance by social scientists on the use of terms derived from ordinary language usages results in an extreme proliferation of the meanings in which the most commonly used words are employed, thus producing a polysemantic jumble which appears to defy all normalizing efforts" (Dahlberg, 1978, p. 142). This quote and the position of Dahlberg can be arguably aligned with the traditions of LIS/KO and the discourse of their seminal founders (many similar quotes can be found in the "armies, railroads and procrustean beds" metaphors by Dewey and many others deconstructed by Olson, 1997, 2001, 2002). Other criticism "on 'conceptual culture' in the social sciences" by Dahlberg during the late 1990s (in German) and the responses are discussed by Ohly (2018).

2. Methodology

We adopted a hermeneutic approach for the analysis of the texts that compose our corpus of study following contingency and categorical techniques for the analysis. The selection of the corpus was done in two stages. We used a contingency analysis (Bardin, 2011, p. 143) of the terms "concept" and "theory" that were searched on the database Library & Information Science Source (EBSCO). Contingency analysis takes into account the distribution of elements and their association, as these aspects constitute a significant point for interpretation while they also provide context. The place or section of the text in which the subjects appear and their co-occurrence with other topics provide relevant indicators for interpretation, which may be associative, equivalent or opposite (Bardin, 2011, p. 143). In the first stage, we based our analysis on the abstracts of the retrieved articles, while in the second stage we analyzed the full text of the papers that

met the objectives of our study in the first stage. These procedures are part of the “hermeneutic spiral” (Kuckartz, 2014, p. 19) inherent to the analytical approach adopted and the progressive understanding of the texts analyzed. The following stages consisted on full and partial readings, creation of categories, coding and analysis, in an interactive process (Kuckartz, 2014, p. 47). As part of that process we have established analytical–theoretical categories (Kuckartz, 2014, p. 41), which have been assigned units of signification constituted by textual segments extracted from the corpus of study (Bardin, 2011, p. 134; Kuckartz, 2014, p. 44).

3. Results and discussion

In our contingency analysis we identified eight papers that clearly deal with concept theory in line with Dahlberg’s proposal (see Table II). In most cases, the authors do not always make their epistemological positions explicit and much less they point out a specific “family.” Thus, with the exception of the explicit pragmatist position of Hjørland, also expressed in terms of “post-Kuhnian” (Hjørland, 2009), the epistemological positions of the remaining authors/papers were implicit, albeit with different signs, and had to be inferred. **It can be argued that the explicitation of the epistemological position is an act of honesty and transparency in research** (García Gutiérrez, 2007; Martínez-Avila and Guimarães, 2013), also linked to ethical aspects and verifiability. While authors ideally should be able to identify and let their positions be clear so readers and organizers can make a best use of the literature, these positions can also be identified by others (“show me your classification and I’ll tell you what theory you subscribe to,” Hjørland 2013a, p. 171). In practice, the best way of identifying a position is not always by the words of the author but by the analysis of the methodology and logics the author uses. The work of identifying these different epistemologies and the knowledge that is needed can be considered a domain-analytic exercise and part of the domain-analytic skills that information professionals should have. The ability and process of identifying the competing theories and epistemological positions within a domain or field can be greatly assisted by the publication of reviews, systematizations and classifications of these positions.

Year/Source	Author	Title
2009/ <i>Journal of the Association for Information Science and Technology</i>	Hjørland	Concept theory
2010/ <i>Journal of the Association for Information Science and Technology</i>	Stock	Concepts and semantic relations in information science
2011/ <i>Journal of the Association for Information Science and Technology</i>	Szostak	Complex concepts into basic concepts
2011/ <i>Ciência da Informação</i>	Francelin and Kobashi	Concepções sobre o conceito na organização da informação e do conhecimento (Conceptions about the concept in information and knowledge organizations)
2011/ <i>Journal of Document</i>	Friedman and Thellefsen	Concept theory and semiotics in knowledge organization
2011/ <i>Knowledge Organization</i>	Fox	Prototype theory: an alternative concept theory for categorizing sex and gender?
2012/ <i>Scire</i>	Arboit	O processo de (re) construção da teoria do conceito no domínio de Organização do Conhecimento: uma visão dialógica (The process of (re)construction of the theory of concept in the Knowledge Organization domain: a dialogical vision)
2016/ <i>Knowledge Organization</i>	Smiraglia	Empirical methods for knowledge evolution across knowledge organization systems

Table II.
Corpus of study

Hjørland (2009) is a good example of this in relation to concept theory. His paper does not only review the different positions in LIS/KO but also makes its own position explicit. Among the five listed groups of theories of concepts listed by Hjørland, namely “the classical theory” of concepts attributed to Aristotle, probabilistic theories of concepts such as “the prototype theory” attributed to Wittgenstein and Rosch, theory-based theories of concepts, neoclassical theories of concepts, and Neoclassical theories of concepts (Hjørland, 2009, pp. 1520-1521), he states that his view is most in accordance with the theory-based theories of concepts. The definition of concepts given by Hjørland is coherent with the post-Kuhnian and pragmatist views the paper states: “Concepts are dynamically constructed and collectively negotiated meanings that classify the world according to interests and theories” (p. 1521). Although Hjørland does not discuss or confront Dahlberg’s concept theory in the article[3], his views can be seen as a departure from Dahlberg’s views and, in a broader sense, part of a pragmatist turn that he has been leading in the KO domain since the mid-1990s (Guimarães *et al.*, 2015). Hjørland (2009, p. 1520) expressed this turn as follows: “a shift in the understanding of concepts is part of a broader shift in our understanding of cognition, knowledge and information.”

Wolfgang Stock (2010) reviewed “Concepts and Semantic Relations in Information Science” stating that “concept-based information retrieval and knowledge representation are in need of a theory of concepts and semantic relations. Guidelines for the construction and maintenance of KOS (such as ANSI/NISO Z39.19-2005 in the U.S.A. or DIN 2331:1980 in Germany) do not consider results of concept theory and theory of relations to the full extent” (p. 1951). Stock acknowledges Hjørland’s families of epistemological positions with some minor modifications (he cites empiricism, rationalism, hermeneutics, pragmatism and critical theory[4]) and states that “each of the five epistemological theories is relevant for the construction of concepts and relations in information science research as well as in information practice” (p. 1953). Although he often draws on prototype theory and the classical theory in very similar terms to Dahlberg (even citing Frege and Aristotle), he also summons a wide spectrum of epistemological choices: Aristotle’s “Metaphysics,” Wittgenstein’s family resemblance, Rosch’s exemplary prototypes, Barsalou’s dynamic frames, Menne’s semantic dependence (syncategoremata), and Max Black’s borderline vagueness. Thus, Stock’s position can be regarded as a type of pluralism in concept theory (Margolis and Laurence, 2014) in which concepts have multiple types of structure.

Rick Szostak (2011) presents in his paper the concept theory that underlies his own “Basic Concepts Classification” (BCC)[5]. Szostak advocates for a “truly universal classification” of documents or ideas comprised of basic concepts that is “not grounded in particular disciplines or cultures.” The paper discusses in the introduction the disagreement with Hjørland (2009) as he claims that “breaking complex concepts into basic concepts, which can then be understood similarly across disciplines, reflects a ‘rationalist’ epistemology. (He [Hjørland] would argue that all concepts can only be understood in terms of theories and thus a web of other complex concepts that will inevitably differ across communities.)” (Szostak, 2011, p. 2247). Szostak states his departure from Hjørland (2009) in several ways: “First, it focuses on concept theories rather than the broader epistemologies in which these might be grounded” (Szostak, 2011, p. 2249). In his paper, “basic concepts” are defined as “concepts that can readily be ascribed similar meanings across disciplines or cultures” (p. 2247), and “as those that lend themselves to an acceptable degree of cross-group understanding for the purposes of classifying scholarly documents or ideas” (p. 2260). Rick Szostak comes from interdisciplinary studies and this background can be seen in conflict with the domain-analytic position (see for instance Hjørland, 2017b, for a summary of the discussion). Interdisciplinary concepts can lack a clear-cut definition according to the established scientific literature until the inter-science is established as a new science. Notwithstanding, Szostak believes the BCC can overcome these problems if users and organizers work with those basic concepts that are

universal and not dependent on specific disciplines. In opposition to the basic concepts, complex concepts are defined as “concepts for which a shared understanding is possible only within particular disciplines or cultures.” The main theoretical claim of this paper is thus: “Complex concepts, so defined, can be broken into basic concepts, so defined, most or all of the time, with a degree of shared understanding suitable for the purposes of information science” (Szostak, 2011, p. 2248). As for the groups of concept theories that are discussed, Szostak lists the classical view (together with the neoclassical theory), the prototype theory, the theory (that Hjørland advocates), conceptual atomism, and pluralism. Although not completely explicit, Rick Szostak posits himself in a stance that fancies a pluralistic view of concept theories, recognizing points in common with conceptual atomism (pp. 2252-2253), and stating that, in relation to the BCC, only “classical (and neoclassical) theory, conceptual atomism (especially once amended rto [sic] allow complex concepts to be built up from basic concepts), and arguably prototype theory are supportive of the possibility of a truly universal classification” (p. 2254). Out of them, it seems that the classical theory is the one that best fits the BCC, as complex concepts are broken into basic concepts in a similar way Dahlberg advocated for the logical and rational development of concepts based on the attributes and verifiable elements of the items of reference, and also as classic philosophers did. Although Szostak does not cite or mention Dahlberg in the whole paper, nevertheless, he considers himself in the tradition of facet analysis (p. 2254) and this is linked to rationalism (Hjørland, 2013b).

Francelin and Kobashi (2011) review the Brazilian LIS literature on concepts for the period 1972–2009. Although the study is limited to Brazilian sources, these dates seem relevant from an international point of view as they range from the date of publication of the first paper on concept theory by Dahlberg to the date of publication of Hjørland’s paper on concept theory. The results showed a great prevalence of rationalist approaches, Aristotelean logic, and citations to rationalist authors in the papers, namely Dahlberg, Ranganathan, Wüster and Guarino. Francelin and Kobashi also point out the lack of criticism/critics among the Brazilian literature on concept theory, commonly focused on practice and holding positivist assumptions. In contrast, the authors also revealed a stream of publications on concepts from the point of view of the philosophy of language, semiotics, linguistics and the theory of communicative terminology and socioterminology that present a pragmatist approach. Although the authors give a preliminary definition of concept by Dahlberg and acknowledge her importance, it can be said that the paper overall shows a pragmatist stance in the analysis and interpretation of results. The underlying ideas of the paper and the impression the authors give seem to be in line with Cabré’s theory of communicative terminology. This theory emphasizes the specific pragmatics of each situation of use of language as an activating factor of the semantic values associated to the lexical units (Cabré, 2009, p. 14).

Friedman and Thellefsen (2011) combined and analyzed Peirce’s semiotics and Dahlberg’s concept theory through the lenses of knowledge representation and Martinich’s (1961) philosophy of language. While Peirce is acknowledged as one of the founders of Pragmatism, Martinich (1983, 1984) (e.g. whose philosophy of language distinguishes between the areas of study of syntax, semantics and pragmatics) can also be regarded as a pragmatist author. Thus, we regard Friedman and Thellefsen’s approach as pragmatist in spite of combining two theories (Dahlberg’s concept theory and Peirce’s semiotics) that are apparently so distant in epistemological terms. In their literature review of the role of language and KO, they point out to two main approaches/families of theories (Friedman and Thellefsen, 2011, p. 647): an interpretive approach, which includes the socio-cognitive approach, semiotics, pragmatics and historicist approaches, and domain analysis; and a descriptive/objectivist approach, which includes cognitive science, computer linguistics, and concept theory, also described as “the information processing paradigm” (Brier, 1996). In our view, a main link between Peirce’s semiotics and Dahlberg’s (classical) concept theory is

realism, something that has been problematic for poststructuralist and neopragmatist authors that are aware of the dangers of essentialism for the social minorities. An important author such as Richard Rorty, for instance, has been characterized as anti-representationalism and in conflict with Peirce's pragmatism (Ramberg, 2009). As for Friedman and Thellefsen's (2011) analysis, they state that the strongest similarity between Peirce and Dahlberg's theories is the use of triangulation as the center of the main categories representing signs and concepts (p. 665), while the main differences include the meaning behind the sign and concept, the classification of terms and the ideology behind the theory (p. 666). The authors believe that Peirce semiotics provides richer possibilities for the analysis of KOS structures and tools.

Melodie Fox (2011) in her paper on prototype theory states that it is not her purpose to come up with a complete concept theory but rather to analyze one of the existing concept theories (prototype theory) to determine how it handles slippery and sensitive concepts such as sex and gender. As Fox puts it, "for those who fall in the borderland between male and female or those who resist the gendered behavior socially prescribed for their sex, the mutually exclusive gender categories afforded by classical theory can cause social and emotional consequences" (p. 329). In this sense, Fox's epistemological position would fall under Hjørland's category of pragmatism as it includes feminist studies, critical theory and others (Hjørland, 2013a), that would arguably cover queer theory and gender studies too. Although Fox focuses on the analysis of prototype theory, she also reviews and criticizes the classical theory because of its hierarchy, mutual exclusivity, inherent essentialism and rigidity "for the shifting nature of social categories" (p. 329). Fox also reviews some of the contributions of concept theory to KO, including Hjørland's (2009) approach, Szostak's response ("which can be incompatible with postmodern epistemologies," p. 330), as well as other authors such as Dahlberg, Bowker and Star (1999) and Jacob (2004).

The two remaining papers (Arboit, 2012; Smiraglia, 2016) can be, respectively, regarded as historicist and empiricist approaches to concept theory. In the case of Aline Arboit, she works with Mikhail Bakhtin's theory of speech genres that can also be considered within the historicist family (Iñiguez, 2004, pp. 271-275). Arboit's paper reviews and reveals the dialogical interpretations of the concept theory that have been developed in different historical moments. As for the identification of Smiraglia's epistemological position, this is a bit more complex. Overall, Richard Smiraglia could be regarded as an empiricist author, as he has done a good amount of empirical research and contributions to the KO field[6]. On the other hand, Smiraglia has also done relevant contributions to the literature on domain analysis (e.g. Smiraglia, 2011, 2012, 2015), that can be framed as pragmatism. While the first part of the title might refer to an empiricist epistemology, the study of knowledge evolution also draws on Tennis' (2006, 2007) studies on subject ontogeny and scheme versioning that might be perhaps regarded as historicist. To add more complexity to the analysis, the paper was published in a festschrift in honor of Hope Olson, who is famous for her feminist epistemology (ascribed to pragmatism). However, Smiraglia's (2016) paper reviews and promotes a set of empirical methods for knowledge evolution across KOS, thus, we consider it to fall under the empiricist family.

The analysis presented above is summarized in Table III.

4. Conclusion

Our epistemological analysis of the literature has corroborated the scarcity of studies on concept theory in LIS and KO, something that had been already detected ten years ago by Hjørland (2009). However, since Hjørland's (2009) paper, we have witnessed an

Citation	Theoretical framework	Definition of concept
Hjørland (2009)	Armed with such a “post-Kuhnian view of concepts,” a dominant contemporary understanding and classification of theories of concepts is presented and discussed [...] (p. 1519) This paper argues further that the most fruitful theories of concepts are related to historicism and pragmatism, [...] (p. 1520) [...] the present paper is most in accordance with “theory-based theories of concepts”, [...] (p. 1521)	Concepts are dynamically constructed and collectively negotiated meanings that classify the world according to interests and theories (p. 1521)
Stock (2010)	[...] with concept explanations (after Aristotle) and family resemblance (after Wittgenstein), introduce syncategoremata (after Menne), thematize vagueness (with Black), as well as prototypes (with Rosch) and model concepts as frames (according to Barsalou). [...] we are concerned with a new view of concepts which will touch on known and established theories and models [...] (p. 1951)	Concepts can be presented as frames with sets of attributes and values, structural invariants (relations) and rule-bound connections (p. 1966)
Szostak (2011)	Though I am very appreciative of the field of natural semantic metalanguage, and its search for “semantic primitives” that carry the same meaning across all languages, it is not the intent here to hold all “basic concepts” to that standard (p. 2248) [...] the classical idea that complex concepts can be broken into basic concepts (that lend themselves to shared understanding) is attractive (at least to this author), [...] (p. 2253)	“Basic concepts” will be defined as “concepts that can readily be ascribed similar meanings across disciplines or cultures.” (p. 2247) Basic concepts are defined as those that lend themselves to an acceptable degree of cross-group understanding for the purposes of classifying scholarly documents or ideas (p. 2260)
Francelin and Kobashi (2011)	[...] Cabré establishes a set of theoretical and pragmatic principles by which concepts can be approached. Therefore, one can agree with Cabré (2000) when she states that the relationships between the concepts go beyond the logical and ontological relationships and that this field of study is still insufficiently explored (p. 213, in translation)	[...] the construction of the concept depends basically on a referent, the expression of judgments about the referent, a verbal form (a term or a name), and a way of using this verbal form in a discursive universe (p. 210, in translation)
Friedman and Thellefsen (2011)	The study of grammar is usually associated with the study of grammatical sentences in pure terms. Semantics involves the study of the meaning of words and sentences. Pragmatics is the study of what speakers do with languages. In this study, we adopt Martinich’s approach by examining the term knowledge representation, using the syntax, semantics, and pragmatic approaches as they are associated with Peirce’s and Dahlberg’s theories (p. 645)	[...] a concept is rooted in a binary distinction with a dialectical method [...], the representation involves a system of reasoning that arrives at the truth by an exchange of logical arguments (p. 648)
Fox (2011)	I will explore prototype theory as an alternative or supplementary concept theory to determine whether it would be a viable option for defining sex and gender in ways that reflect the diversity that classical concept theory cannot capture [...] because it permits commonality without essentialism, difference without eliminating	Generally speaking, concepts are universals whose particulars reside together in a category. Concepts do not have a one-to-one relationship with language, as different terms can be used to express the same concept (p. 329)

Table III.
Theoretical frameworks and definition of concepts of the retrieved papers
(continued)

Citation	Theoretical framework	Definition of concept
Arboit (2012)	<p>similarity. However, the instability of prototypical definitions would cause difficulty in a practical environment (p. 329)</p> <p>The Bakhtinian perspective is adopted as a methodological theoretical approach, especially when trying to understand, in a non-isolated way, the discourses expressed by Dahlberg, Hjørland, Tennis, and Sutton, respectively, on the concept as a theoretical entity of the KO domain (p. 130, in translation)</p>	[...] the reading and interpretation of concepts such as dialogism, polyphony, and carnivalization proposed by Bakhtin can be useful in relation to a deeper study of the processes of construction of the conceptual instances (p. 133, in translation)
Smiraglia (2016)	<p>Like its sibling domain analysis (Smiraglia, 2015), classification evolution will require much replication and additional empirical evidentiary analysis to reach the level of predictability it promises. It must be accompanied by empirical replication of scheme change analysis along the lines suggested by Tennis (2007). It must be interwoven with social discourse analysis as suggested and demonstrated by Martínez-Ávila and Fox (2015) (p. 356)</p>	The concepts, their representations, and their groupings as represented in texts or other contextual environments (which we call domains) are derived according to a system known as warrant [which] is the justification for using a specific term to represent a particular concept (p. 351)

Table III.

epistemological turn on concept theory that could be considered a continuation of a broader paradigm shift in LIS that has been called pragmatic turn in KO (Kleineberg, 2016; Guimarães *et al.*, 2017), following the introduction of the domain-analytic approach in the 1990s. This paradigm shift in the theory of KO and concept has brought richer discussions and better understandings of the problems that affect the representation and inclusion of diverse social groups and conflicting theories. If considered in practice by information systems, this paradigm could result, among other things, in a better information retrieval. The results of our study also reveal that after the publication of Hjørland’s paper, that broke the hegemony of the rationalist approach to concept theory in KO and introduced the discussion of other epistemological positions, all papers except two have followed pragmatist or historicist approaches. The only clear exception to this turn (Szostak, 2011) can be regarded as a response to Hjørland and a proof that the rationalist tenets in KO are still pretty much alive, in the form of Dahlberg’s concept theory, the facet analysis approach, and new proposals such Rick Szostak’s Basic Concepts Classification. This plurality of views is a positive thing for KO as it is part the natural development of science in which different views are competing and struggling in a dialectical way to keep the field alive and move toward new findings and developments.

Notes

1. One example prior to 2010 that would not be exclusively rationalist is Gonçalves and Souza (2008), as Farradane’s relation indexing, discussed in the paper together with Dahlberg’s contributions to concept theory, can be considered an empiricist approach (Justice, 2004, p. 277).
2. Another quote that reflects her lack of influence from the computer science field is “In information science, we are at present confronted with the necessity to translate between our existing terms and the newly coined terms in the field of artificial intelligence and computer science for concepts already existing in our field and which are penetrating or rather conquering our field as if they were denoting new concepts, such as ‘domain’ for subject field, ‘inheritance’ for hierarchy, etc.” (Dahlberg, 1992, p. 70).

3. The only mention to Dahlberg is confined to an endnote (pp. 1533-1534) in which Hjørland includes an early definition of concept by Dahlberg (1974) (“A concept is regarded as the common element of both classification systems and thesauri (and other kinds of KOS),” p. 12), he highlights the importance of concept theory and Dahlberg for the KO field and the ISKO journal Knowledge Organization, subtitled an “international journal devoted to concept theory, classification, indexing and knowledge representation,” and he notes the lack of research on concept theory in the KO field and LIS with the exception of Dahlberg herself, citing Dahlberg (1974, 1981).
4. While hermeneutics would correspond with historicism (Stock asks “Is it grounded on the historical development (hermeneutics)?”, p. 1953), he also splits critical theory from pragmatism. It should be noted that we do not believe in the necessity of adding this fifth category as we do not agree with the separation of critical theory from pragmatism. As discussed by Martínez-Ávila *et al.* (2016), both the methods and logics of critical theories (in plural, reflecting pluralistic views and groups beyond the Frankfurt School’s) reflect the goals, values and consequences of those groups.
5. <https://sites.google.com/a/ualberta.ca/rick-szostak/research/basic-concepts-classification-web-version-2013>
6. Being a proud PhD graduate of the University of Chicago, home of empirical methods for most of the sciences in the USA, Smiraglia clearly considers himself an empiricist author based on his work (see for instance the following excerpt from his interview for cataloging and classification quarterly, Smiraglia and Graf, 2017, p. 281: “It can be seen in my work, that mix of what I learned from Julie Hurd about communication among scientists and the metrical evidence of that and I use that same technique to create the empirical analysis of works.”)

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Corresponding author

Daniel Martínez-Ávila can be contacted at: dmartinezavila@gmail.com

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