A Formal Taxonomy of Knowledge Organization: Meta-Analysis and Facet Analysis

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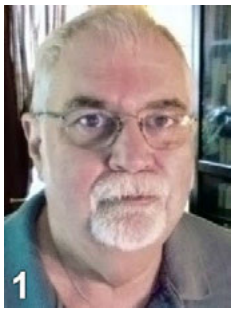

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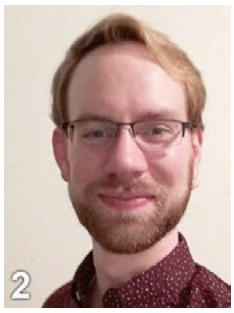

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Abstract: Nearly fifty years after the incorporation of the International Society for Knowledge Organization and the introduction of its formal scientific journal *Knowledge Organization*, a comprehensive encyclopedia of the domain appeared. The practice of domain analysis for knowledge organization, twenty years after its introduction as a core methodology, has created the largest corpus of theoretical knowledge in the domain analysis of knowledge organization itself. A substantial body of research data, therefore, is available in the corpus of articles and conference papers reporting on the epistemological and ontological pillars of the science of knowledge organization. This paper is a report on the evolution of a formal taxonomy of knowledge organization, which is a product of an exhaustive meta-analysis of the KO domain. Our team compiled the corpus of twenty-nine formal published analyses together with key formative historical documents. We then analyzed the corpus thematically, bibliographically, and using co-word analysis to extract key concepts and the underlying faceted conceptual infrastructure. The taxonomy itself is faceted and is linked where possible to published definitions in the KO literature and as well as to the online *ISKO Encyclopedia of Knowledge Organization*. A dynamic project, the taxonomy will be maintained as linked open data and will grow as emergent research contributes new concepts or generates new facets.

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1.0 Introduction: doman-critical taxonomic underpinning

Taxonomy is the essential act of any science; at the most basic level, scientific activity is the identification, clustering, and disambiguation of empirical observations. The named list of any domain-specific set of observations is that domain's taxonomy. In structured form, a taxonomy then is the authoritative representation of the core concepts in a science that serves as the basic reference set from which hypotheses may be developed and tested. It is in this manner that science moves forward by enriching its taxonomy through enhanced observations across time. Smiraglia (2014a, 51) wrote:

> At the most basic level a taxonomy is an ordered list of terms together with their definitions or other determinant characteristics. Taxonomy is a way of defining the component entities in a domain ... The form and content of any taxonomy is dependent on the epistemology of the domain for which it has been developed.

and (54):

> Rooted in empirical observation, taxonomies supply defining characteristics and identify the sources of the definitive science from which the characteristics were observed.

The science of knowledge organization as we practice it today was named by and evolved from promulgation by Ingetraut Dahlberg beginning in 1974 with the founding of the journal *International Classification*, followed auspiciously by the founding of the International Society for Knowledge Organization in 1989 (Dahlberg 2008, 82; Smiraglia 2014a, 40). Considered by its founder to be a science of science (Dahlberg 2006), in other words a meta-discipline, knowledge organization has constituted the formal application of "concept-theoretic" for the application of discovered concepts to ontological systems of various stripes. The activity of organizing knowledge has ancient roots, the mechanization and codification of which has occupied much of the period from 1839 (eg. Panizzi 1839; Jewett 1850; cf. Strout 1956) to the present (Smiraglia 2014a, 36-41). A hallmark of the maturation of a science is its production of formal systems for the representation of its theoretical positions. Such systems may take the form of ontologies or classifications, such as the 1993 "Classification of Knowledge Organization Literature" developed by Dahlberg (2006, 15). More recently, the online *ISKO Encyclopedia of Knowledge Organization* (*IEKO*) began to appear in 2017 (https://www.isko.org/cyclo/).

The science of knowledge organization was enhanced by the development of the methodological paradigm of domain analysis (Smiraglia 2015a), which involves the empirical identification of core concepts in every domain. The growth of knowledge of the domain of KO has been apparent from the increasing number of domain-analytical studies published about the domain (Smiraglia 2015b; 2015c). This effort, which involved overlapping studies of the literature and discourse of KO as a domain also embraced a fair amount of replication, thus generating the potential for further systematization of the core concepts in the domain of KO. In 2019, the Institute for Knowledge Organization and Structure, Inc. introduced the methodological meta-analytical tool of the domain analysis clinic or DAC (Smiraglia 2019), derived from

Dahlberg's (2006; 2011) idea of an institute devoted to the discovery of concepts but extended by the embrace of meta-analysis and empirical methods. From the first execution of the DAC came a formal taxonomy of knowledge organization that is the product of exhaustive meta-analysis of KO domain analytical research (Milonas 2019).

This paper reports on the evolution of a formal taxonomy of knowledge organization, which is a product of an exhaustive meta-analysis of the KO domain (Milonas 2019). Our team compiled the corpus of twenty-nine formal published analyses together with key formative historical documents. We then analyzed the corpus thematically, bibliographically, and using co-word analysis to extract key concepts and the underlying faceted conceptual infrastructure. The taxonomy itself is faceted and is linked where possible to published definitions in the KO literature and as well as to the *IEKO* (Zherebchevsky 2019).

1.1 The meta-analytical corpus

Our attempt at an exhaustive meta-analysis had to start with a corpus that included analyses of the KO literature. Many studies have been conducted about the domain analysis of KO, but it was important to include papers that synthesized these in order to achieve an exhaustive meta-analysis. Three texts by Smiraglia (2013; 2015b; 2015c) provided the corpus with this synthesis. The breadth of his earliest work in the set is apparent when he explains (2013, 19-20) that:

> In the 12 years or so in which KO has turned its attention specifically in a domain- analytical direction, there has been a modest increase in the number and frequency of studies specifically devoted to using Hjørland's 11 approaches to the analysis of domains for the purpose of revealing their shared ontologies. In this chapter, we look briefly at those studies, which appear in KO's three principal venues. Interestingly, we know from research (Smiraglia, 2011, 2012, 2013a) that those venues are primarily the biennial international conference proceedings from the International Society for Knowledge Organization (published in the series Advances in Knowledge Organization) and the journal *Knowledge Organization*, and a smattering of papers from the information science literature at large. Other sources are doctoral dissertations produced in schools of KO, although most of these are eventually reported formally in one of the other three venues.

His second study in the set synthesizes (2015b, 5):

> 17 studies of knowledge organization literature incorporated 3494 source papers, of which 1100 appeared in journals such as *Cataloging & Classification Quarterly*, *Library Resources & Technical Services*, or *Library Quarterly*, 444 appeared in Knowledge Organization, but 600 appeared in ISKO conference proceedings, and 1350 were papers in ISKO regional conference proceedings (the results of the meta-analysis are gathered in Smiraglia 2012b.)

Finally, his third study (2015c, 603) is "based on this core of 100 papers ... The 100 articles were contributed by 80 authors. Only 9 authors contributed more than one paper." Although this last study might include the smallest amount of papers, Smiraglia points out (2015b, 610) that "this research is limited by the choice of which papers constitute the core of domain analysis, in KO, for KO. Other researchers might constitute the core differently. However, everything domain analytical in either the journal *Knowledge Organization* or the proceedings Advances in Knowledge Organization has been included."

To further bolster the corpus with texts that contained core vocabulary that was likely to be considered taxonomic, we included Dahlberg's seminal "Classification System for KO Literature" and the unpublished index to Smiraglia's *Elements of Knowledge Organization*. These texts already provided a high-level view of KO, making them invaluable to our corpus.

Various domain analyses of ISKO or ISKO chapter publications also were included in the corpus. Although these papers are not syntheses of the KO literature, they provide a snapshot in time of the epistemological stance of KO from the primary organization for the scholarly discourse of KO. The authors of these papers used bibliometric and epistemological methods to analyze the KO domain internationally or regionally or to look at a particular aspect such as indexing (Guimarães and Tennis 2012) or the meaning of "concept" (Araújo, Tennis and Guimarães 2017). The various approaches share a common goal of understanding KO as a domain or stated differently (Castanha et al 2017, 8):

> We understand that bibliometric studies are an important approach in domain analysis. Their use in combination with epistemological studies leads to better qualitative and quantitative analyses that take into account social and contextual aspects of indicators in order to better aid in the analysis. It also provides a valuable way to understand the information design, the visualization of the domain and the theoretical underpinnings of the social processes that permeate the information.

To round out our corpus, we included core writings of Joseph Tennis, former president of ISKO and the keynote speaker for the first DAC. These writings provided us with

Document	***Most Frequent (Top-Level) Terms Identified***	***Number of Occurrences of Terms***
Dahlberg's *Classification System for Knowledge Organization Literature (CSKOL)*	1. classification 2. indexing 3. systems 4. thesauri 5. knowledge	186 130 127 78 69
Smiraglia's Index to *Elements of Knowledge Organization*	1. knowledge 2. bibliographic 3. information 4. analysis 5. social	8 6 6 5 5

Table 1. Voyant frequency analysis.

a possible classification of KO research (2008), an ethical view of KO (2013), an understanding of classification theory (2005; 2015) and a way to approach domain analysis (2003). In regards to the last of these, Tennis suggests (193) two axes to conceptualize and delineate domains:

> The Areas of Modulation, axis one, is an explicit statement of the name and extension of the domain examined. It states what is included, what is not included, and what the domain is called. Details as to how the domain is organized beneath this extension and name are the province of the second axis, Degrees of Specialization.

In total, our corpus constitutes a breadth of meta-level views of KO, which allowed us to conduct a meta-analysis of KO as a domain.

2.0 Corpus analysis for meta-analysis

To begin, meta-analysis of Dahlberg's *Classification System for Knowledge Organization Literature (CSKOL)* and Smiraglia's unpublished "Index" to the book *Elements of Knowledge Organization* was conducted. This meta-analysis was the first step in producing a formal knowledge organization taxonomy. Terms found in the two documents were analyzed, and unnecessary text (e.g., book section codes, introductory text, indefinite and definite articles, and conjunctions) was stripped. The remaining terms were uploaded into Voyant, an Internet-based open-source text mining tool (https://voyant-tools.org/?corpus=f02406bab97ca8671c8b9cfb3cc1032b). The text mining tool identified the terms in order of their frequency within the stripped documents. Table 1 displays the most frequently occurring terms within each of the stripped documents. These terms include classification, indexing, systems, thesauri, knowledge, bibliographic, information, analysis, and social. The identification of these terms as the most frequently occurring is expected as these frequently occur in discourse related to the knowledge organization domain.

Terms with a frequency of five or higher were used as part of the facet analysis process. These terms were imported into an Excel spreadsheet. The terms from each of the stripped documents were placed in separate Excel columns. A side-by-side comparison of the terms in these two columns was conducted. Repeating terms were omitted and unique terms were identified and placed in a third column. Different word forms were regularized (e.g., "phenomena, phenomenon"). These common unique terms were examined as part of the facet analysis process.

Spiteri's (1998) facet analysis model was then utilized. The facets were created with focus on the idea plane principles; differentiation (5), relevance (6), ascertainability (6), permanence (6), homogeneity (18), mutual exclusivity (18), and fundamental categories (18-9). In addition, when creating the facets, focus was also given to the verbal plane principles; context (11) and currency (11). As a result of the facet analysis, six facets and ten sub-facets were identified as follows; community (sub-facets: living things, society), tools (sub-facets: material, systems), action (sub-facets: methods, behavior, language), knowledge (sub-facets: concepts, subjects, of being), place, and time. Table 2 below displays the facets, sub-facets, and related terms.

An interesting yet predictable outcome from the meta-analysis and facet analysis of terms in both Smiraglia's index and Dahlberg's CSKOL is the absence of the significant and prominent themes of gender and identity. The project team, who were well-versed in both, was troubled by this apparent gap. A possible cause for this omission may be that although these documents present a fairly comprehensive view of the KO domain, they do not cover the breadth and width of the domain. Also, meta-analysis relying on frequency distribu-

Facets	**Sub-facets**	**Terms** **Smiraglia's Index**	**Terms** **Dahlberg CSKOL**
Community	Living things	names, actors, author, public, plant, animal	human, persons, user, public
	Society	society, communities, domain, culture	groups, societies
Knowledge	Concepts	phenomena, phenomenon, concept, specificity, boundary, stance, perception, consciousness, cognitive, warrant, epistemic, epistemology, ontological, theory	religion, methodology, mathematical, standards, concepts, logic, policy, principles, kinds, concept, organizational, orientation, foundations, functions, level, standard, thought, trends, value, relations, shared, commodity, theoretical, theory
	Subjects	science, subject	science, sciences, subject, fields, history, literature, mathematics, music, psychology, biology, sociology, ecology, economy, electronics, engineering, food, geography, geosciences, household, law, medicine, military, philosophy, physics, politics, sports, veterinary, biological, economic, mechanical, scientific, agriculture, arts, astronomy, chemistry
	Of Being	physical	knowledge, characteristics, state
Tools	Material	work, vocabularies, text, unit, term, resources, facet, element, document, descriptor, heading, content, code, categories, book, catalog, artifacts, apparatus, thesaurus, objects, network, metadata, map, entities, data, citation, catalogs, information, bibliography, sign, device , description, applications, taxonomies, ontologies, instantiation	index, indexes, thesauri, data, information, work, computer, catalogues, programs, textbooks, books, bibliography, taxonomies, records, terms, codes, dictionaries, files, periodical, text, thesaurus, taxonomy, descriptors, manual, subjects, documents, glossaries , application, descriptor, editions, file, journals, materials, title, dictionary, documentation, headings, abstracts, archival, databases, document, internet, networks, forms, grammar, keywords, object, phrase, patents, pattern, record, specifications, storage, value, topics, word, content
	Systems	KOS	systems, education, MARC, Bliss, Colon, Dewey Decimal System, Faceted Classification System, BBK
Action	Methods	FRBR, typology, taxonomy, documentation, ontology, notation, hierarchy, schema, rules, collocating, bibliographic, bibliographical	classification, documentation, indexing, method, bibliographic, taxonomy, technique, translation, procedures, reviews, guidelines, rules, hierarchy, ISBD, grammatical, standardization, copyright
	Behavior	social, seeking, searching, retrieval, productivity, role, representation, intension, indexing, discovery, networking, discourse, classification, cataloging, analysis, activity, construction, controlled, control, descriptive, exploitative, consequences	social, indexing, organization, construction, evaluation, analysis, research, management, use, standardization, activities, mining, representation, coding, communication, labor, reclassification, relationships, retrieval, notation, teaching, translation, reviews, searches, abstracting, control, encoding, query, training, consistency, computerization, consolidation, concordance, linking, precision, search, selection, shelving, recurring, professional, authority
	Language	semantic, linguistic, language, semiotic, Symbolic	language, languages, terminology, semiotic, multilingual, semantics, syntax, linguistics, semantic, terminological
Places	Places	library, organization, universe, space, international, universal	universal, library, institution, online, international, countries, libraries, country, national, state
Time	Time		generation, current

Table 2. Facet generation using Spiteri's (1998) framework.

tions of terms picks up the upper tier of a distribution but the granularity in the long tail does not get into the analysis. Alternatively, the lack of these important themes from these documents may reflect the recurring challenge of inclusiveness within KOSs (Olson and Schlegl 1999, Olson 2001, Fox 2016). The linear and hierarchical nature of these systems create an environment in which misrepresentation and elimination of themes are prevalent (Olson 2007). This pattern can be seen even in the widely used *Dewey Decimal Classification* where themes such as gender and identity are misrepresented or omitted (Olson 1998). Further study is warranted to determine the exact cause of the lack of gender and identity themes within the documents analyzed for this study.

3.0 Linking the Taxonomy of Knowledge Organization

A search for information within the corpus of the empirical research published in the KO literature inevitably turns up a spate of referential materials. Because we were looking for "definitions or other determinant characteristics" (Smiraglia 2014a, 51) of the taxonomic terms, the importance of achieving efficiency of retrieval seemed obvious. To accomplish this objective, a representative pool of KO literature—twenty-eight domain analytical articles and articles published in the journal *Knowledge Organization* (*KO*) from 1993 through 2019 were converted into digital text dossiers using Adobe Acrobat DC Pro v.9.1 computer software. The *Elements of Knowledge Organization* (*EKO)* (Smiraglia 2014a) was also available as a searchable e-book.

The initial search was done using the "find" and "full Acrobat search" functions of Adobe software within the merged dataset of KO literature. These automated search functions enabled the user to navigate from one instance of the term to another and view the list of all terms and its conceptual definitions within digital sets. However, the result of this first attempt to identify most relevant definitions was disappointing. First, although the search was conducted within a representative sample of the KO literature, some definitions describing basic KO terms were not found. Thus, a definition for the term "field," which Taylor (1999, 242) defined as "A separately designated part of an encoded record; it may contain one or more subfields," was not found in the corpus of KO journals. To overcome this problem, we expanded the pool of reviewed literature to include classic texts from Arlene Taylor, Carol Bean and Rebecca Green, Elaine Svenonius, and Richard Smiraglia.

Second, not all definitions available in the literature were contextually meaningful for our taxonomy. This finding might be explained by the fact that (https://www.isko.org/ko.html 2020):

> *Knowledge Organization* publishes original research articles that: (1) clarify theoretical foundations (general ordering theory, philosophical foundations of knowledge and its artifacts, theoretical bases of classification, data analysis and reduction); (2) describe practical operations associated with indexing and classification, as well as applications of classification systems and thesauri, manual and machine indexing; (3) trace the history of knowledge organization; (4) discuss questions of education and training in classification; and (5) problems of terminology in general and with respect to special fields

Therefore, this plethora of knowledge required careful examination to reveal out the most meaningful content. Third, important for developing a better searching strategy was the realization that most of the core terms could not be adequately defined with one basic conceptual definition. Once these considerations were taken into account, the searching strategy was modified. It was decided to search two types of definitions, conceptual and intentional, illustrating different aspects of the term usage. Both types were supposed to be meaningful in the context of our research field.

An example below shows definitions selected to describe terms "bibliographic/bibliography":

> Bibliographic classification – "a classification of knowledge and thought, and conversely, classification of knowledge [that] is available for a bibliographic classification" (Bliss 1952, 3). According to Bliss (1952, 2), such classifications are based on five principles: Subordination, Collocation, Maximal efficiency, Relativity of Classification, and Alternative location.
>
> Bibliographic control – [is] "encompassing the creation, storage, manipulation, and retrieval of bibliograpic data" (Smiraglia 1987, 2).
>
> Bibliographic data – "information gathered in the process of creating bibliographic records" (Taylor 1999, 234)
>
> Bibliographic entities – sets of individual documents that represent equivalence clustering of documents (Smiraglia 2014a, 13). "Sets have both abstract intellectual content and concrete semantic content" (Smiraglia 2014a, 26).
>
> Bibliographic universe – "is a subset of all knowledge in which all instances of recorded and therefore potentially retrievable knowledge reside (Smiraglia 2001, 1).

Bibliography – "a list of the books referred to in a scholarly work, typically printed as an appendix" (Lexico 2019).

Using modified search criteria described above, we obtained a sufficiently comprehensive and meaningful set of definitions that were used to populate our taxonomy.

4.0 Applied online taxonomy

The formal taxonomy is maintained online at (https://knoworg.org); a copy appears in the appendix below. Ongoing work includes continued linkage to the online *IEKO*, which is constantly growing. It also is our intention to create operable links to the Knowledge Organization System Observatory (KOSo) housed at the Dutch DANS (Data Archiving and Network Services) institute (Coen et al. 2019a-b). It is our intention to publish the taxonomy as linked open data (LOD) in the near future. A dynamic project, the taxonomy can then be maintained and continue to grow as emergent research contributes new concepts or generates new facets.

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Appendix:
The Core Taxonomy of Knowledge Organization, version 1.0, published 25 November 2019.

Facets	Terms	Notes
Behavior	Analysis	Denotes the domain analytical work within KO (Smiraglia and Lopez-Huertas 2015, 554) including domain analysis techniques, e.g. Citation Analysis, Co-word Analysis, Author Co-citation Analysis, Network Analysis, Cognitive Work Analysis (Smiraglia 2014a). Domain analysis – (Hjørland 2017b) IEKO: https://www.isko.org/cyclo/domain_analysis
	Construction/ structure	Construction – "... the construction of sets of terms (concepts) that are used in a specific community—or domain—mapped together with the relationships among them" (Smiraglia 2014a, 44). Structure – "a general framework or structure within which KOS can be built" (46).
	Discourse	Discourse – the cultural action "by which language mediates knowledge" (Smiraglia 2014a, 27). "Epistemology is the division of philosophy that investigates the nature and origin of knowledge. In philosophy at large, epistemology is central because it embraces the theory of knowledge itself. ...The philosophical process engages a discourse in which skeptical challenges to any definition must be rebuked and therein lies the dilemma, for how can we study that which we cannot even define?" (20).

Facets	Terms	Notes
	Documentation (see also Document)	"Documentation was a set of techniques developed to manage significant (or potentially significant) documents, meaning, in practice, printed texts" (Buckland 1997).
Concepts/ideas/ beliefs/theories	Boundary objects	"Terms used to pivot from one vocabulary to another"‘ (Smiraglia 2014, 99).
	Concept	Concepts are the building blocks of thoughts (*Stanford Encyclopedia of Philosophy* 2019). "A concept is a knowledge unit" (Dahlberg 2010, 2946). "A concept is regarded as the common element of both classification systems and thesauri" (Dahlberg 1974, 12). "...knowledge is made up of concepts; ... concepts can be ordered in diverse and useful ways (Smiraglia 2013, 2). "The meaning (i.e., intension) of a term is the concept associated with that term" (Harney 2013, 135). "Concepts mean different things in different areas" (Hjørland 1997, 4).
	Epistemology	"Epistemology is the division of philosophy that investigates the nature and origin of knowledge. In philosophy at large, epistemology is central because it embraces the theory of knowledge itself. The central problems for epistemology are the definition of knowledge, and the means of its acquisition" (Smiraglia 2014a, 20)
	Phenomenon/ Phenomena	Phenomenon (singular); phenomena (plural) – "A fact or situation that is observed to exist or happen, especially one whose cause or explanation is in question. (*LEXICO Dictionary* 2019)
	Specificity	"...the concept of specificity. The level of language to be employed is related to the intended functionality of the thesaurus. Specificity is related to the intended audience. ...the more formal the language the more specific and precise the terms must be..." (Smiraglia 2014a, 81).
	Theory	"Theory is a frequently-tested (and thereby affirmed) statement of the interacting requirements of a phenomenon" (Smiraglia 2014a, 7)
Language	Language	Language – "A system which consists of a set of symbols (sentences) — realised phonetically by sounds — which are used in a regular order to convey a certain meaning. Apart from these formal characteristics, definitions of languages tend to highlight other aspects such as the fact that language is used regularly by humans and that it has a powerful social function." (*Small Dictionary of Linguistics*)
	Linguistics	Linguistics – "The study of language. (*SmallDictionary of Linguistics*)
		Semantic – "Relating to meaning in language or logic" (*LEXICO Dictionary* 2019). "Intension refers to the logical or definitional conditions that specify the set of all possible things a word or phrase could describe, while extension refers to the

Facets	Terms	Notes
	Semantic [extension, intension]	set of all actual things the word or phrase describes" (*New World Encyclopedia* 2018).
	Semiotic [sign]	Semiotic [theory] – "the description of the dynamic process of being in relation of any sort" (Smiraglia 2014a, 24). "Semiotic theory originated with American philosopher Charles Sanders Peirce" (23). Semiotic [sign] – "For Peirce, the sign consists of three components. These are the Representamen, the Interpretant, and the Object. The representamen is the concept as signal, the interpretant is the concept as reception, and the object is the concept as perception" (24).
	Terminology	"The body of terms used with a particular technical application in a subject of study, profession, etc." (*LEXICO Dictionary* 2019).
Material	Bibliography (list)(see also Bibliography (science)	Bibliography – "a list of the books referred to in a scholarly work, typically printed as an appendix" (*LEXICO Dictionary* 2019).
	Catalog	Catalog – a complete list of items, typically one in alphabetical or other systematic order (*LEXICO Dictionary* 2019). Catalog – "retrieval tool; an organized compilation of bibliographic metadata or an organized set of surrogate records that represent the holdings of a particular collection and/or resources to which access may be gained ..." (Joudrey and Taylor 2018, 625). Library catalog – descriptive cataloging that applies a standardized set of rules, "currently RDA: Resource Description and Access, to record the title, authorship, and publication data for a work, describe the physical extent of the work, add bibliographic notes as necessary, and add access points for persons or entities associated with the creation of the work" (ALA 2019).
	Categories	Category – "a grouping of people or things by type in any systematic arrangement" (*Cambridge Dictionary* 2019).
	Citation	Citation – "A quotation of or explicit reference to a source for substantiation, as in a scholarly paper" (*YOUR Dictionary* 2019). Citation Indexing – (Carina de Araújo, Gutierres Castanha and Hjørland 2019). IEKO: https://www.isko.org/cyclo/citation
	Document (see also Documentation)	Document – "the physical container (an item) on which the text is recorded (Smiraglia 2001, 3). Document – "an information-bearing message in recorded form" (Svenonius 2000, 8). Document theory = (Buckland 2018) IEKO: https://www.isko.org/cyclo/document

Facets	Terms	Notes
	Information	Information is knowledge perceived. That is, what is contained in documents is potential information—it is recorded knowledge that may be consulted for whatever reason. But when that knowledge is consulted and is perceived by the human brain, information is the result .... Information is a process and not a thing. Information therefore, is dynamic and not static. Information is what happens to a person when knowledge is perceived, because that new perception alters the person's previously existing knowledge-base. (Smiraglia 2014, 11) Information – "something received or obtained through informing" (Svenonius 2000, 7).
	Metadata	"Metadata are descriptive terms that are applied to information resources, primarily for the purpose of facilitating retrieval" (Smiraglia, 2014a, 65).
	Objects [artifacts, books, etc.]	... information objects, including not only books in libraries, but also representations of artifacts in museums and archival entities, as well as scientific models, ontological structures, and so forth. (Smiraglia 2008, 7). Objects – '"boundary objects," or terms used to pivot from one vocabulary to another"' (Smiraglia 2014a, 99).
	Taxonomy	"Taxonomy is a framework in which elements are defined, and categories are mutually exclusive and collectively exhaustive; ..." (Smiraglia 2014a, 4). "... a taxonomy is an ordered list of terms together with their definitions or other determinant characteristics. ... the form and content of any taxonomy is dependent on the epistemology of the domain for which it has been developed. In the generic sense, meaning the assignment of phenomena to specific categories, taxonomy is a form of classification. ... taxonomy a highly specific sort of ontology, that arrives along with the definitions of the characteristics of the phenomena involved, and that also includes certain kinds of relationships, such as genus-species, etc." (51).
	Term	Term – "a generic term for a specific kind of recorded knowledge (Smiraglia 2014a, 70). Term – "although a word may have several senses, only one of them is intended when it is used as a term. Hence, a word is a term only when it designates one of its possible meanings" (Riggs 179, 152). "A term is a word or phrase used to denote a concept" (Pathak 2000, 29). Terms – "In a specific discipline, items can be categorized and named as concepts of that discipline. The delimitation of knowledge into specific compartments is not easy, and as a result, in many fields of knowledge, specifically in the social sciences, where the same term is used in different discipline-specific contexts, the literature of that field provides the context in which a term is used and to which concept a term represents" (27) "In both computer science and information we see the construction of sets of terms (concepts) that are used in a specific community—or domain—mapped together with the relationships among them" (Smiraglia 2014a, 44).

Facets	Terms	Notes
		Terms – "boundary objects, or points of opportunity for creating interoperable neighboring vocabularies from shared ontologies" (99).
	Textbooks [object]	"An instantiation of a work" ... whenever the work is manifest in physical form (in a book, for example)." (Smiraglia 2006).
	Text	"A text is a set of semantic strings that communicate ideational content" (Smiraglia 2014a, 70). "... the set of words that constitute a writing. A text is not the same as a document, which is the physical container (an item) on which the text is recorded. A document may have only one text, but a text may appear on many documents." Text, then, is another generic term that denotes the communicative aspect of the evidentiary value of a document." (Smiraglia 2001, 3).
	Thesaurus	"A thesaurus is a complete knowledge organization system structured in natural language instead of according to its ontological construct. That is, the elements in a thesaurus are given in alphabetical order. Each term is then accompanied by a set of relational indicators that show its place in the overall hierarchy. Thesauri can be faceted, when terms from several facets are chosen and entered into a system in a string. Thesauri increasingly are multi-lingual to accommodate complex cultural demands" (Smiraglia 2014a, 79). Thesaurus (for information retrieval) – Dextre Clarke 201 IEKO: https://www.isko.org/cyclo/thesaurus
Methods	Bibliography [science]	"The term bibliography can have two definitions: there is bibliography itself, an activity, and there is *a* bibliography, the product of this activity. Bibliographies generally belong to two groups, one concerned with the listing of books and other documents, the other concerned primarily with the study of books as physical objects. ... It includes two specialities called *systematic* and *enumerative* bibliography ... The second group is concerned with the study of books as physical objects ... The several overlapping specialities in this side of the field include *analytical* bibliography, concerned with the ways in which specific books as physical objects were produced; *textual* bibliography, which uses these findings in the important work of establishing authenticity of content; and *historical* bibliography, which considers the relationships between a civilization and its books .... [The two groups} usefully come together ... most conspicuously in *descriptive* bibliography, concerned with the specification of particulars, based on the methods of analytical bibliography. (Krummel 1984, 4-5). "It was around 1439 that Gutenberg created the mechanisms for printing from movable type that were to revolutionize the printing of books. We are looking, then, at the flowering of the marketplace for books only a bit more than a century after this remarkable invention. It was the need of the marketplace that drove the development of more sophisticated forms of bibliography." (Smiraglia 2014a, 35)

Facets	Terms	Notes
		"By the middle of the twentieth century Clapp (1950) was writing that bibliography was one of the arts of communication found at a second level of utterance, treating prior records of communication, and in need of patterns of effective arrangement .... In the same volume, Jesse Shera and Margaret Egan referred to social role of bibliography as part of the problem of inter and between group communication (1950, 17) (Smiraglia 2014a, 40)."
	Classification	Classification – "the systematic ordering of knowledge" (Smiraglia 2014a, 48). Classification – "the placing of subjects into categories; in organization of information, classification is the process of determining where an information resource fits into a given hierarchy and then assigning the notation associated with the appropriate level of the hierarchy to the information resource and to its metadata" (Joudrey and Taylor 2018, 626). Classification – (Hjørland 2017a) IEKO: https://www.isko.org/cyclo/classification
	Classification [typology]	"Classifications of characteristics of phenomena, and these need not be mutually exclusive nor collectively exhaustive" (Smiraglia 2014a, 53). "The term typology is used for the same sort of arrangement when the entities involved are called types instead of taxa. Typologies are used in anthropology, archaeology, linguistics, theology, and psychology. In most instances, typologies are less robust scientifically than taxonomies, which means a type is assigned based on empirical observation but always is subject to change given analysis from future observations" (53). Classification – (Hjørland 2017a) IEKO: https://www.isko.org/cyclo/classification
	Indexing	Indexing – "intellectual analysis of the subject matter of a document (2.15) to identify the concepts (2.11) represented in it, and allocation of the corresponding index terms (2.26) to allow the information to be retrieved" (ISO 2011, 5) The process of creating surrogate records, especially the access points for information packages; such work done in commercial enterprises is often called indexing, while similar work done in not-for-profit agencies is usually called cataloging (Taylor 1999, 244). Indexing: Concepts and theory – (Hjørland 2018) IEKO: https://www.isko.org/cyclo/indexing
	Method	Method – "a systematic procedure, technique, or mode of inquiry employed by or proper to a particular discipline or art." *Merriam-Webster Dictionary.* 2019)

Facets	Terms	Notes
	Ontology	Ontology – "a domain of thought in philosophy. In philosophy ontology is the study of being—of what is. ... ontology allows us to isolate certain principles of physical vs. metaphysical, of categories and the entities that are their contents, of the relationships among all of the above, of attributes of phenomena such as facts, properties, energy, space, time, etc." (Smiraglia 2014a, 43).
Of Being	Knowledge	Knowledge – "that which is known" (Smiraglia 2014a, 3).
People/living things	Persons and institutions in KO	Class 92 covers selected items of knowledge organization literature. It is found in the cumulative database of International Society for Knowledge Organization (ISKO 2019).
	Actors	Principal actors in the domain – knowledge producers and knowledge users (Smiraglia 2014a, 16).
	Author	In the context of domain analysis – a producer of knowledge (Smiraglia, 2014a, 16). The primary metric for measuring the scientific productivity of an author in domain analysis techniques, e.g. Citation Analysis, Author Co-citation Analysis.
	Entities	"Whatever we consider to be the most basic element of reality, we deem to be things or, more formally, entities" (Bean and Green 2001, 3). Entity – "a term used in the field of knowledge organization to indicate an item; both "entity" and "item" are used in order to avoid using "book" or other such specific designation" (Taylor 1999, 242). "A bibliographic entity is a unique instance of recorded knowledge (e.g., a dissertation, a novel, a symphony, etc.)" (Smiraglia 2001, 2).
Society	Domain (see also Analysis)	"A domain is a group that shares an ontology, undertakes common research or work, and also engages in discourse or communication, formally or informally" (Smiraglia 2014a, 85). "A domain is best understood as a unit of analysis for the construction of a KOS" (86).
	Social	In the context of knowledge organization, the "social" refers to "the confluence of art, commerce, and technology... [that] come together at important moments to act as a collective catalyst to move the domain forward (Smiraglia 2014a, 33). In KO, the prevailing point of view is that "the growth of knowledge over the whole course of human history" (34) and the way knowledge is organized is shaped by the social realities of the world.
	Disciplines	Discipline – (Hammarfeldt 2019) IEKO: https://www.isko.org/cyclo/discipline
	Subject	Subject – one of "the attributes of a given bibliographic condition... such as "origin" or "subject" the better to define the intension of each set over against the intensions of the other sets" (Smiraglia 2014a, 13). Subject (of document) (Hjørland 2017c) IEKO: https://www.isko.org/cyclo/subject

Facets	Terms	Notes
Systems	Universal classification	Universal classification – "one that applies the same approach and terminology across domains" (Szostak 2014, 161). Universal classification – "should be considered the sum of a number of domain specific systems (birds, cars, countries, religions, sciences, etc.)." (Hjørland 2017 447). Universal classification – "... bibliographic classifications such as the Dewey Decimal Classification or the Universal Decimal Classification" (Smiraglia 2014a, 52).

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