Systematifier: In Rescue of a Useful Tool in Domain Analysis †

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Abstract: Literature on the systematifier is remarkably limited in knowledge organization. Dahlberg created the procedure in the seventies as a guide for the construction of classification systems and showed its applicability in systems she developed. According to her initial conception, all disciplines should be structured in the following sequence: Foundations and theories—Subjects of study—Methods—Influences—Applications—Environment. The nature of the procedure is determined in this study and the concept is situated in relation with the domain analysis methodologies. As a tool for the organization of the map of a certain domain, it is associated with a rationalist perspective and the top-down design of systems construction. It would require a reassessment of its scope in order to ensure its applicability to multidisciplinary and interdisciplinary domains. Among other conclusions, it is highlighted that the greatest potential of the systematifier is given by the fact that—as a methodological device—it can act as: i)an analyzer of a subject area; ii)an organizer of its main terms; and, iii)an identifier of links, bridges and intersection points with other knowledge areas.

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1.0 Introduction

The term "systematifier" appeared for the first time in a publication that collected a series of conferences given by Ingetraut Dahlberg (1978) in India during the Eleventh Sarada Ranganathan Lectures; this work is almost unavailable today. Unless proven otherwise, the term was coined in that rather short book—entitled *Ontical structures and Universal Classification*—because, although Dahlberg does not expressly claim motherhood there, she does not quote in the bibliography an earlier work in which the expression "systematifier" had been proposed, used or explained by other authors. Literature on the systematifier is remarkably scarce; in fact, specialists in knowledge organization frown when they hear that term, and many of them barely achieve to place it or have difficulties to relate it to the terminology of the area. Besides the regular references made by Dahlberg herself on several occasions (1993; 1995; 2008), it has only received attention in isolated instances (Riggs 1988; Aschero et al

1995; Negrini and Adamo 1996; Fujita 2008; Barité 2011).

In this paper, the history of the term and its concept, which goes back forty years ago, is reconstructed; the reference literature is reviewed with the primary aim of defining and placing the concept in the structure of the knowledge organization (KO) domain. Then, its functions and uses are determined in relation to the design of new knowledge organization systems, and the reach of its contributions, limitations and projection are discussed, taking into account its methodological potential. Finally, the conclusions resulting from said critical review are established.

2.0 The systematifier: history and discussion

2.1 Concept and use

Dahlberg placed the systematifier in the building process of classification systems, starting from the proposal of a new universal system she was developing in the seventies, as an alternative to the weaknesses she had found in the Universal Decimal Classification, and as an answer to the opposition of the Central Committee on Classification of the International Federation for Documentation (FID) to introduce any substantial changes into it (Dahlberg 1978).

The process of system construction proposed by her can be extended without prejudice to the construction of any other kind of knowledge organization system (thesauri, lists, taxonomies). Within this process, she proposed, as the first stage, the development of five subsystems to collect indexing terms at the same time (Dahlberg 1978, 38): "general object concepts, general form concepts, special aspect concepts (field concepts), special space—and location-related concepts, [and] special time-related concepts."

After having established the need of presenting those concepts in a hierarchical way, Dahlberg proposed to arrange them according to the increasing complexity criterion, and, among several examples, she suggested (Dahlberg 1978, 39) organizing organisms in the following sequence: "microorganisms—plants—animals."

The second phase of the construction process was named "fundamentalization of sciences" (Dahlberg 1978, 39). It was presented as the internal organization of the topics structure of disciplines, in such a way that in social and human sciences, for instance, the historical, philosophical, psychological and sociological aspects precede applicative aspects. Thus, in the classification system proposed by Dahlberg (1978, 41), education was subdivided at a first level into sociology, history, philosophy and psychology of education.

It was only in the third phase of development of her classification system that Dahlberg mentioned the systematifier and defined it (1978, 42), in a somehow ambiguous way, if we do not follow the previous explanation, as "a set of system principles" or "a structured sequence for the systems positions." After having selected the topics which will make up the classification system, the systematifier works as a distributing and organizing tool for them. This tool follows a double progression logic; from the simplest organizing elements to the most complex ones (Iyer 2012, 189) and from the core of each subject area to its environment.

In her original text, Dahlberg pointed out that the topics of any subject field aimed at activities or phenomena should be organized according to the following nine groups (1978, 42):

1. General theoretical foundations (including philosophical, historical, psychological and/or sociological aspects, as it has been said).
2. Object or objects (units, organisms, elements, parts).
3. Methodology and technology of the field (nature of its specific activities and dynamics, states, processes, operations).
4. Special phenomena (properties, pathologies, conflicts).
5 and 6. Special forms determined by specific kinds of objects or methodologies.
7. External influences and relations established with other areas.
8. Applications, particularly the applications of the methods in other subject fields.
9. Environment: its professionals, organizations, pedagogy, didactics, documentation, legal aspects, distribution and sharing of its activities.

The most concrete concept established by Dahlberg (1978, 43) at the time is that the systematifier "is based on the recognition that a field of knowledge is characterized by having a special object of concern … special methods and techniques for investigating or handling the object(s) … very often special circumstances … and usually also special subfeatures."

Some time later, at an undetermined date but close to 1978, the author developed the schemes of the *Classification System for Knowledge Organization Literature* (CSKOL). In the beginning, CSKOL was named *Classification Literature Classification* (CLC), and it was developed with the aim of providing a specialized classification for the knowledge organization area. During those same years, Dahlberg had finished (1982) the drafting of her proposal for a universal system as an alternative to the Decimal Universal

Classification, which she finally named *Information Coding Classification* (ICC). She advocated for a common design of the methodology for both classifications, and, in this process, she defined more clearly the features of the systematifier, as will be explained.

To select the terminology of the CSKOL system, Dahlberg (1993) analyzed three hundred periodicals, relevant monographs and proceedings of congresses and similar events in the fields of library and information science (librarianship, archival science, documentation and museology), computer science, linguistics, terminology and other similar areas. The CSKOL system was developed on the basis of traditional and established principles of the area, such as decimality and facet analysis of its schemes. Thus, the knowledge organization domain was subdivided in ten classes called groups. As group 0 was used to classify formal aspects of documents or their contents, the other nine classes were devoted to organize the topics belonging to the area. The organizing elements of the systematifier clearly appear behind the structure of these nine classes.

> Group 1—Theoretical foundations and general problems of knowledge organization.
> Group 2—Classification systems and thesauri. Structure and construction.
> Group 3—Methodology of classification and indexation.
> Group 4—On classification systems and universal thesauri.
> Group 5—On special objects classifications (taxonomies).
> Group 6—On special subject classifications and thesauri.
> Group 7—Knowledge representation through language and terminology.
> Group 8—Applied classification and indexation.
> Group 9—Knowledge organization environment (including legal issues, persons and institutions, education and training in knowledge organization)

Dahlberg went a step further and she suborganized the nine groups in subdivisions of three in the following way:

> Groups 1-3: divisions which constitute the subject area (theories, fundamentals, study objects and methods). Groups 4-6: group of applications of the theories and methods developed in the first group; and Groups 7-9: areas of influence, application and environment of the domain.

The CSKOL was used to organize by subject the structure of the unfinished work entitled *International Classification and Indexing Bibliography*; three volumes were published between 1982 and 1985, covering the whole universe of bibliographic references of the literature on the area in the 1950-1982 period (Dahlberg 1982; 1985; 1993). The first version of CSKOL was published in issue 3, volume 12, of *International Classification* corresponding to 1985, under the name of *Classification Literature Classification* (CLC). The second edition already appeared under the name of *Classification System for Knowledge Organization Literature* in issue 4, volume 20, of the *Knowledge Organization* journal corresponding to 1993, as an appendix of an article in which Dahlberg (1993) reviewed the scope and possibilities of knowledge organization as a knowledge area. On that occasion, she presented three tables: a summary with the ten main classes, another summary with one hundred divisions, and, finally, the extended scheme with the whole development of the system. Likewise, a summary with the one hundred main divisions of the *Information Coding Classification* (ICC), a universal system which relates the set of specialized areas of knowledge and which works as a summary of all disciplines was also published in that same article.

The last edition of CSKOL was published in issue 4, volume 26, of the *Knowledge Organization* journal corresponding to 1999, which was entirely devoted to the compilation of the bibliography of that journal, as well as the proceedings of the international congresses, national conferences and other publications by ISKO (International Society for Knowledge Organization), on the celebration of the first ten years of the aforementioned scientific society.

In a communication at the ISKO-Spain meeting in 1993, Dahlberg—using the systematifier—identified trends in research and scientific production in knowledge organization, through the quantitative analysis of contributions recorded in the literature section of the last two volumes of the *International Classification* journal corresponding to 1991 and 1992 and the first volume (1993) of the continuing journal entitled *Knowledge Organization* (Dahlberg 1995). In that paper, Dahlberg distributed 3,402 references published in the literature section from 1991 to 1993, among the nine subject classes of the CSKOL system. In turn, she grouped the data of the nine classes in three groups, made up of three classes each, in the following way: group of classes 1-3, group of classes 4-6 and group of classes 7-9. In this way, she incorporated the systematifier, an analysis device which enabled her to extract statistical data of scientific production and establish conclusions in relation to the publication trends of the period. For instance, she pointed out that (1995, 15): "the majority of references occur in the first three subdivisions" [i.e., a, Group of classes 1-3], "these are the foundational facets in our field with a ten-

dency to increase from theory and general aspects via the objects of concern and the activities." This same procedure was used by Barité to review the trends of scientific production in the knowledge organization area, in the following sixteen years, from 1994 to 2009 (Barité 2011).

Since the 1980s, UNESCO has intended to develop an International Encyclopedia of Social Sciences (INTERCOCTA), and they requested Riggs to make a handbook for the development of specialized glossaries in specific social subjects or disciplines. As a way to establish previous mappings of these areas, Riggs proposed (1988, 86)—among other methods coming from knowledge organization—the use of the systematifier as a good starting point due to the fact that it was formulated as "a comprehensive set of form-based categories applicable, as facets, to any subject field." In fact, Dahlberg had already advocated for the generality of application of her tool, stating the following (1993, 212): "sequence of facets which can be used in almost every subject area and field and helps to mnemotechnically memorize what must be considering as belonging to every subject field."

Summing up, in the initial document of 1978, the systematifier was presented as a logical progression of the topics of a field of knowledge or, in other words, as a structured design according to a protocol with the aim of introducing rationality into the end product: a classification of a domain. Further on, on the occasion of the creation of the CSKOL system, Dahlberg extended her original idea by dividing domains in three groups related with theory and methods, applications and environment, respectively. With her review of the scientific production of the area starting from what had been published in each of the three groups, Dahlberg (1995) transformed the systematifier from a merely organizing device into an analyzing device as well.

Beyond some sporadic and isolated references (Sigel 2003; Moraes 2014; Terra, Fujita and Agustín Lacruz 2015), this has almost been the whole story of knowledge accumulation in relation to the systematifier; a curious course for a concept which is at the basis of the CSKOL system and has been organizing by subject the literature of the area, for over thirty years, in the literature section of the *Knowledge Organization* journal.

2.2 Situation of the "systematifier" in KO

Knowledge organization, "as a field of study is concerned with the nature and quality of such knowledge organizing processes (KOP) as well as the knowledge organizing systems (KOS) used to organize documents, document representations, works and concepts" (Hjørland 2008, 86). The two processes traditionally recognized in the area are classification and indexing (Hjørland 2013; Giunchiglia, Dutta and Maltese 2013), however, condensation or abstracting work in the subject field can also be integrated into the process (Barzun and Graff 1985).

Insofar as systems are concerned, activities such as creation, revision or evaluation are recognized. In this sense, theories and methodologies of the systems have been created, such as facet analytical theory and methodology (Ranganathan 1967), domain analysis (Hjørland and Albrechtsen 1995; Hjørland 2002) or vocabulary control (Barité 2014), as well as rules and standards seeking to standardize the practices of languages construction (for instance, British Standard Institution 2005). Within the dyad of processes and systems which support the knowledge organization area, the systematifier concept is placed in the second group (the group of the knowledge organization systems), since it provides a possible way to design the map and distribute the terms of a certain area.

At this point, we may wonder about the nature of the systematifier: is it a planning principle, a method, a methodological guideline or a methodological device? Just as a speculation, and given the lack of explicit references in literature, we can anticipate the idea that it is a methodological device since it seems to be more restricted than a method, and it is a mechanism with a predominantly organizing function. As all methodological devices, it is inserted in—and at the service of—an established methodology, whether qualitative or quantitative. In this case, it seems clear that the systematifier is included within the qualitative methods traditionally used in the mapping of domains. The planning and guidance profiles of the systematifier as a methodological device can be identified in the implicit ground of its justification. However, in a broad sense, maybe it could also be said that the systematifier is a method in itself, with its own purposes and application procedures. In any case, it seems reasonable to consider that, within the subarea of knowledge organization systems, the systematifier is more directly related to the various methodological approaches covered by the common umbrella of what we know as domain analysis and, therefore, it is part of its terminological structure.

Domain analysis was introduced in the area of computer science by Neighbors (1980, 1), with the aim of describing "the activity of identifying the objects and operations of a class of similar systems in a particular problem domain," and contributing to the solution of these problems. Neighbors added (1980, 1) that "a domain analysis is represented by a domain-specific language, a prettyprinter, source-to-source transformations, and software components." A few years later, the term was extrapolated to library and information science, though modified in its semantic content, to adapt it to the nature of

knowledge organization problems (Albrechtsen 1993; Hjørland and Albrechtsen 1995). Since its original formulation and in Neighbors' as well as in Hjørland's and Albrechtsen's perspective, domain analysis has a methodological nature insofar as it is used as a tool to describe and represent a determined domain in a reasonable and acceptable way.

In a document which can already be considered as canonical, Hjørland identified eleven approaches or forms of domain analysis: producing literature guides or subject gateways; constructing special classifications and thesauri; indexing and retrieving specialties; empirical user studies; bibliometric studies; historical studies; document and genre studies; epistemological and critical studies; terminological studies, language for special purpose (LSP), database semantics and discourse studies; structures and institutions in scientific communication; and, scientific cognition, expert knowledge and artificial intelligence (Hjørland 2002). If it is accepted that the systematifier is an integral and constituent concept of the terminology of domain analysis, which expresses a methodological guidance and becomes a methodological device, it is reasonable to wonder about the kind of relation or application that the systematifier may have regarding each of the abovementioned approaches. In some cases, this link seems to build up in a more or less natural way (for instance, with regard to the construction of specialized classifications or thesauri, or the production of literature guides). In other cases, its applicability and utility can be qualified as doubtful (i.e., bibliometric studies, historical studies), and in others, its figure appears as inadequate for the nature or purposes of the modality of domain analysis (i.e., studies of documents or genres, structures and institutions in scientific communication). More specific and detailed studies should yield more convincing answers.

Summing up this section, it can be said that the systematifier is undoubtedly a term belonging to knowledge organization, particularly linked to the system aspect and, therefore, associated to the procedures intended for the design, construction, revision and/or evaluation of knowledge organization systems. Due to its nature, it is a method or, speaking more precisely, a methodological device which can be associated with some of the different methodological approaches of domain analysis listed by Hjørland (2002).

2.3 Critical notes and projection

From a different perspective, it can be said that a method or a methodological device, regardless of the discipline and the situation in which they are used, are or could be seen, in principle, as independent and foreign elements to theories or epistemological foundations. Case studies could be submitted as an example of empirical research ways which, in their generic format, show results in social sciences as well as in human sciences, in engineering and biomedical disciplines. However, that statement becomes relative, for instance, in cases such as ethnography which can either be considered as a stance or attitude when facing the facts which are under research or as a method in itself. It, therefore, raises questions such as if ethnography "is an epistemological issue about the knowledge of social matters, as part of a discipline tradition or if it is a special kind of methodological proposal which implies a different approach of what field work means" (Ameigeiras 2009, 108).

There are also *ad hoc* methodologies only developed to obtain certain results or products in a given context, and which are difficult to transfer to other research areas as it happens with the methods for thesauri development. In this context, we might wonder if the systematifier, either as a method or a methodological device, has a subsurface but decisive link with any of the four approaches proposed by Hjørland for knowledge organization. These approaches are empiricism—based on the data provided by observation and induction—rationalism—based on logic principles, pure reason or deductions—historicism—studies of context, development and evolution of knowledge fields—and pragmatism—underpinned by the analysis of values, aims and consequences (Hjørland 2003 and 2013).

In a brief analysis, it can be said—as a first and provisional answer—that the systematifier, as a tool to organize the map of a domain, seems to be associated to a rationalistic perspective, with all its advantages and disadvantages. This perspective relies on the trust in the value of deductions and certainties provided by a certain logic prevailing in the presentation and classification of accumulated and shared knowledge. As Hjørland points out (Hjørland 2005, 135), "the method favoured by rationalism is to reduce any problem to what cannot be questioned: to evident statements. From here evident statements may be combined and new knowledge may be deduced."

An example of rationalist stance in the design of knowledge organization systems can be seen in an article (Beghtol 1995) where it is said that at least two stages are required to develop a knowledge organization system: 1) the determination of the categories or main classes of the subject field; and, 2) the analysis of the topics and issues which have deserved specialists' attention. To fulfil the first stage, Beghtol notes (30) that determinations of the categories are conventionally made on relatively intuitive grounds, such as examining subject encyclopedias, dictionaries and text books, becoming familiar with the terminology of the field; and invoking personal and/or expert knowledge. In this case, the risk lies in the fact that

the systematifier, as a methodological device associated to a rationalist approach, may tend to better adapt to top-down methods in which a set of previously established categories is the starting point to weave the basic fabric of concepts which will sustain the knowledge organization system being constructed.

As seen in Beghtol's case, these categories usually come from experts' opinions—either from the analysis of the more general literature by the classificationist, or from a group of specialists or experts, under the assumed idea of establishing an "objective" look. Thus, if the systematifier is exclusively associated with rationalist design approaches, it can be trapped in processes of description as well as logical and formal organization of the disciplines structure, at a time in the history of knowledge organization when attention is turning to other design perspectives of a domain, for classification and indexing purposes (for example, approaches based on user warrant or cultural warrant). In fact, the initial documents on domain analysis try to promote the idea that classifications are social constructions which capture—or should capture—the activities and exchanges within a user's community; this leads to overcome models merely developed on the basis of expert opinion (Hjørland and Albrechtsen 1995; Albrechtsen and Jacob 1998; Hjørland 2002). Mai clearly interprets (2004, 46) this turn when he mentions, among the theoretical foundations for research in document classification, the following:

> The methodology for construction of classification schemes needs to rest on studies of users' information interactions, works and habits, as well as, the structures of domains [and] the practice of classifiers and classificationist's needs to be freed from attempts to be objective and neutral [because] the practice of classification is inherently political and value-laden.

After having stated that the systematifier needs to overcome the barriers of rationalist approaches in the design of systems, in order to achieve a better use of it, we have to express that we are concerned about the following fact: is the systematifier a tool with enough flexibility to adapt itself to the mapping of all knowledge domains? If we start from Dahlberg's organizing scheme, all disciplines should be structured in terms of the following sequence: fundamentals and theories—subject of study—methods—influences—applications—environment.
However, there are knowledge areas with particularities that could demand an adjustment of the model. Medicine, for instance, as it is treated in most universal and specialized systems, is based on four important subdisciplines: anatomy (because without a human body there is no medicine), physiology (comprising the description of the normal processes in a human body), pathology (referring to abnormal processes such as diseases, disorders and conditions) and therapeutics (the development of procedures seeking to reverse, relieve or control abnormal processes). Each of these four subareas is so relevant that the sequence of the systematifier could be used for its internal organization. But the subject intersection between them could turn this tool into an obstacle or an either insufficient or inaccurate instrument when used.

In the case of law, the first division which needs to be made in a system—either universal or specialized—is between law of Roman origin and law based on common law. Or as an alternative, those in charge of the system design could offer independent tables according to legal systems, and corresponding to each country, for its full application. After this first distinction, there are two division criteria which can be at the same level of importance: the types of law (the traditional ones: civil, commercial, criminal, constitutional; and the special ones: computer, mining, women's) and the sources (doctrine, legislation, jurisprudence and/or custom). The use of the systematifier in the legal field seems to have the same difficulties or limitations as in medicine due to the high complexity and interaction of the subdisciplines and reference terms.

We should also consider the case of multidisciplinary fields (often focused on topics or phenomena and not on disciplines, such as abortion, femicide or tsunamis) and interdisciplinary spaces (such as cultural studies, gender studies, ecological sciences, cognitive sciences). In these crossed subject fields, theories and methods are not only shared, hybridized or disputed, but they also encounter greater difficulties of institutional nature since their specialists are scattered over different knowledge areas; they do not have integrated specialized libraries and—depending on the case—they have difficulties to achieve academic recognition or to obtain their own budgets (Dogan 1996).

Many of these fields fall in the middle of two or more preexisting areas, and they generate their own development dynamics where the unequal share of traditional disciplines in the growth of the new subject field can be verified. As Klein pointed out twenty years ago (Klein 1996, 139), "a significant number of new specialties have evolved from crossfertilizations of hierarchically unrelated fields, mission oriented fields, and interdisciplinary subject fields." And later (Klein 1996, 139), "the perception that knowledge is increasingly interdisciplinary further derives from daily cross-fertilizations of borrowing tools and instruments, methods and techniques, data and information, concepts and theories span science and technology, the social sciences, and the humanities." This cross-fertilization in which notions, theories, methods and forms of conceiving reality are mixed and resignified should attract our atten-

tion since it can cause adjustments in the traditional conception of the systematifier.

3.0 Conclusions

The systematifier notion was created by Ingetraut Dahlberg towards the end of the 1970s and has received very scarce—and lateral—attention in the literature of the knowledge organization area. There are almost no studies on its application and valuation. Almost nothing has been said with regard to the placement of the concept in the terminological structure of knowledge organization. There has been a predominance of descriptive texts, explaining what the systematifier is and the elements used to organize the components of a subject field. The lack of analytical studies hinders a better appraisal of the scope and possibilities offered by this tool.

If we assume that there are no orphan terms in any knowledge area, because each notion has its own place in the conceptual structure of the domain it belongs to, we may wonder which is the place of the systematifier in knowledge organization. In this paper, we propose to place it in the subarea of knowledge organization systems and especially as a term directly related with—or even subordinated to—domain analysis. Already in its place, we then sought an answer as to what kind of element it is. In this paper, we support the idea that the systematifier is a methodological device, i.e., a mechanism which opens the door to a wider application of a methodology of knowledge organization. As a methodological device, in a first approach—not confirmed yet by specific research—it seems to fit or adapt to a greater or lesser extent to some of the eleven approaches of domain analysis proposed by Hjørland, though not to all of them.

In this paper, we intend to give an evidence principle on the fact that due to the brief history of its creation and application, the systematifier seems to be associated to a rationalist approach in which the top-down methodologies for the creation of knowledge organization systems usually prevail. If the tool as such has a future, its application in domain analysis processes will require ways of adapting it to other design orientations, whether based on data (empiricism), evolution studies (historicism) or values (pragmatism). The greatest potential of the systematifier lies in the fact that as a methodological device it can operate as: 1) an analyzer of a subject area; 2) an organizer of its main terms; and, 3) an identifier of links, bridges and intersection points with other knowledge areas. As an analyzer, it allows to reveal the essential subdivisions of a knowledge field. As an organizer of terms and concepts, it creates the scenario to distinguish the main facets in which they can be grouped or separated. Besides, there are areas of the systematifier which can clearly favor the identification of links, bridges and intersection points of the domain under study in relation to others, especially with regard to the identification of influences (from and to the domain) and the environment (professional environment, teaching and training, legal implications, code of ethics).

All knowledge areas without exception—whether we talk about sciences or technologies, social and human sciences or natural sciences, pure or applied science, knowledge areas of larger or smaller size—have a part of their territory shared or related with other areas. Likewise, the emergence—and fast increase—of interdisciplines, studies and specialties arising in areas of multiple disciplinary intersection becomes more and more noticeable. Therefore, the point that intersection or hybridization processes of disciplines have reached justifies wondering on how the notion and procedures associated to the systematifier should be updated in order to enable it to fulfill its function in a useful and efficient way. The topic under review requires a greater attention in the knowledge organization area, among other reasons, because it refers to a notion belonging to the specialty, borne inside it, and it has proven to be effective to establish the semantic basis of classification systems as well as to carry out analytical studies of fulfilled scientific production and trends towards the future.

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