

# Foundational, First-Order, and Second-Order Classification Theory

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Tennis, Joseph T. **Foundational, First-Order, and Second-Order Classification Theory.** *Knowledge Organization.* 42(4), 244-249. 53 references.

**Abstract:** Both basic and applied research on the construction, implementation, maintenance, and evaluation of classification schemes is called classification theory. If we employ Ritzer’s metatheoretical method of analysis on the over one-hundred year-old body of literature, we can see categories of theory emerge. This paper looks at one particular part of knowledge organization work, namely classification theory, and asks 1) what are the contours of this intellectual space, and, 2) what have we produced in the theoretical reflection on constructing, implementing, and evaluating classification schemes? The preliminary findings from this work are that classification theory can be separated into three kinds: foundational classification theory, first-order classification theory, and second-order classification theory, each with its own concerns and objects of study.

Received: 19 June 2015; Accepted: 29 June 2015

Keywords: classification theory, work, constructs, foundational, schemes, metatheory

## 1.0 Introduction

The organizers of this North American Symposium on Knowledge Organization ask us to consider how we produce knowledge organization. In answer to the question of how we do this, we can take a metatheoretical approach. Metatheory, as used in sociological literature, is an exercise in studying past theory (Ritzer 1991a; 1991b). This work in sociology has been imported into both information science and knowledge organization (Cronin 1998; Tennis 2005; Tognoli 2013). This paper looks at one particular part of knowledge organization work, namely classification theory, and asks 1) what are the contours of this intellectual space, and 2) what have we produced in the theoretical reflection on constructing, implementing, and evaluating classification schemes?

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tion schemes is called classification theory. If we employ Ritzer’s metatheoretical method of analysis on the over one-hundred year-old body of literature, we can see categories of theory emerge. The preliminary findings from this work are that classification theory can be separated into three kinds: foundational classification theory, first-order classification theory, and second-order classification theory, each with its own concerns and objects of study. In the next section I outline metatheory. I then go on to scope and describe classification theory. The third section is the application of Ritzer’s work in relation to classification theory.

## 2.0 Metatheory

Metatheory, in general, is the analysis of theory. In the context of sociology, George Ritzer (2000) established a vocabulary and framework to do this analysis. Ritzer’s ap-

proach to metatheory helps us do three things: 1) better understand theory, 2) serve as a prelude to future theory, and 3) provide us with an overarching perspective on theory. Colomy (1991) added to Ritzer's conception by claiming that metatheoretical work could also help us evaluate theory.

Metatheory is a good tool for our purposes because our object of study is theory. Further, the questions we have about how classification theory is produced can be addressed using this particular perspective. That is, we must understand how theory is produced, metatheory in the first sense; we want to do this to encourage further theory development, metatheory in the third sense; and evaluate—perhaps by putting various conceptions in relation to one another and asking which work and why. This is metatheory in the fourth sense. We will use these together to talk about how classification theory can be subdivided into three kinds: foundational, first-order, and second order.

### 3.0 Classification Theory

As defined above, classification theory is a body of knowledge that reflects on the process of construction, implementation, maintenance, and evaluation of classification schemes as well as the act of classing documents. Classification and classification schemes can be narrowly or broadly defined. Broadly, classification is the identification of concepts and relationship between concepts. Narrowly, and for the purposes of subject-based retrieval of books, classification is a mutually exclusive, jointly exhaustive, hierarchically, and systematically ordered set of classes. As a scholarly community, knowledge organization researchers have reflected on the practice of classification in order to improve it. If we look at the whole of the literature we see a pendulum swinging from purely pragmatic arguments for understanding classification (Mai 2001) to a more realist position, which manifests in materialism (Hjørland 1992) or referentialism (Svenonius 1994).

Within that spectrum of approaches, classification theorists commonly develop constructs that allow them to describe the work of classification and its structures. Example constructs include facets, warrant, and authority control. These constructs, and others signal how we might engage in metatheoretical examination of the literature. We might interrogate the literature for the objects of study, the relationships that obtain between different constructs, and perhaps even where constructs are contested or missing. We can also pin this to the first question I asked about what classification theory has produced. So we might lift up constructs as useful tools to identify the contours of the literature as well. However, this is not without epistemological and ontological commitments. One could argue that even using the term constructs places us into a camp

with pragmatists. If that is so, we hope this work useful to both ends of the spectrum.

What then is the scope of classification theory? What is considered relevant to this metatheoretical investigation? For our purposes, we sampled English language literature, ranging from 1825 to the present, which concern itself with bibliothecal classification either, directly or in response to the problems presented by bibliothecal classification. This means we are concerned with a particular refinement of the narrow definition of classification mentioned above. Bibliothecal classification is classification concerned with the arrangement of books on shelves by subjects using notation. While this may seem narrow, it is in fact a model system of theory in my view. We can learn much about other bodies of literature that are concerned with classification in the broader sense by fully understanding bibliothecal classification theory. For example, we might from this model system of English language literature compare concerns with literature in other languages, like Russian (Аблов 1921; Шамурин 1955 and 1959; Maceviciute and Janonis 2004).

### 4.0 Metatheoretical Examination of Classification Theory

Following Ritzer's formulation and using Cronin (1998) as an example, we can examine the literature at a high level and document our findings with example cases. We will do this by arguing for three kinds of classification theory: foundational, first-order, and second-order classification theory.

#### 4.1 First-Order Classification Theory

First-order classification theory is solely concerned with methods of classification scheme construction and use. In this context we are concerned with constructs like warrant, facets, connecting digits, analysis for creating mutually exclusive and jointly exhaustive systems. There is debate in the literature about when one should use one of these or another (cf., Foskett 1974; Langridge 1976; Vickery 1959; Hjørland and Pederson, 2005; Broughton 2006).

Exemplar literature in this area is the work of S. R. Ranganathan (1937; 1957; 1967), the CRG, and contemporary summaries of design patterns and discussions of semantic web work (cf., Frické 2012; Hlava 2014). In each of these cases, we see reported out various constructs, either required, advocated for, or optional, that one can use to build a classification scheme. We also see problems addressed by the authors—problems that may stay in the first-order, or lead to further investigation either at a fundamental level or move to second-order considerations.

#### 4.2 *Second-Order Classification*

Second-order classification theory is concerned with what to do with classification schemes once they are built. Three major concerns in this space are 1) how schemes change over time and how we update them, 2) how installed schemes interoperate, and 3) how systems change when they change context (reapplied or reengineered).

In the context of scheme change, we see various concerns surface. We want to know what effects classification scheme change has on our ability to collocate documents (Tennis 2012; 2013). We are also concerned about how we do analysis of subjects knowing that change will affect future interpretation of searching and browsing. Buckland (2012) discusses this as a Janus-faced perspective on subjects—and by extension classes. That is, the classifier is looking, at the present, into both the past and the future interpretations of a class. This is because previous interpretations and decisions have shaped the extension of the class, but we know those interpretation are subject to revision. Other work in this traces subjects in extant schemes in order to make sense of fundamental questions about the nature of the work of maintaining classification schemes over time (Furner 2007; Tennis 2002; Tennis and Sutton 2008). This is often called subject ontogeny.

Another body of literature in second-order classification theory deals with switching and reconciling vocabularies and by extension, classification schemes (e.g., Neville 1970; Doerr 2001; van Hooland et al. 2013). The concern here is that we use our investment in extant schemes to our advantage by facilitating all possible interactions with other vocabularies and repositories or collections. In the linked data environment this has resurfaced as a major concern (Michael Culture Association 2015).

We would also place transformations of one kind of structure to another into this second-order. In these cases we capitalize on the loose definition of classification in that we see concepts and relationships that obtain between relationships and we feel open to modify structure, often adding functionality, but sometimes taking it away. Example literature examines ways we can transform classification schemes or thesauri into ontologies (Soergel et al. 2004; Liang et al. 2006; Green and Panzer 2010; Zeng et al. 2010).

In the context of changed context we see a growing concern about local-global tensions (Mai 2015). And we see various implementations of classification, which do not comport with their original purposes. These range from application in archives (Lewinson 1939), collection assessment (Luther et al. 2003), to social critique (Olson 2002). In each of these cases thinkers create constructs through their analysis of the situation. For example, from this work we have constructs like switching languages, crosswalks, application profiles, semantic gravity, and con-

cept neighborhoods. Of course, with the rise of these constructs we are redirected to more definitional or foundational issues.

#### 4.3 *Foundational Classification Theory*

This brings us to foundational classification theory, which is concerned with philosophical and definitional aspects of classification. In foundational classification theory, the nature of the process and the products of classification are called into question. Examples of this kind of theory production are primarily conceptual papers that argue for a perspective. We might point to early examples of this work by Richardson ([1901] 1964) and Broadfield (1946), who were intellectualizing a practical work mode in libraries. This work is alive and well today with many arguments for particular philosophical stances toward classification (e.g., Hjørland and Pederson 2005; Lee 2011), or arguments for particular ontological understanding of concepts in the field (Furner 2009).

Other work has been in the development of a clear language to talk about classification. This is a troubled area of study because we have not settled, as a group on terms and definitions. However there was much activity in the past with Ranganathan leading the drive to develop a metalanguage for classification.

Foundational theory can and should be divided into two kinds, intentional foundational theory and tacit foundational theory. This is because when we engage in first-order or second-order classification work we cannot help but make assumptions about the definitions of the constructs we are using. Further, we work within a particular philosophical position, whether we know it or not. In this case we might be tacitly defining categories (Dousa 2015) by our use of them in our classification work. Conversely we might explicitly define and explore the scope of representation, for example (Friedman and Thellefsen 2010). This latter case is an instance of intentional foundational theory.

All of this seems essential work in the context of classification theory and in how we produce knowledge organization. However, I can also make arguments, based on this metatheoretical analysis that we have some work to do and some work we might leave behind.

#### 5.0 **Arguments Based on the Metatheoretical Work**

With this categorization of classification theory proposed, we can move to make use of it. One way we might do so is by considering what research questions remain in each of the three areas.

With regard to first-order classification theory, we have very few unresolved research questions. The methods of

classification construction are well understood, and while there may be different points of view as to what constitutes a good method of classification scheme construction (cf., Szostak and Gnoli, 2008; Broughton 2006), we have at hand a wealth of literature and constructs that we can deploy for the task at hand. There are some research questions that surface at the intersection of these established and well-known methods and epistemologies that do not accept western assumptions about classification. For example, methods derived from indigenous ways of knowing may reshape our understanding of first-order classification work (Doyle 2103; Duarte and Belarde-Lewis forthcoming). However, much of that work may need to be sorted out on a foundational level first, and then move into other methods of the first-order.

This takes us to consider what work needs to be done at the foundational level. It would seem that might make an inventory of what we have explored at this level. What definitions are well accepted and which are contested? Why are some controversial? What is the effect of this controversy on first-order classification work? Are there new insights gained from this reflective work on foundational assumptions? When we compare our assumptions with other modes of classification do we gain some insight into the act of classification in general (cf., Lee 2011)?

Finally, it is clear that there are some major work to be done in the second-order of classification theory. We have enduring research questions in the field (Gnoli 2008) and contemporary technological environment that demands we address, at a theoretical level, what we do with schemes after they are built and deployed (Baker and Sutton, 2015).

## 6.0 Conclusion

The work of classification theory is work at improving the design, use, maintenance, and evaluation of classification schemes. Organically, we have, as a field of scholarship, developed different questions and concomitant literatures to address the various aspects of this intellectual work. In order to make sense of the similarities and differences in the literature we have applied Ritzer's metatheory work to example literature. We have argued for a tripartite categorization of the literature into foundational, first-order, and second-order classification theory. We have also used constructs as a concept to discuss what is of concern to thinkers working in each of these literatures. Finally, we began an argument for what research questions are left unanswered when viewed through this lens of different kinds of classification theory.

While we only focused on bibliothecal classification, we believe it is a model system of classification that can be used to compare different kinds of classification work, while still holding to this three-part division.

What is left undone is to make the argument for grand challenges for each of these areas, and the alignment of intellectual resources to address them. A grand challenge is a large research question that mobilizes a large number of thinkers. It is possible, in our opinion, to argue that this categorization of classification theory offers us a tool to organize such grand challenges. This seems less about doing new things, than reconceptualizing how we identify our work and what that work contributes to the improvement of classification schemes.

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